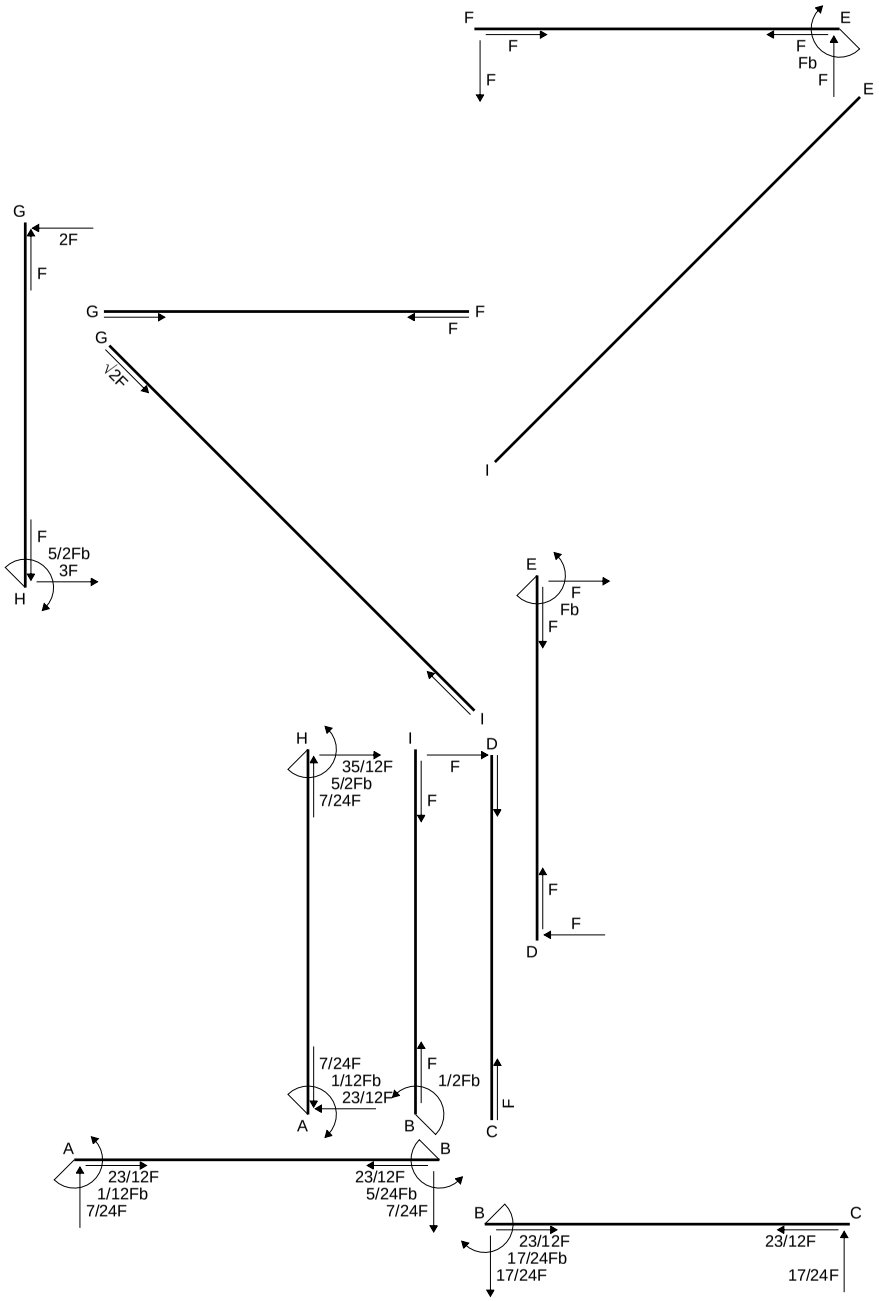
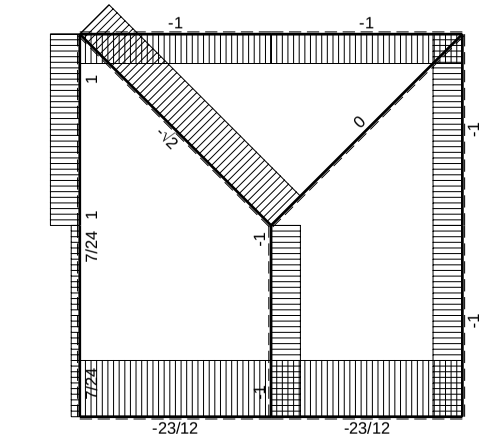
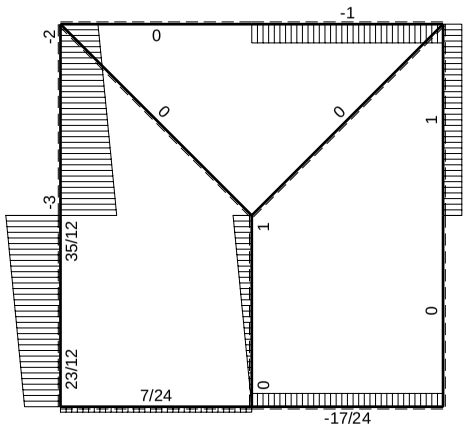
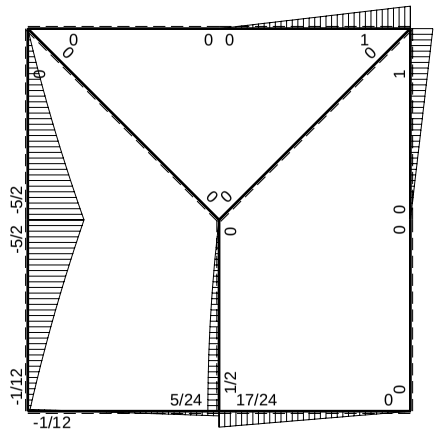

F
F
F
E
F
Fb
F
E
G
2F
F
G
F
F
G
√2F
I
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5/2Fb
3F
H
I
E
F
Fb
F
F
F
D
H
35/12F
5/2Fb
7/24F
I
F
F
D
7/24F
1/12Fb
23/12F
A
F
1/2Fb
B
F
C
A
23/12F
1/12Fb
7/24F
B
23/12F
5/24Fb
7/24F
B
23/12F
17/24Fb
17/24F
C
23/12F
17/24F


-1
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-1
-1
7/24
1
-1
-1
-1
-1
-23/12
-23/12

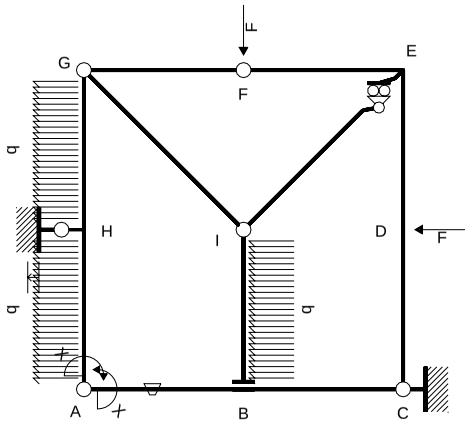

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0
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-3
35/12
1
1
0
23/12
0
7/24
-17/24

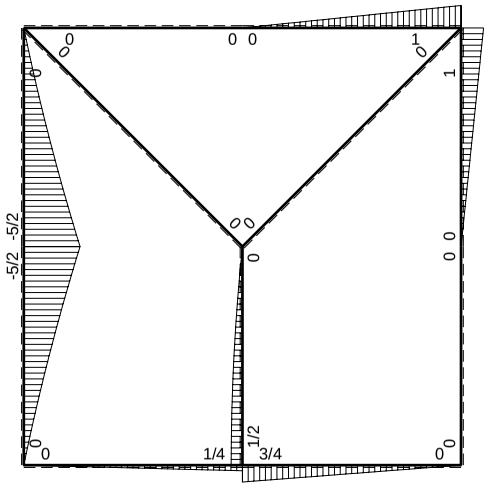
←□→ F

↑□↓ F

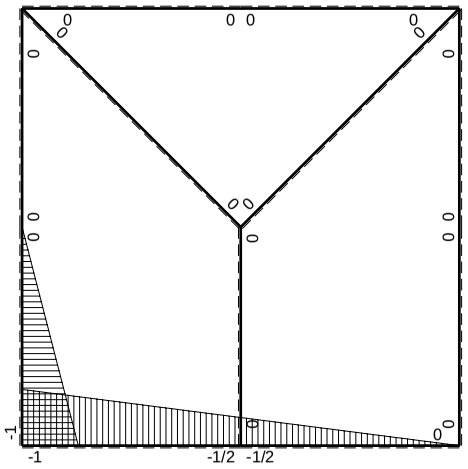

0
0 0
1
0
0
1
0
0 0
-5/2
-5/2
0
0 0
-1/12
5/24
1/2
17/24
0
0
-1/12

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 249087 CI04.xxxx.001

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	-Fb/EJ	$-1/4Fx+1/8Fx^2/b$	Fb/EJ-1/2Fx/EJ	$1-x/b+1/4x^2/b^2$	$(-1/12+3/4)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb+1/4Fx	Fb/EJ	$-1/8Fb+1/8Fx^2/b$	1/2Fb/EJ+1/2Fx/EJ	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/12Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1 - 1/2\ x/b\right)\ \theta\ dx$

$= \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ + \left(\ b - 1/4\ b\ \right)\ \theta\ \ = 2/3\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2 - 1/2\ x/b\right)\ \theta\ dx$

$= \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 2/3\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

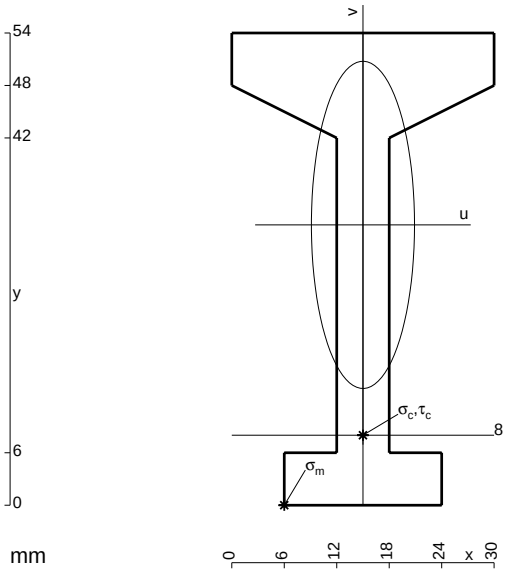
$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

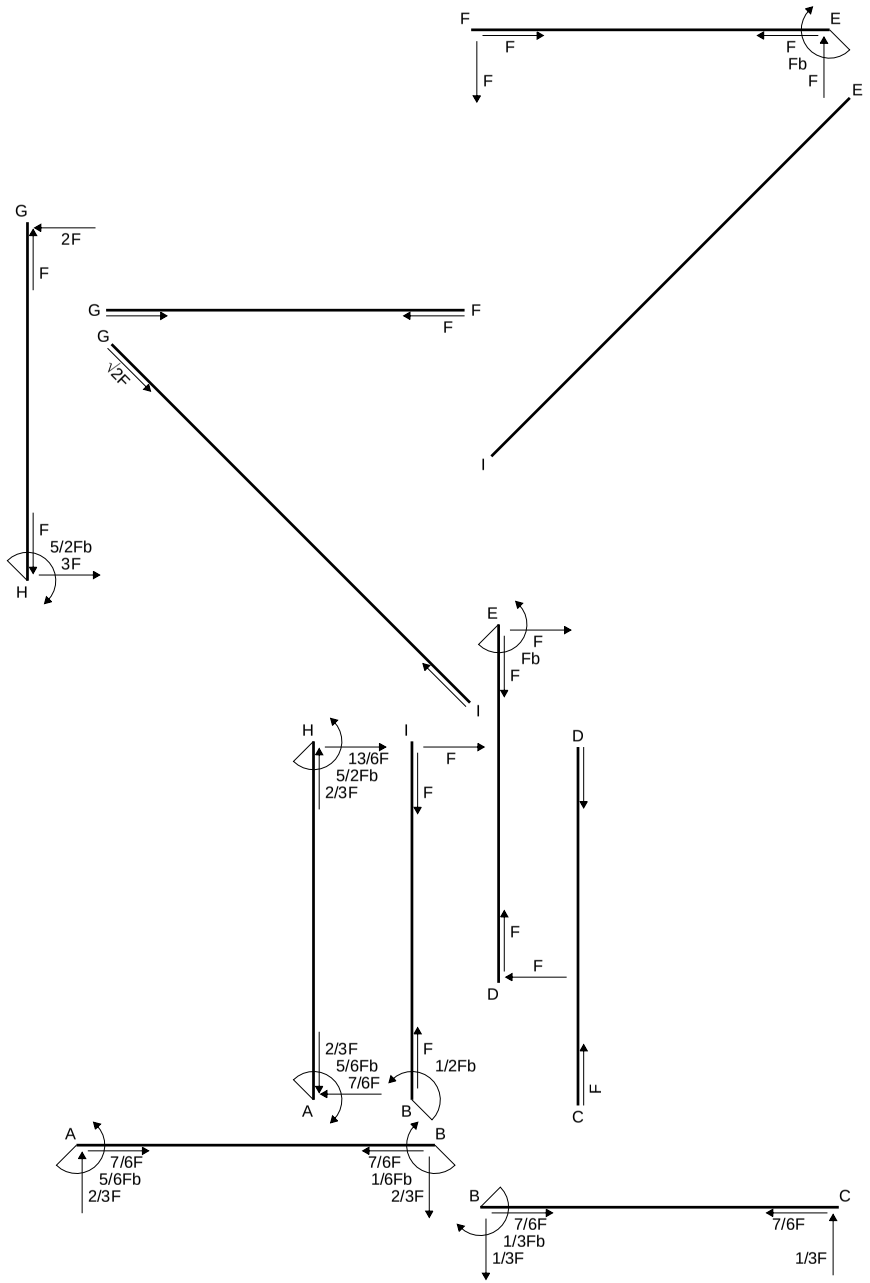
$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

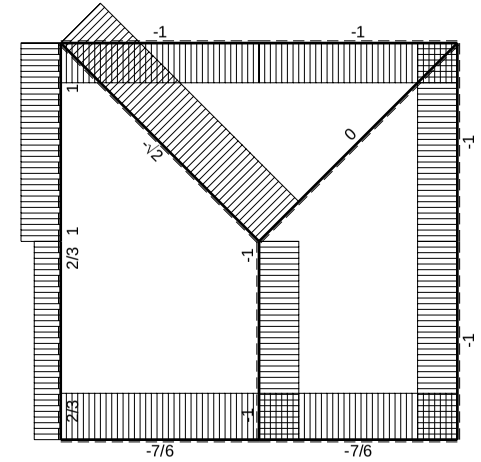
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

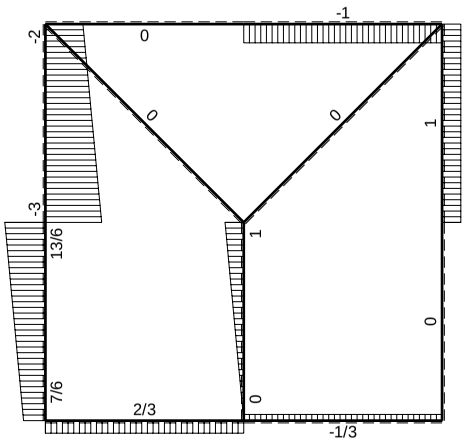
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

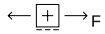


A = 612. mm^2
J_u = 214270. mm^4
J_v = 21276. mm^4
y_g = 32.06 mm
N = 1020. N
T_y = -3060. N
M_x = -1402500. Nmm
x_m = 6. mm
u_m = -9. mm
v_m = -32.06 mm
$\sigma_m = N/A - Mv/J_u$ = -208.2 N/mm^2
x_c = 15. mm
y_c = 8. mm
v_c = -24.06 mm
$\sigma_c = N/A - Mv/J_u$ = -155.8 N/mm^2
τ_c = 8.186 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 156.5 N/mm^2
S^* = 3439. mm^3

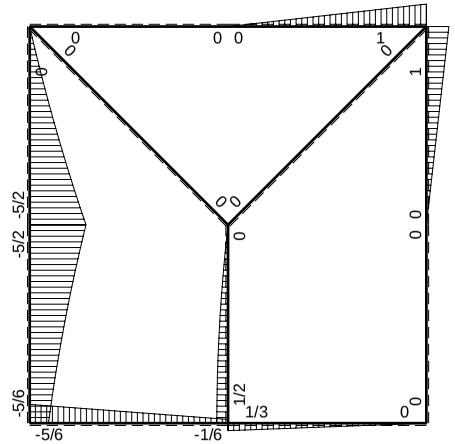

F
E
F
F
Fb
F
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2F
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G
F
F
G
½F
I
F
5/2Fb
3F
H
E
F
Fb
F
I
H
13/6F
5/2Fb
2/3F
I
F
F
D
F
F
D
2/3F
5/6Fb
7/6F
F
1/2Fb
A
B
F
C
A
B
7/6F
5/6Fb
2/3F
7/6F
1/6Fb
2/3F
B
C
7/6F
1/3Fb
1/3F
7/6F
1/3F


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-1
1
-½
0
-1
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-1
-1
2/3
1
-1
-7/6
-7/6

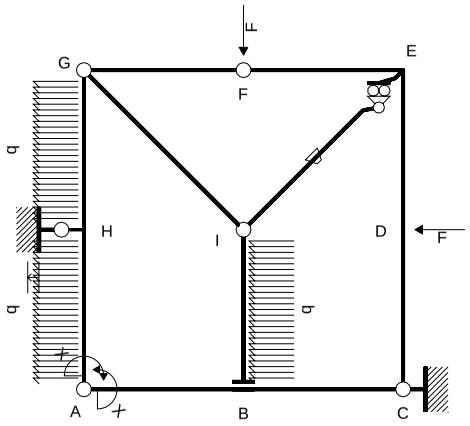

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1
-3
13/6
1
0
7/6
2/3
0
-1/3

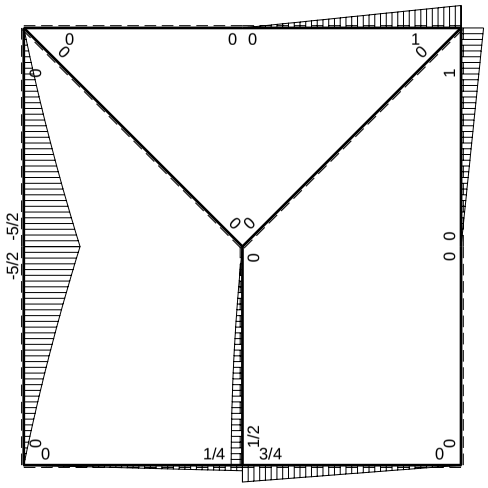

F


F

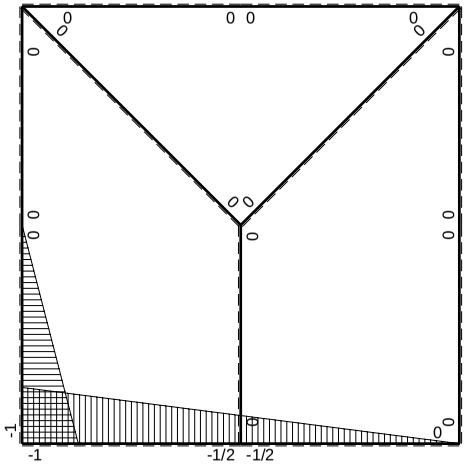

0
0 0
1
0
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0
0
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0 0
-5/2
-5/2
-5/6
1/2
1/3
0
0
-5/6
-1/6


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 957766 CI04.xxxx.002

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PROCEDIMENTO E RISULTATI 957766 CI04.xxxx.002

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

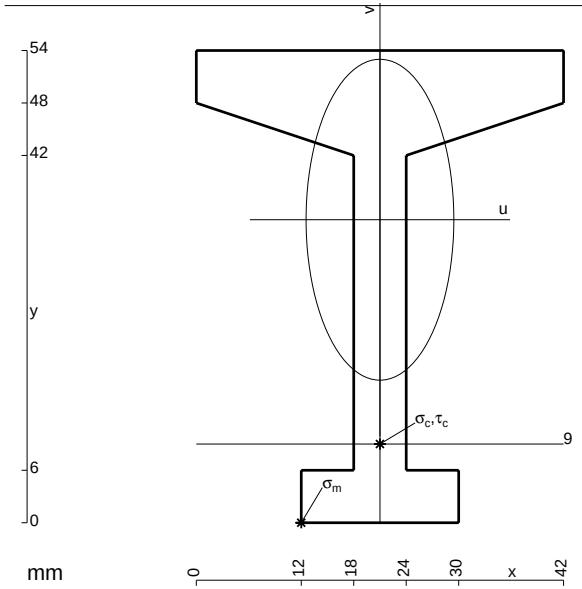
$$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

$$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$

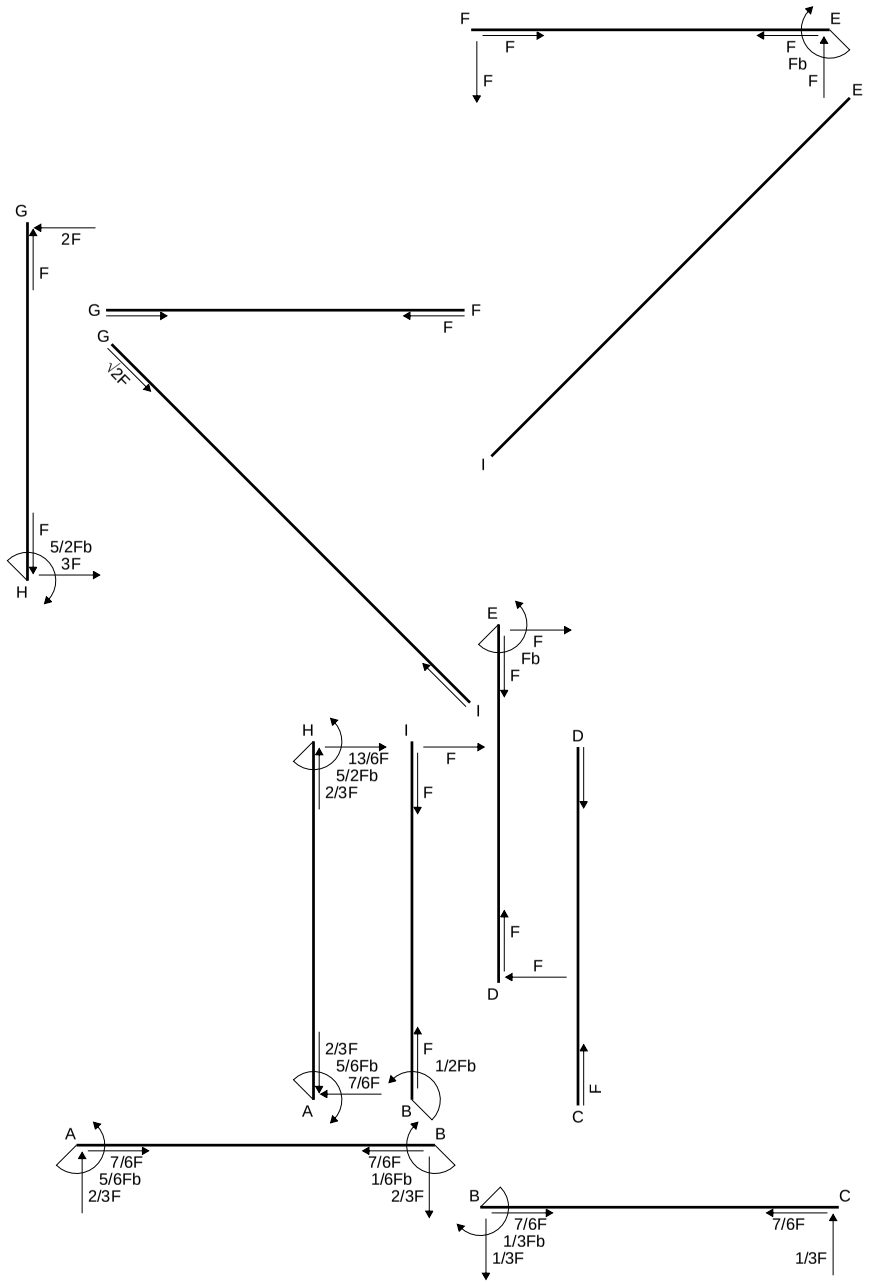
$$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$

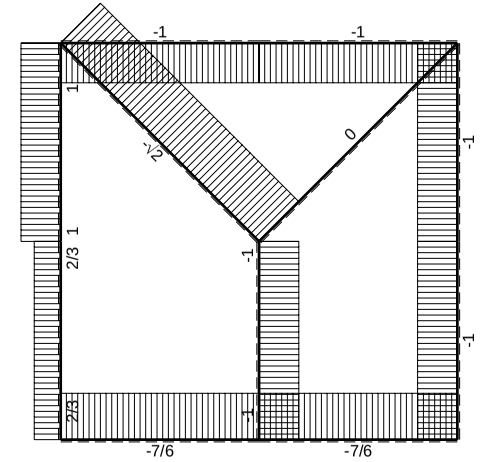
PROCEDIMENTO E RISULTATI 957766 CI04.xxxx.002

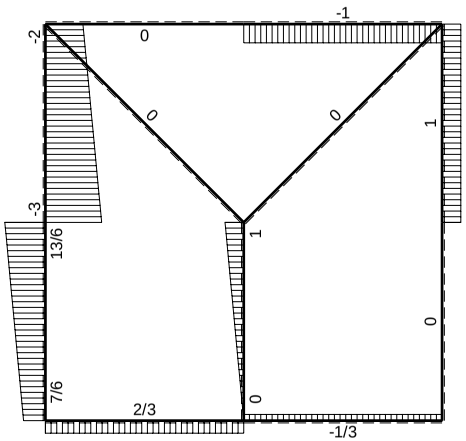


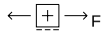
A = 720. mm^2
J_u = 242552. mm^4
J_v = 51408. mm^4
y_g = 34.65 mm
N = 1030. N
T_y = -3090. N
M_x = -1545000. Nmm
x_m = 12. mm
u_m = -9. mm
v_m = -34.65 mm
$\sigma_m = N/A - Mv/J_u$ = -219.3 N/mm^2
x_c = 21. mm
y_c = 9. mm
v_c = -25.65 mm
$\sigma_c = N/A - Mv/J_u$ = -162. N/mm^2
τ_c = 8.295 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 162.6 N/mm^2
S^* = 3907. mm^3

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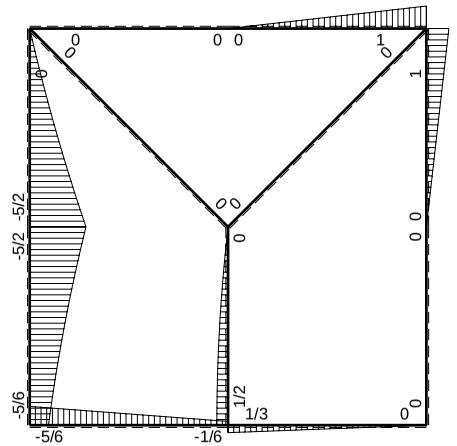

F
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5/2Fb
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F
Fb
F
H
I
D
13/6F
5/2Fb
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I
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D
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2/3F
5/6Fb
7/6F
F
1/2Fb
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C
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5/6Fb
2/3F
7/6F
1/6Fb
2/3F
B
C
7/6F
1/3Fb
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7/6F
1/3F


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-7/6

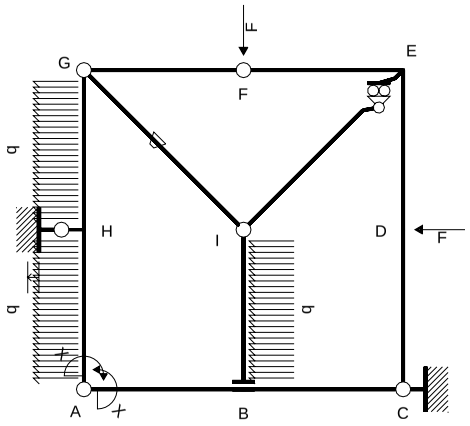

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13/6
1
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7/6
2/3
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-1/3

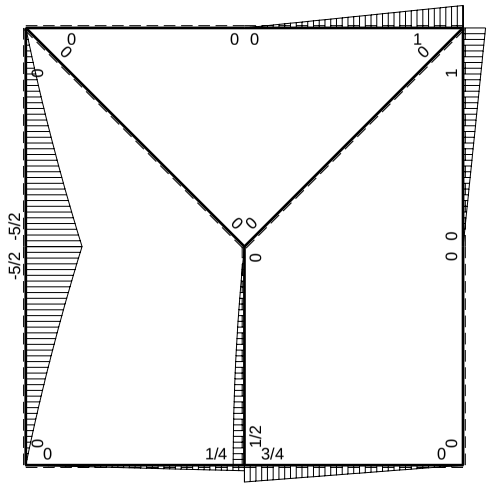

F


F

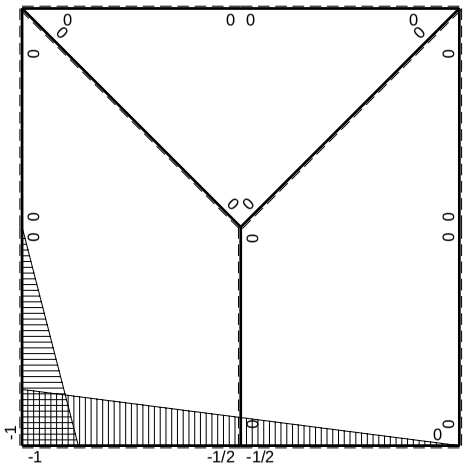

0
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0 0
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-5/2
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0 0
-5/6
1/2
1/3
0
0
-5/6
-1/6


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 218144 CI04.xxxx.003

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-3/4Fx$	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\right)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\right)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\right)\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\right)\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

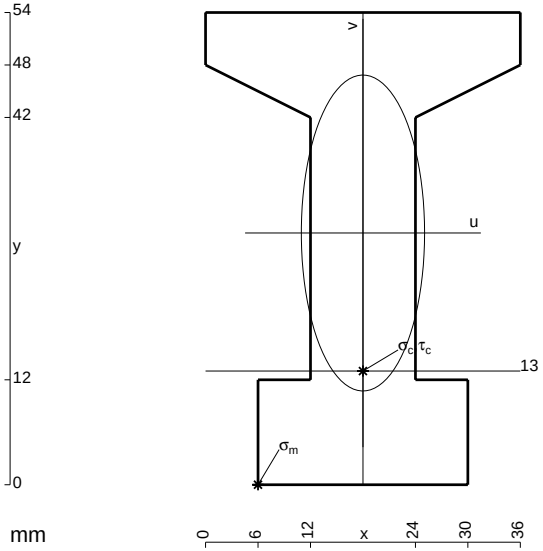
$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(5/4\ b - b + 1/8\ b\right)\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

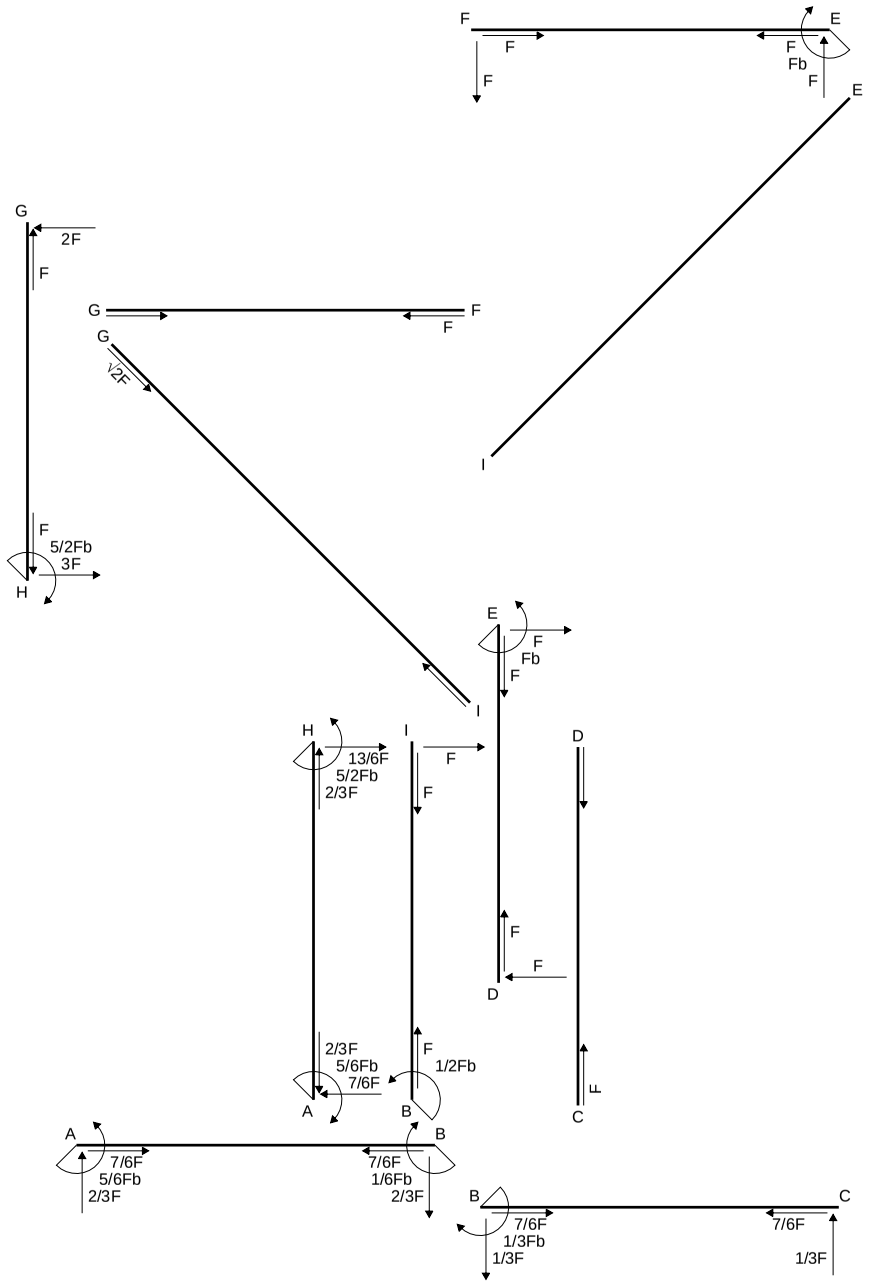
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

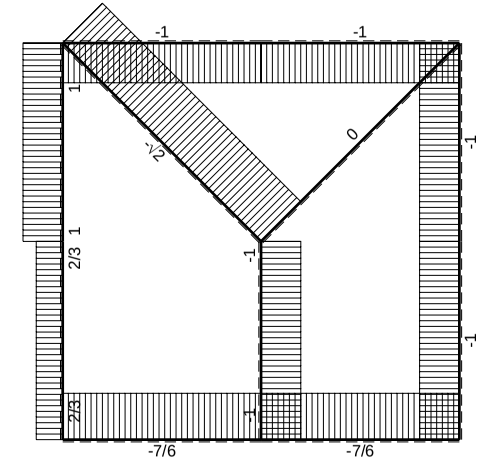
PROCEDIMENTO E RISULTATI 218144 CI04.xxxx.003

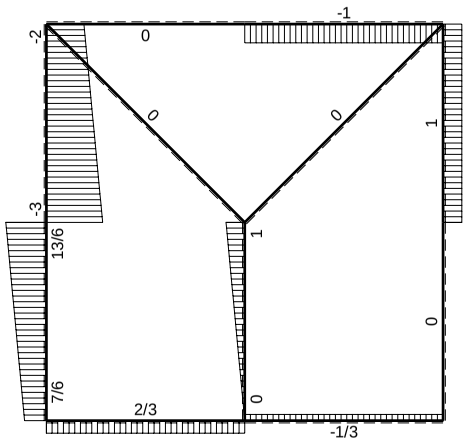


A = 1008. mm^2
J_u = 328994. mm^4
J_v = 50112. mm^4
y_g = 28.79 mm
N = 1620. N
T_y = -4860. N
M_x = -2632500. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.79 mm
$\sigma_m = N/A - Mv/J_u$ = -228.7 N/mm^2
x_c = 18. mm
y_c = 13. mm
v_c = -15.79 mm
$\sigma_c = N/A - Mv/J_u$ = -124.7 N/mm^2
τ_c = 8.319 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 125.5 N/mm^2
S^* = 6758. mm^3

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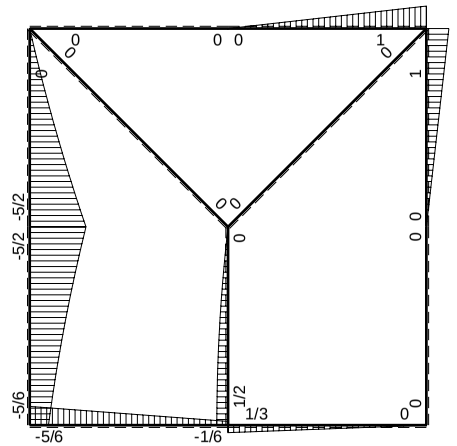

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B
C
7/6F
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1/3F
7/6F
1/3F


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-7/6

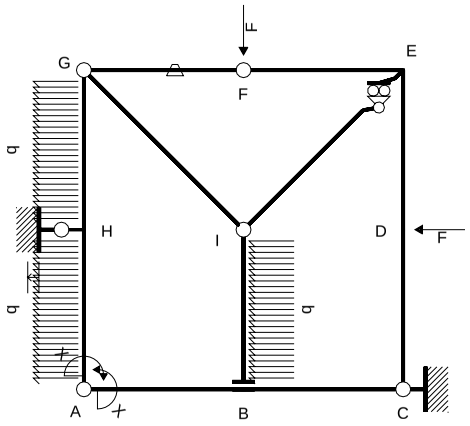

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13/6
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7/6
2/3
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-1/3

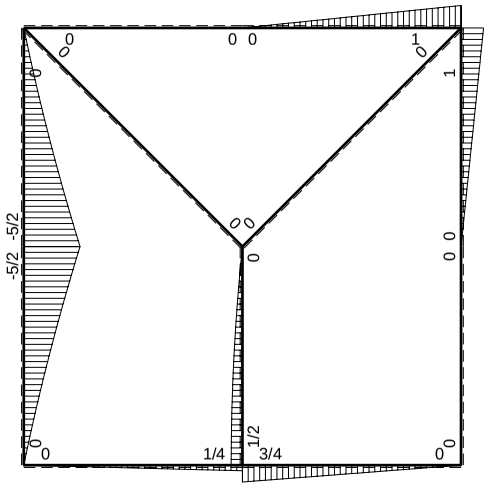
←□→ F

↑□↓ F

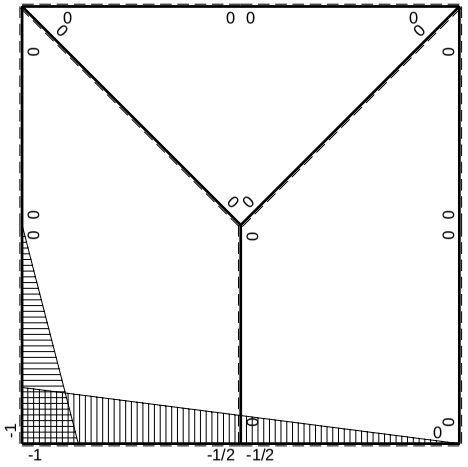

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-5/2
0 0
-5/6
1/2
1/3
0
-5/6
-1/6

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 213350 CI04.xxxx.004

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PROCEDIMENTO E RISULTATI 213350 CI04.xxxx.004

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	-Fb/EJ	0	0	0	0+0	0
GF b	0	0	Fb/EJ	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

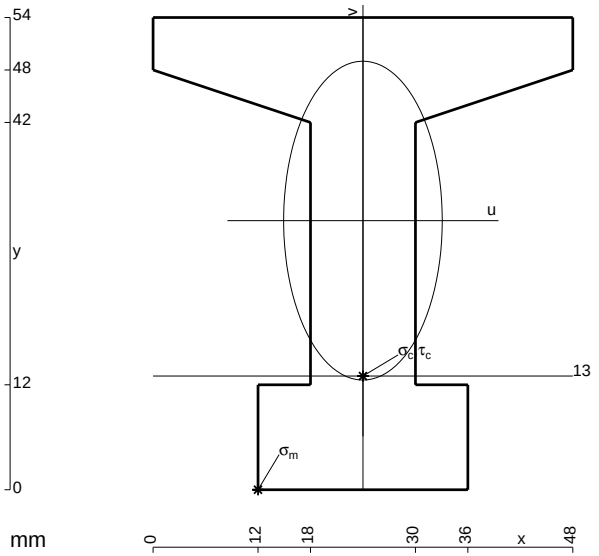
$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

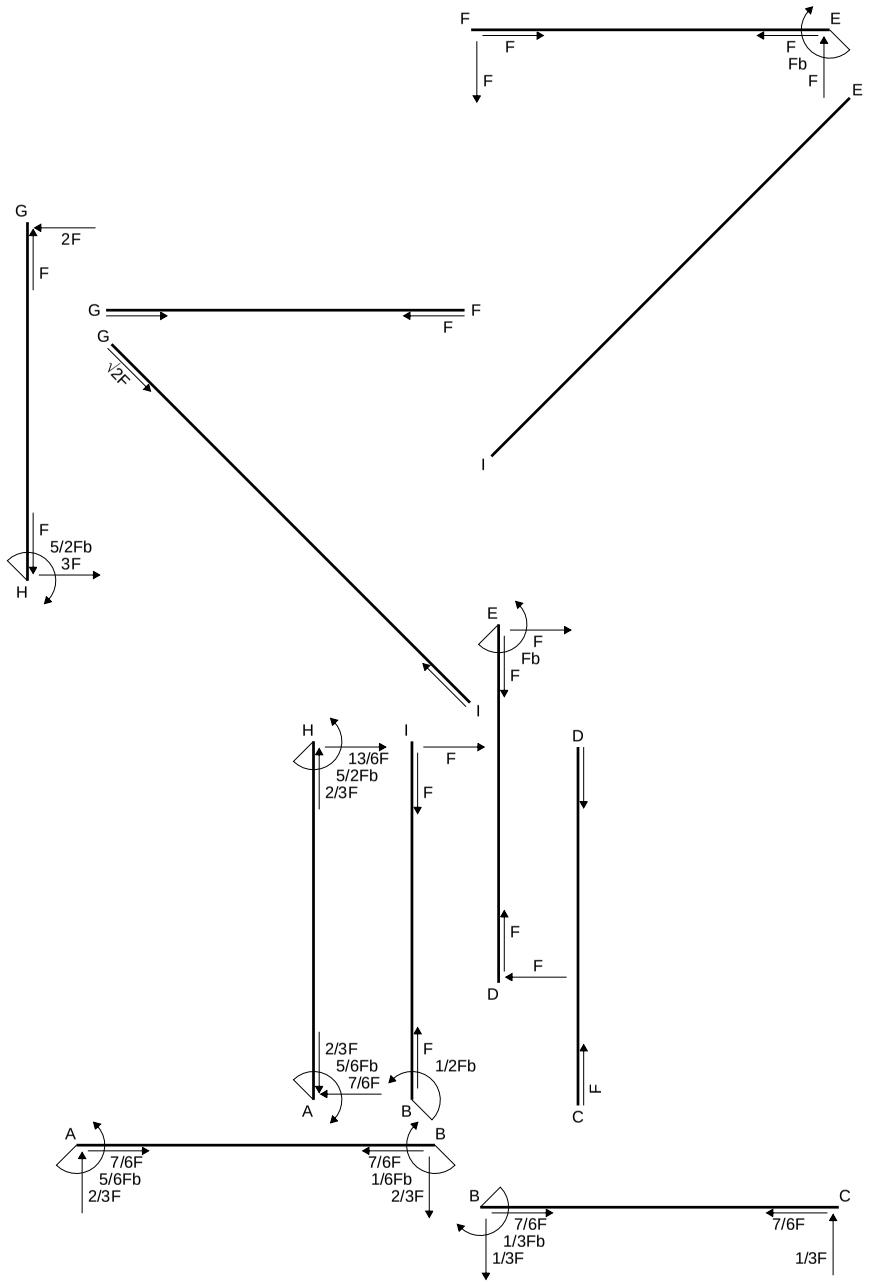
$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

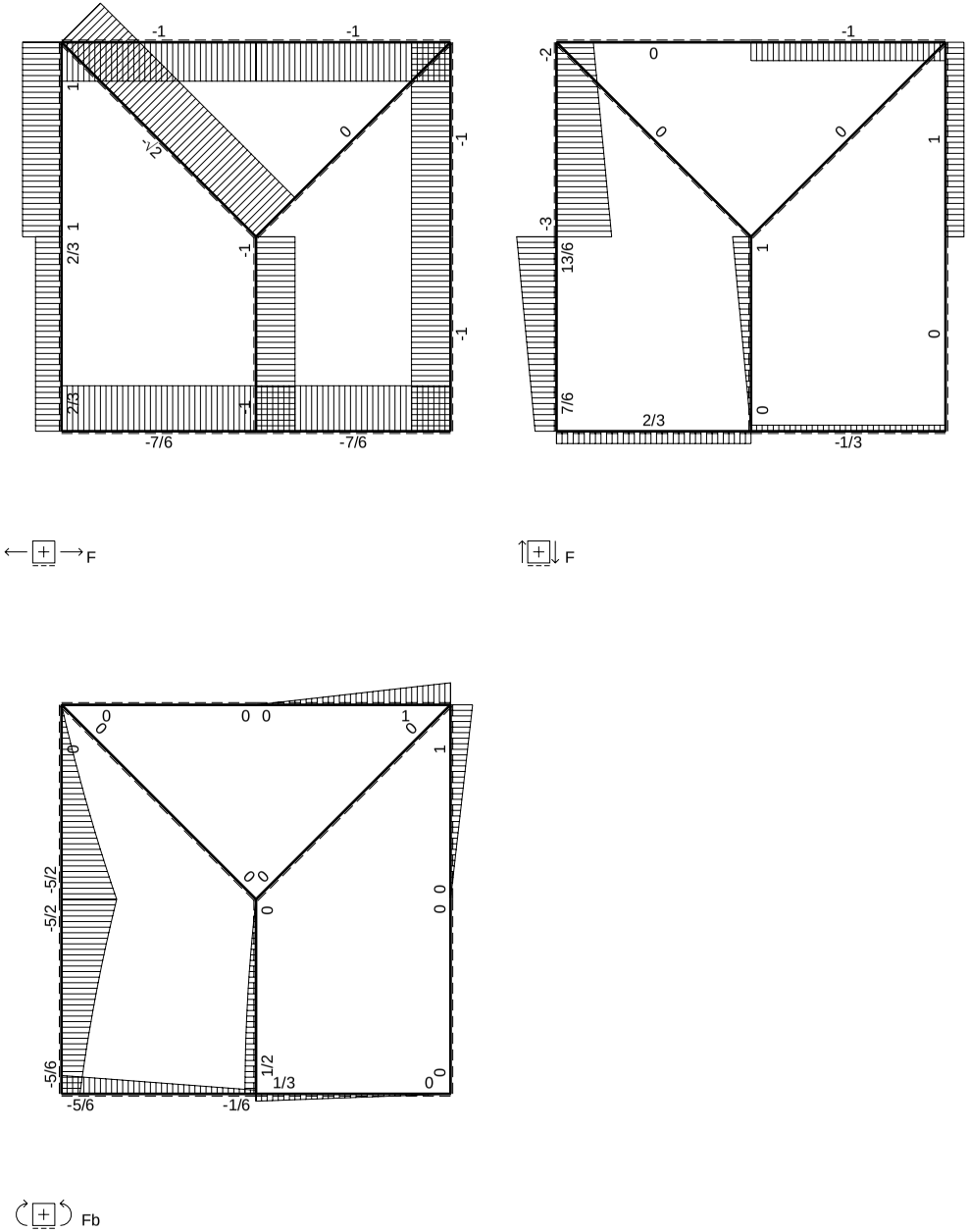
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

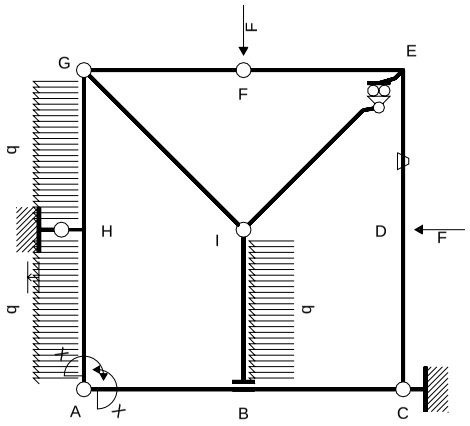
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

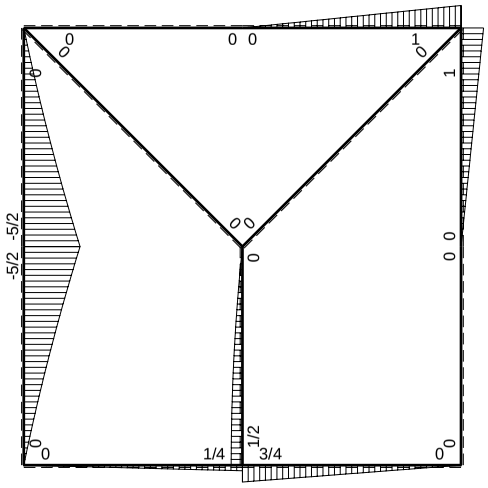


A = 1116. mm^2
J_u = 371067. mm^4
J_v = 91800. mm^4
y_g = 30.77 mm
N = 1660. N
T_y = -4980. N
M_x = -2905000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.77 mm
$\sigma_m = N/A - Mv/J_u$ = -239.4 N/mm^2
x_c = 24. mm
y_c = 13. mm
v_c = -17.77 mm
$\sigma_c = N/A - Mv/J_u$ = -137.7 N/mm^2
τ_c = 8.225 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 138.4 N/mm^2
S^* = 7354. mm^3

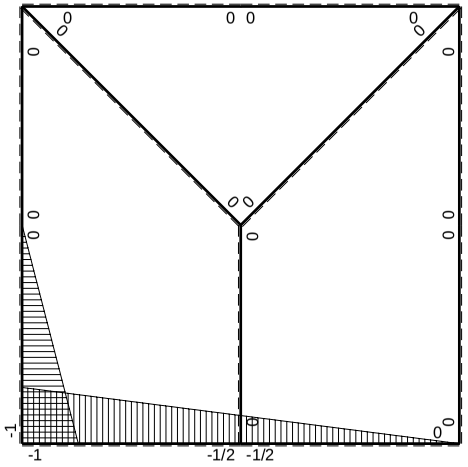

F
E
F
F
Fb
F
E
G
2F
F
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F
F
G
½F
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5/2Fb
3F
H
E
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Fb
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13/6F
5/2Fb
2/3F
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F
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D
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D
2/3F
5/6Fb
7/6F
F
1/2Fb
A
B
F
C
A
B
7/6F
5/6Fb
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7/6F
1/6Fb
2/3F
B
C
7/6F
1/3Fb
1/3F
7/6F
1/3F


-1
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1
-1
-7/6
-7/6
F
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-2
0
0
0
1
-3
13/6
1
0
7/6
2/3
0
-1/3
F
0 0
0 0
1
0
0
1
0
0
-5/2
-5/2
0
0 0
-5/6
1/2
1/3
0
0
-5/6
-1/6
Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-Fb+Fx	Fb/EJ	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

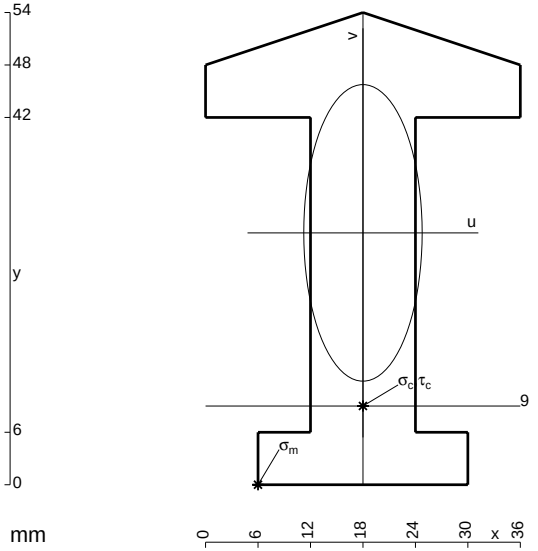
$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

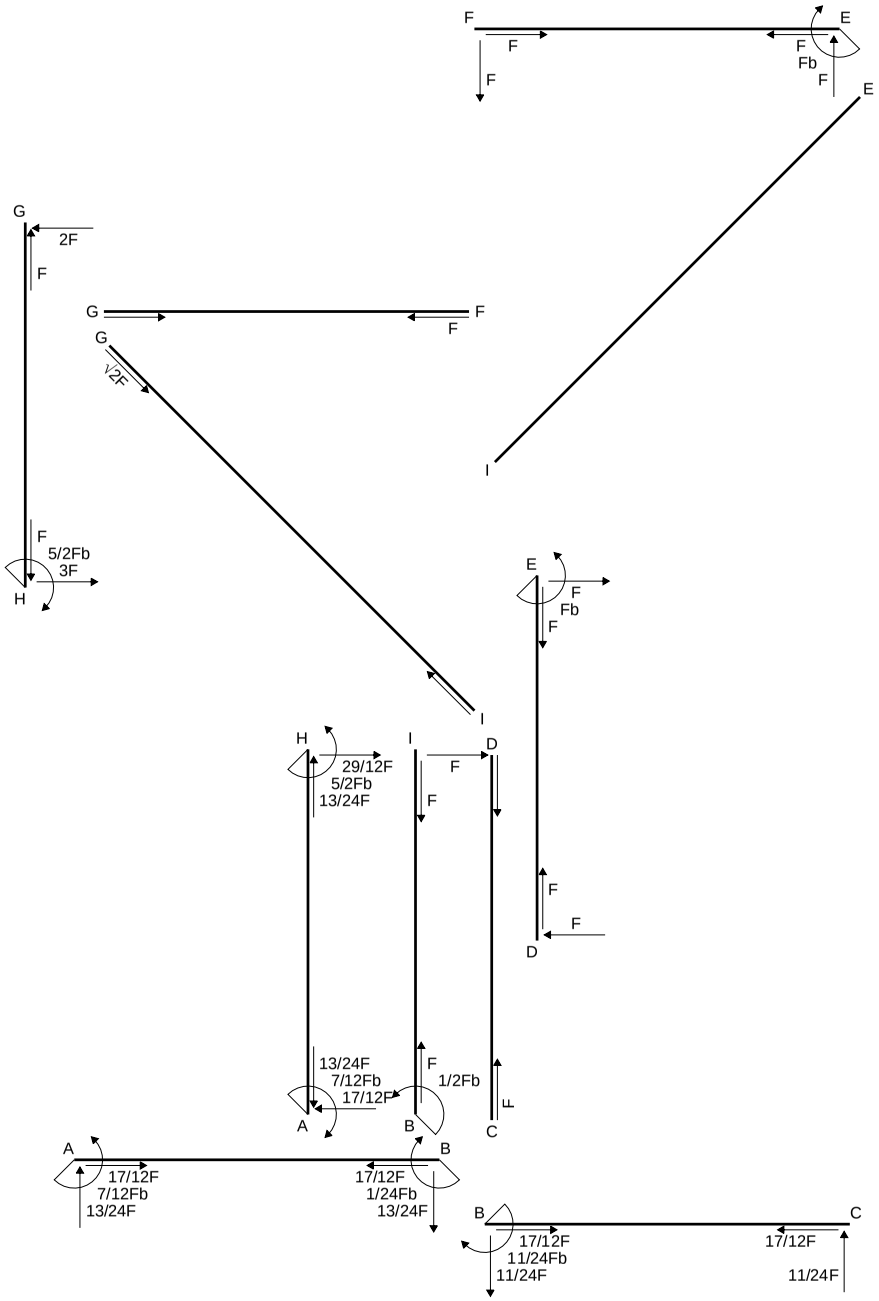
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

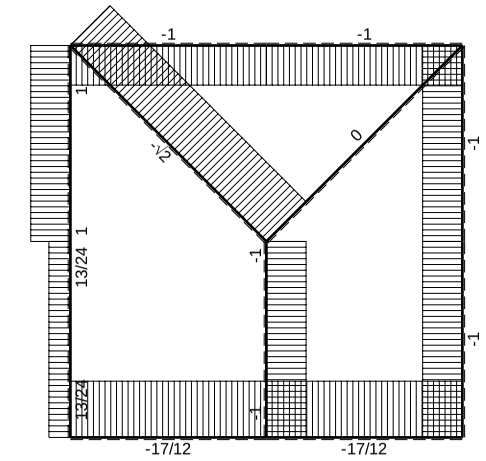
PROCEDIMENTO E RISULTATI 265319 CI04.xxxx.005

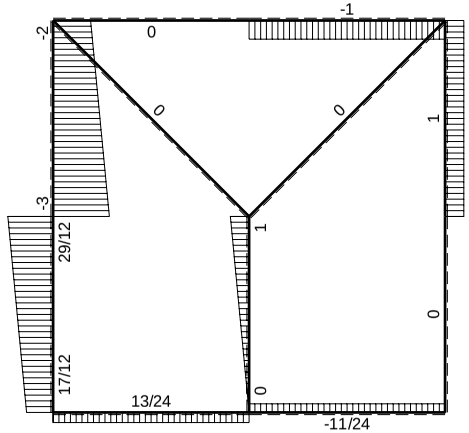


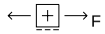
A = 900. mm^2
J_u = 258984. mm^4
J_v = 41256. mm^4
y_g = 28.8 mm
N = 960. N
T_y = -2880. N
M_x = -1800000. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.8 mm
$\sigma_m = N/A - Mv/J_u$ = -199.1 N/mm^2
x_c = 18. mm
y_c = 9. mm
v_c = -19.8 mm
$\sigma_c = N/A - Mv/J_u$ = -136.5 N/mm^2
τ_c = 4.153 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 136.7 N/mm^2
S^* = 4482. mm^3

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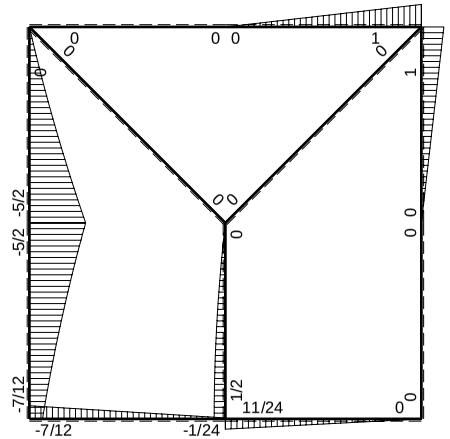

F
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Fb
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G
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G
√2F
I
F
5/2Fb
3F
H
I
E
F
Fb
F
F
F
D
H
29/12F
5/2Fb
13/24F
I
F
F
D
13/24F
7/12Fb
17/12F
A
F
1/2Fb
B
F
C
A
17/12F
7/12Fb
13/24F
B
17/12F
1/24Fb
13/24F
B
17/12F
11/24Fb
11/24F
C
17/12F
11/24F


-1
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-1/2
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-1
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-1
-17/12
-17/12

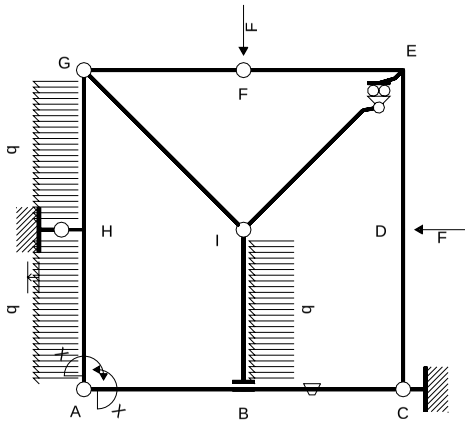

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-3
29/12
1
0
17/12
13/24
0
-11/24

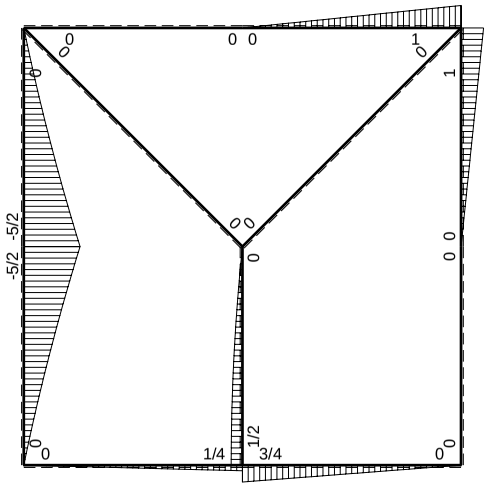

F


F

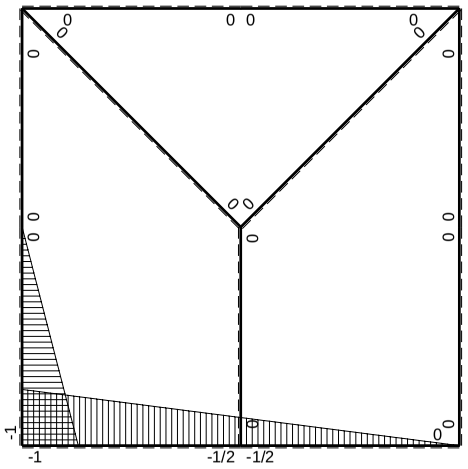

0
0 0
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0
0
1
0 0
-5/2
-5/2
0 0
0
-7/12
1/2
11/24
0
-7/12
-1/24


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 299327 CI04.xxxx.006

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	-Fb/EJ	$-3/8Fb+3/4Fx-3/8Fx^2/b$	$1/2Fb/EJ-1/2Fx/EJ$	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-3/4Fx$	Fb/EJ	$-3/8Fx^2/b$	$1/2Fx/EJ$	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/12Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1/2 - 1/2\ x/b\ \right)\ \theta\ \ dx$

$= \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x - 1/4\ x^2/b\right]_o^b\ \theta$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2\ x/b\ \right)\ \theta\ \ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/4\ x^2/b\ \right]_o^b\ \theta$

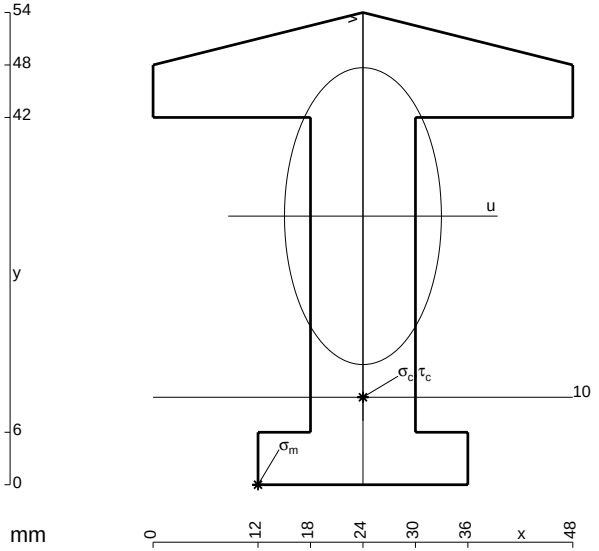
$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/4\ b\ \right)\ \theta\ \ = 1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

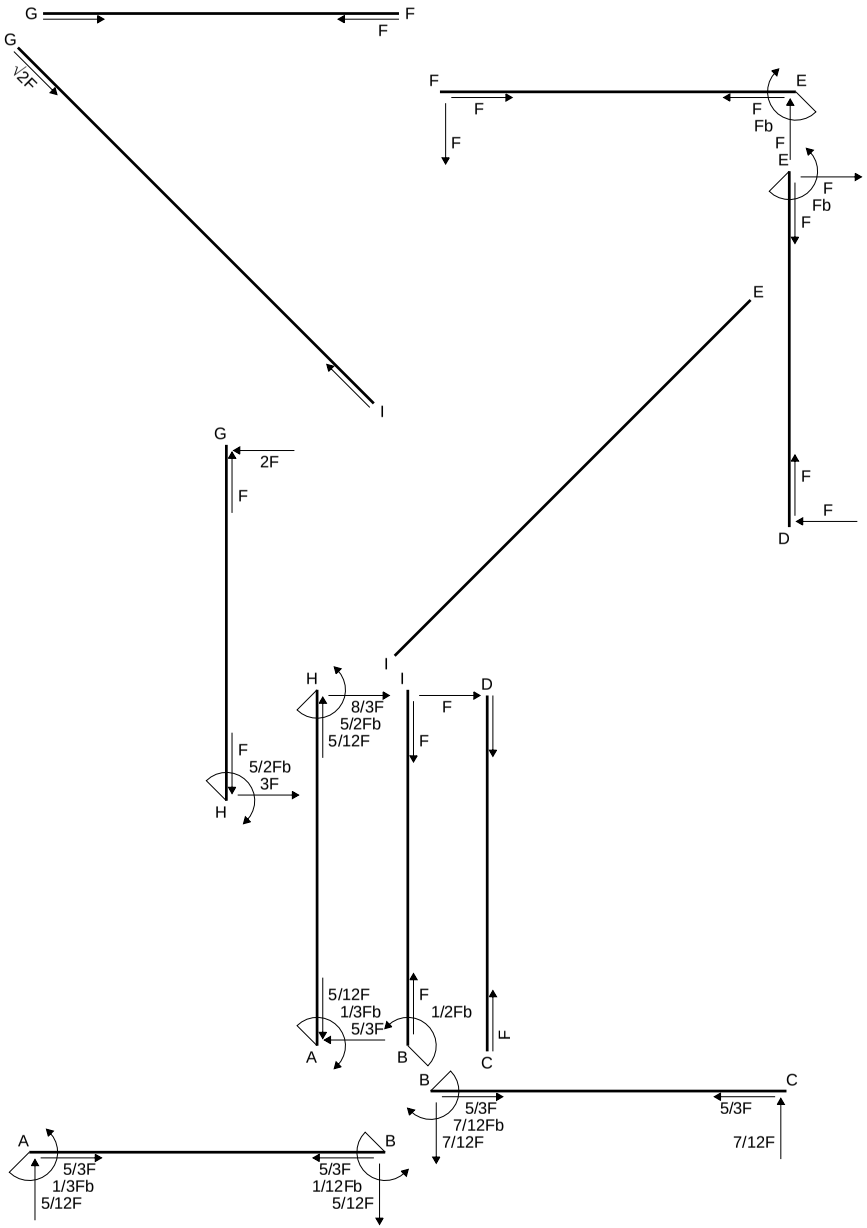
$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

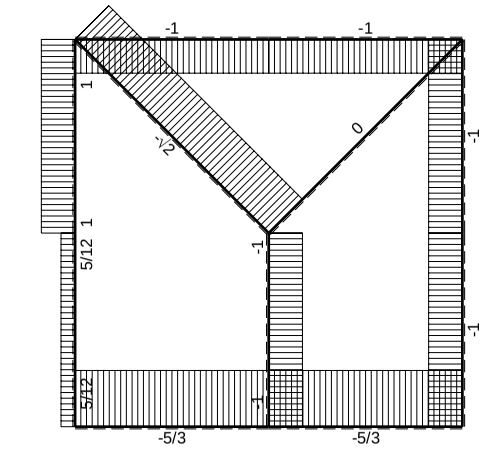
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

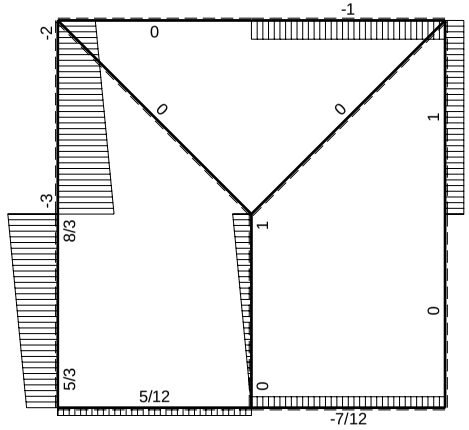


A = 1008. mm^2
J_u = 290654. mm^4
J_v = 81216. mm^4
y_g = 30.71 mm
N = 990. N
T_y = -2970. N
M_x = -1980000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.71 mm
$\sigma_m = N/A - Mv/J_u$ = -208.3 N/mm^2
x_c = 24. mm
y_c = 10. mm
v_c = -20.71 mm
$\sigma_c = N/A - Mv/J_u$ = -140.1 N/mm^2
τ_c = 4.327 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 140.3 N/mm^2
S^* = 5081. mm^3

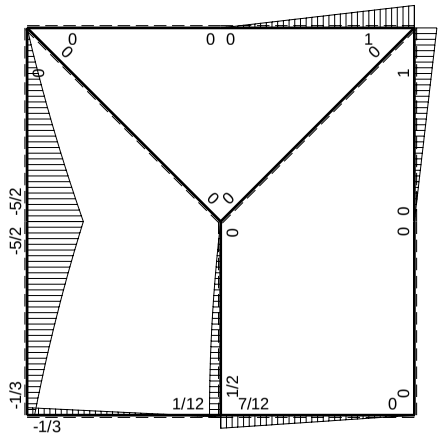

G
F
F
G
√2F
I
F
F
F
E
F
Fb
F
E
F
Fb
F
E
F
F
D
G
2F
F
F
5/2Fb
3F
H
I
H
8/3F
5/2Fb
5/12F
I
F
D
F
F
5/12F
1/3Fb
5/3F
A
F
1/2Fb
B
F
C
B
5/3F
7/12Fb
7/12F
C
5/3F
7/12F
A
5/3F
1/3Fb
5/12F
B
5/3F
1/12Fb
5/12F


-1
-1
1
-√2
0
-1
-1
5/12 1
-1
-1
5/12
-1
-5/3
-5/3

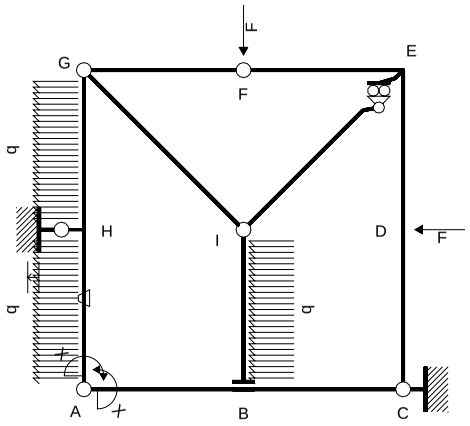
F

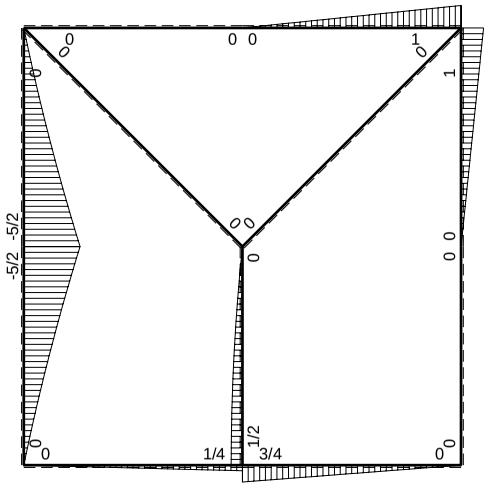

-2
0
-1
0
0
1
-3
8/3
1
5/3
0
5/12
0
-7/12

F

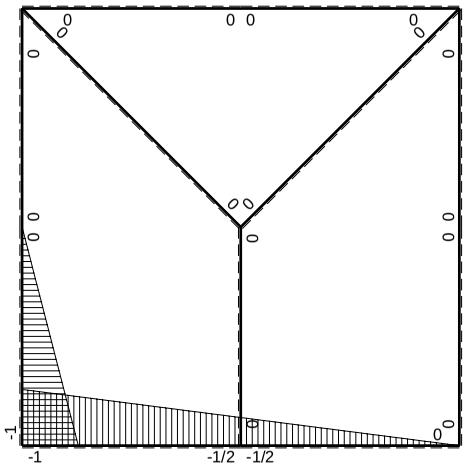

0
0 0
1
0
0
1
0 0
-5/2
-5/2
0
0 0
-1/3
1/12
1/2
7/12
0
0
-1/3

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 248501 CI04.xxxx.007

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PROCEDIMENTO E RISULTATI 248501 CI04.xxxx.007

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-3/4Fx$	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	-Fb/EJ	$5/2Fx-3Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(3/8+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	Fb/EJ	$2Fx-3/2Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/3Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/3Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\ \theta\ \ dx$

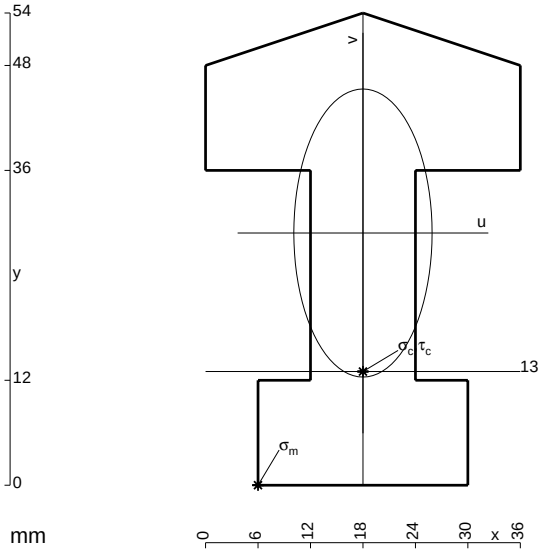
$= \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b\ \theta$

$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b\ \right)\ \theta\ \ = 7/8\ \ Fb^2/EJ$

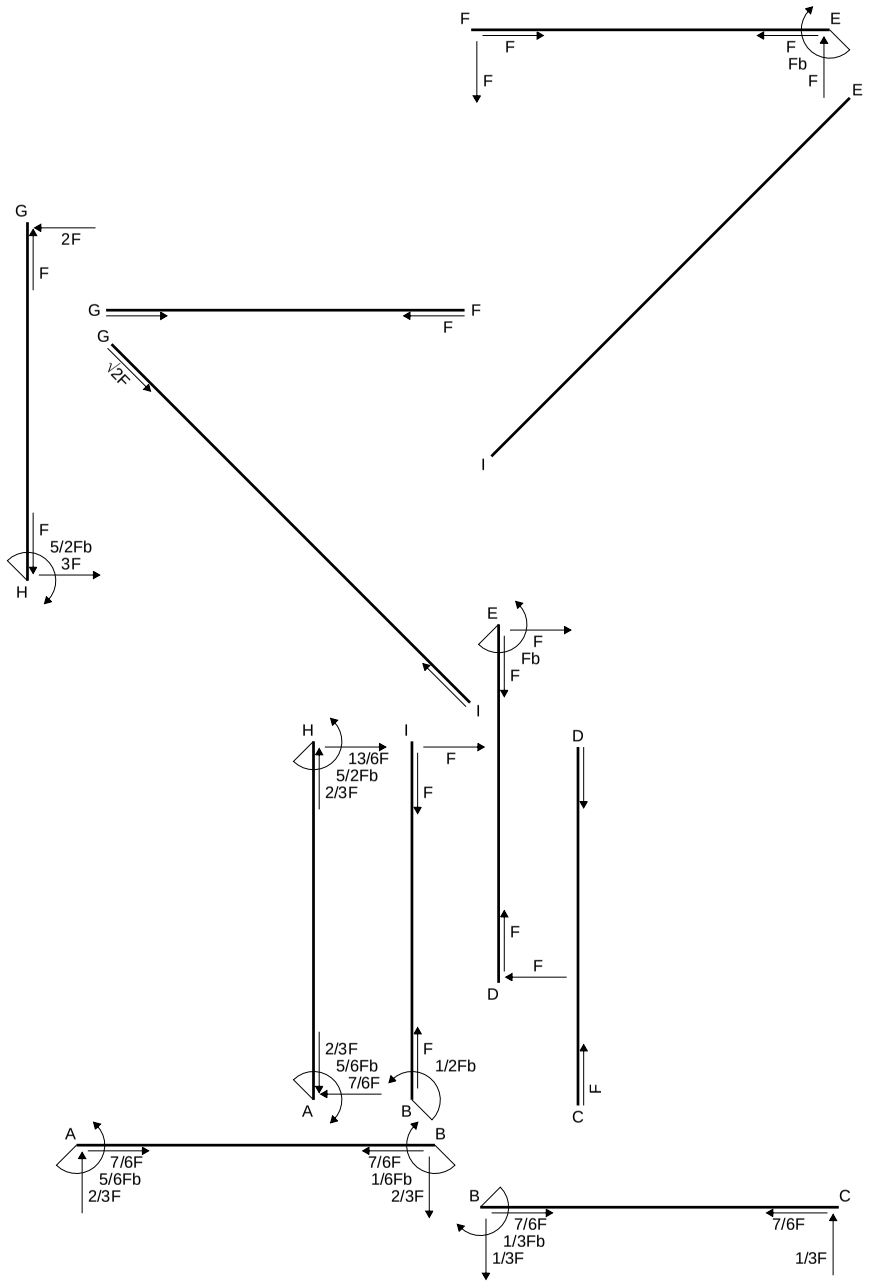
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\ \theta\ \ dx$

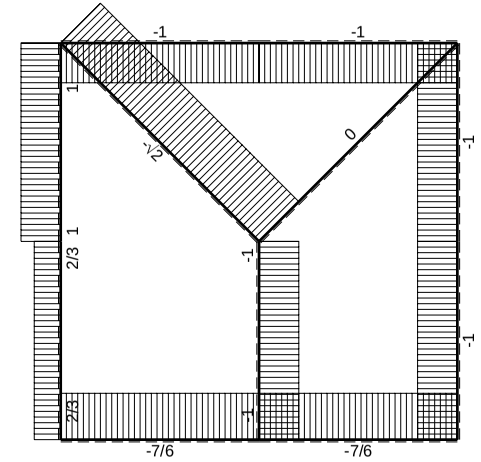
$= \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b\ \theta$

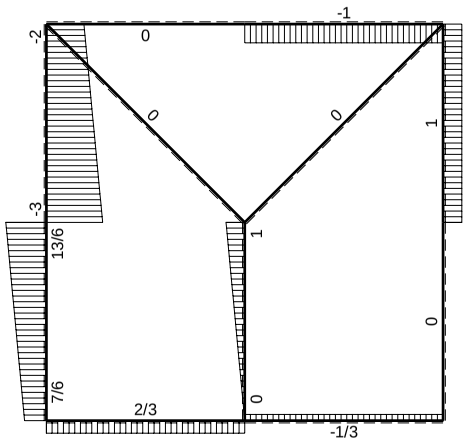
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\ \theta\ \ = 7/8\ \ Fb^2/EJ$

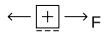


A = 1116. mm^2
J_u = 302839. mm^4
J_v = 69768. mm^4
y_g = 28.84 mm
N = 1090. N
T_y = -3270. N
M_x = -2316250. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.84 mm
$\sigma_m = N/A - Mv/J_u$ = -219.6 N/mm^2
x_c = 18. mm
y_c = 13. mm
v_c = -15.84 mm
$\sigma_c = N/A - Mv/J_u$ = -120.2 N/mm^2
τ_c = 6.095 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 120.6 N/mm^2
S^* = 6774. mm^3

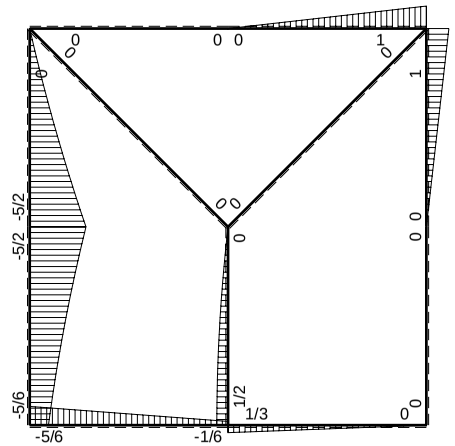

F
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F
F
G
½F
I
F
5/2Fb
3F
H
E
F
Fb
F
H
I
13/6F
5/2Fb
2/3F
I
F
F
D
F
F
D
2/3F
5/6Fb
7/6F
A
F
1/2Fb
B
F
C
A
B
7/6F
5/6Fb
2/3F
7/6F
1/6Fb
2/3F
B
C
7/6F
1/3Fb
1/3F
7/6F
1/3F


-1
-1
1
½
0
-1
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-1
-1
2/3
1
-7/6
-7/6

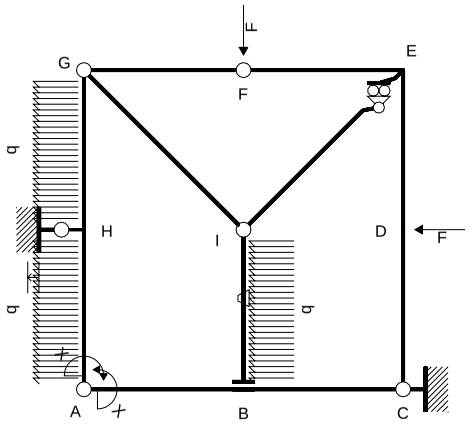

-1
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1
-3
13/6
1
0
7/6
2/3
0
-1/3

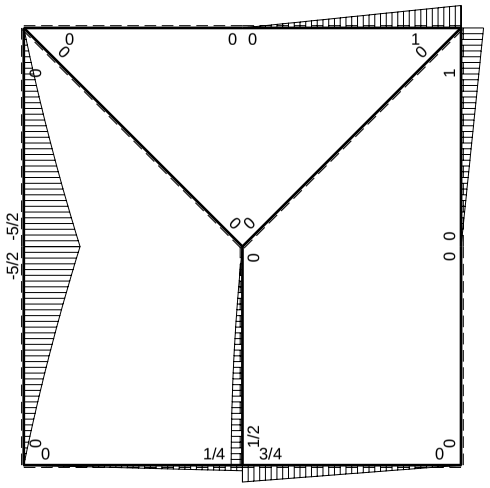

F


F

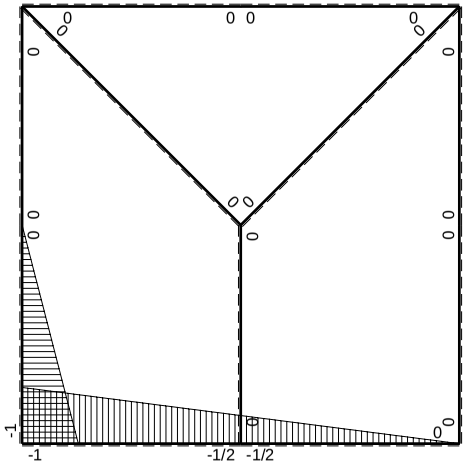

0
0 0
1
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1
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0
0
0
-5/2
-5/2
0 0
-5/6
1/2
1/3
0
-5/6
-1/6


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 267042 CI04.xxxx.008

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PROCEDIMENTO E RISULTATI 267042 CI04.xxxx.008

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b (-1/4\ x/b + 1/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/8\ x^2/b + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b (-1/8 + 1/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-1/8\ x + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b (-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-3/8\ b + 3/8\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-3/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b\ )\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

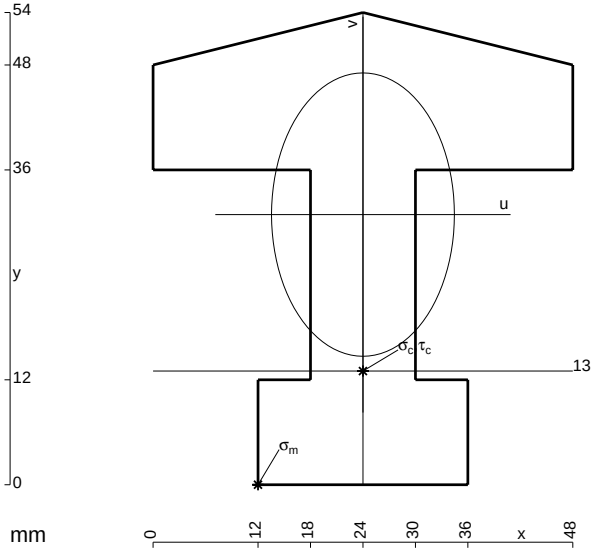
$L^{Xo}_{HA} = \int_o^b (5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (5/4\ b - b + 1/8\ b\ )\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

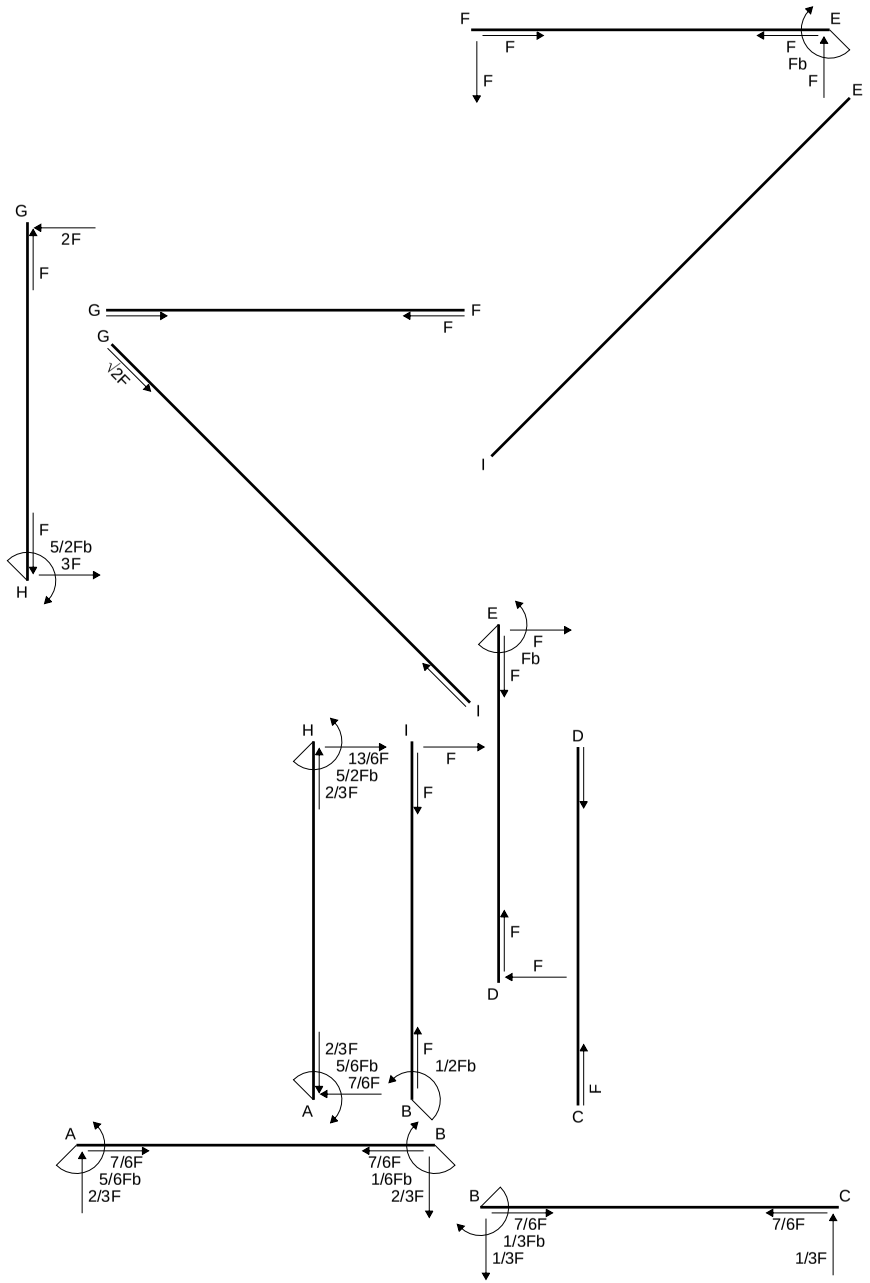
$L^{Xo}_{AH} = \int_o^b (2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

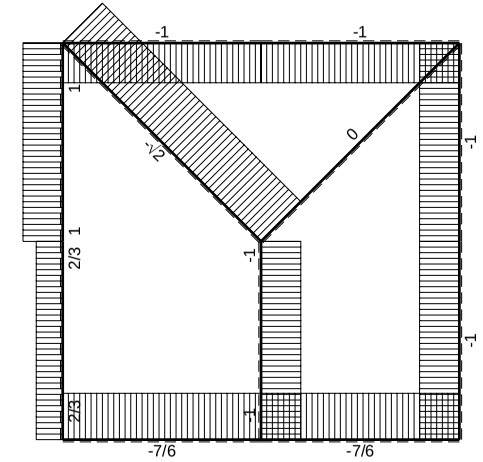
$= (\ b - 1/2\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

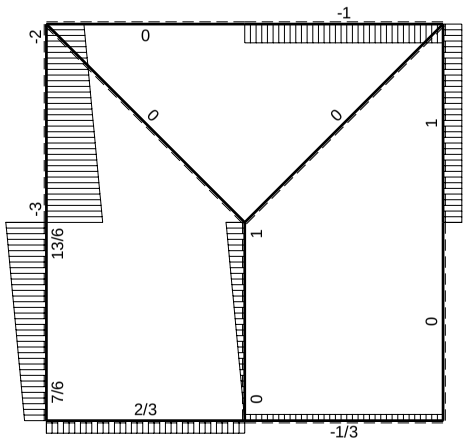
PROCEDIMENTO E RISULTATI 267042 CI04.xxxx.008



A = 1296. mm^2
J_u = 340256. mm^4
J_v = 141696. mm^4
y_g = 30.89 mm
N = 1130. N
T_y = -3390. N
M_x = -2542500. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.89 mm
$\sigma_m = N/A - Mv/J_u$ = -229.9 N/mm^2
x_c = 24. mm
y_c = 13. mm
v_c = -17.89 mm
$\sigma_c = N/A - Mv/J_u$ = -132.8 N/mm^2
τ_c = 6.134 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 133.2 N/mm^2
S^* = 7389. mm^3

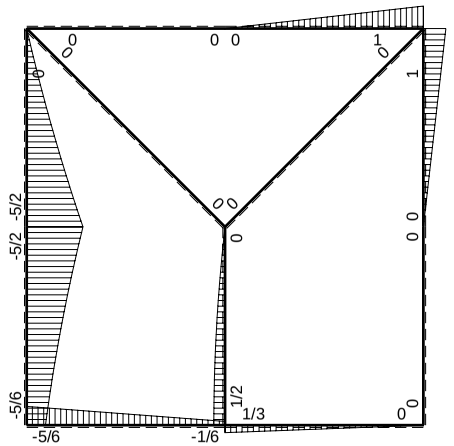

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F
Fb
F
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H
13/6F
5/2Fb
2/3F
I
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F
D
F
F
D
2/3F
5/6Fb
7/6F
F
1/2Fb
A
B
F
C
A
B
7/6F
5/6Fb
2/3F
7/6F
1/6Fb
2/3F
B
C
7/6F
1/3Fb
1/3F
7/6F
1/3F


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-½
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-1
-1
2/3
1
-7/6
-7/6

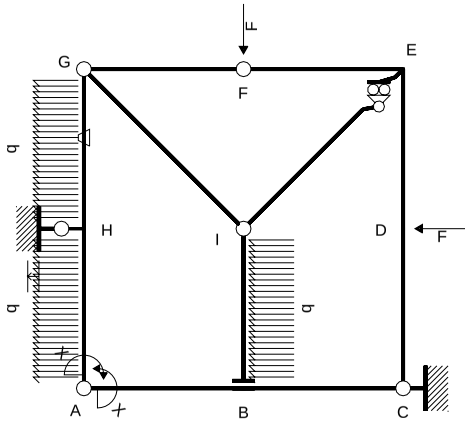

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-3
13/6
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0
7/6
2/3
0
-1/3

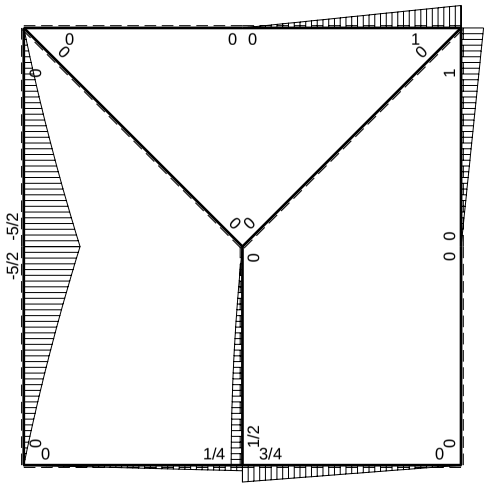
←□→ F

↑□↓ F

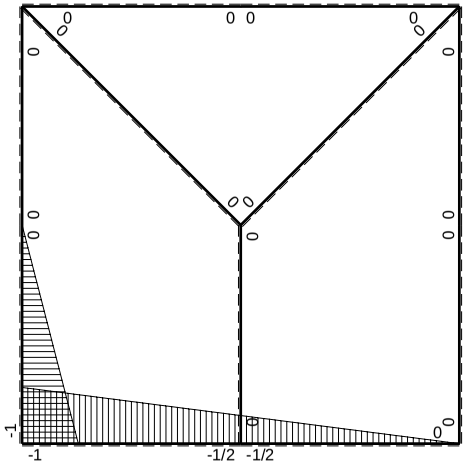

0
0 0
1
0
0
1
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0
0
-5/2
-5/2
0 0
-5/6
1/2
1/3
0
0
-5/6
-1/6

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 266299 CI04.xxxx.009

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PROCEDIMENTO E RISULTATI 266299 CI04.xxxx.009

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

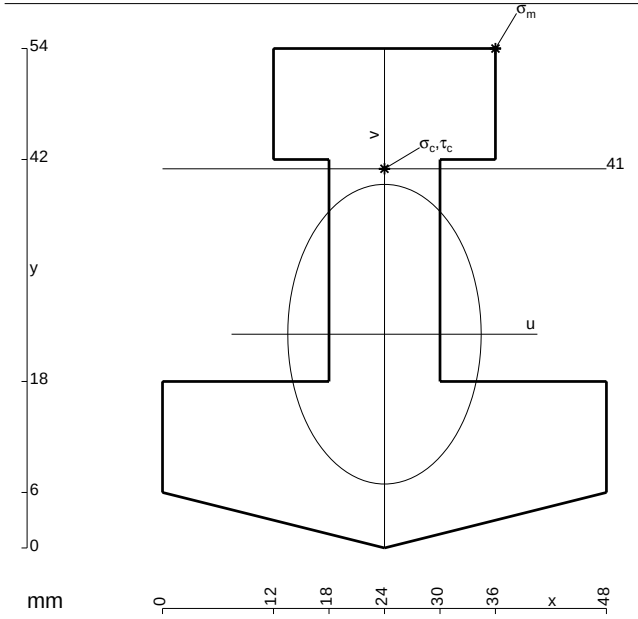
$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

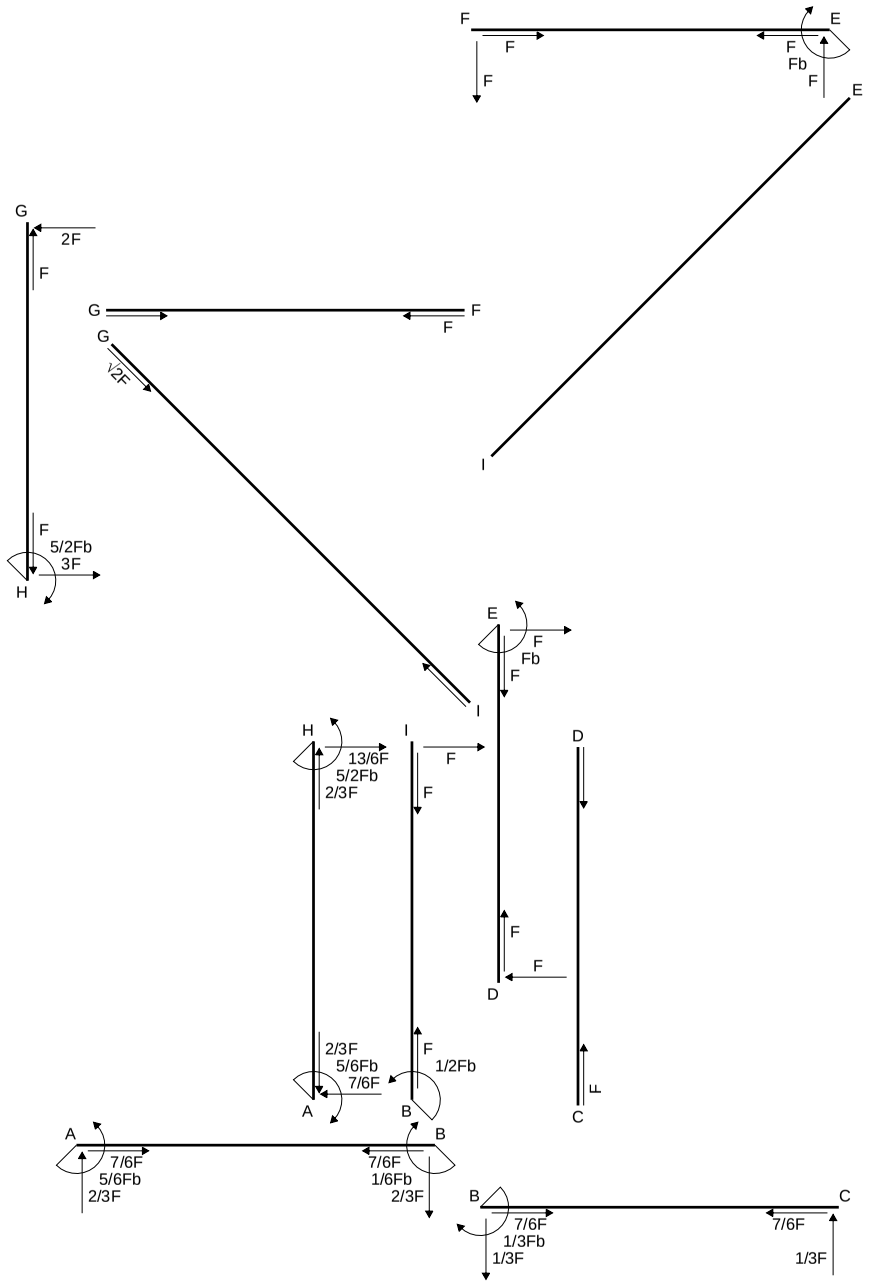
$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

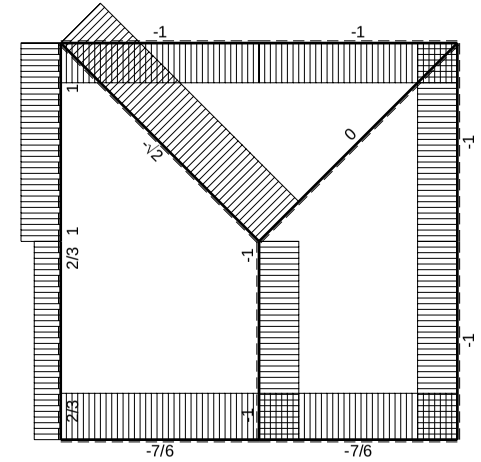
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

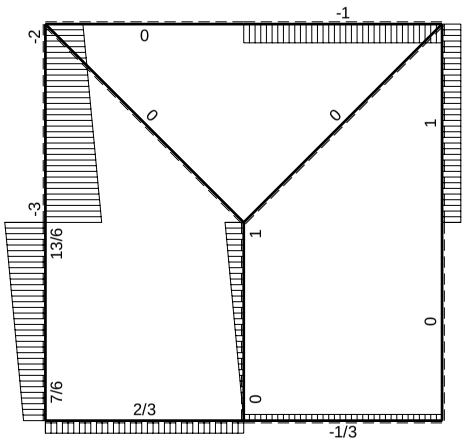
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$



A = 1296. mm^2
J_u = 340256. mm^4
J_v = 141696. mm^4
y_g = 23.11 mm
N = 1100. N
T_y = -3300. N
M_x = -2612500. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 30.89 mm
$\sigma_m = N/A - Mv/J_u$ = 238. N/mm^2
x_c = 24. mm
y_c = 41. mm
v_c = 17.89 mm
$\sigma_c = N/A - Mv/J_u$ = 138.2 N/mm^2
τ_c = 5.972 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 138.6 N/mm^2
S^* = 7389. mm^3

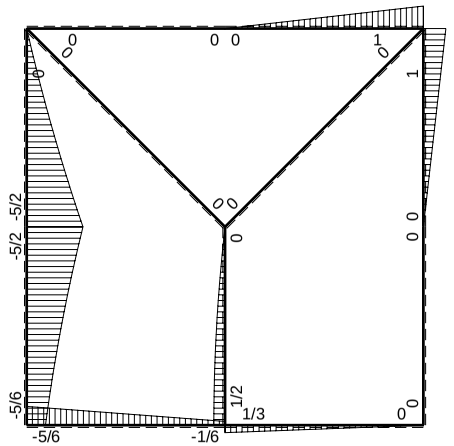

F
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F
Fb
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2F
F
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F
F
G
½F
I
F
5/2Fb
3F
H
E
F
Fb
F
I
H
13/6F
5/2Fb
2/3F
I
F
F
D
F
F
D
2/3F
5/6Fb
7/6F
F
1/2Fb
A
B
F
C
A
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7/6F
5/6Fb
2/3F
7/6F
1/6Fb
2/3F
B
C
7/6F
1/3Fb
1/3F
7/6F
1/3F


-1
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-1
2/3
1
-7/6
-7/6

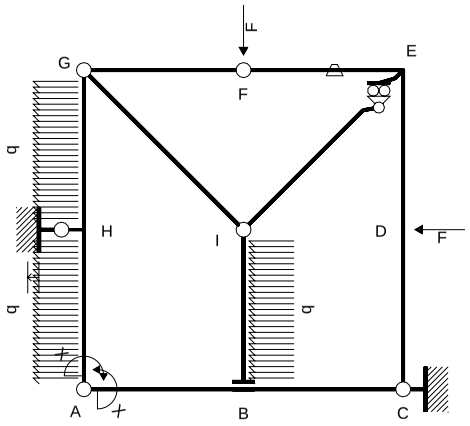

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1
0
7/6
2/3
0
-1/3

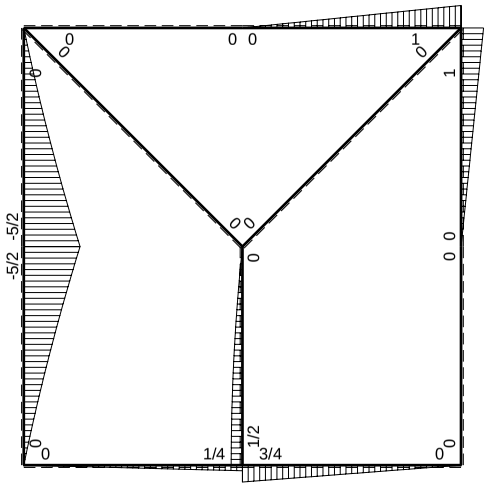
←□→ F

↑□↓ F

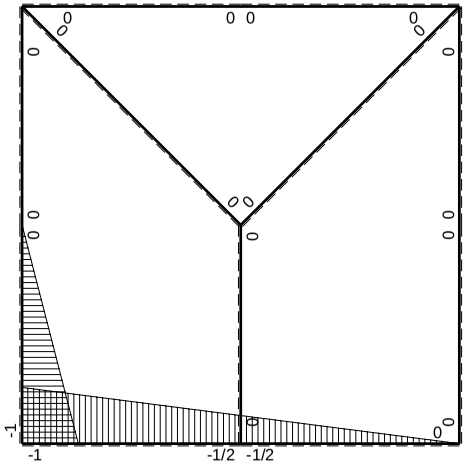

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-5/2
0 0
-5/6
1/2
1/3
0
-5/6
-1/6

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 937106 CI04.xxxx.010

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	-Fb/EJ	0	0	0	0+0	0
FE b	0	-Fx	Fb/EJ	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

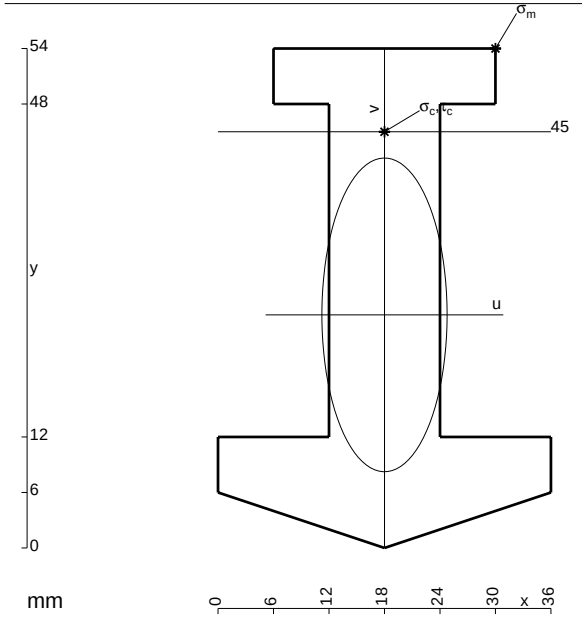
$$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

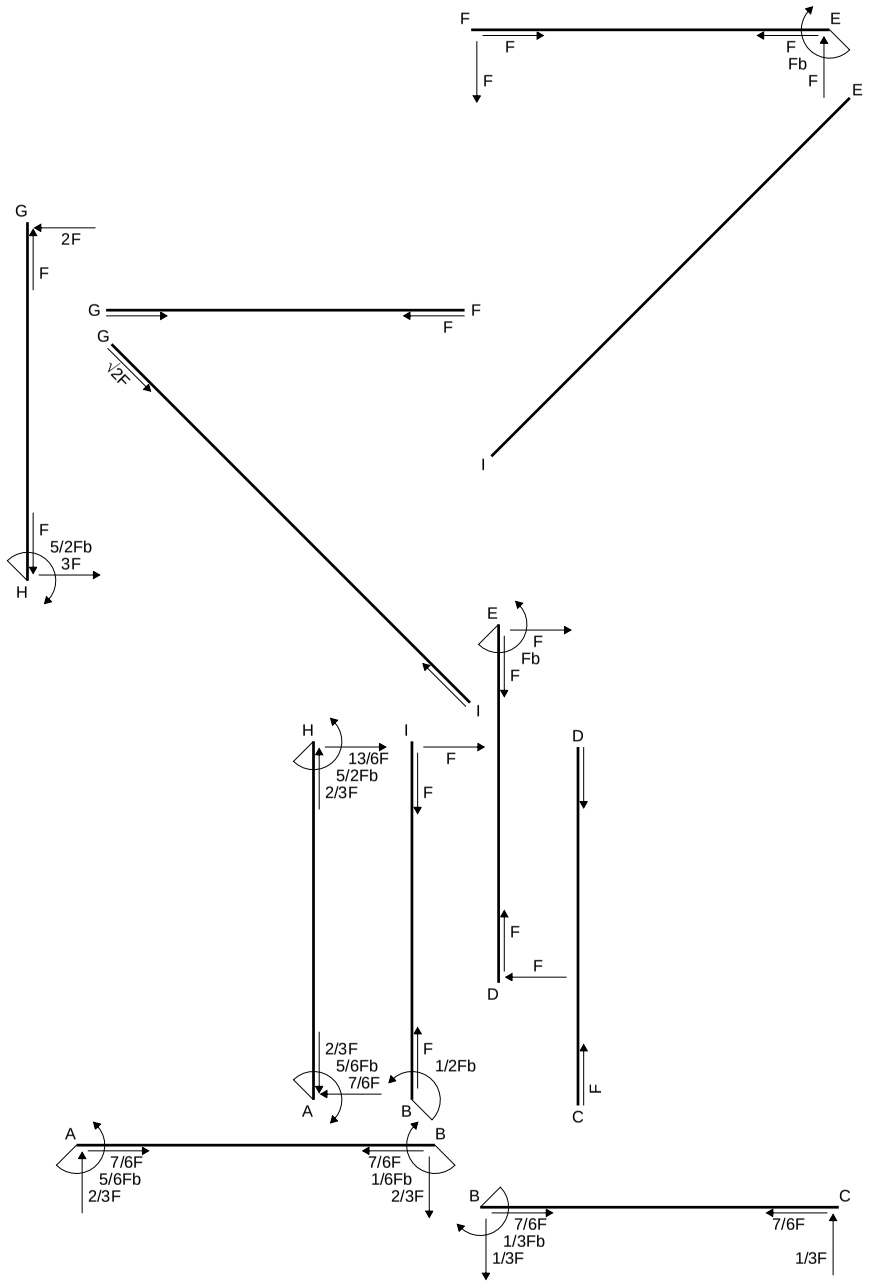
$$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

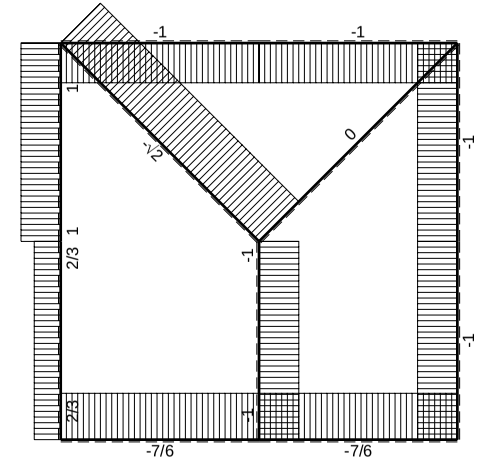
$$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$

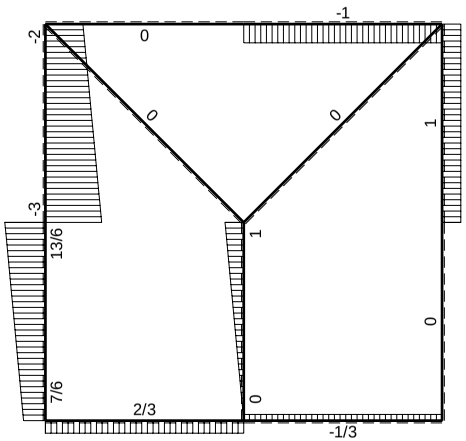
$$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$



A = 900. mm^2
J_u = 258984. mm^4
J_v = 41256. mm^4
y_g = 25.2 mm
N = 1420. N
T_y = -4260. N
M_x = -1775000. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 28.8 mm
$\sigma_m = N/A - Mv/J_u$ = 199. N/mm^2
x_c = 18. mm
y_c = 45. mm
v_c = 19.8 mm
$\sigma_c = N/A - Mv/J_u$ = 137.3 N/mm^2
τ_c = 6.144 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 137.7 N/mm^2
S^* = 4482. mm^3

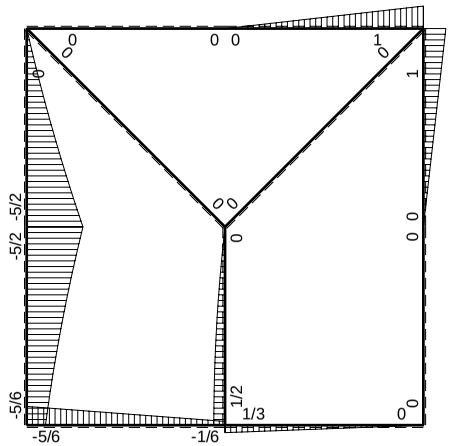

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Fb
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H
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D
13/6F
5/2Fb
2/3F
I
F
F
F
D
2/3F
5/6Fb
7/6F
F
1/2Fb
A
B
C
F
A
B
7/6F
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2/3F
B
C
7/6F
1/3Fb
1/3F
7/6F
1/3F


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-1
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1
-7/6
-7/6

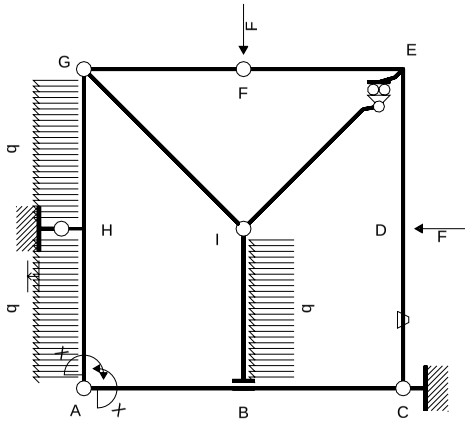

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-1/3

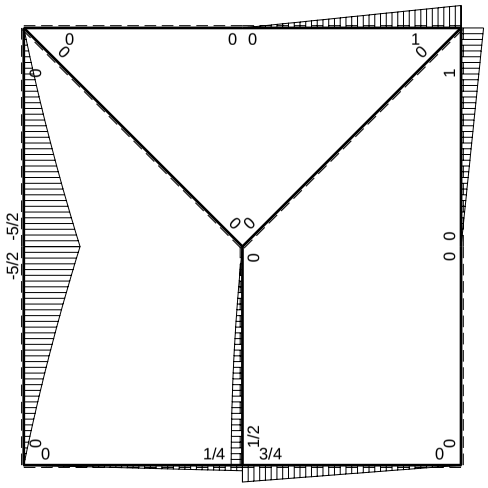
←□→ F

↑□↓ F

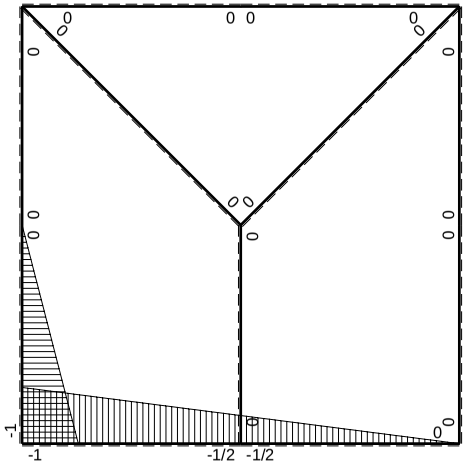

0
0 0
1
0
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0
-5/2
-5/2
0 0
-5/6
1/2
1/3
0
0
-5/6
-1/6

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 265724 CI04.xxxx.011

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PROCEDIMENTO E RISULTATI 265724 CI04.xxxx.011

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	-Fb/EJ	0	0	0	0+0	0
DC b	0	0	Fb/EJ	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

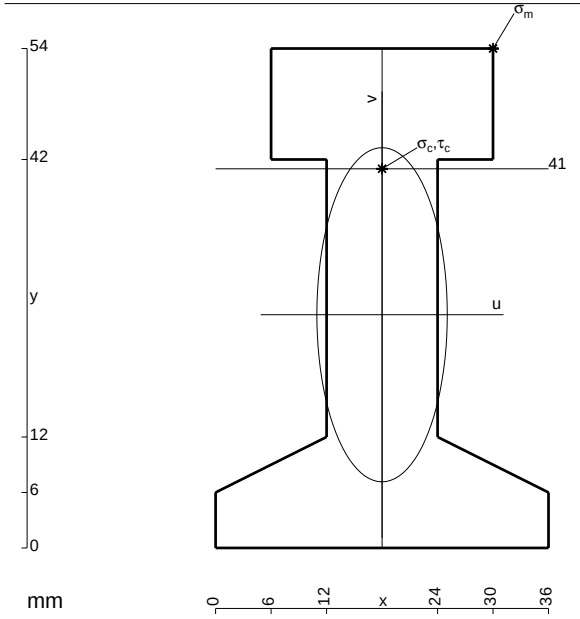
$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

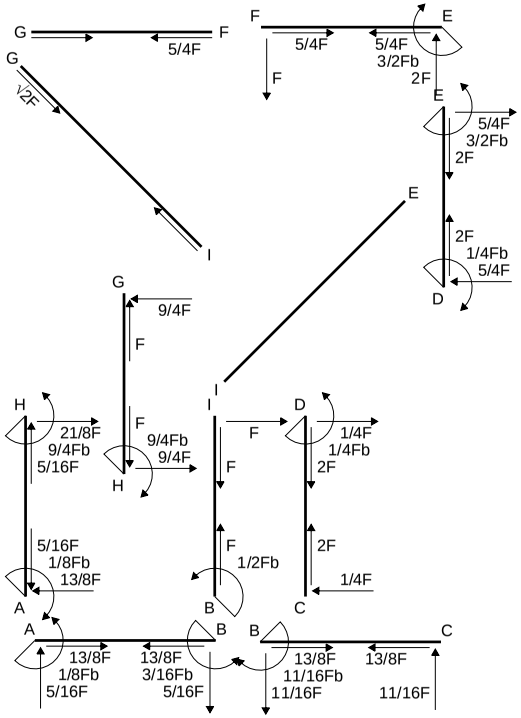
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

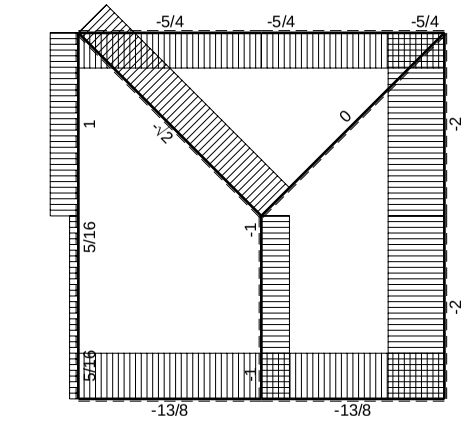
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

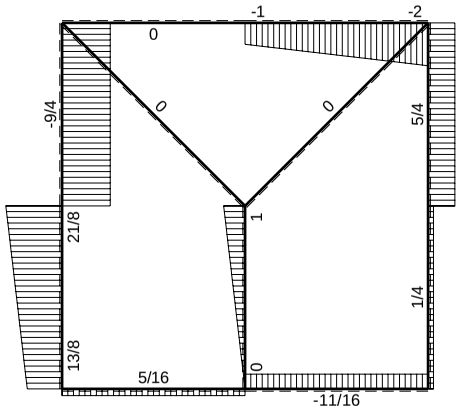
PROCEDIMENTO E RISULTATI 265724 CI04.xxxx.011



A = 1008. mm^2
J_u = 328994. mm^4
J_v = 50112. mm^4
y_g = 25.21 mm
N = 1730. N
T_y = -5190. N
M_x = -2378750. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 28.79 mm
$\sigma_m = N/A - Mv/J_u$ = 209.8 N/mm^2
x_c = 18. mm
y_c = 41. mm
v_c = 15.79 mm
$\sigma_c = N/A - Mv/J_u$ = 115.9 N/mm^2
τ_c = 8.884 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 116.9 N/mm^2
S^* = 6758. mm^3

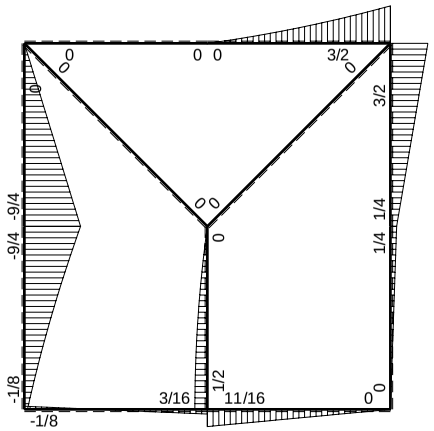

G
F
5/4F
G
√2F
I
F
5/4F
5/4F
3/2Fb
2F
F
E
E
5/4F
3/2Fb
2F
E
2F
1/4Fb
5/4F
D
G
9/4F
F
H
21/8F
9/4Fb
5/16F
H
F
9/4Fb
9/4F
I
I
F
F
D
1/4F
1/4Fb
2F
5/16F
1/8Fb
13/8F
A
F
1/2Fb
B
2F
1/4F
C
A
B
B
C
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13/8F
11/16Fb
11/16F
13/8F
11/16F


-5/4
-5/4
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√2
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5/16
-1
-2
5/16
-1
-13/8
-13/8

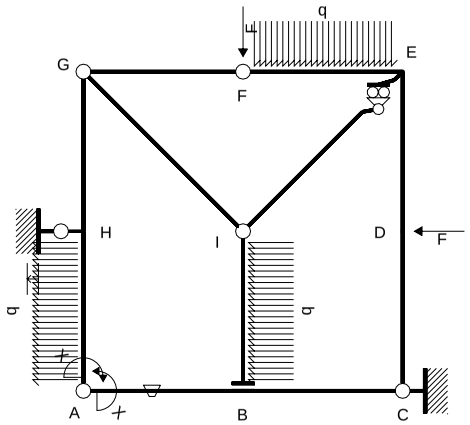

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-9/4
0
0
5/4
1
21/8
1/4
13/8
5/16
0
-11/16

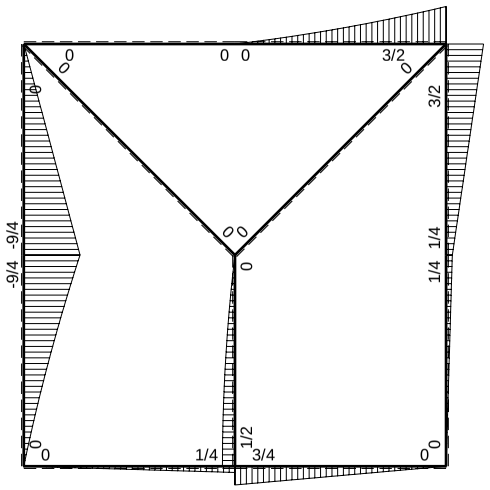
F

F

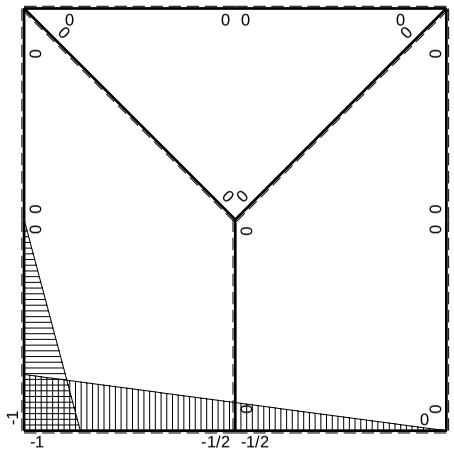

0
0 0
3/2
0
0
3/2
-9/4
0 0
0
-9/4
1/4
1/4
-1/8
3/16
-1/2
11/16
0
0
-1/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 248385 CI04.xxxx.012

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	-Fb/EJ	$-1/4Fx+1/8Fx^2/b$	Fb/EJ-1/2Fx/EJ	$1-x/b+1/4x^2/b^2$	$(-1/12+3/4)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb+1/4Fx	Fb/EJ	$-1/8Fb+1/8Fx^2/b$	1/2Fb/EJ+1/2Fx/EJ	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1 - 1/2\ x/b\ \right)\ \theta\ \ dx$

$= \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ + \left(\ b - 1/4\ b\ \right)\ \theta\ \ = 2/3\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2 - 1/2\ x/b\ \right)\ \theta\ \ dx$

$= \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 2/3\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

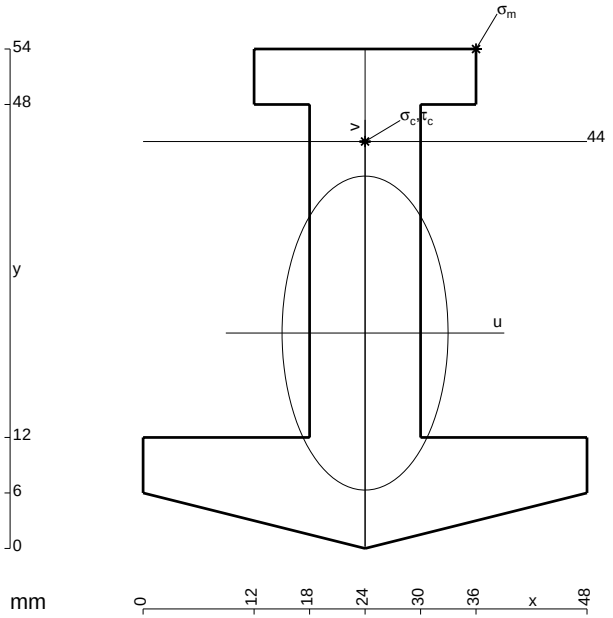
$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

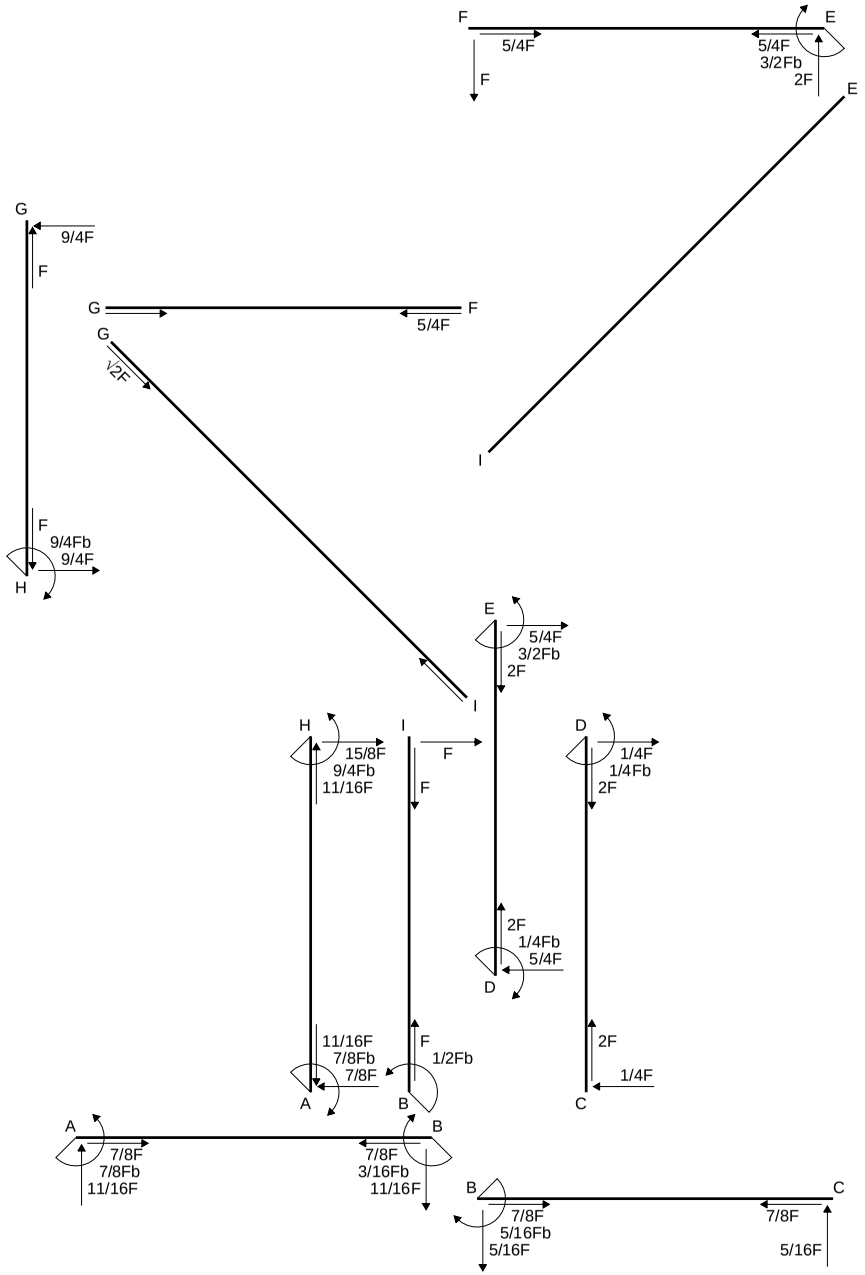
$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

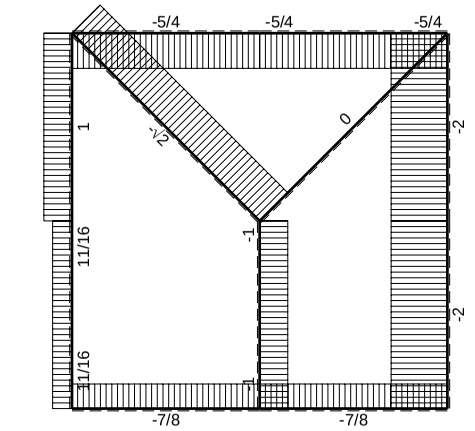
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

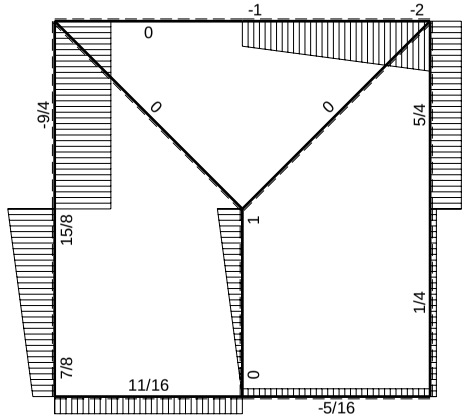
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$



A = 1008. mm^2
J_u = 290654. mm^4
J_v = 81216. mm^4
y_g = 23.29 mm
N = 1530. N
T_y = -3443. N
M_x = -2065500. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 30.71 mm
$\sigma_m = N/A - Mv/J_u$ = 219.8 N/mm^2
x_c = 24. mm
y_c = 44. mm
v_c = 20.71 mm
$\sigma_c = N/A - Mv/J_u$ = 148.7 N/mm^2
τ_c = 5.015 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 149. N/mm^2
S^* = 5081. mm^3

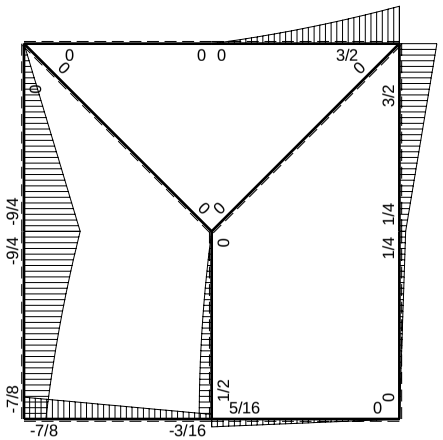

F
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2F
F
E
G
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G
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7/8F
A
F
1/2Fb
B
2F
1/4F
C
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7/8Fb
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B
7/8F
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11/16F
B
7/8F
5/16Fb
5/16F
C
7/8F
5/16F


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11/16
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-7/8

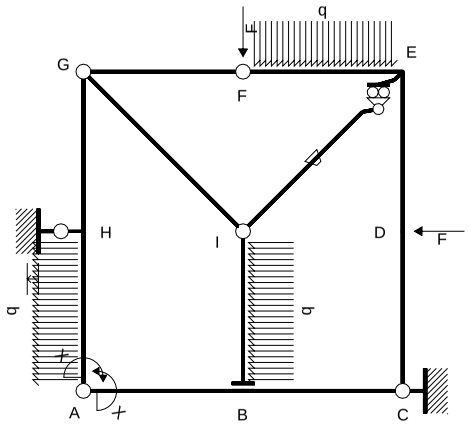

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5/4
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15/8
1/4
7/8
0
11/16
-5/16

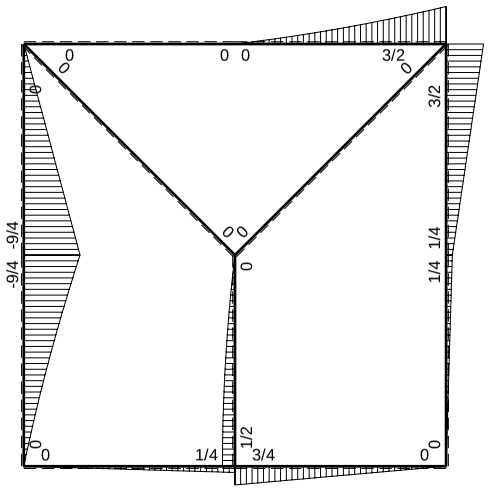
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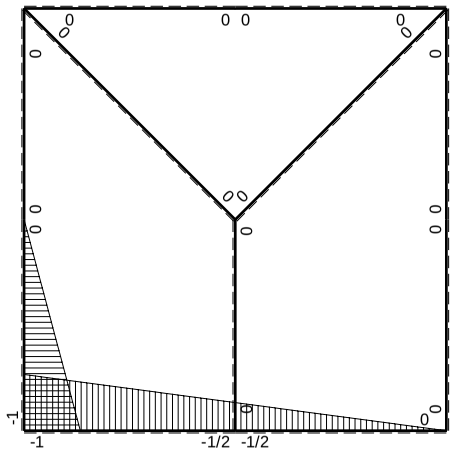

0
0 0
3/2
0
0
3/2
-9/4
0
0
-9/4
1/4
1/4
0
-7/8
1/2
5/16
0
0
-7/8
-3/16

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 984264 CI04.xxxx.013

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PROCEDIMENTO E RISULTATI 984264 CI04.xxxx.013

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

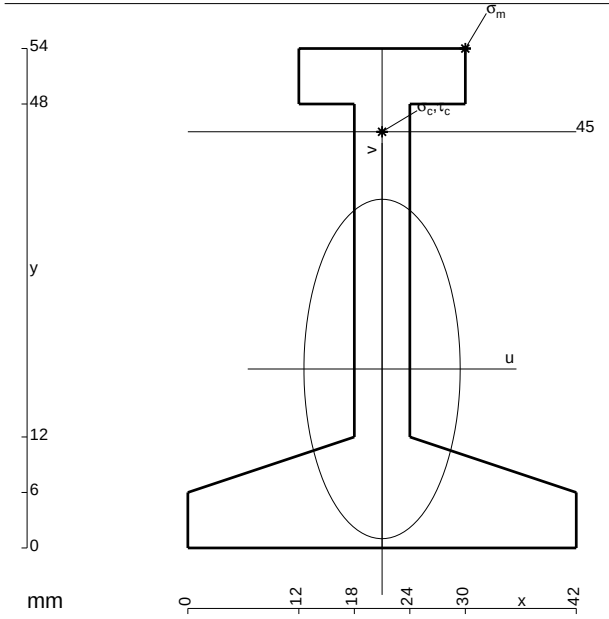
$$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

$$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

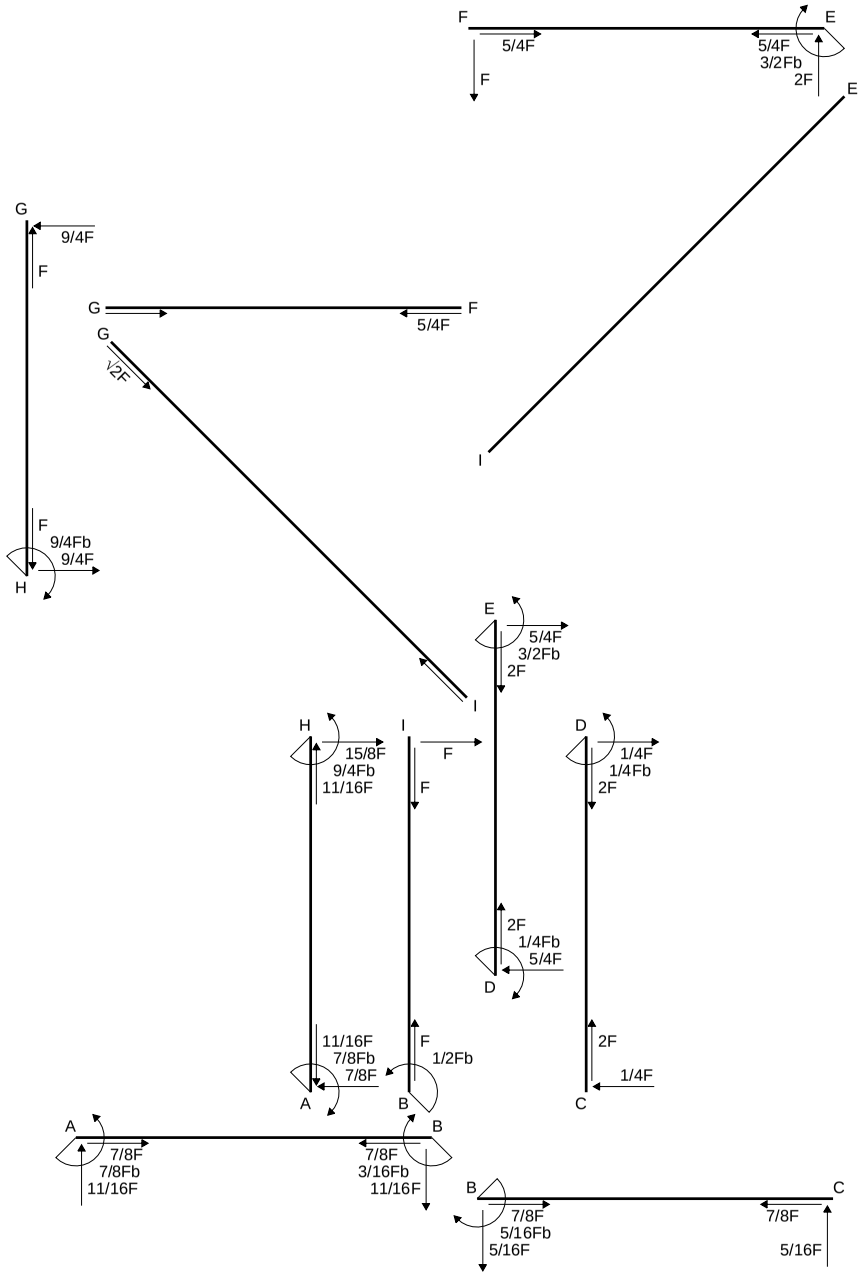
$$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

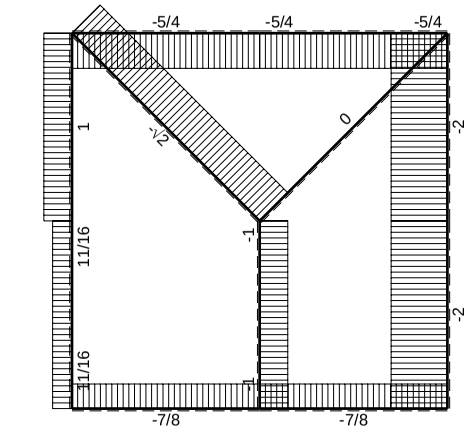
PROCEDIMENTO E RISULTATI 984264 CI04.xxxx.013



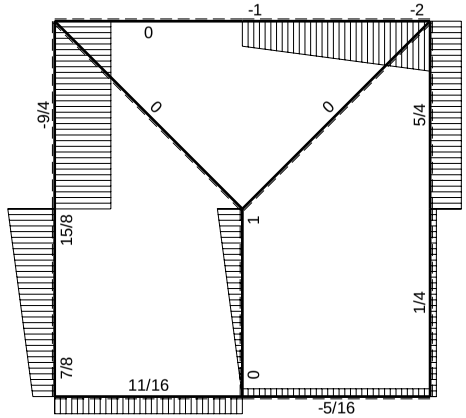
A = 720. mm^2
J_u = 242552. mm^4
J_v = 51408. mm^4
y_g = 19.35 mm
N = 1090. N
T_y = -2453. N
M_x = -1594130. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 9. mm
v_m = 34.65 mm
σ_m = N/A-Mv/J_u = 229.2 N/mm^2
x_c = 21. mm
y_c = 45. mm
v_c = 25.65 mm
σ_c = N/A-Mv/J_u = 170.1 N/mm^2
τ_c = 6.584 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 170.5 N/mm^2
S^* = 3907. mm^3

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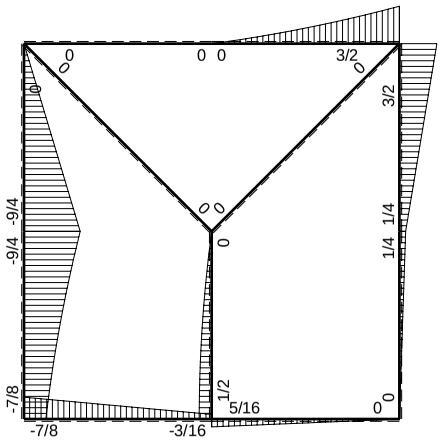




F

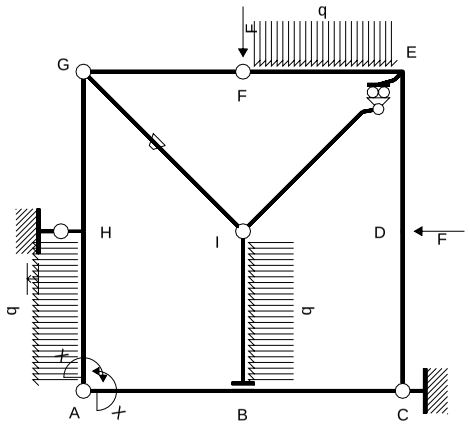


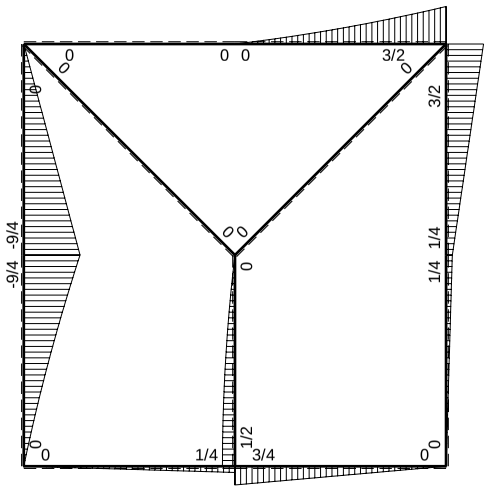
F



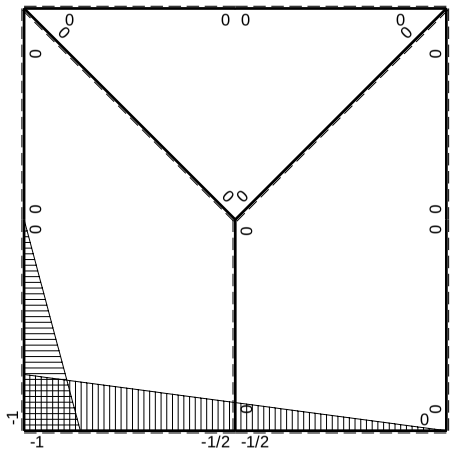
Fb

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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

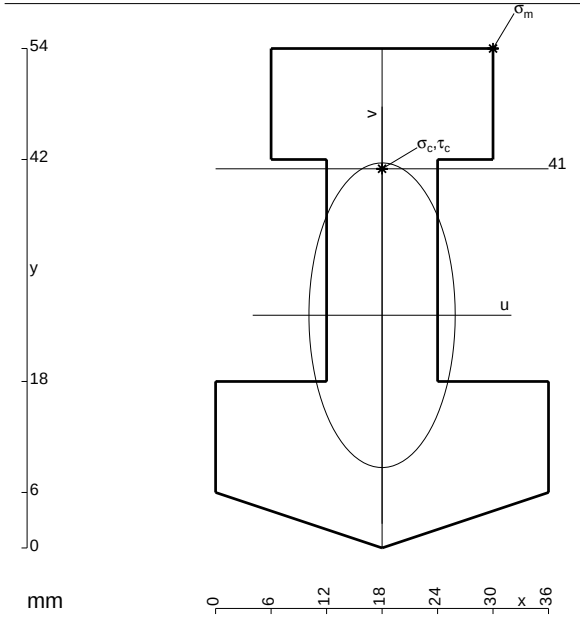
$$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

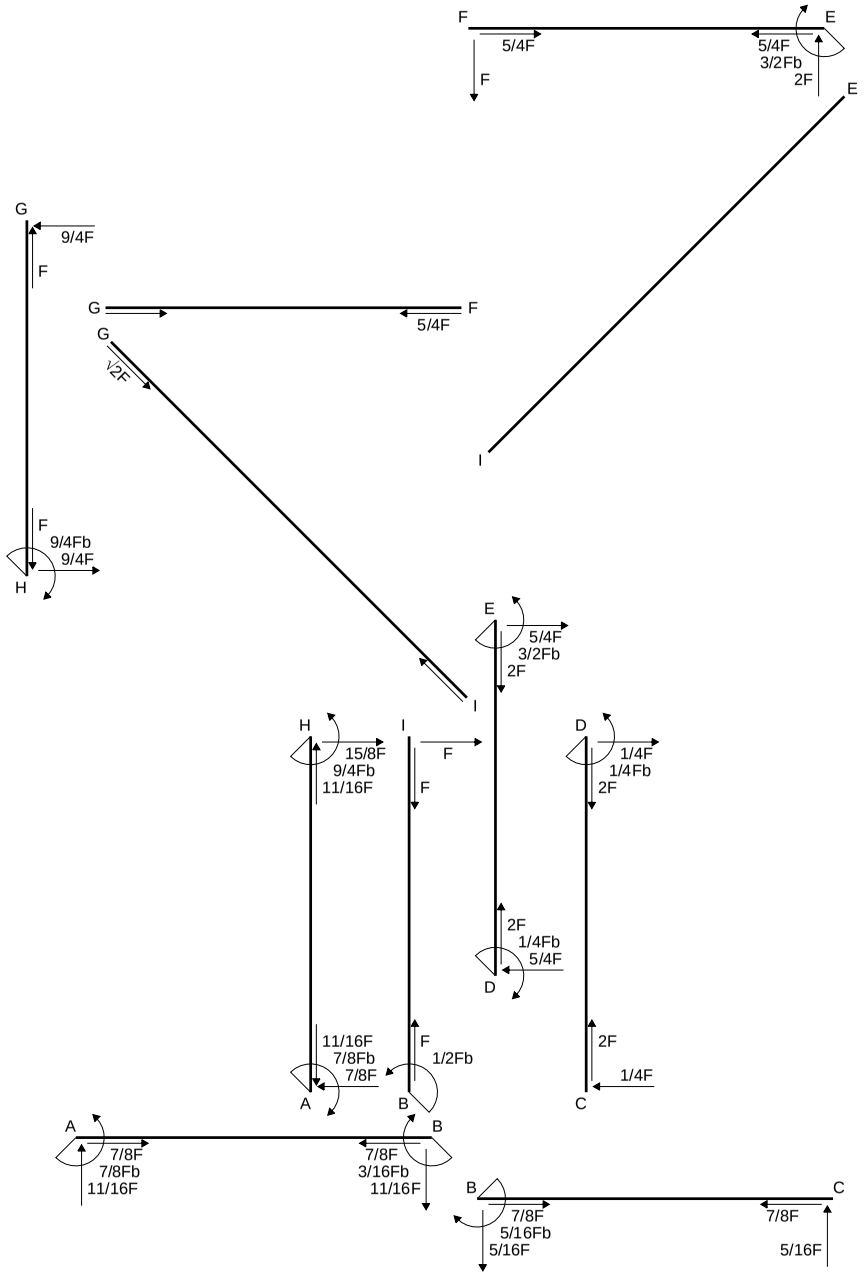
$$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

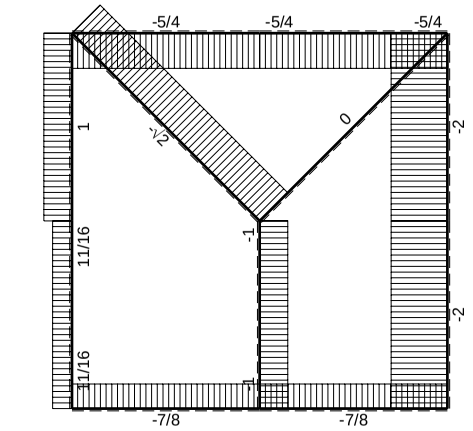
$$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

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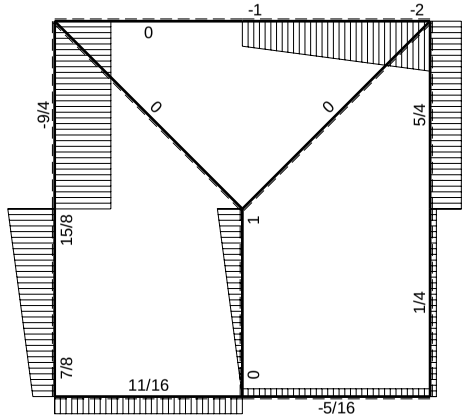


A = 1116. mm^2
J_u = 302839. mm^4
J_v = 69768. mm^4
y_g = 25.16 mm
N = 1590. N
T_y = -3578. N
M_x = -2504250. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 28.84 mm
$\sigma_m = N/A - Mv/J_u$ = 239.9 N/mm^2
x_c = 18. mm
y_c = 41. mm
v_c = 15.84 mm
$\sigma_c = N/A - Mv/J_u$ = 132.4 N/mm^2
τ_c = 6.668 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 132.9 N/mm^2
S^* = 6774. mm^3

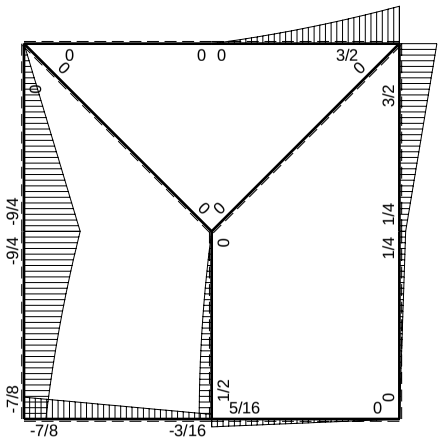




F

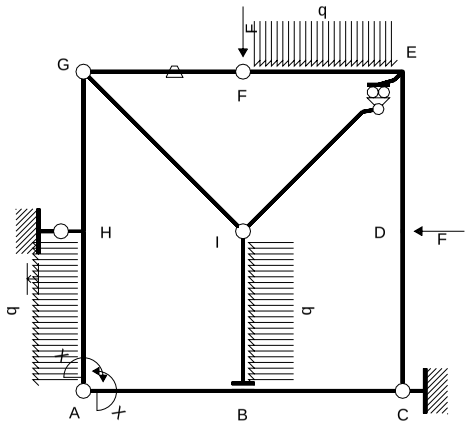


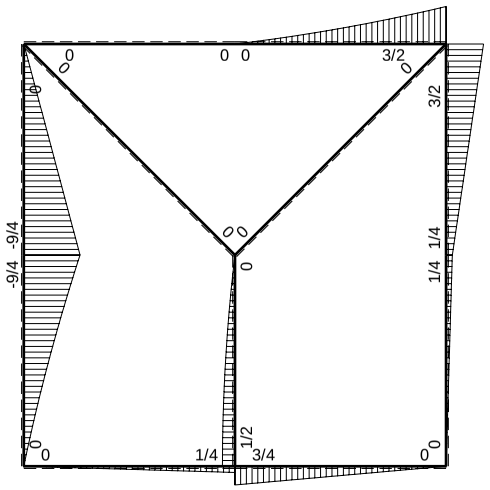
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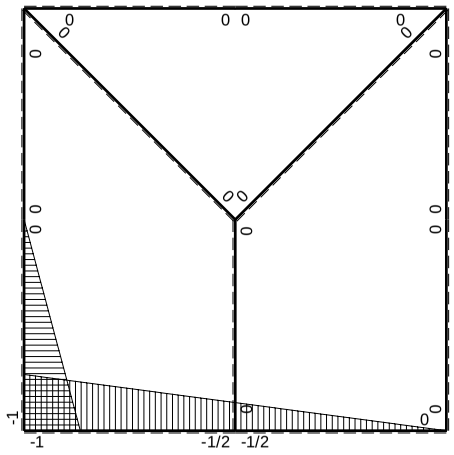
Fb

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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	-Fb/EJ	0	0	0	0+0	0
GF b	0	0	Fb/EJ	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b (-1/4\ x/b + 1/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/8\ x^2/b + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b (-1/8 + 1/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/8\ x + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b (-3/8 + 3/4\ x/b - 3/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-3/8\ b + 3/8\ b - 1/8\ b)\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-3/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b)\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

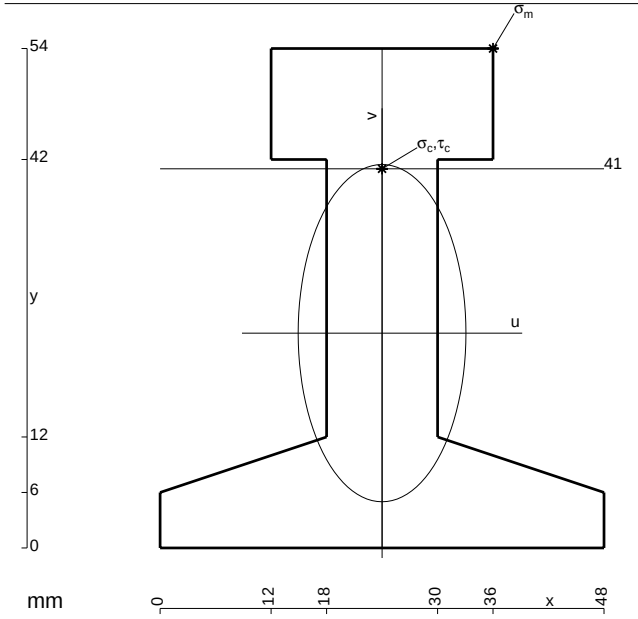
$L^{Xo}_{HA} = \int_o^b (9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (9/8\ b - 11/12\ b + 1/8\ b)\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

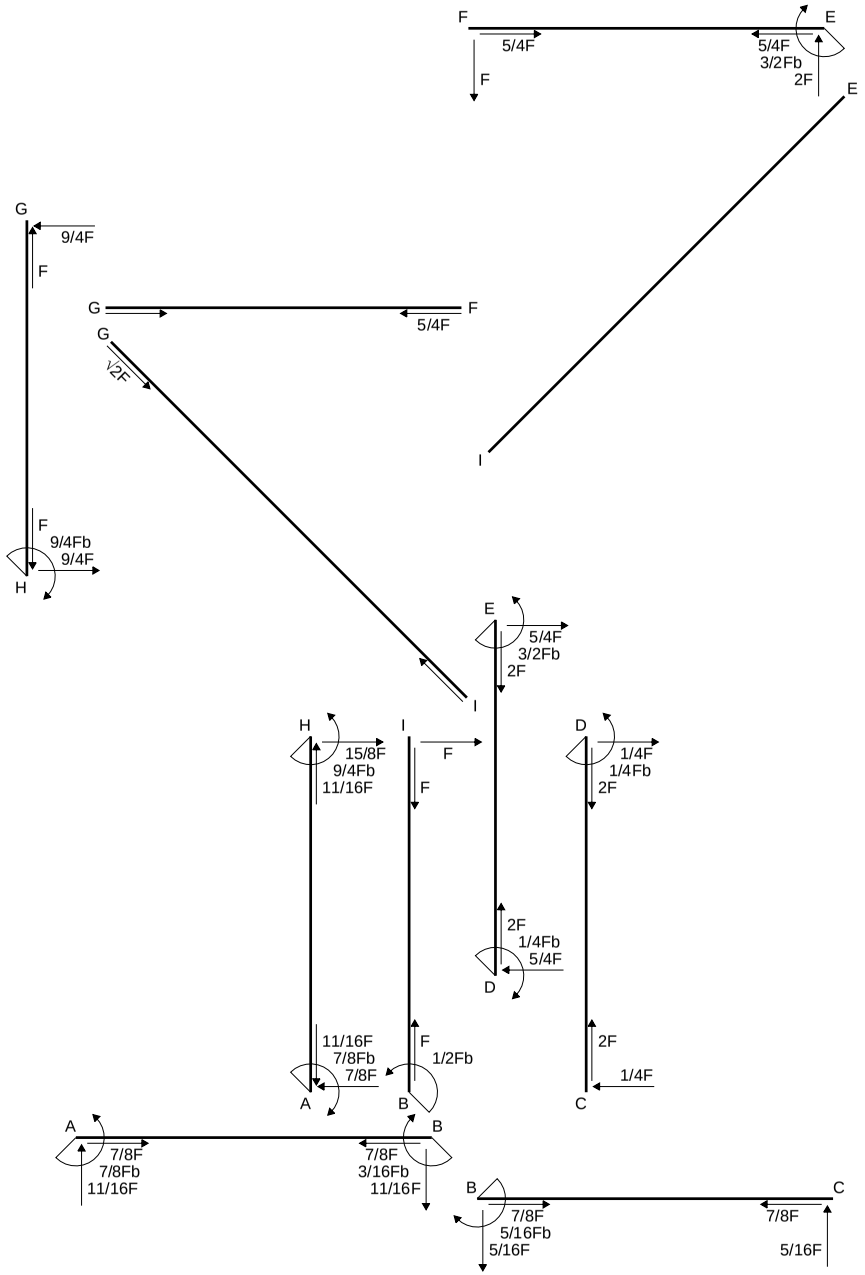
$L^{Xo}_{AH} = \int_o^b (7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

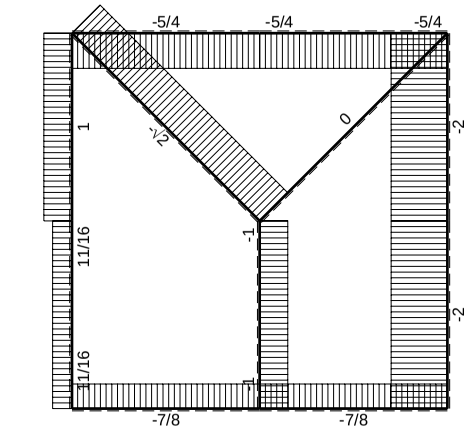
$= (7/8\ b - 5/12\ b - 1/8\ b)\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

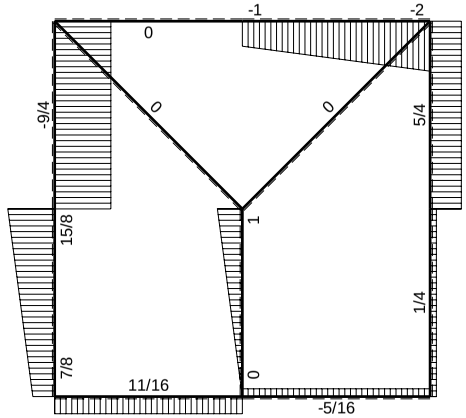
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A = 1116. mm^2
J_u = 371067. mm^4
J_v = 91800. mm^4
y_g = 23.23 mm
N = 1410. N
T_y = -3173. N
M_x = -2379380. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 30.77 mm
$\sigma_m = N/A - Mv/J_u$ = 198.6 N/mm^2
x_c = 24. mm
y_c = 41. mm
v_c = 17.77 mm
$\sigma_c = N/A - Mv/J_u$ = 115.2 N/mm^2
τ_c = 5.24 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 115.6 N/mm^2
S^* = 7354. mm^3

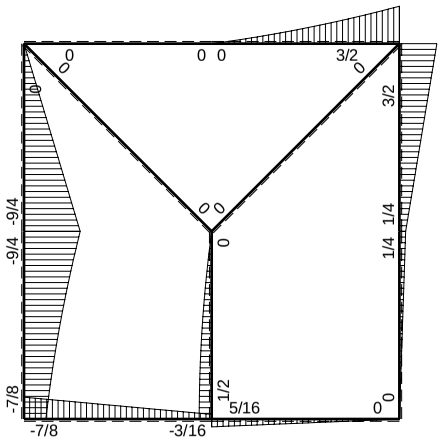






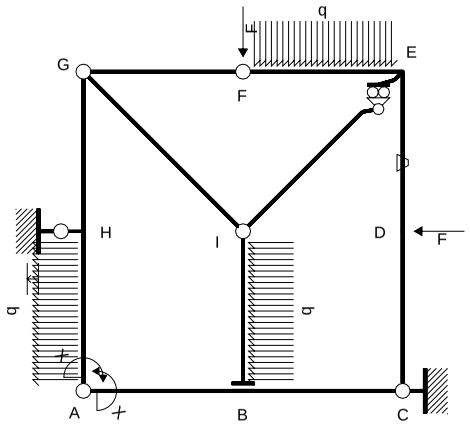
F

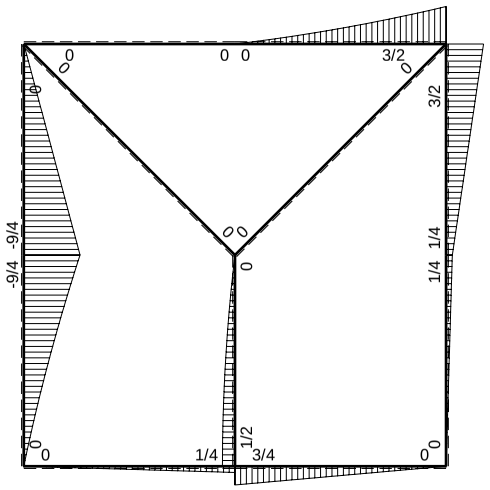
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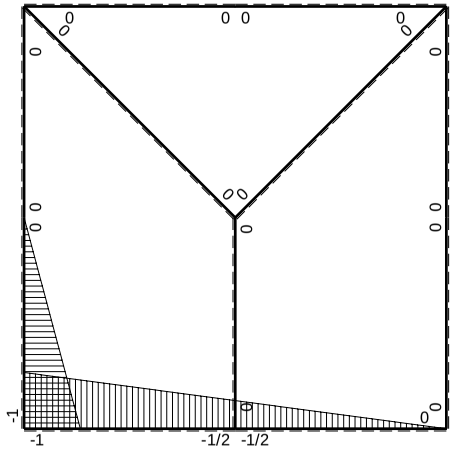
Fb

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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	Fb/EJ	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

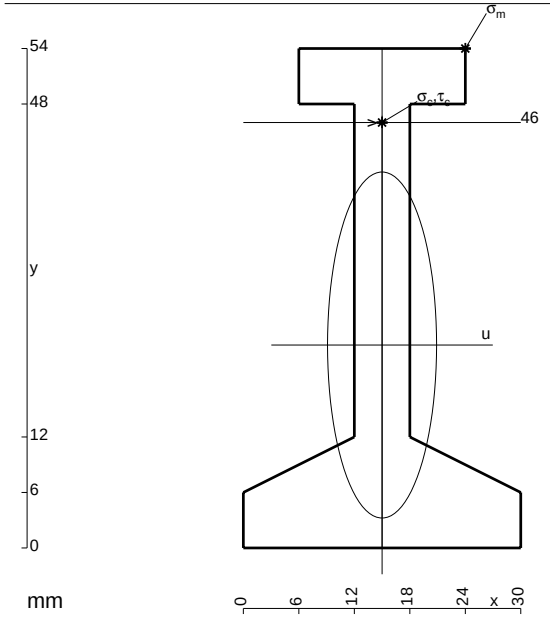
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

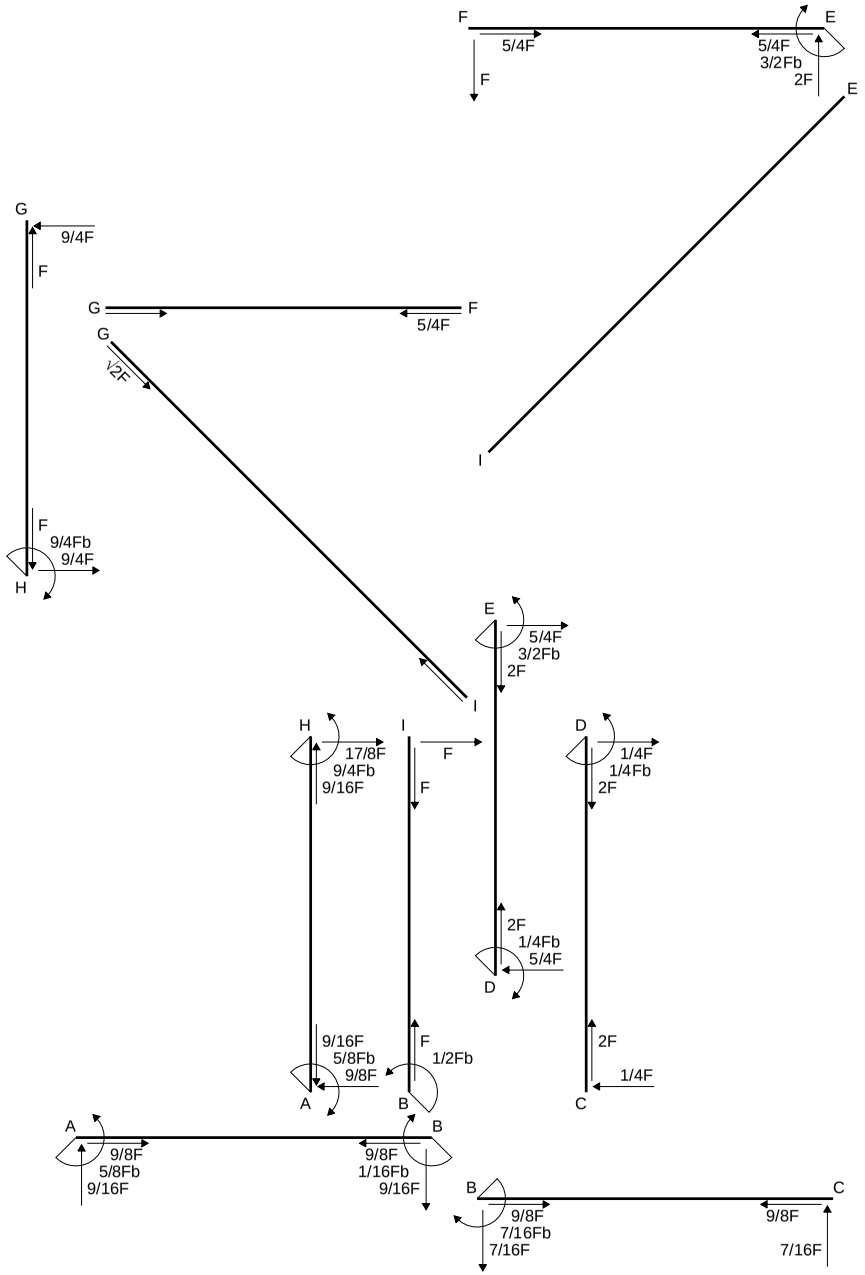
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

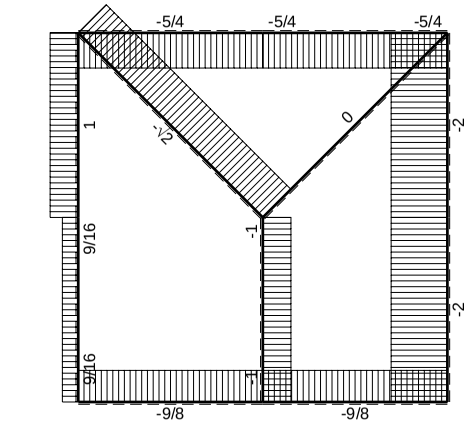
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

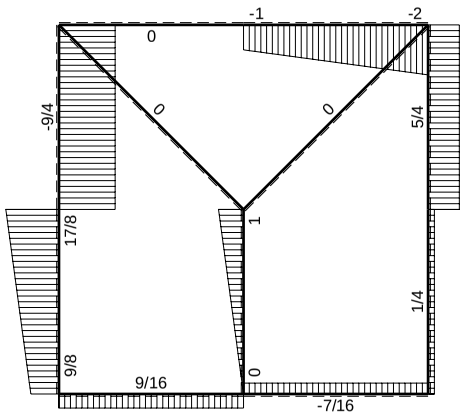
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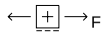


A = 612. mm^2
J_u = 214270. mm^4
J_v = 21276. mm^4
y_g = 21.94 mm
N = 770. N
T_y = -1733. N
M_x = -1386000. Nmm
x_m = 24. mm
y_m = 54. mm
u_m = 9. mm
v_m = 32.06 mm
$\sigma_m = N/A - Mv/J_u$ = 208.6 N/mm^2
x_c = 15. mm
y_c = 46. mm
v_c = 24.06 mm
$\sigma_c = N/A - Mv/J_u$ = 156.9 N/mm^2
τ_c = 4.634 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 157.1 N/mm^2
S^* = 3439. mm^3

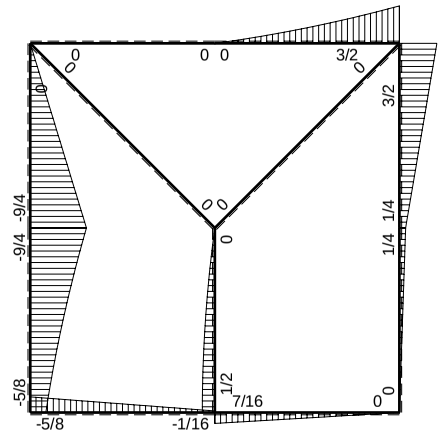

F
5/4F
E
5/4F
3/2Fb
2F
F
E
G
9/4F
F
G
F
5/4F
G
½F
I
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
I
H
17/8F
9/4Fb
9/16F
I
F
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
9/16F
5/8Fb
9/8F
A
F
1/2Fb
B
2F
1/4F
C
A
9/8F
5/8Fb
9/16F
B
9/8F
1/16Fb
9/16F
B
C
9/8F
7/16Fb
7/16F
9/8F
7/16F


-5/4
-5/4
-5/4
1
-½
0
-2
-2
9/16
-1
-1
9/16
-1
-9/8
-9/8

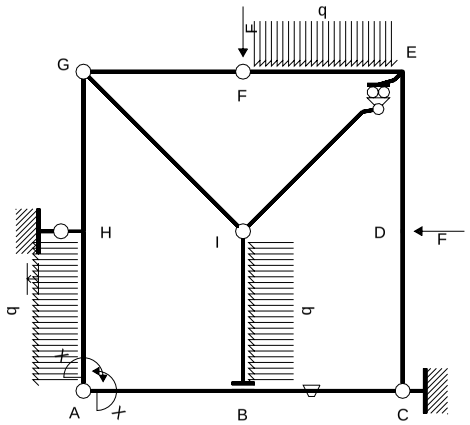

0
-1
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-9/4
0
0
5/4
1
17/8
1/4
9/8
9/16
0
-7/16

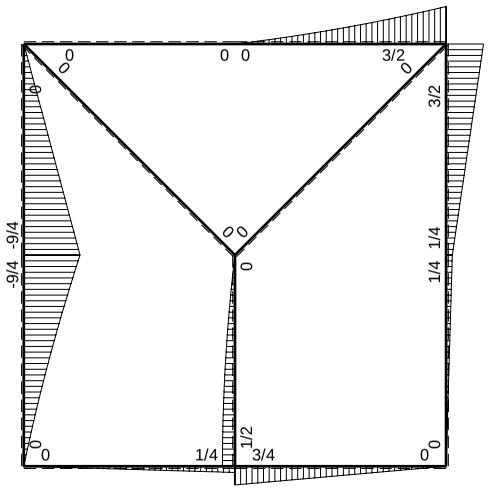

F


F

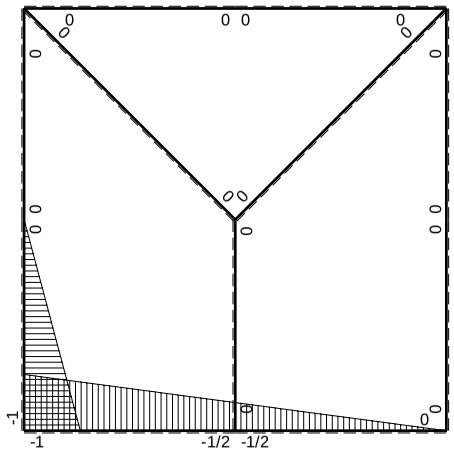

0
0 0
3/2
0
0
3/2
-9/4
0
0
-9/4
1/4
1/4
0
-5/8
1/2
7/16
0
0
-5/8
-1/16


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	-Fb/EJ	$-3/8Fb+3/4Fx-3/8Fx^2/b$	$1/2Fb/EJ-1/2Fx/EJ$	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	Fb/EJ	$-3/8Fx^2/b$	1/2Fx/EJ	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1/2 - 1/2\ x/b\ \right)\ \theta\ \ dx$

$= \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2\ x/b\ \right)\ \theta\ \ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/4\ b\ \right)\ \theta\ \ = 1/8\ \ Fb^2/EJ$

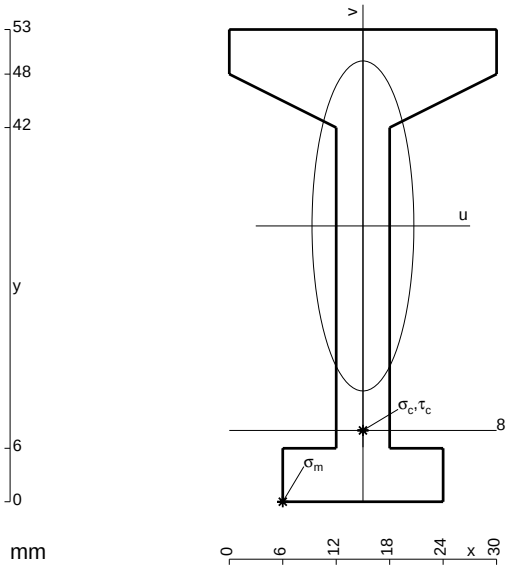
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

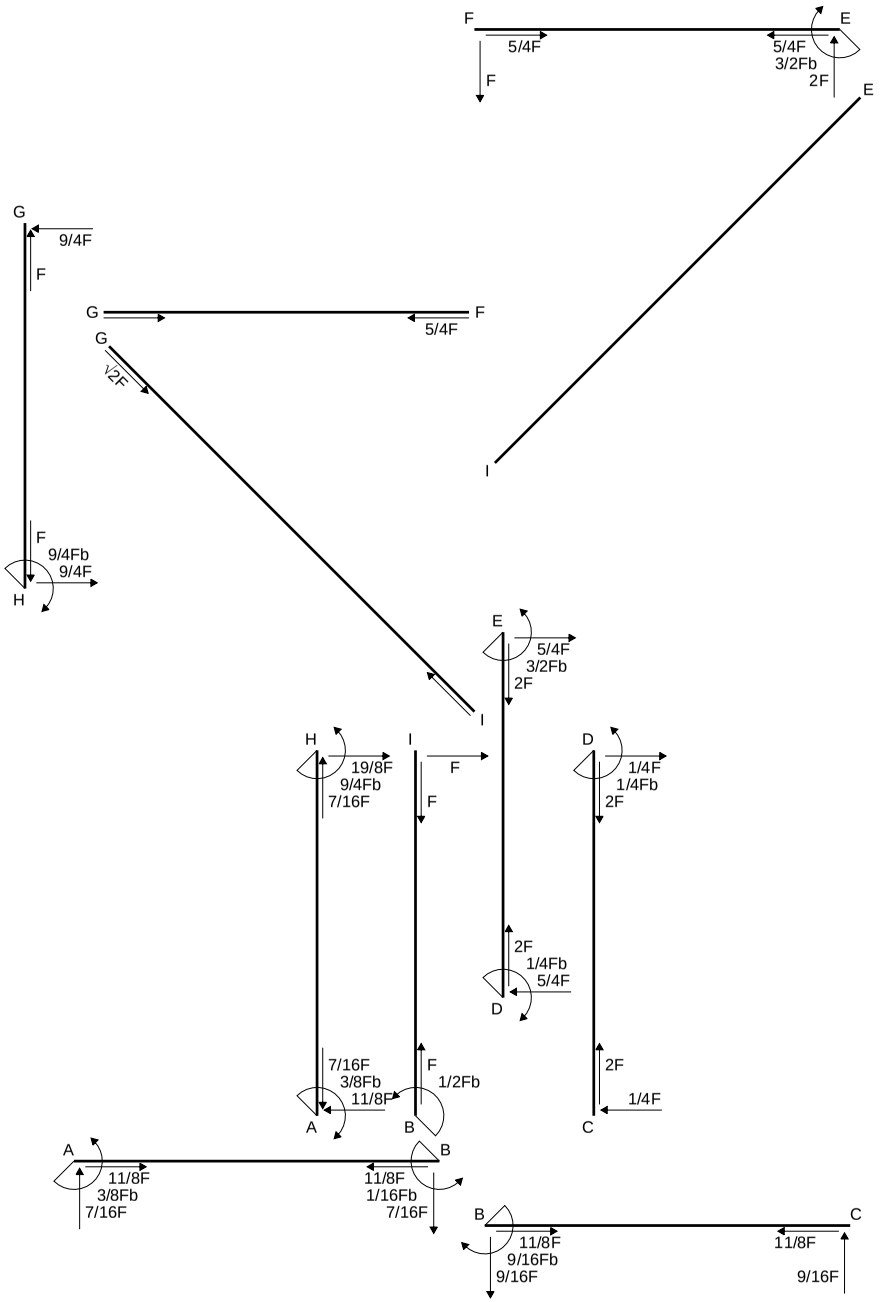
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

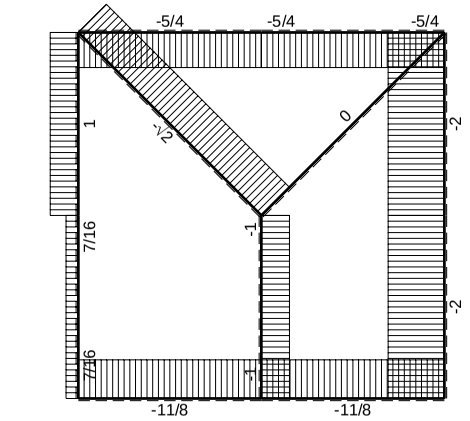
PROCEDIMENTO E RISULTATI 226747 CI04.xxxx.017

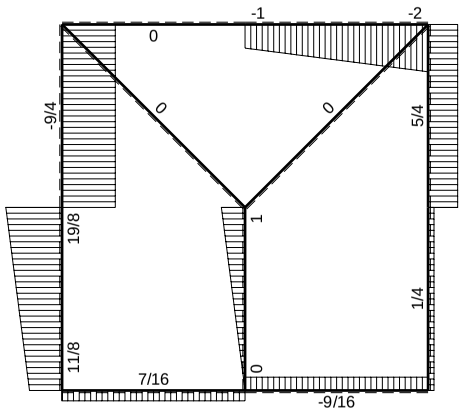


A = 582. mm^2
J_u = 199765. mm^4
J_v = 19026. mm^4
y_g = 30.95 mm
N = 760. N
T_y = -1710. N
M_x = -1419300. Nmm
x_m = 6. mm
u_m = -9. mm
v_m = -30.95 mm
$\sigma_m = N/A - Mv/J_u$ = -218.6 N/mm^2
x_c = 15. mm
y_c = 8. mm
v_c = -22.95 mm
$\sigma_c = N/A - Mv/J_u$ = -161.8 N/mm^2
τ_c = 4.717 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 162. N/mm^2
S^* = 3306. mm^3

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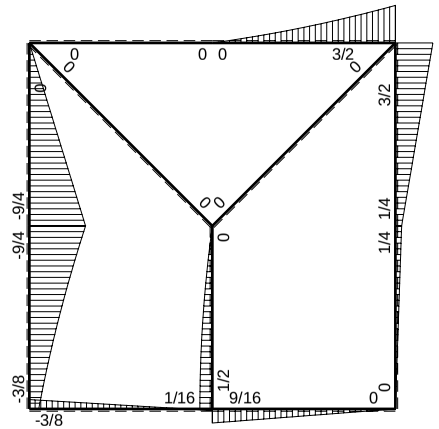

F
5/4F
F
E
5/4F
3/2Fb
2F
E
G
9/4F
F
G
F
5/4F
G
√2F
I
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
I
H
19/8F
9/4Fb
7/16F
I
F
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
7/16F
3/8Fb
11/8F
A
F
1/2Fb
B
2F
1/4F
C
A
11/8F
3/8Fb
7/16F
B
11/8F
1/16Fb
7/16F
B
11/8F
9/16Fb
9/16F
C
11/8F
9/16F


-5/4
-5/4
-5/4
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0
-2
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7/16
-2
7/16
-1
-11/8
-11/8

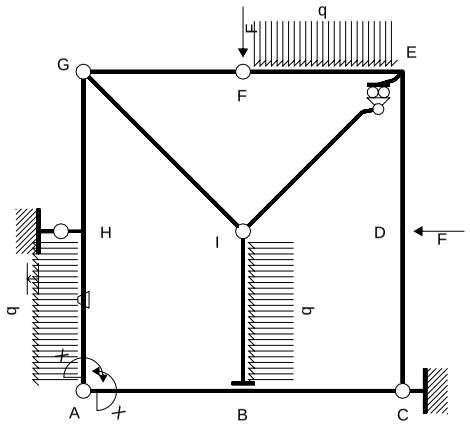

-1
-2
0
-9/4
0
0
5/4
1
19/8
1/4
11/8
7/16
0
-9/16

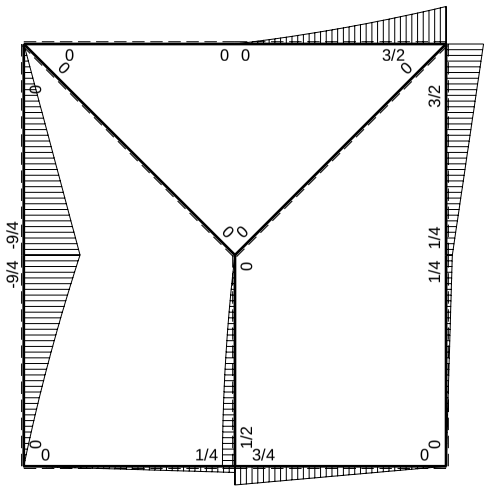
←□→ F

↑□↓ F

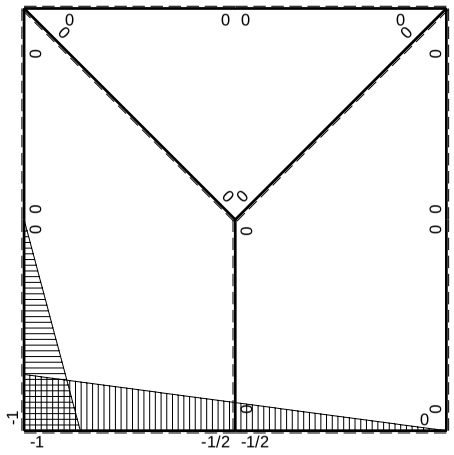

0
0 0
3/2
0
0
3/2
0
0
-9/4
-9/4
1/4
1/4
0
-3/8
1/16
-1/2
9/16
0
0
-3/8

□ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	-Fb/EJ	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(1/3+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	Fb/EJ	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/8Fb	

Sviluppi di calcolo iperstatica

PROCEDIMENTO E RISULTATI 986512 CI04.xxxx.018

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\ \theta\ \ dx$

$= \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b\ \theta$

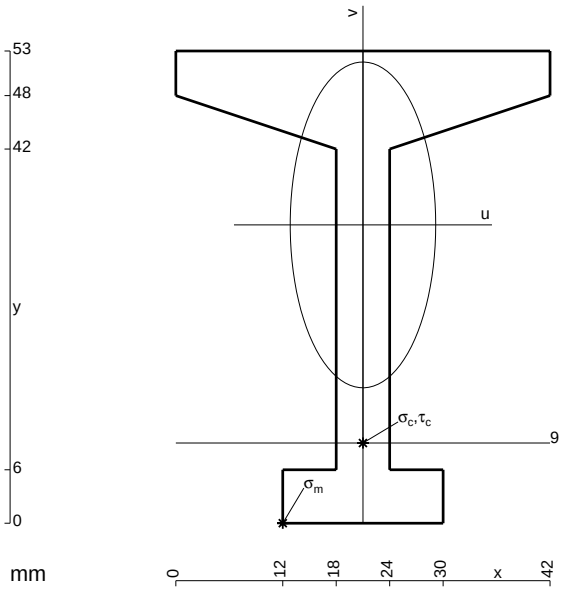
$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b\ \right)\ \theta\ \ = 5/6\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\ \theta\ \ dx$

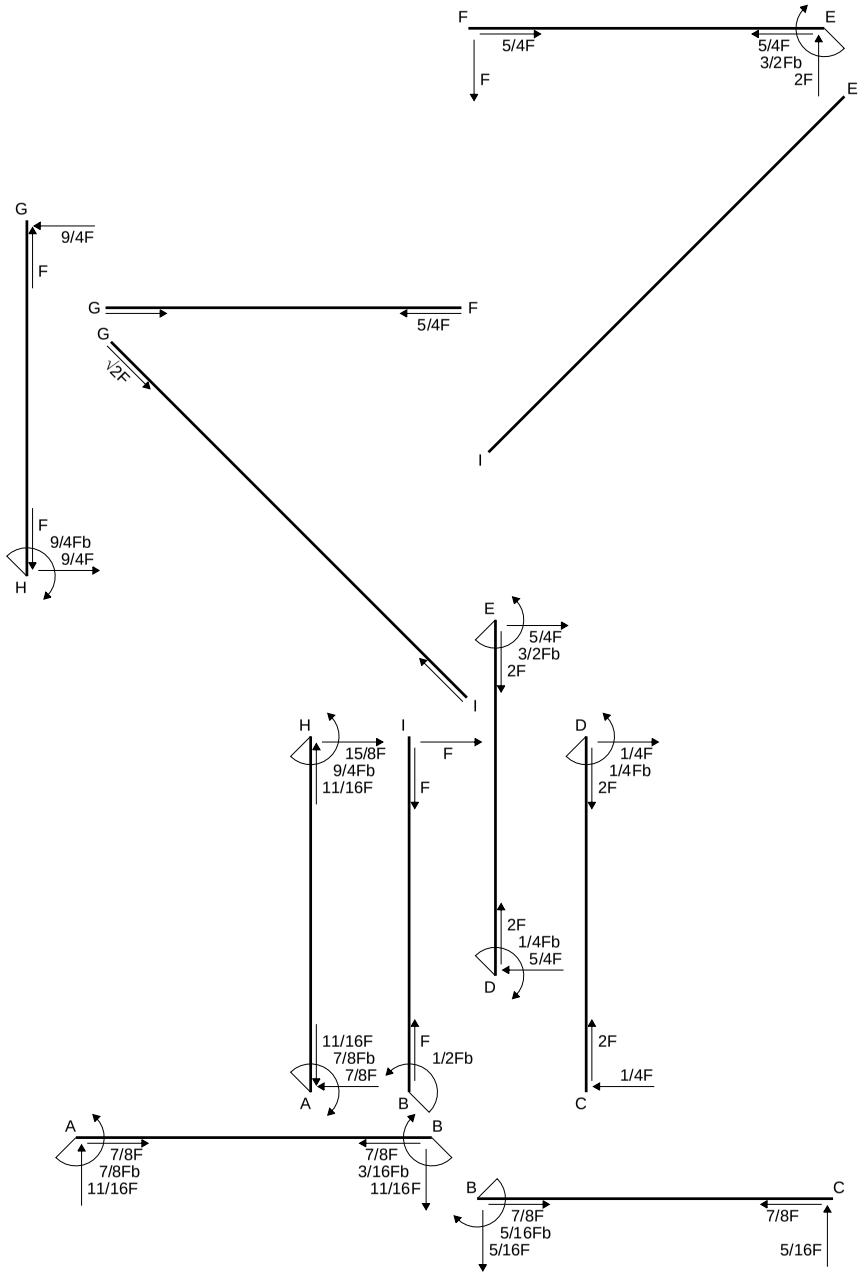
$= \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b\ \theta$

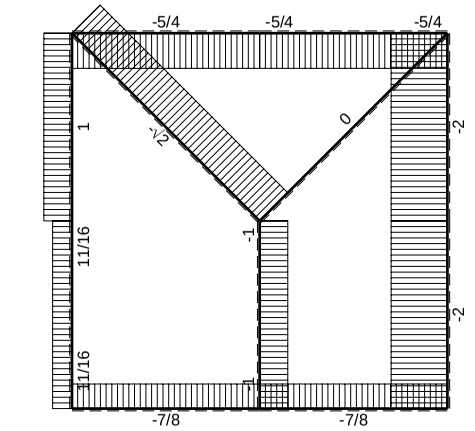
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\ \theta\ \ = 5/6\ \ Fb^2/EJ$

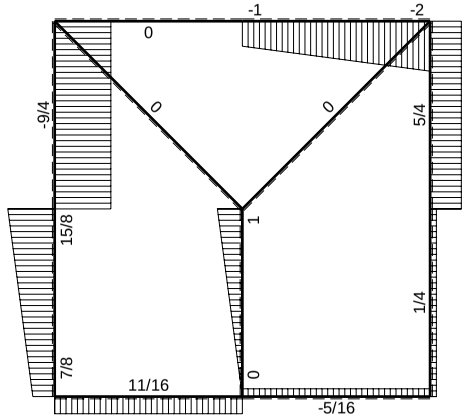
PROCEDIMENTO E RISULTATI 986512 CI04.xxxx.018

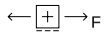


A = 678. mm^2
J_u = 226700. mm^4
J_v = 45234. mm^4
y_g = 33.48 mm
N = 790. N
T_y = -1778. N
M_x = -1564200. Nmm
x_m = 12. mm
u_m = -9. mm
v_m = -33.48 mm
$\sigma_m = N/A - Mv/J_u$ = -229.9 N/mm^2
x_c = 21. mm
y_c = 9. mm
v_c = -24.48 mm
$\sigma_c = N/A - Mv/J_u$ = -167.8 N/mm^2
τ_c = 4.913 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 168. N/mm^2
S^* = 3760. mm^3

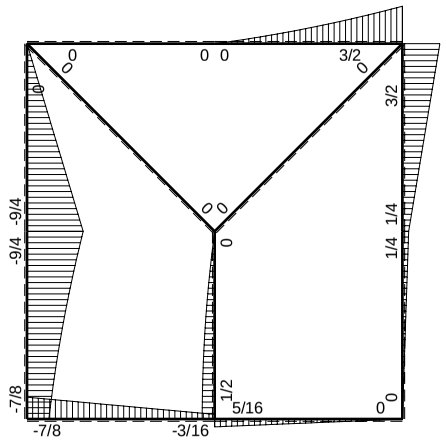

F
5/4F
E
5/4F
3/2Fb
2F
F
E
G
9/4F
F
G
F
5/4F
G
½F
I
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
I
H
15/8F
9/4Fb
11/16F
I
F
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
F
1/2Fb
2F
1/4F
A
B
C
A
B
7/8F
7/8Fb
11/16F
7/8F
3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
-5/4
-5/4
1
½
0
-2
-1
11/16
-2
11/16
-1
-7/8
-7/8

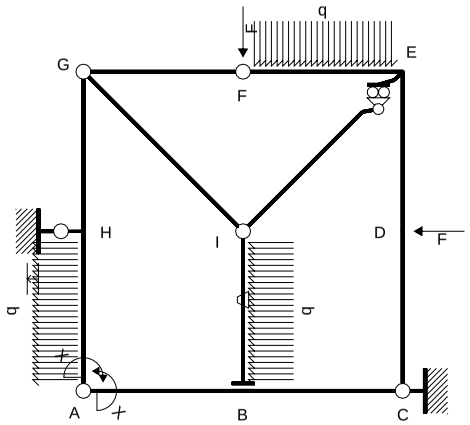

-1
-2
0
-9/4
0
0
5/4
15/8
1
1/4
7/8
0
11/16
-5/16

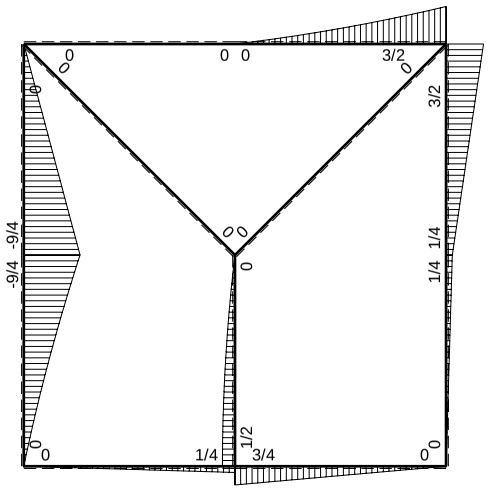

F


F

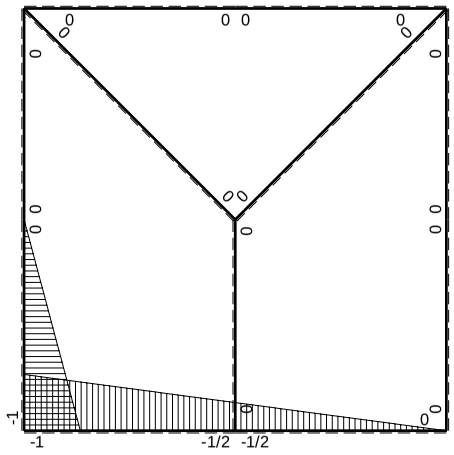

0
0 0
3/2
0
0
3/2
-9/4
0
0
-9/4
-9/4
1/4
1/4
0
-7/8
1/2
5/16
0
0
-7/8
-3/16


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb+1/4Fx	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

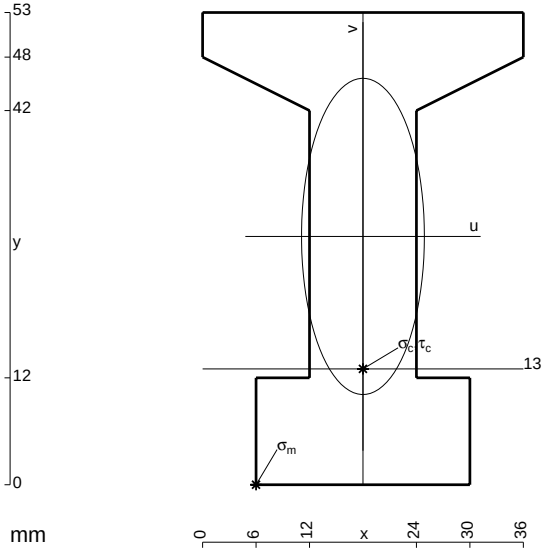
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

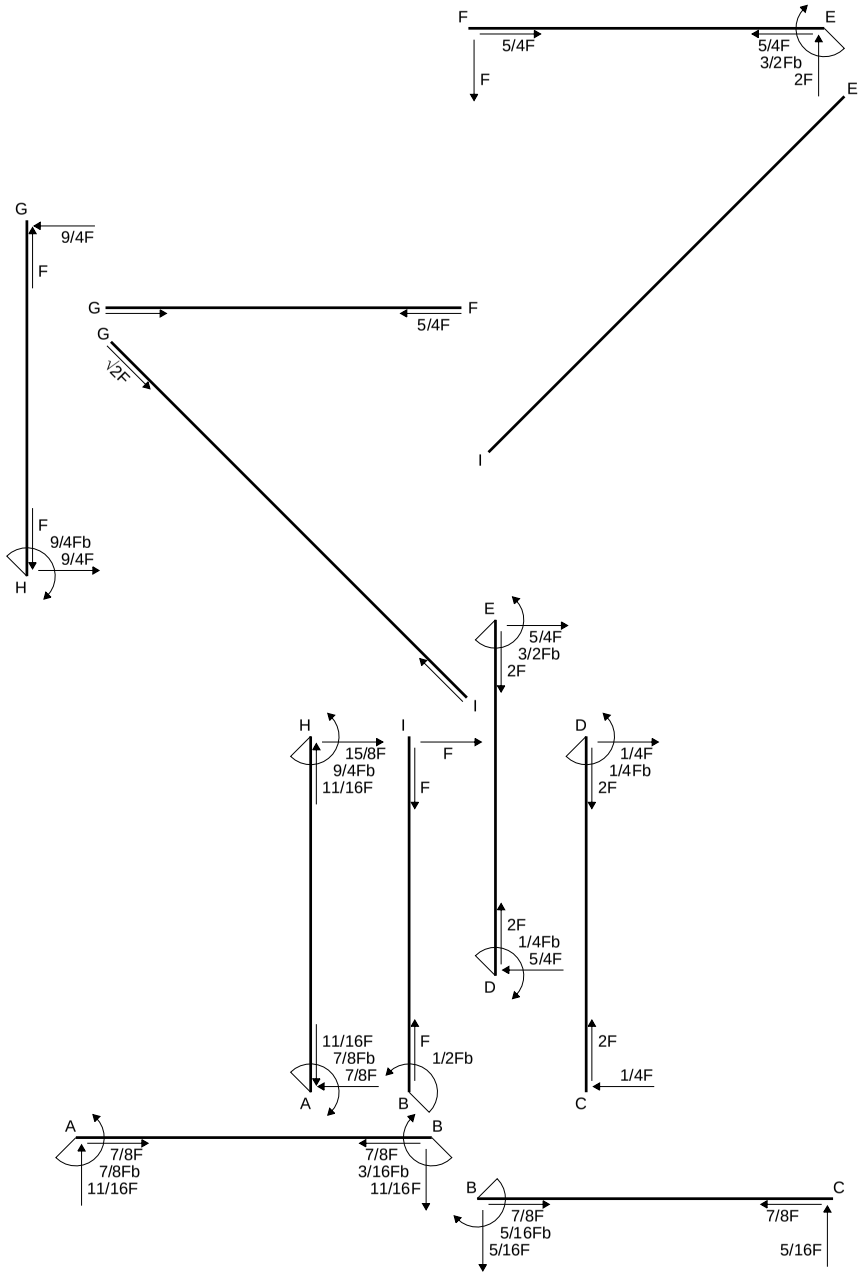
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

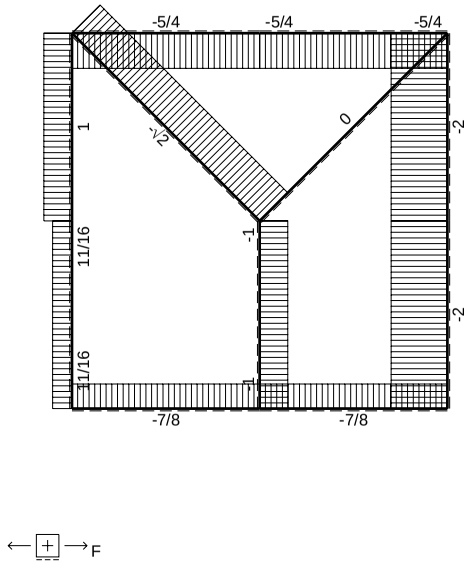
PROCEDIMENTO E RISULTATI 265064 CI04.xxxx.019

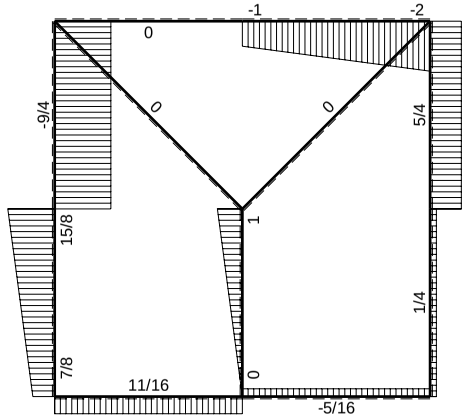


A = 972. mm^2
J_u = 306188. mm^4
J_v = 46224. mm^4
y_g = 27.87 mm
N = 1260. N
T_y = -2835. N
M_x = -2636550. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -27.87 mm
$\sigma_m = N/A - Mv/J_u$ = -238.7 N/mm^2
x_c = 18. mm
y_c = 13. mm
v_c = -14.87 mm
$\sigma_c = N/A - Mv/J_u$ = -126.8 N/mm^2
τ_c = 5.002 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 127. N/mm^2
S^* = 6483. mm^3

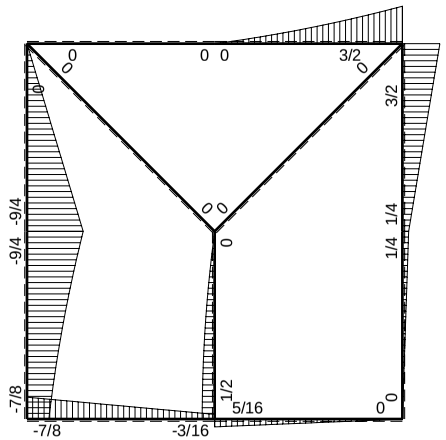
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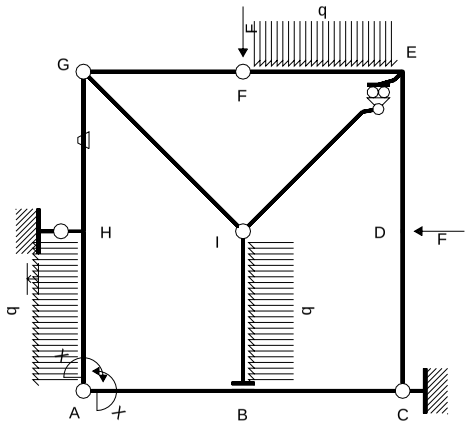


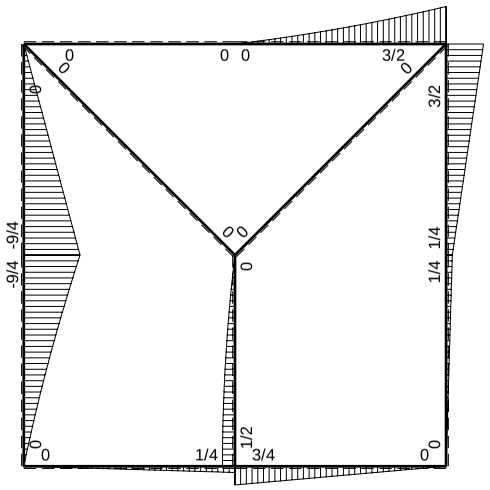




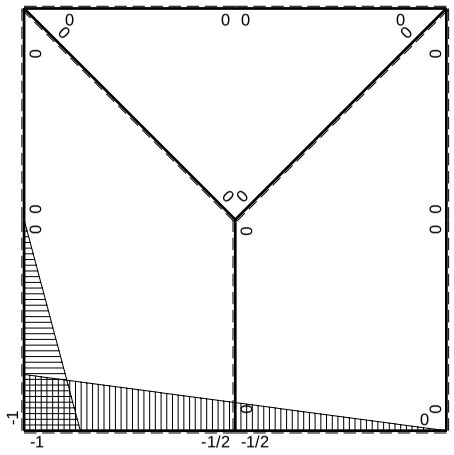


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 269138 CI04.xxxx.020

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PROCEDIMENTO E RISULTATI 269138 CI04.xxxx.020

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	-Fb/EJ	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

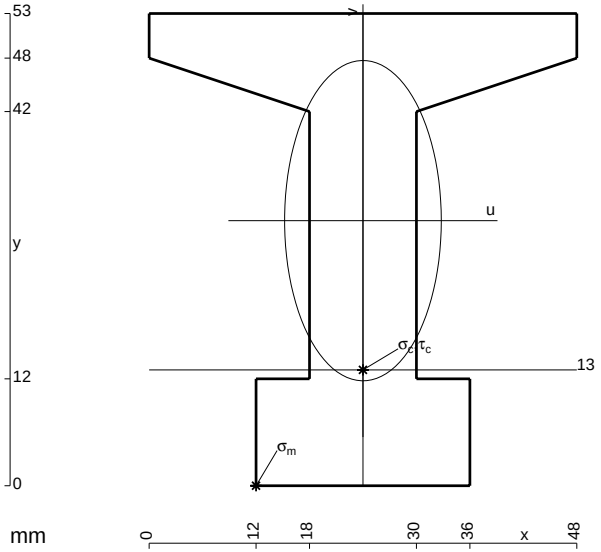
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

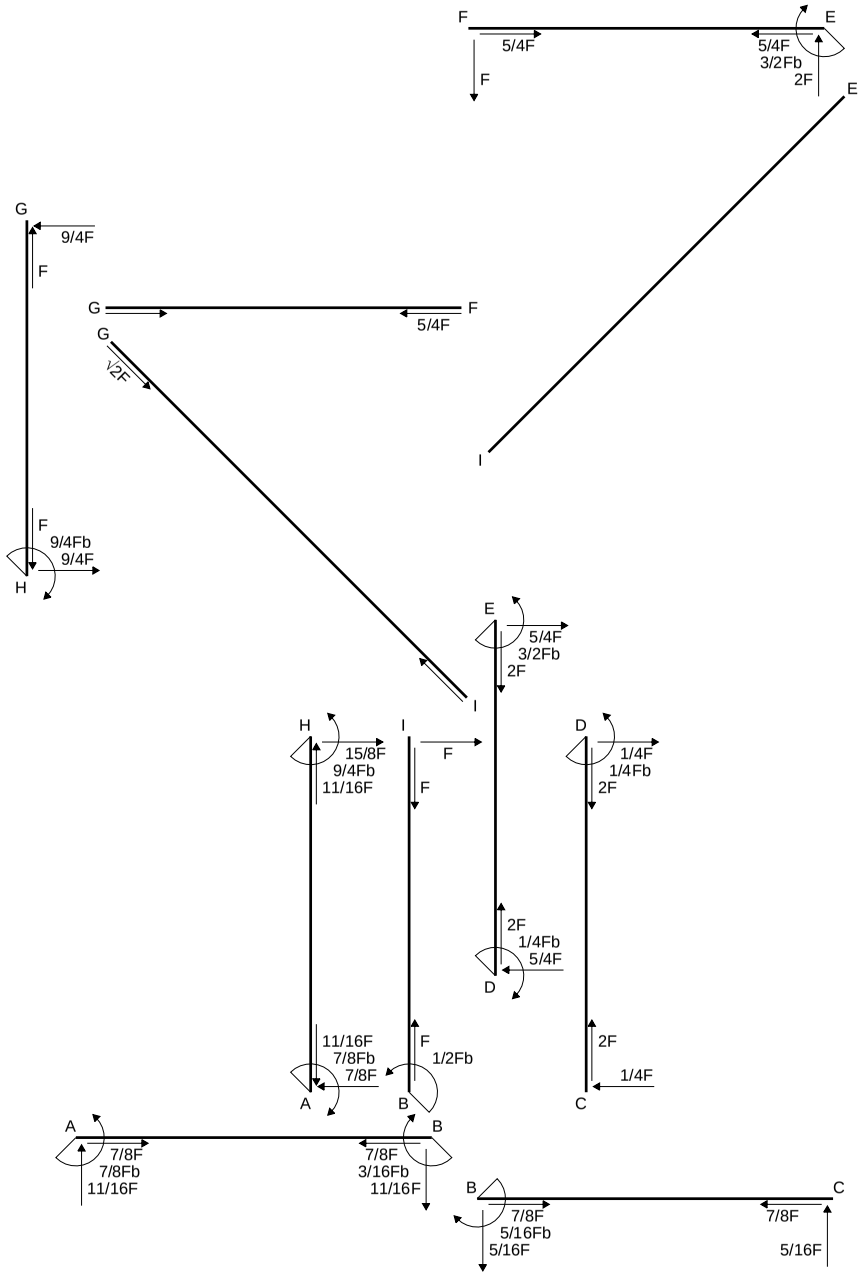
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

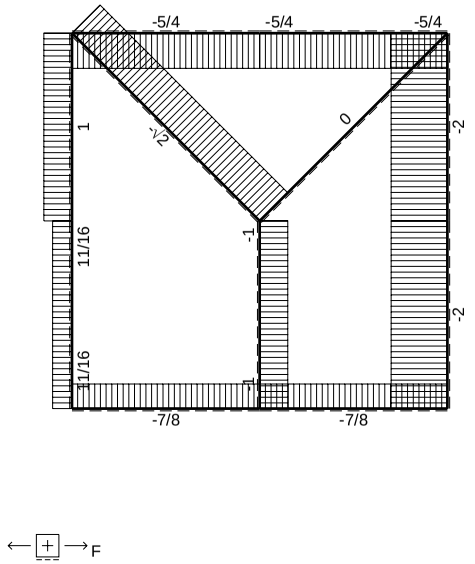
PROCEDIMENTO E RISULTATI 269138 CI04.xxxx.020

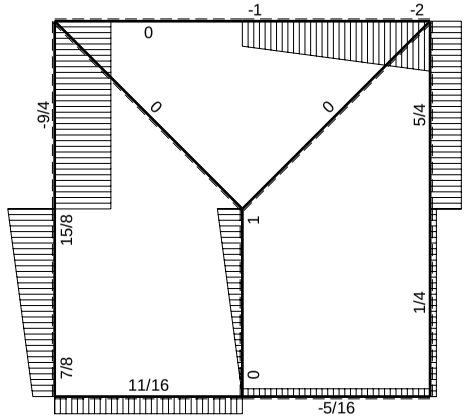


A = 1068. mm^2
J_u = 345159. mm^4
J_v = 82584. mm^4
y_g = 29.75 mm
N = 2120. N
T_y = -4770. N
M_x = -2337300. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -29.75 mm
$\sigma_m = N/A - Mv/J_u$ = -199.5 N/mm^2
x_c = 24. mm
y_c = 13. mm
v_c = -16.75 mm
$\sigma_c = N/A - Mv/J_u$ = -111.5 N/mm^2
τ_c = 8.117 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 112.3 N/mm^2
S^* = 7048. mm^3

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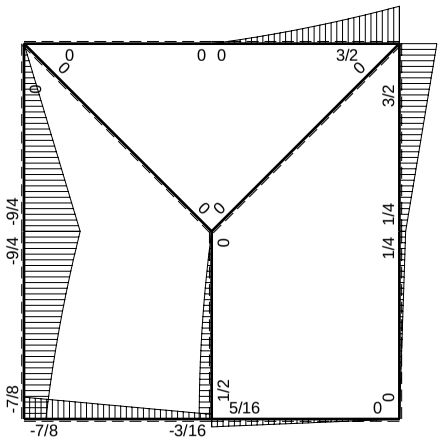

F
5/4F
E
5/4F
3/2Fb
2F
F
E
G
9/4F
F
G
F
5/4F
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I
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
I
H
15/8F
9/4Fb
11/16F
I
F
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
F
1/2Fb
2F
1/4F
A
B
C
A
B
7/8F
7/8Fb
11/16F
7/8F
3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
-5/4
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1/2
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11/16
-2
11/16
-1
-7/8
-7/8

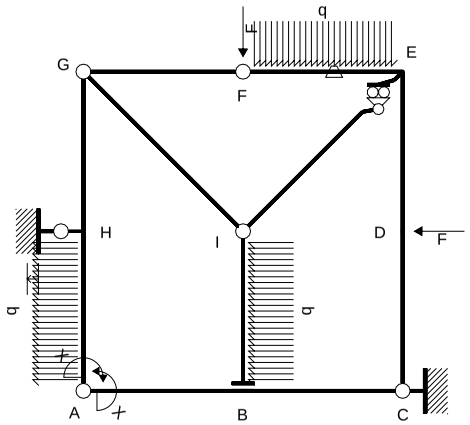

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5/4
15/8
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1/4
7/8
0
11/16
-5/16

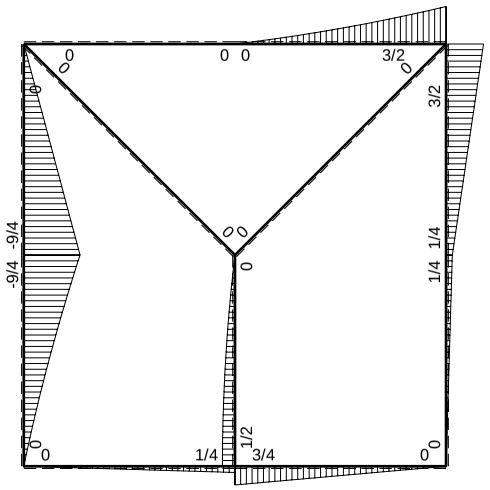
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F

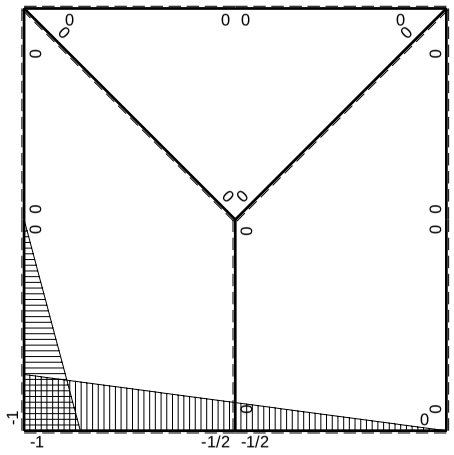

0
0 0
3/2
0
0
3/2
-9/4
0
0
-9/4
1/4
1/4
0
-7/8
1/2
5/16
0
0
-7/8
-3/16

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	Fb/EJ	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

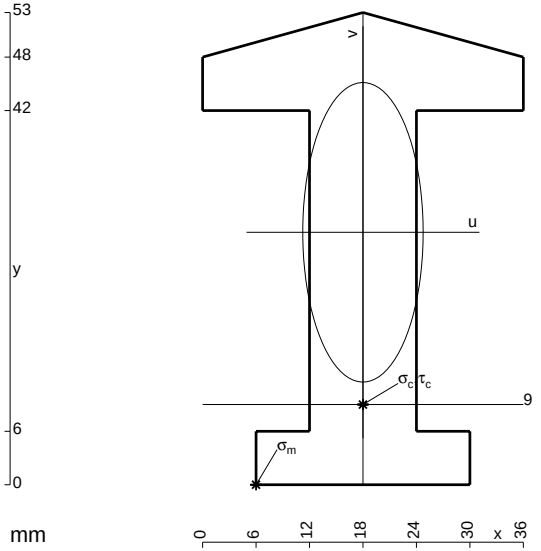
$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

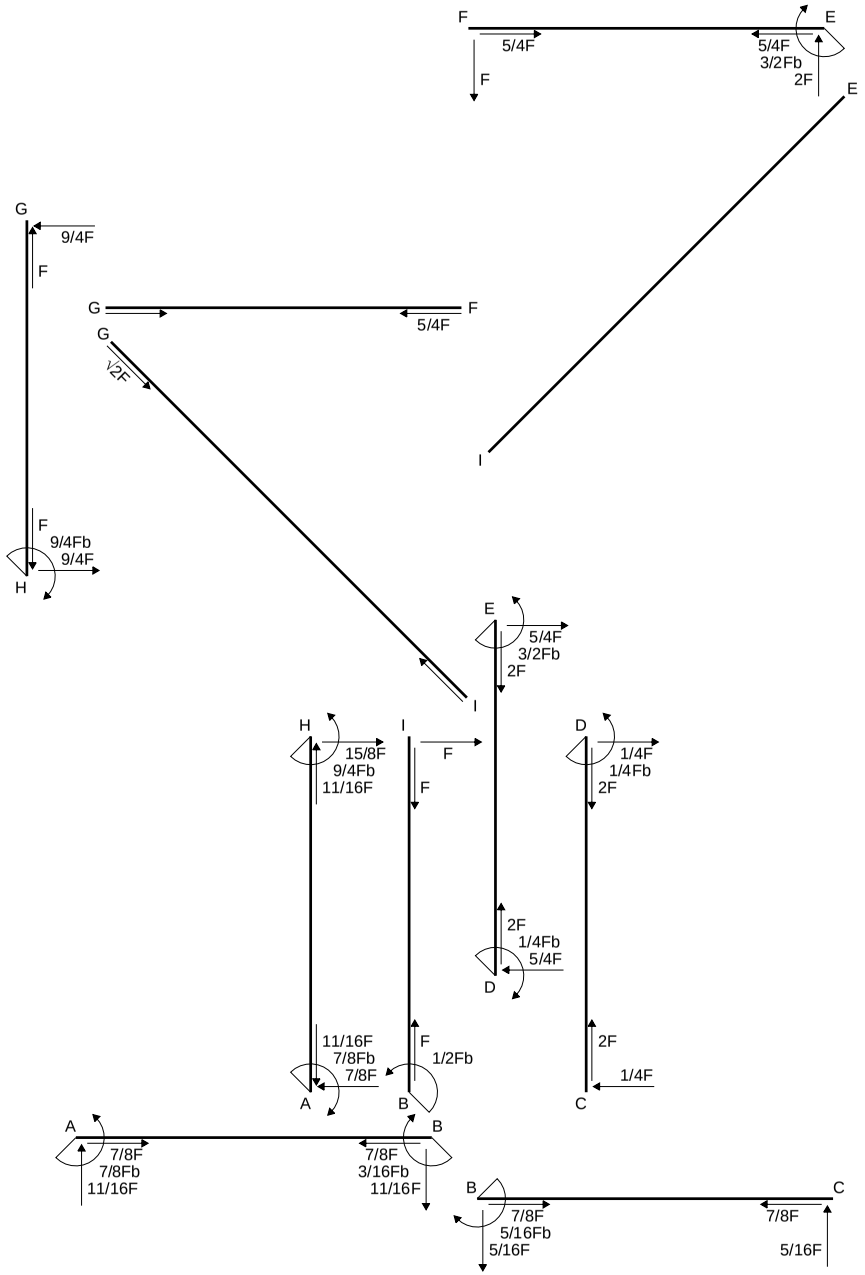
$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

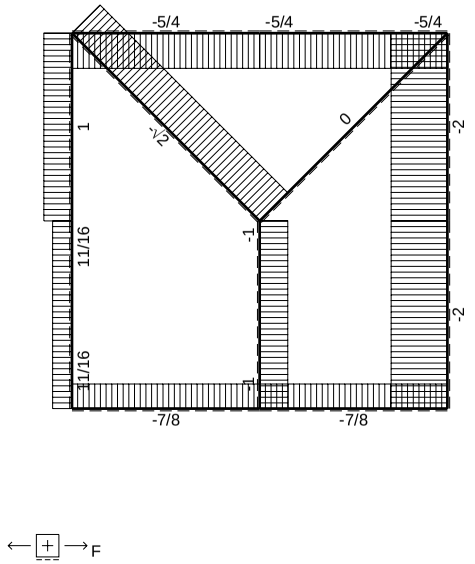
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

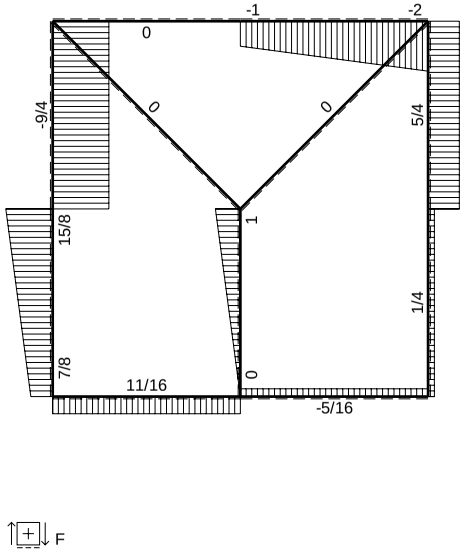
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$



A = 882. mm^2
J_u = 249349. mm^4
J_v = 40284. mm^4
y_g = 28.33 mm
N = 1560. N
T_y = -3510. N
M_x = -1860300. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.33 mm
$\sigma_m = N/A - Mv/J_u$ = -209.6 N/mm^2
x_c = 18. mm
y_c = 9. mm
v_c = -19.33 mm
$\sigma_c = N/A - Mv/J_u$ = -142.5 N/mm^2
τ_c = 5.159 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 142.8 N/mm^2
S^* = 4398. mm^3

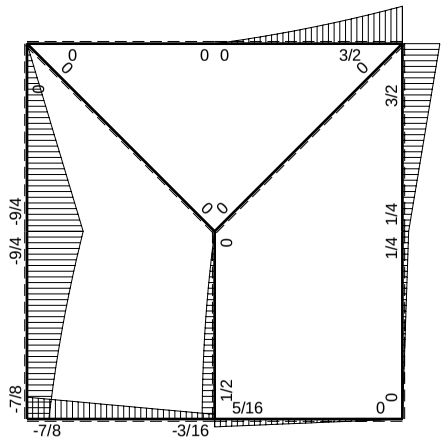

F
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3/2Fb
2F
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G
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G
F
5/4F
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I
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9/4Fb
9/4F
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5/4F
3/2Fb
2F
I
H
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9/4Fb
11/16F
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B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
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-7/8

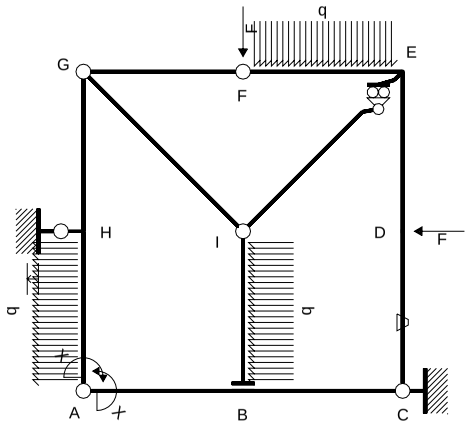

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1/4
7/8
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-5/16

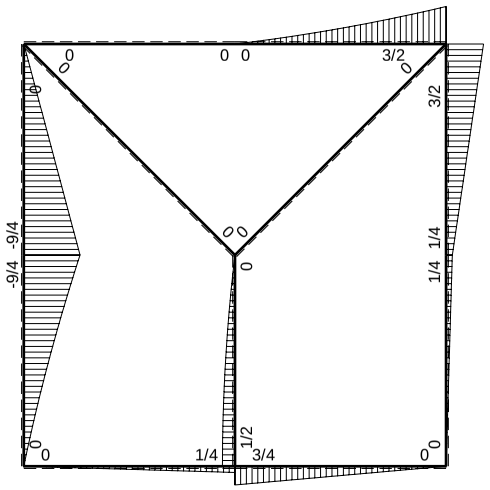
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F

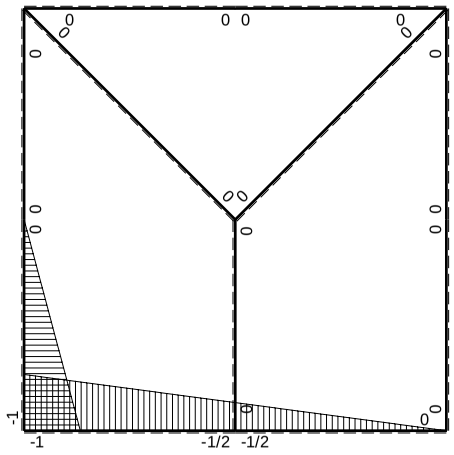

0
0 0
3/2
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0
3/2
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-9/4
-9/4
1/4
1/4
0
-7/8
1/2
5/16
0
0
-7/8
-3/16


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264292 CI04.xxxx.022

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	-Fb/EJ	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	Fb/EJ	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

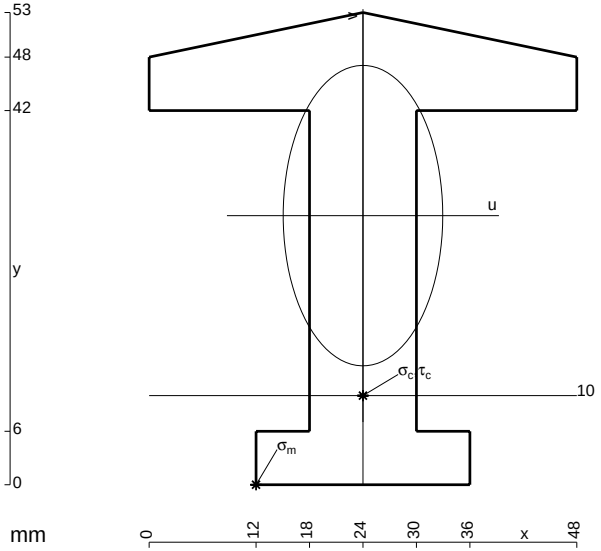
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

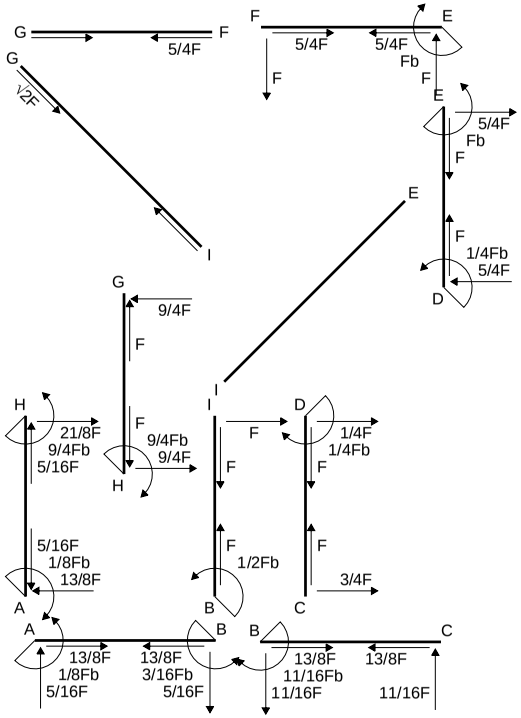
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

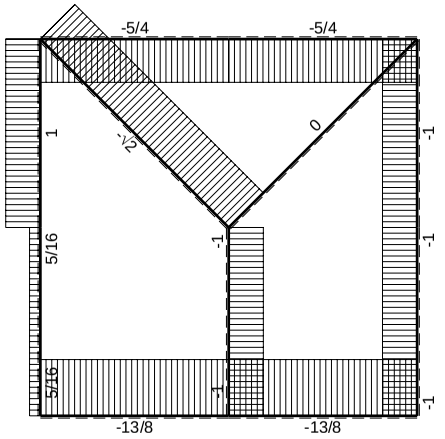
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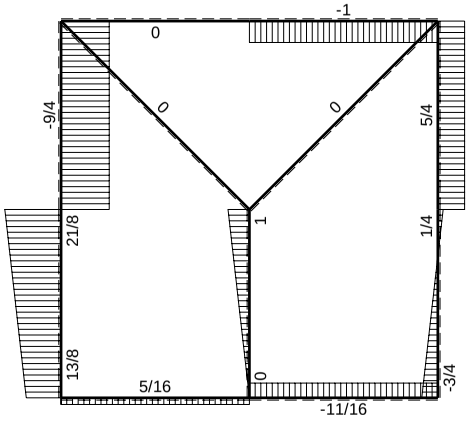


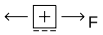
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J_u = 279819. mm^4
J_v = 78912. mm^4
y_g = 30.2 mm
N = 1570. N
T_y = -3533. N
M_x = -2048850. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.2 mm
$\sigma_m = N/A - Mv/J_u$ = -219.6 N/mm^2
x_c = 24. mm
y_c = 10. mm
v_c = -20.2 mm
$\sigma_c = N/A - Mv/J_u$ = -146.3 N/mm^2
τ_c = 5.242 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 146.6 N/mm^2
S^* = 4983. mm^3

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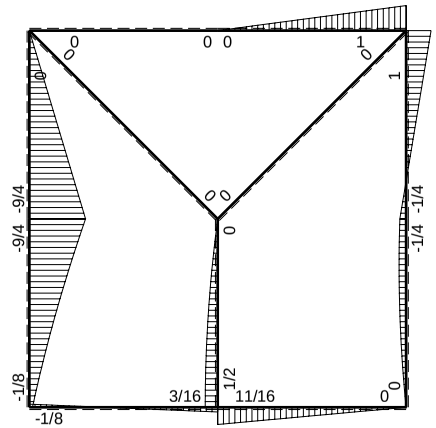

G
F
5/4F
G
1/2F
I
F
5/4F
5/4F
Fb
F
E
F
E
5/4F
Fb
F
E
F
1/4Fb
5/4F
D
G
9/4F
F
H
21/8F
9/4Fb
5/16F
F
9/4Fb
9/4F
H
I
F
F
I
D
F
1/4F
1/4Fb
F
5/16F
1/8Fb
13/8F
A
F
1/2Fb
B
F
3/4F
C
A
B
B
C
13/8F
1/8Fb
5/16F
13/8F
3/16Fb
5/16F
13/8F
11/16Fb
11/16F
13/8F
11/16F


-5/4
-5/4
1
-1/2
0
-1
5/16
-1
-1
5/16
-1
-1
-13/8
-13/8

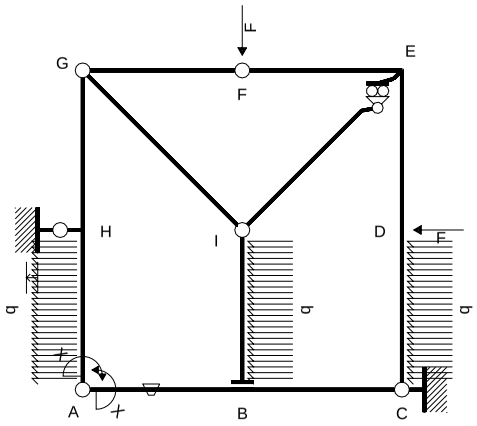

-1
0
-9/4
0
0
5/4
21/8
1
1/4
13/8
5/16
0
-3/4
-11/16

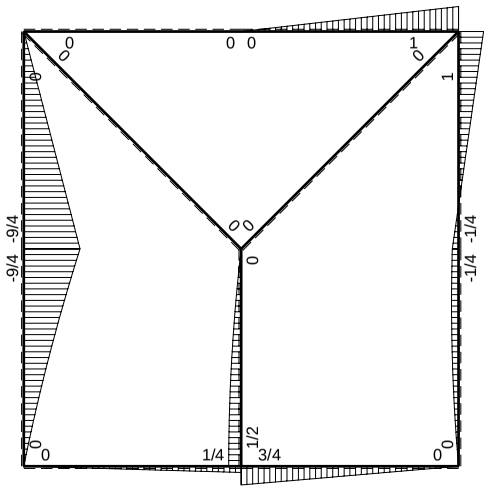

F


F

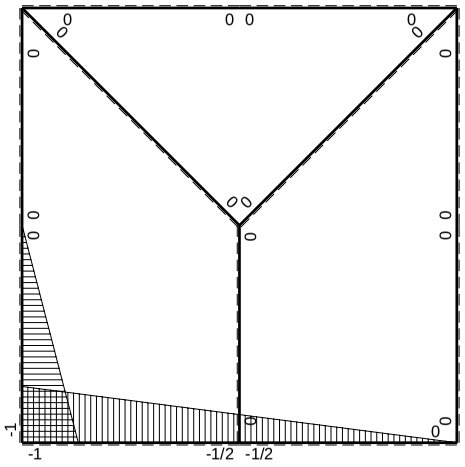

0
0 0
1
0
0
1
0 0
-9/4
-9/4
0
-1/4
-1/4
-1/8
3/16
1/2
11/16
0
-1/8


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	-Fb/EJ	$-1/4Fx+1/8Fx^2/b$	Fb/EJ-1/2Fx/EJ	$1-x/b+1/4x^2/b^2$	$(-1/12+3/4)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb+1/4Fx	Fb/EJ	$-1/8Fb+1/8Fx^2/b$	1/2Fb/EJ+1/2Fx/EJ	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1 - 1/2\ x/b\right)\ \theta\ \ dx$

$= \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ + \left(\ b - 1/4\ b\ \right)\ \theta\ \ = 2/3\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2 - 1/2\ x/b\right)\ \theta\ \ dx$

$= \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 2/3\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

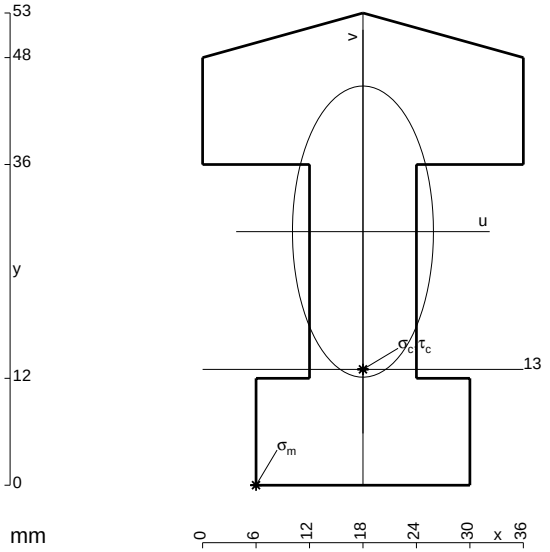
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

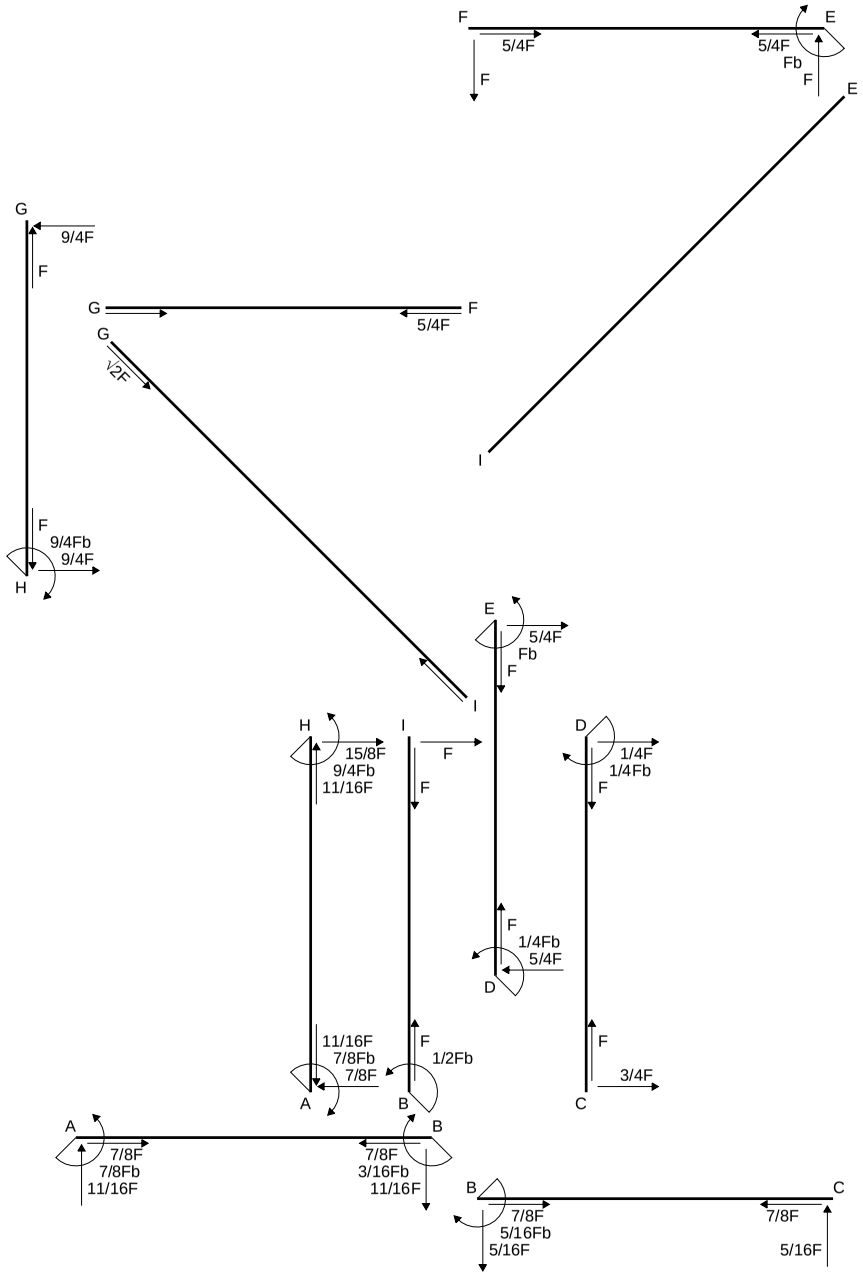
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

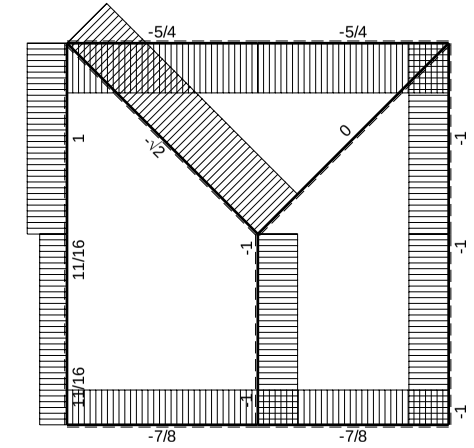
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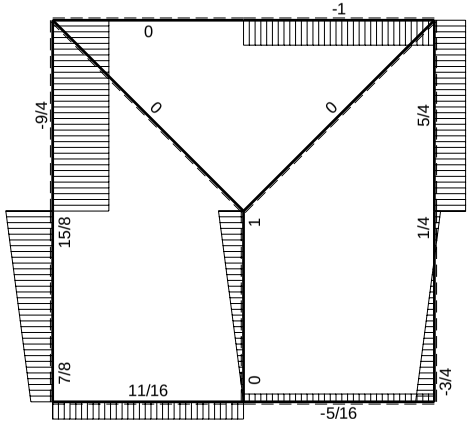


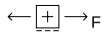
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J_u = 293274. mm^4
J_v = 68796. mm^4
y_g = 28.46 mm
N = 1680. N
T_y = -3780. N
M_x = -2381400. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.46 mm
$\sigma_m = N/A - Mv/J_u$ = -229.6 N/mm^2
x_c = 18. mm
y_c = 13. mm
v_c = -15.46 mm
$\sigma_c = N/A - Mv/J_u$ = -124. N/mm^2
τ_c = 7.155 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 124.7 N/mm^2
S^* = 6661. mm^3

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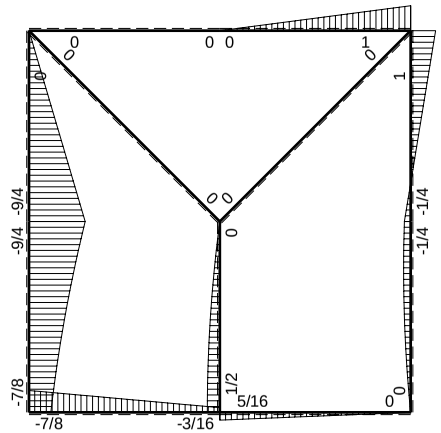

F
5/4F
E
5/4F
Fb
F
F
E
G
9/4F
F
G
F
5/4F
G
½F
I
F
9/4Fb
9/4F
H
E
5/4F
Fb
F
I
H
15/8F
9/4Fb
11/16F
I
F
F
D
1/4F
1/4Fb
F
F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
A
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F
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-1
-7/8
-7/8

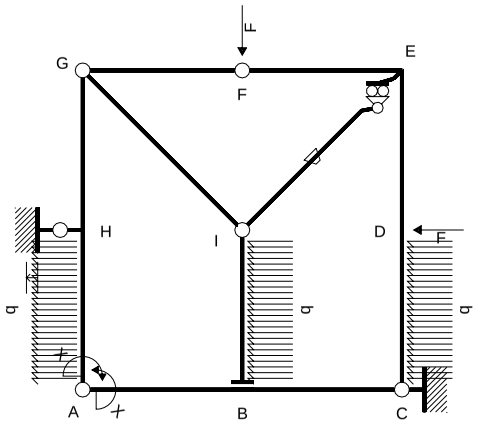

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5/4
15/8
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7/8
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-3/4
11/16
-5/16

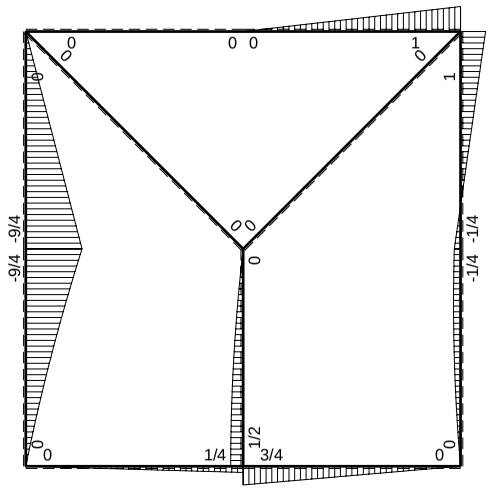

F


F

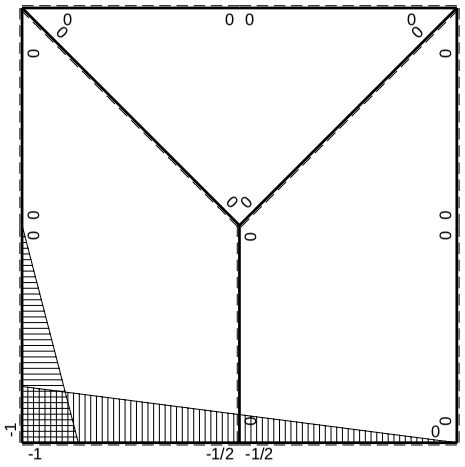

0
0 0
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1
0 0
-9/4
-9/4
-1/4
-1/4
0
1/2
5/16
0
-7/8
-7/8
-3/16


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 267066 CI04.xxxx.024

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PROCEDIMENTO E RISULTATI 267066 CI04.xxxx.024

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	$-1+1/2x/b$	$1/4Fx$	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	$7/12Xb/EJ$
BA b	$1/2+1/2x/b$	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	$-1/2+1/2x/b$	$3/4Fb-3/4Fx$	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	$1/12Xb/EJ$
CB b	$1/2x/b$	$-3/4Fx$	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	$-1/4Fb+5/4Fx$	0	0	0	0	0+0	0
ED b	0	$-Fb+5/4Fx$	0	0	0	0		
EF b	0	$Fb-Fx$	0	0	0	0	0+0	0
FE b	0	$-Fx$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-9/4Fx$	0	0	0	0	0+0	0
HG b	0	$9/4Fb-9/4Fx$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	$-Fb/EJ$	0	0	0	0	0
HA b	$-x/b$	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	$1/3Xb/EJ$
AH b	$1-x/b$	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						$7/8Fb$	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b\ )\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b\ )\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2\ )\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b (-1/4\ x/b + 1/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/8\ x^2/b + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b (-1/8 + 1/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-1/8\ x + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b (-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-3/8\ b + 3/8\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-3/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

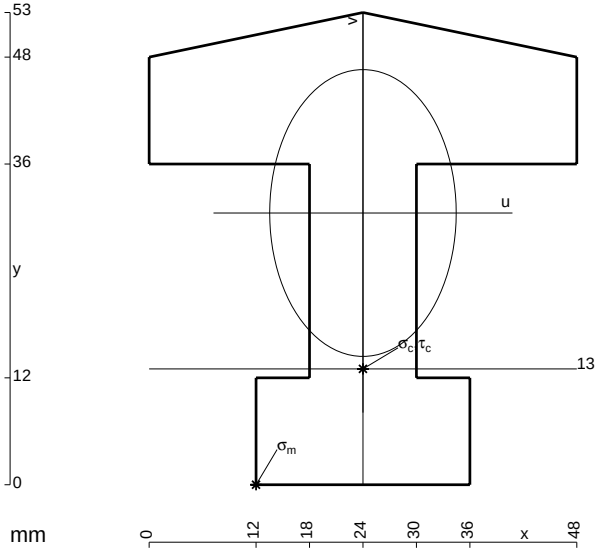
$= (-1/8\ b\ )\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b (9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

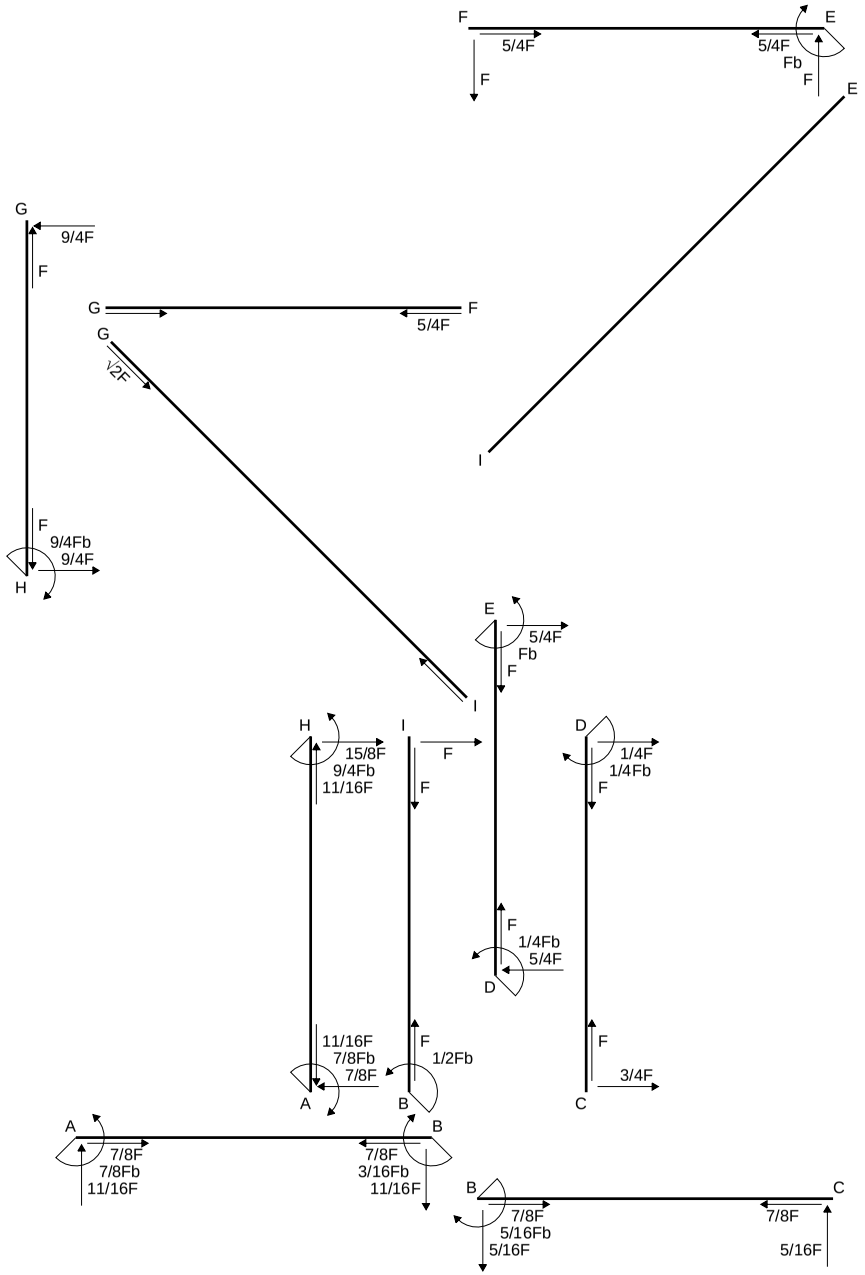
$= (9/8\ b - 11/12\ b + 1/8\ b\ )\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

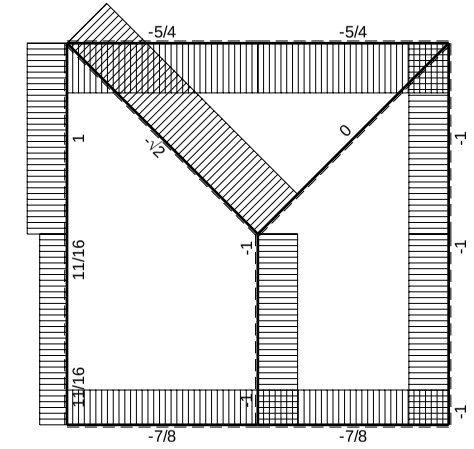
$L^{Xo}_{AH} = \int_o^b (7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

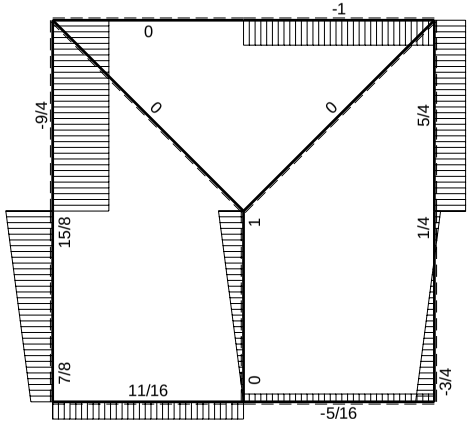
$= (7/8\ b - 5/12\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$



A = 1272. mm^2
J_u = 329658. mm^4
J_v = 139392. mm^4
y_g = 30.5 mm
N = 1700. N
T_y = -3825. N
M_x = -2601000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.5 mm
$\sigma_m = N/A - Mv/J_u$ = -239.3 N/mm^2
x_c = 24. mm
y_c = 13. mm
v_c = -17.5 mm
$\sigma_c = N/A - Mv/J_u$ = -136.7 N/mm^2
τ_c = 7.03 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 137.3 N/mm^2
S^* = 7271. mm^3

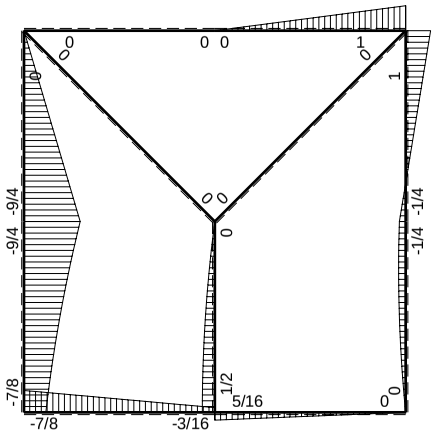

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9/4F
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5/4F
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½F
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9/4Fb
9/4F
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5/4F
Fb
F
I
H
15/8F
9/4Fb
11/16F
I
F
F
D
1/4F
1/4Fb
F
F
1/4Fb
5/4F
D
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7/8Fb
7/8F
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B
F
3/4F
C
A
B
7/8F
7/8Fb
11/16F
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11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
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-7/8

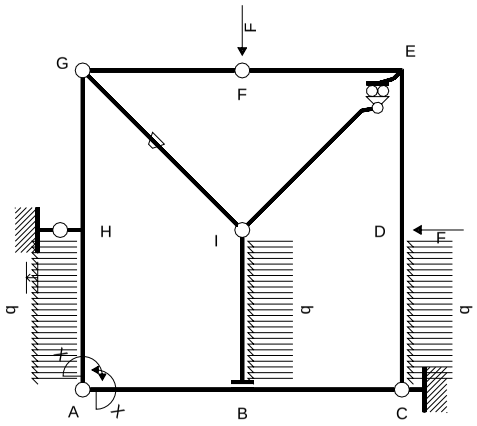

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7/8
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11/16
-5/16

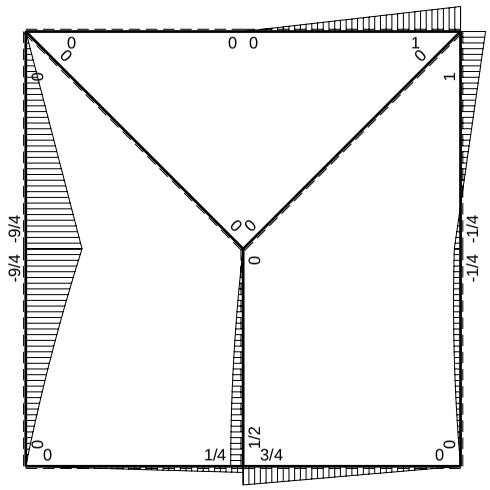
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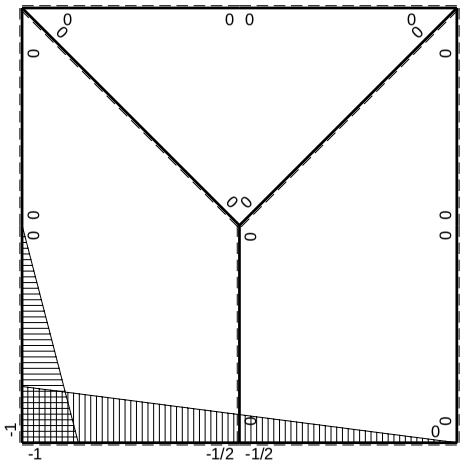

0
0 0
1
0
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1
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0
-9/4
-9/4
-1/4
-1/4
0
-7/8
1/2
5/16
0
-7/8
-3/16

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 267821 CI04.xxxx.025

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PROCEDIMENTO E RISULTATI 267821 CI04.xxxx.025

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb+1/4Fx	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b (-1/4\ x/b + 1/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/8\ x^2/b + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b (-1/8 + 1/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-1/8\ x + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b (-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-3/8\ b + 3/8\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-3/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b\ )\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

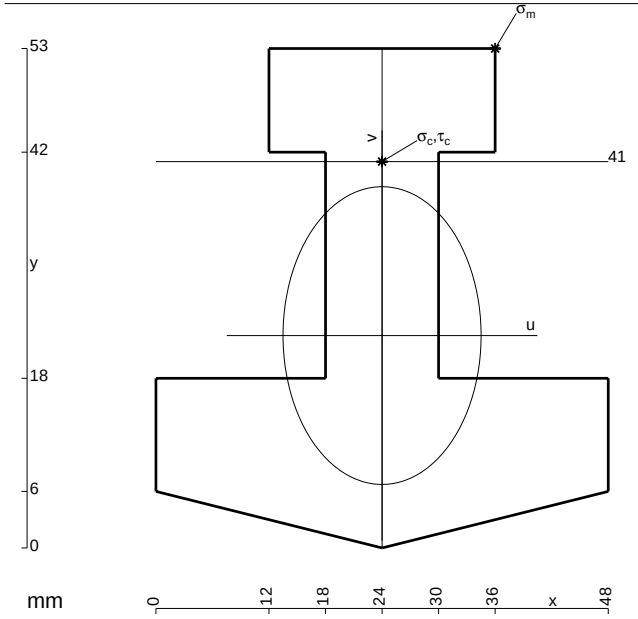
$L^{Xo}_{HA} = \int_o^b (9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (9/8\ b - 11/12\ b + 1/8\ b\ )\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

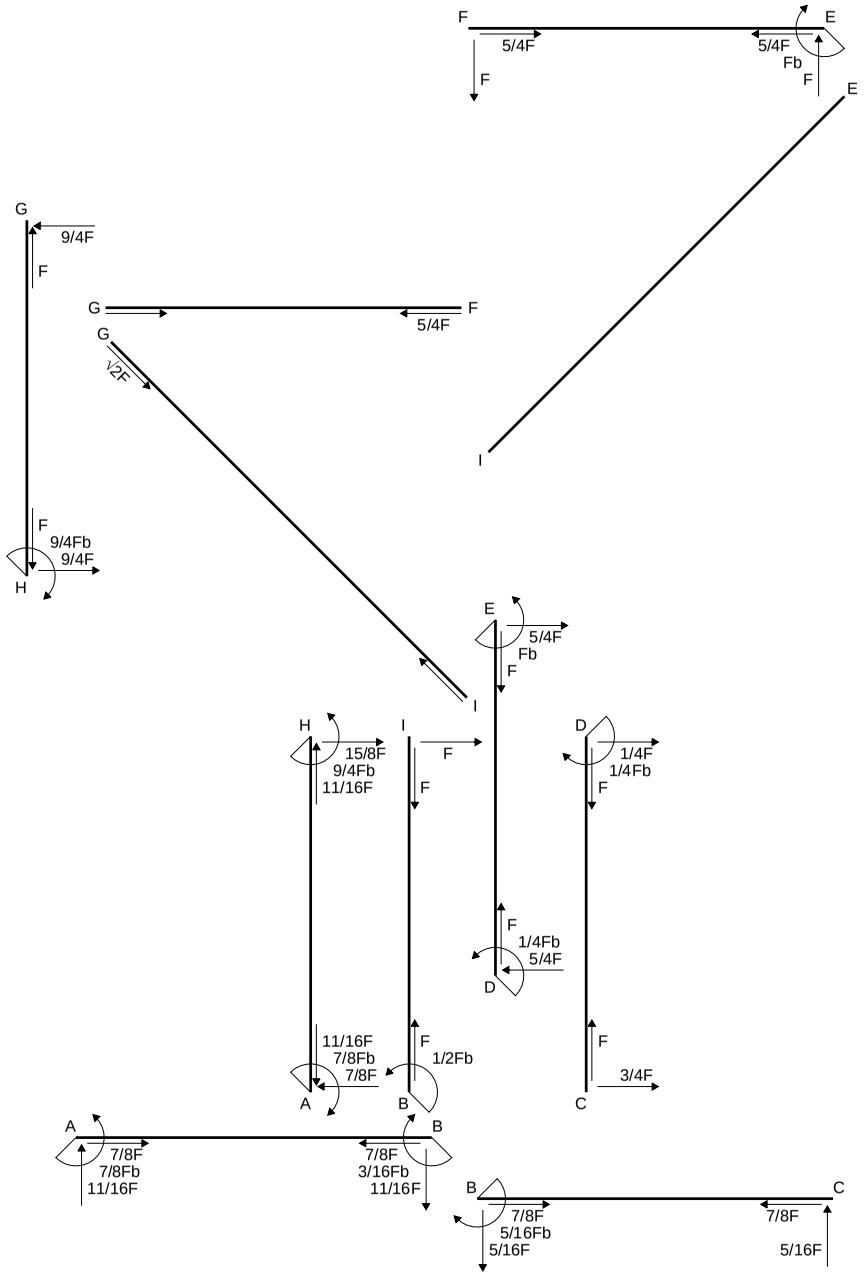
$L^{Xo}_{AH} = \int_o^b (7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

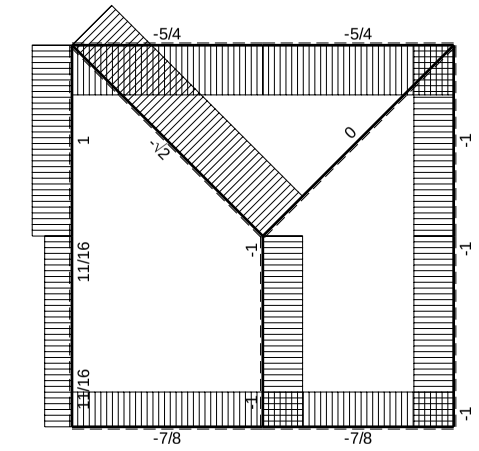
$= (7/8\ b - 5/12\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

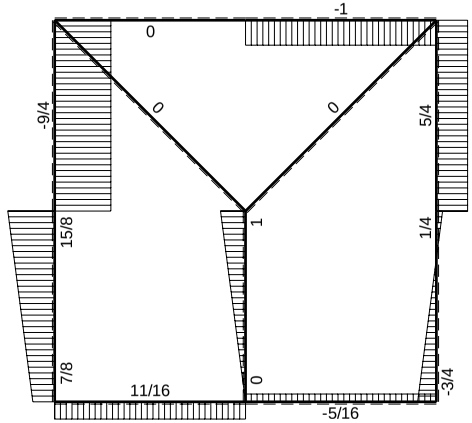
PROCEDIMENTO E RISULTATI 267821 CI04.xxxx.025



A = 1272. mm^2
J_u = 317672. mm^4
J_v = 140544. mm^4
y_g = 22.54 mm
N = 1260. N
T_y = -2835. N
M_x = -2069550. Nmm
x_m = 36. mm
y_m = 53. mm
u_m = 12. mm
v_m = 30.46 mm
$\sigma_m = N/A - Mv/J_u$ = 199.4 N/mm^2
x_c = 24. mm
y_c = 41. mm
v_c = 18.46 mm
$\sigma_c = N/A - Mv/J_u$ = 121.3 N/mm^2
τ_c = 5.07 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 121.6 N/mm^2
S^* = 6818. mm^3

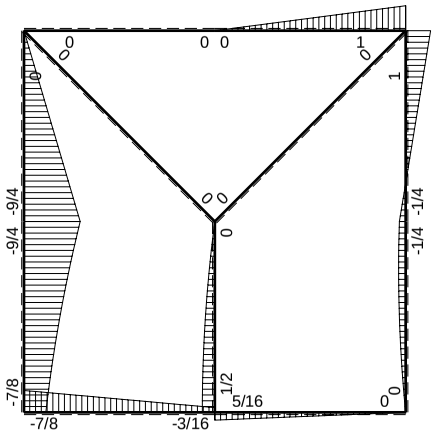

F
5/4F
E
5/4F
Fb
F
F
E
G
9/4F
F
G
F
5/4F
G
½F
I
F
9/4Fb
9/4F
H
E
5/4F
Fb
F
I
H
15/8F
9/4Fb
11/16F
I
F
F
D
1/4F
1/4Fb
F
F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
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F
1/2Fb
B
F
3/4F
C
A
B
7/8F
7/8Fb
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11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
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11/16
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11/16
-1
-1
-7/8
-7/8

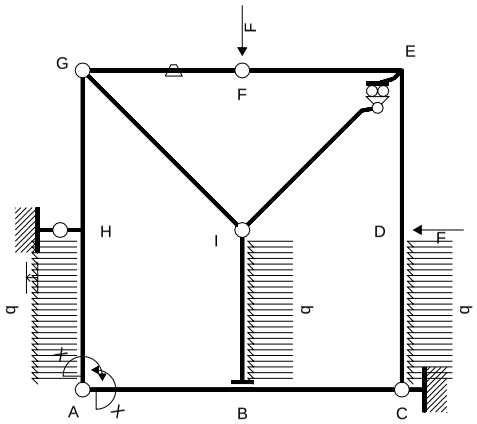

-1
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0
0
5/4
15/8
1
1/4
7/8
0
-3/4
11/16
-5/16

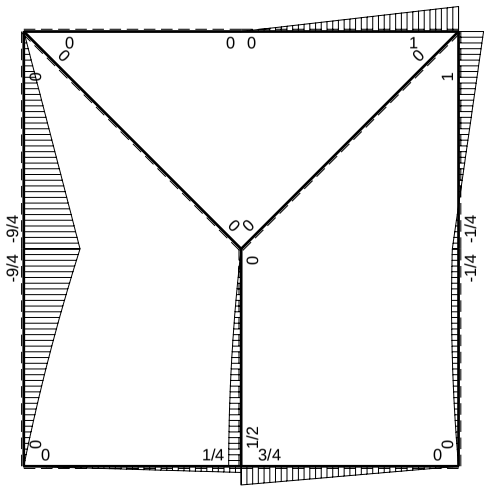
←□→ F

↑□↓ F

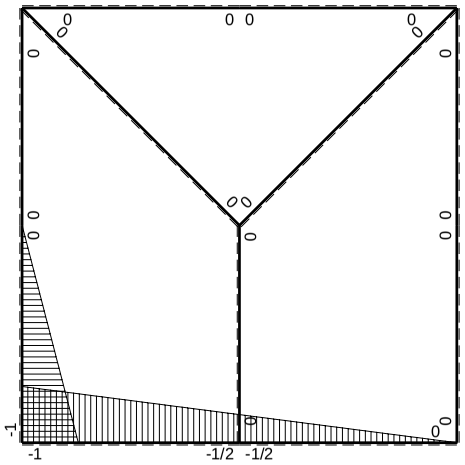

0
0 0
1
0
0
1
0 0
-9/4
-9/4
-1/4
-1/4
0
-7/8
1/2
5/16
0
-7/8
-3/16

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 218343 CI04.xxxx.026

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb+1/4Fx	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	-Fb/EJ	0	0	0	0+0	0
GF b	0	0	Fb/EJ	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

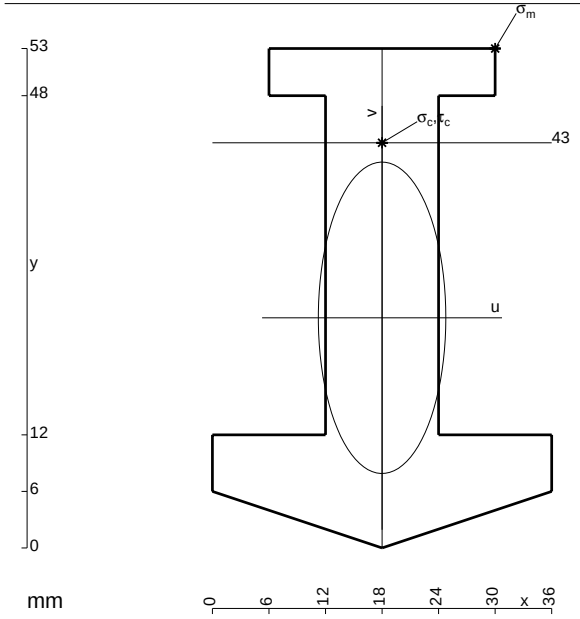
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

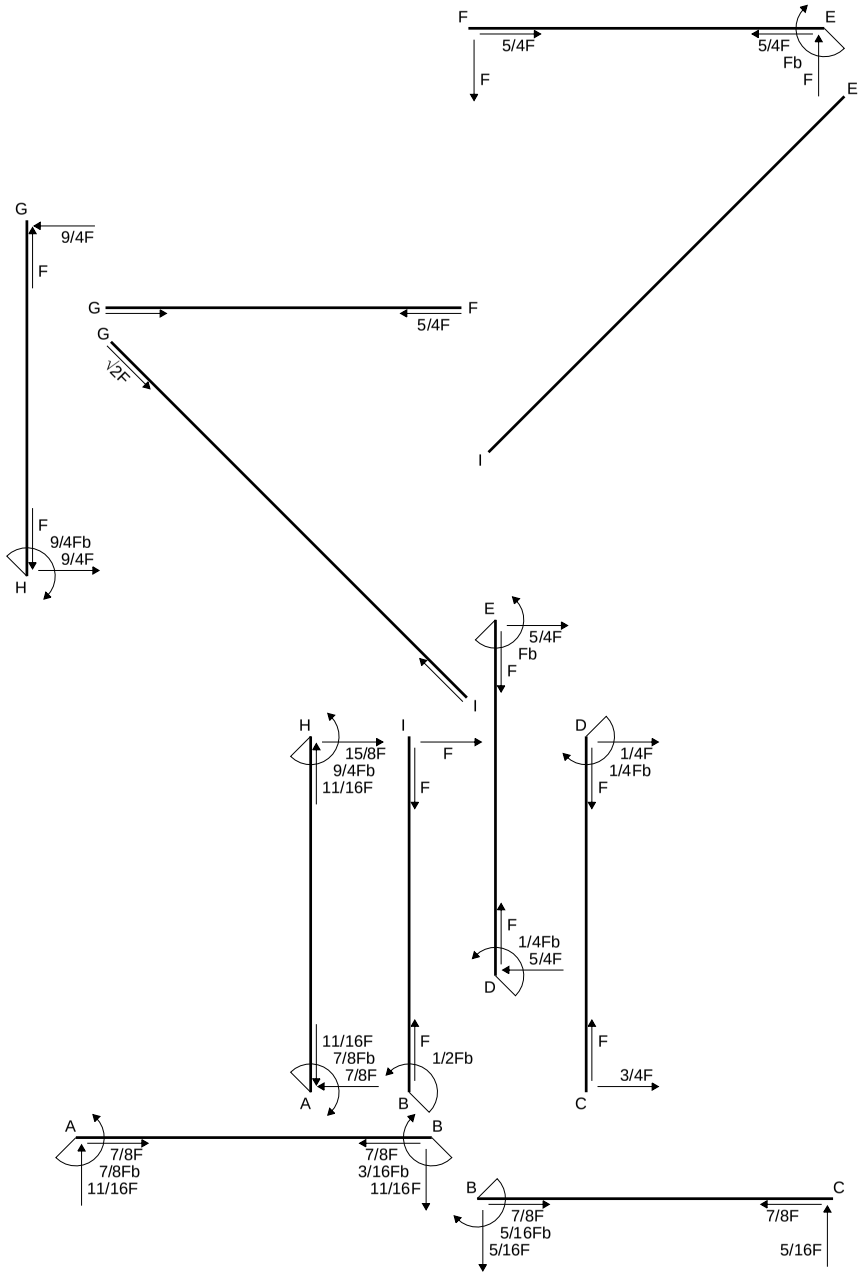
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

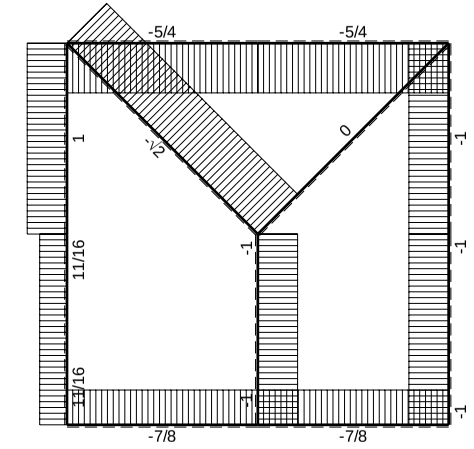
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

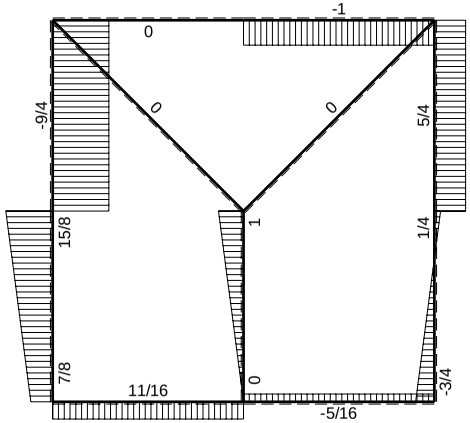
PROCEDIMENTO E RISULTATI 218343 CI04.xxxx.026

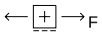


A = 876. mm^2
J_u = 239234. mm^4
J_v = 40104. mm^4
y_g = 24.42 mm
N = 990. N
T_y = -2228. N
M_x = -1737450. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 12. mm
v_m = 28.58 mm
$\sigma_m = N/A - Mv/J_u$ = 208.7 N/mm^2
x_c = 18. mm
y_c = 43. mm
v_c = 18.58 mm
$\sigma_c = N/A - Mv/J_u$ = 136. N/mm^2
τ_c = 3.409 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 136.2 N/mm^2
S^* = 4394. mm^3

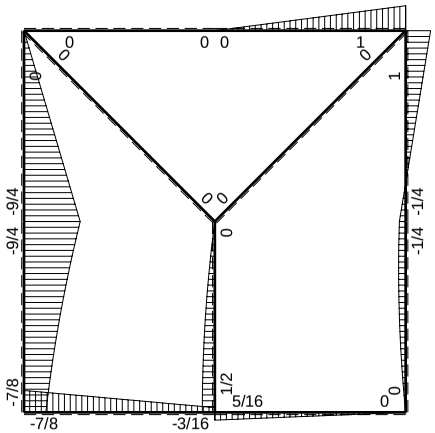

F
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Fb
F
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E
G
9/4F
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5/4F
G
½F
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F
9/4Fb
9/4F
H
E
5/4F
Fb
F
I
H
15/8F
9/4Fb
11/16F
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F
F
D
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F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
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1/2Fb
B
F
3/4F
C
A
B
7/8F
7/8Fb
11/16F
7/8F
3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
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11/16
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11/16
-1
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-7/8

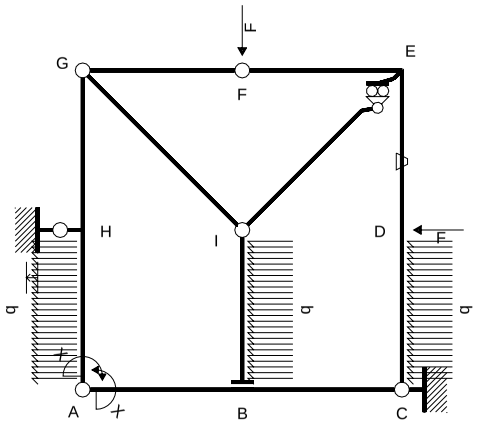

-1
0
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0
5/4
15/8
1
1/4
7/8
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-3/4
11/16
-5/16

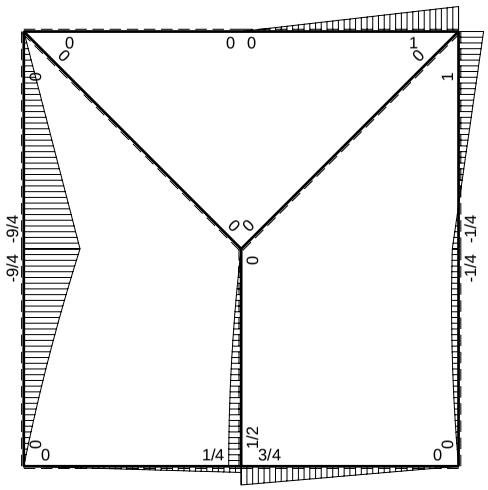

F


F

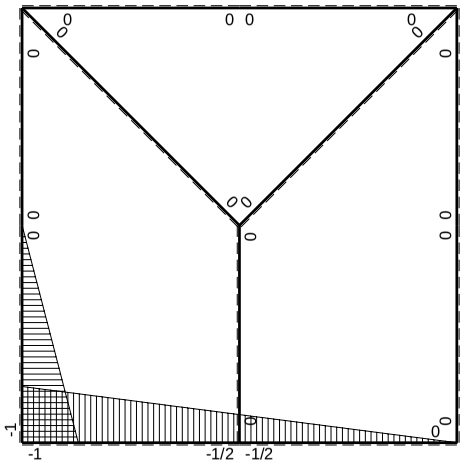

0
0 0
1
0
0
1
0 0
0
-9/4
-9/4
-1/4
-1/4
0
-7/8
1/2
5/16
0
-7/8
-3/16


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 271093 CI04.xxxx.027

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PROCEDIMENTO E RISULTATI 271093 CI04.xxxx.027

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb+1/4Fx	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	Fb/EJ	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

@ Adolfo Zavelani Rossi, Politecnico di Milano, vers.27.03.13 16.04.26

$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

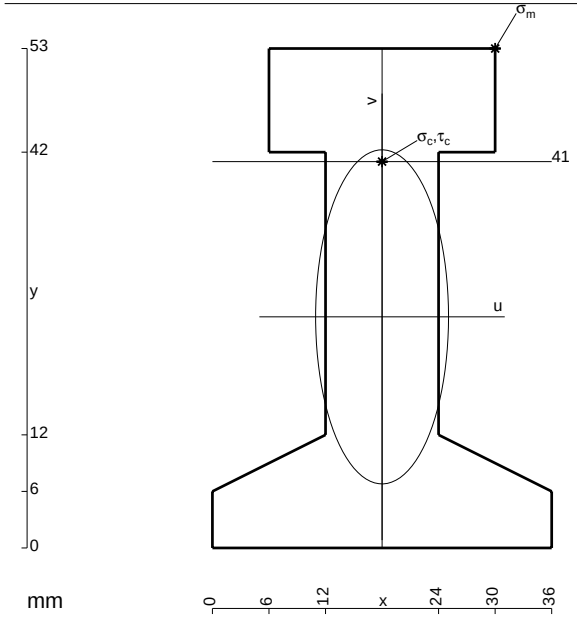
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

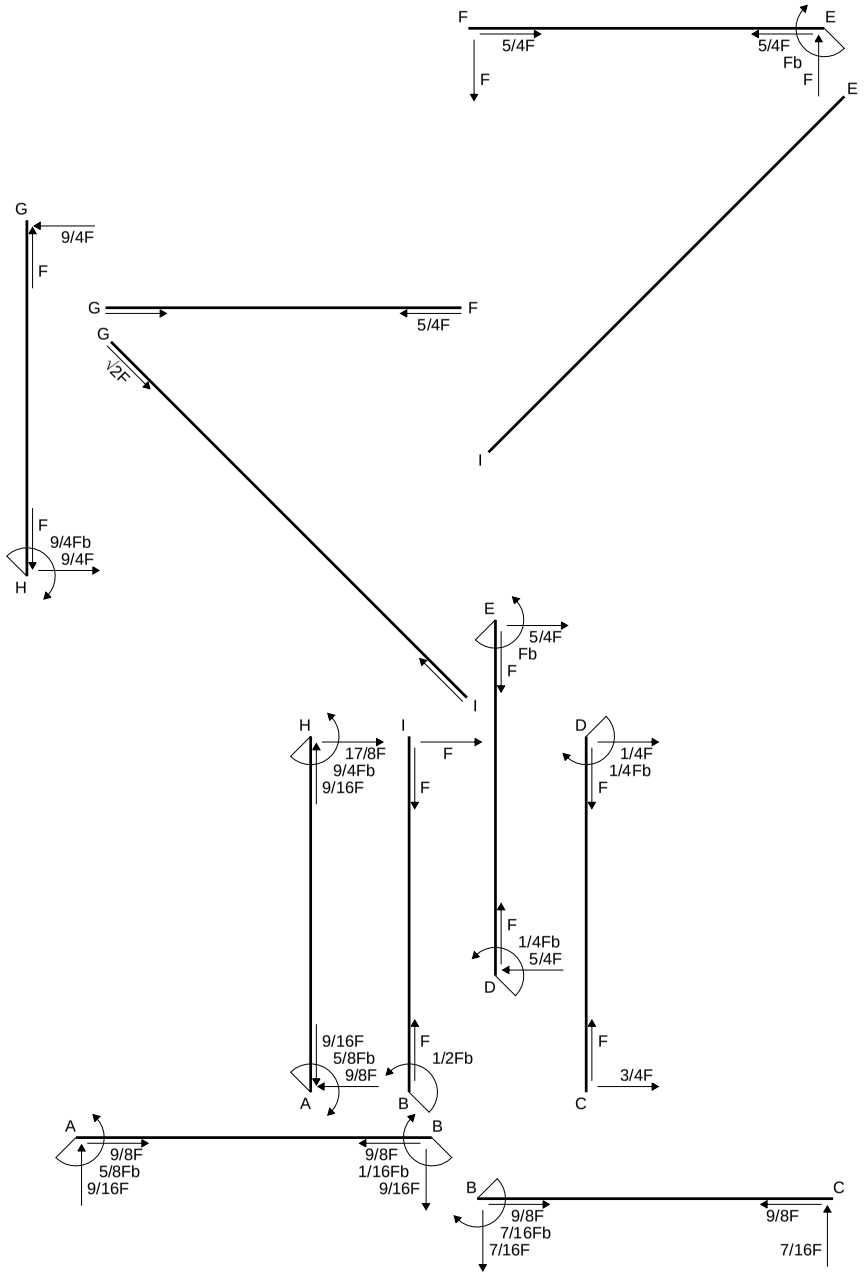
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

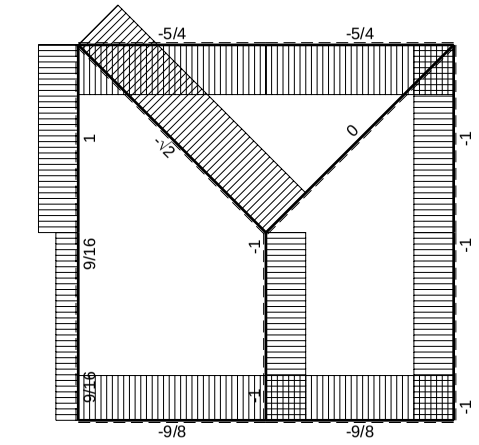
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

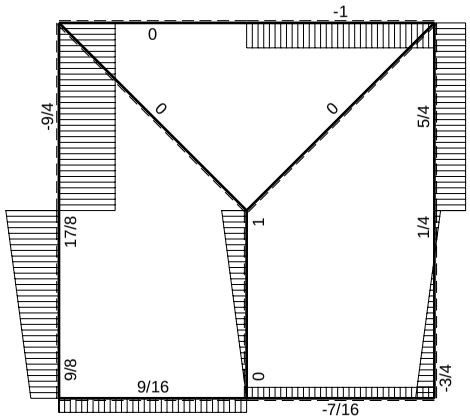
PROCEDIMENTO E RISULTATI 271093 CI04.xxxx.027



A = 984. mm^2
J_u = 309321. mm^4
J_v = 48960. mm^4
y_g = 24.52 mm
N = 1270. N
T_y = -2858. N
M_x = -2371730. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 12. mm
v_m = 28.48 mm
$\sigma_m = N/A - Mv/J_u$ = 219.6 N/mm^2
x_c = 18. mm
y_c = 41. mm
v_c = 16.48 mm
$\sigma_c = N/A - Mv/J_u$ = 127.6 N/mm^2
τ_c = 4.826 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 127.9 N/mm^2
S^* = 6269. mm^3

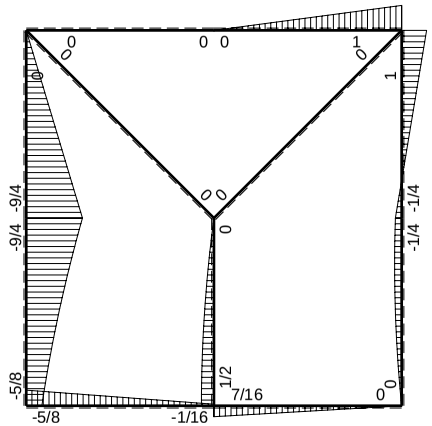

F
5/4F
E
5/4F
Fb
F
F
E
G
9/4F
F
G
F
5/4F
G
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F
9/4Fb
9/4F
H
E
5/4F
Fb
F
I
H
17/8F
9/4Fb
9/16F
I
F
F
D
1/4F
1/4Fb
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F
1/4Fb
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D
9/16F
5/8Fb
9/8F
F
1/2Fb
A
B
F
3/4F
C
A
B
9/8F
5/8Fb
9/16F
9/8F
1/16Fb
9/16F
B
C
9/8F
7/16Fb
7/16F
9/8F
7/16F


-5/4
-5/4
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½
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9/16
-1
-1
-9/8
-9/8

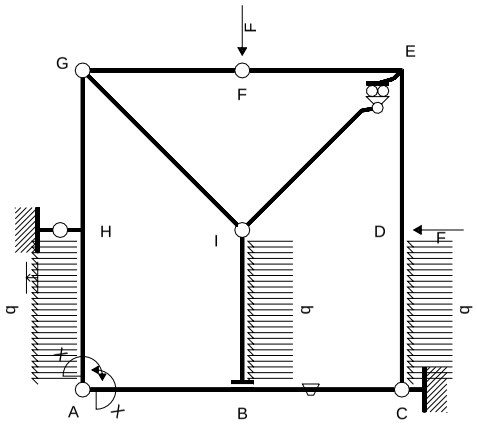

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0
5/4
17/8
1
1/4
9/8
9/16
0
-3/4
-7/16

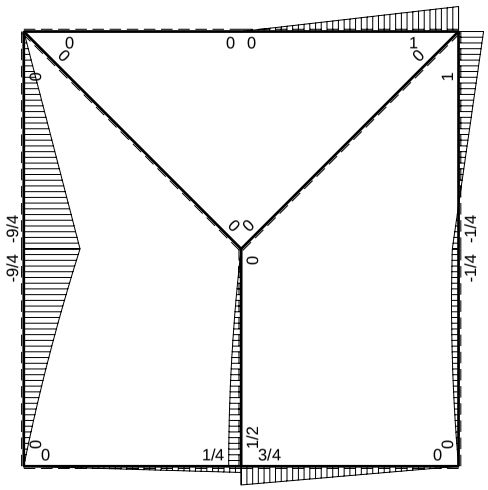
←□→ F

↑□↓ F

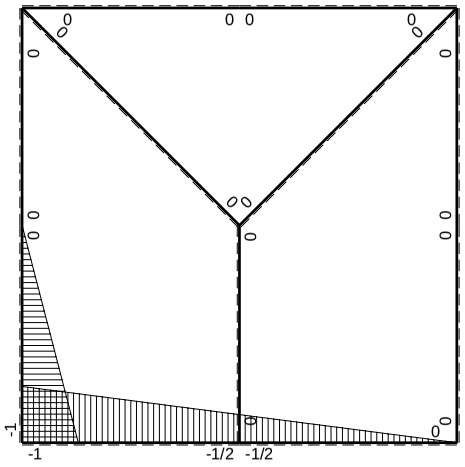

0
0 0
1
0
0
1
0
0 0
0
-9/4
-9/4
-1/4
-1/4
1/2
-5/8
7/16
0
0
-5/8
-1/16

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264395 CI04.xxxx.028

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	-Fb/EJ	$-3/8Fb+3/4Fx-3/8Fx^2/b$	$1/2Fb/EJ-1/2Fx/EJ$	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	Fb/EJ	$-3/8Fx^2/b$	1/2Fx/EJ	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1/2 - 1/2\ x/b\ \right)\ \theta\ \ dx$

$= \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x - 1/4\ x^2/b\right]_o^b\ \theta$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2\ x/b\ \right)\ \theta\ \ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/4\ b\ \right)\ \theta\ \ = 1/8\ \ Fb^2/EJ$

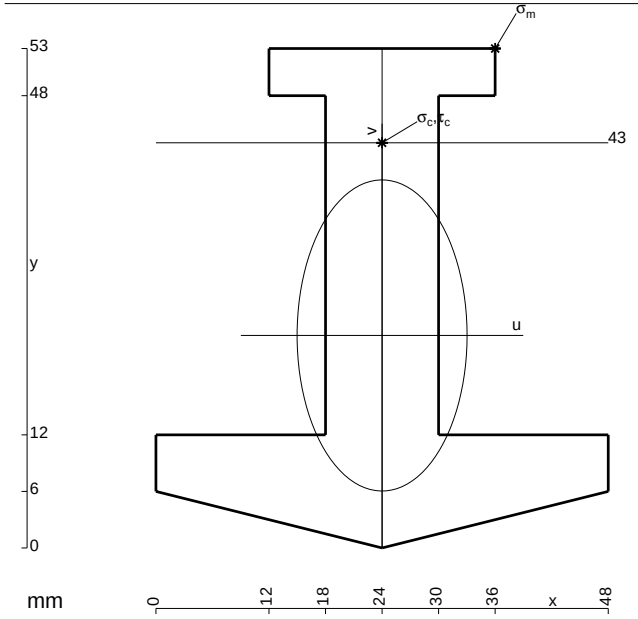
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

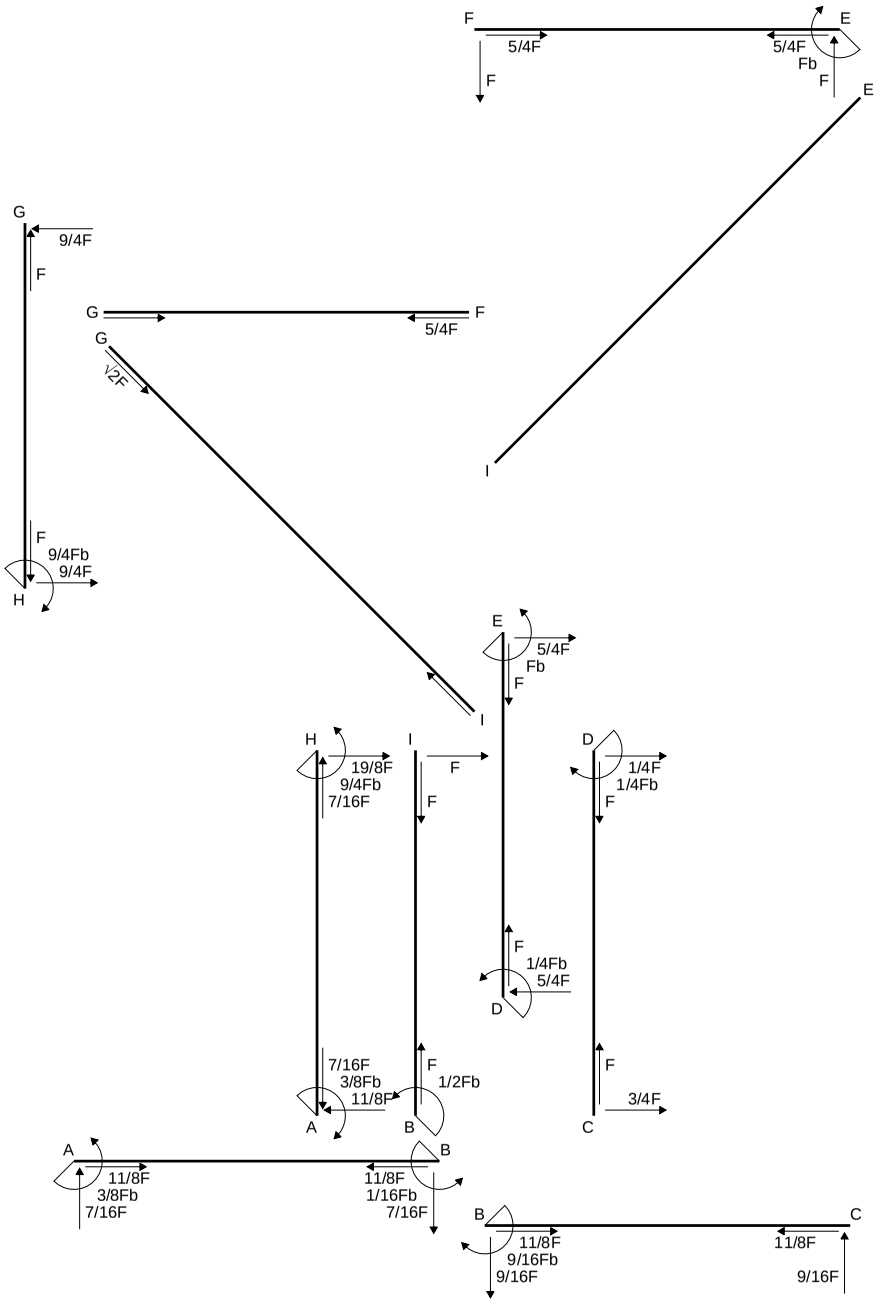
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

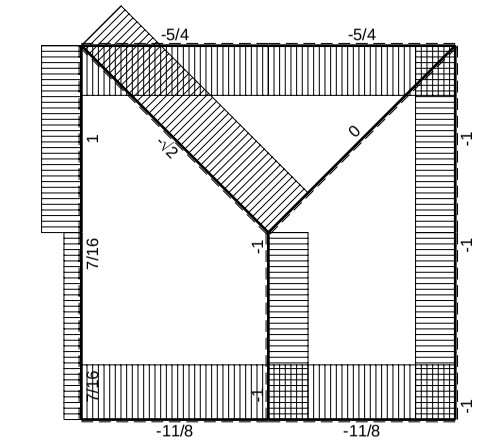
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

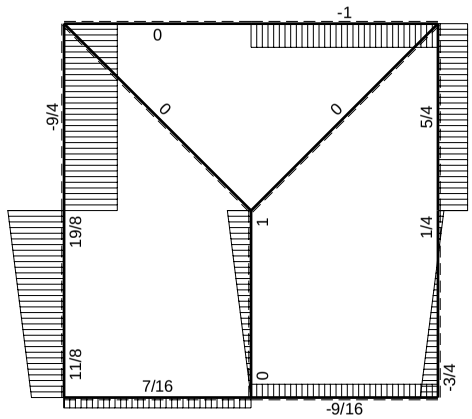
PROCEDIMENTO E RISULTATI 264395 CI04.xxxx.028

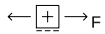


A = 984. mm^2
J_u = 268208. mm^4
J_v = 80064. mm^4
y_g = 22.55 mm
N = 1010. N
T_y = -2273. N
M_x = -1999800. Nmm
x_m = 36. mm
y_m = 53. mm
u_m = 12. mm
v_m = 30.45 mm
$\sigma_m = N/A - Mv/J_u$ = 228.1 N/mm^2
x_c = 24. mm
y_c = 43. mm
v_c = 20.45 mm
$\sigma_c = N/A - Mv/J_u$ = 153.5 N/mm^2
τ_c = 3.341 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 153.6 N/mm^2
S^* = 4731. mm^3

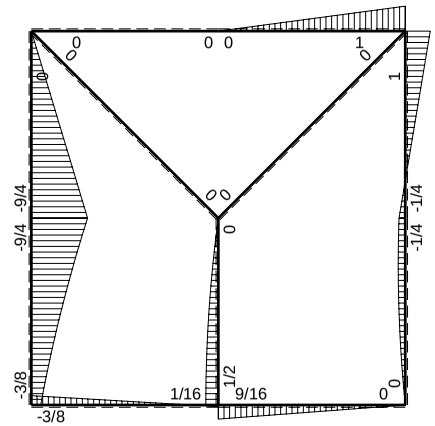

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Fb
F
F
E
G
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5/4F
G
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I
F
9/4Fb
9/4F
H
E
5/4F
Fb
F
I
H
19/8F
9/4Fb
7/16F
I
F
F
D
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1/4Fb
F
F
1/4Fb
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D
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3/8Fb
11/8F
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1/2Fb
A
B
F
3/4F
C
A
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3/8Fb
7/16F
B
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7/16F
B
11/8F
9/16Fb
9/16F
C
11/8F
9/16F


-5/4
-5/4
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7/16
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-11/8

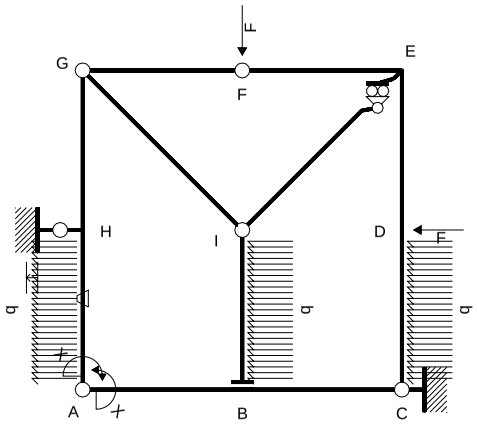

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11/8
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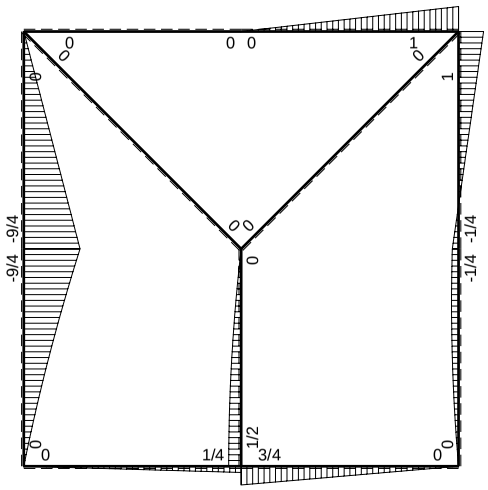

F


F

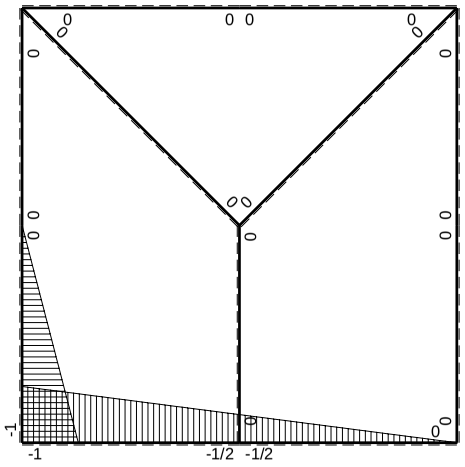

0
0 0
1
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1
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0
0
-9/4
-9/4
-1/4
-1/4
0
-3/8
1/16
1/2
9/16
0
0
-3/8


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 268891 CI04.xxxx.029

@ Adolfo Zavelani Rossi, Politecnico di Milano, vers.27.03.13 16.04.26

PROCEDIMENTO E RISULTATI 268891 CI04.xxxx.029

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	$-1/4Fb+5/4Fx$	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	-Fb/EJ	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(1/3+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	Fb/EJ	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\ \theta\ \ dx$

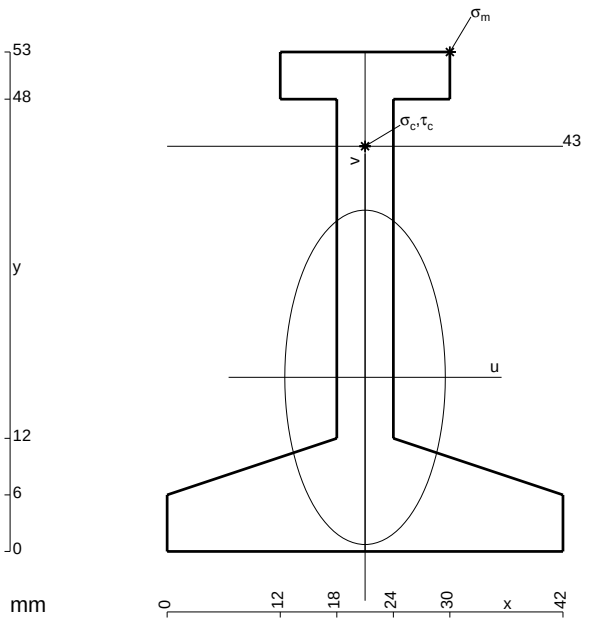
$= \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b\ \theta$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b\ \right)\ \theta\ \ = 5/6\ \ Fb^2/EJ$

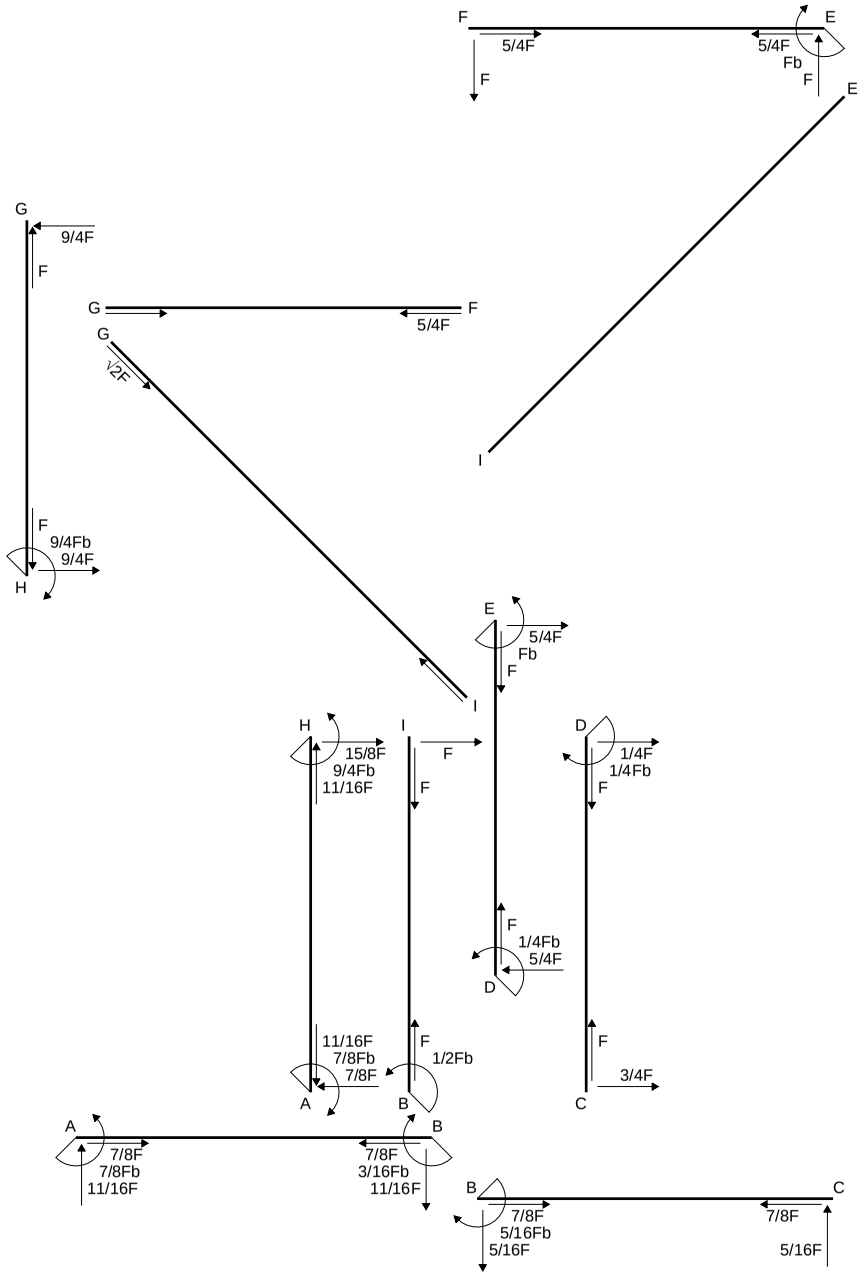
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\ \theta\ \ dx$

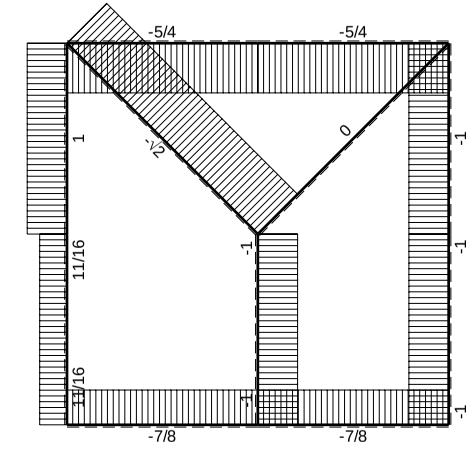
$= \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b\ \theta$

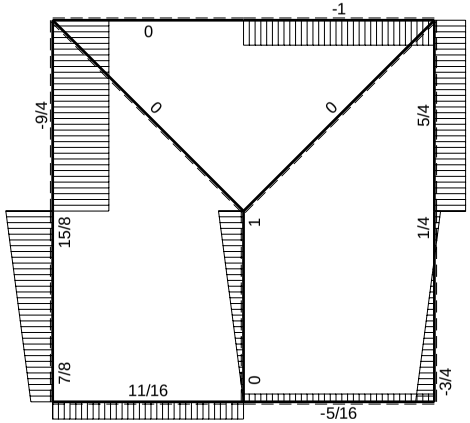
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\ \theta\ \ = 5/6\ \ Fb^2/EJ$



A = 702. mm^2
J_u = 221020. mm^4
J_v = 50922. mm^4
y_g = 18.47 mm
N = 730. N
T_y = -1643. N
M_x = -1527530. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 9. mm
v_m = 34.53 mm
$\sigma_m = N/A - Mv/J_u$ = 239.7 N/mm^2
x_c = 21. mm
y_c = 43. mm
v_c = 24.53 mm
$\sigma_c = N/A - Mv/J_u$ = 170.5 N/mm^2
τ_c = 4.574 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 170.7 N/mm^2
S^* = 3693. mm^3

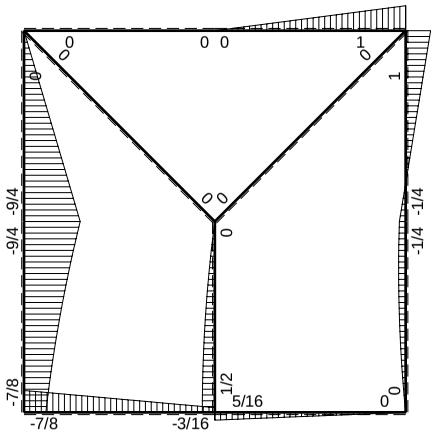

F
5/4F
E
5/4F
Fb
F
F
E
G
9/4F
F
G
F
5/4F
G
½F
I
F
9/4Fb
9/4F
H
E
5/4F
Fb
F
I
H
15/8F
9/4Fb
11/16F
I
F
F
D
1/4F
1/4Fb
F
F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
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F
1/2Fb
B
F
3/4F
C
A
B
7/8F
7/8Fb
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B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
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-7/8

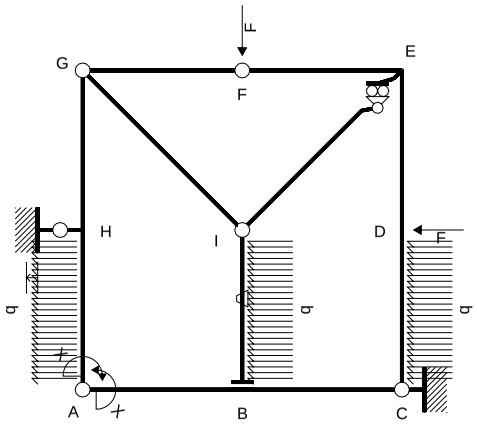

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0
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0
0
5/4
15/8
1
1/4
7/8
0
-3/4
11/16
-5/16

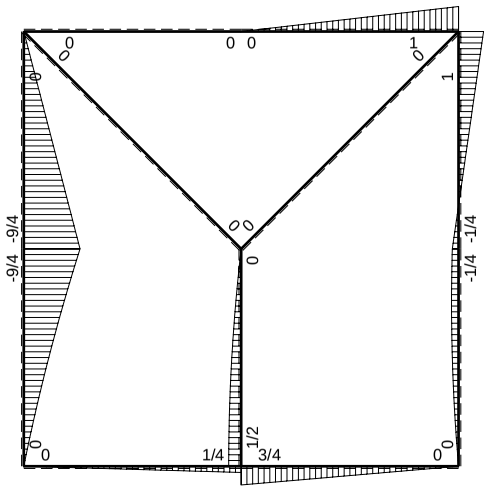
←□→ F

↑□↓ F

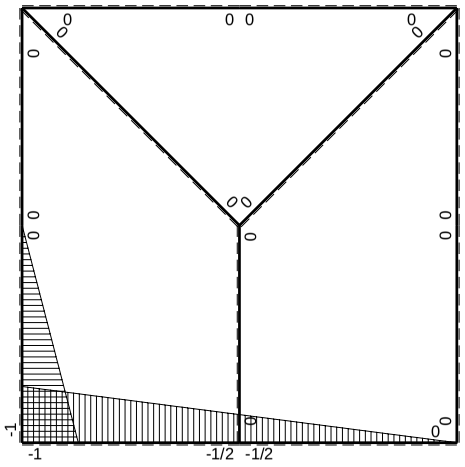

0
0 0
1
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1
0 0
-9/4
-9/4
-1/4
-1/4
0
-7/8
1/2
5/16
0
-7/8
-3/16

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 267675 CI04.xxxx.030

@ Adolfo Zavelani Rossi, Politecnico di Milano, vers.27.03.13 16.04.26

PROCEDIMENTO E RISULTATI 267675 CI04.xxxx.030

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb+1/4Fx	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

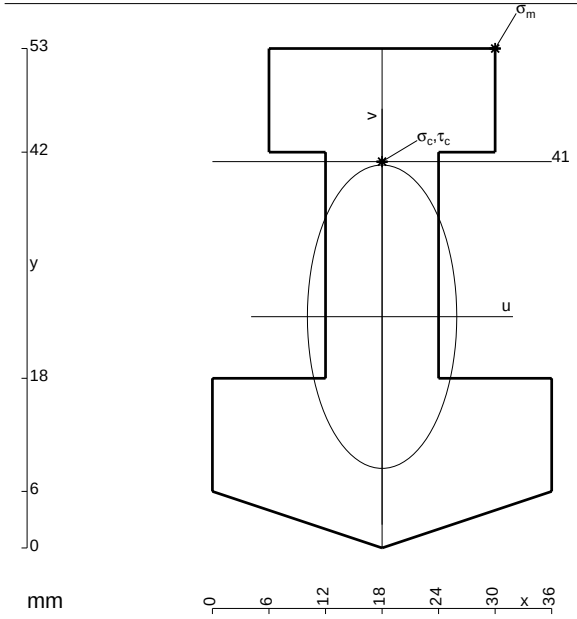
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

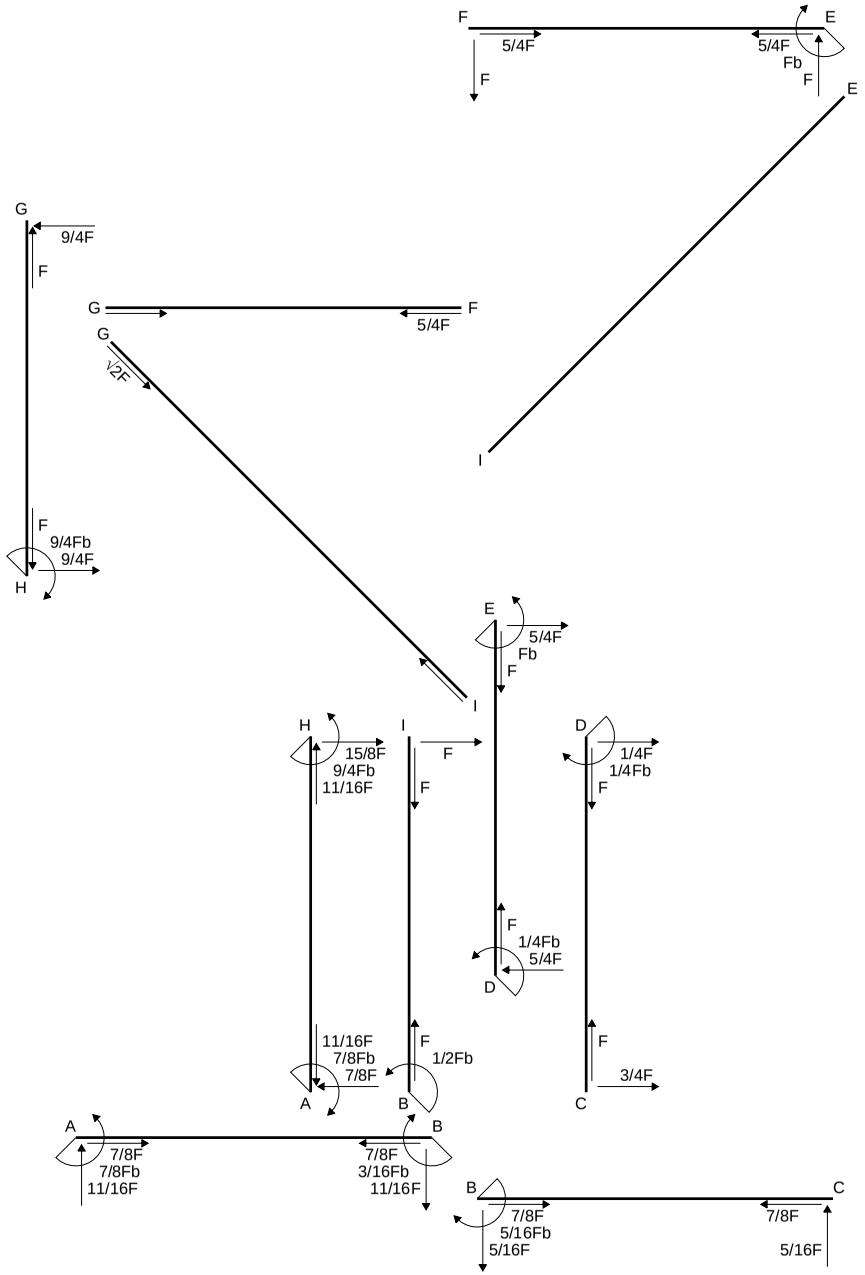
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

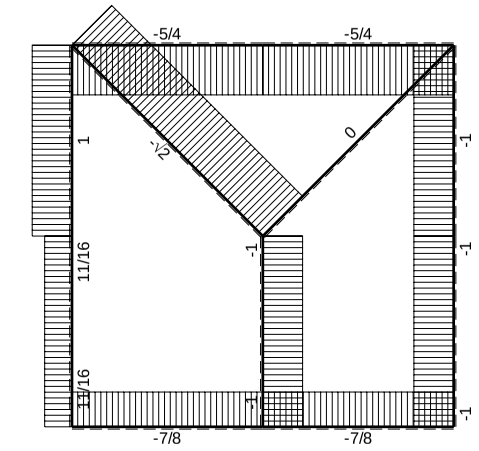
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

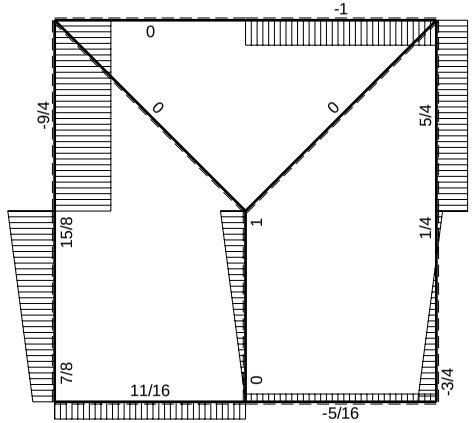
PROCEDIMENTO E RISULTATI 267675 CI04.xxxx.030



A = 1092. mm^2
J_u = 283139. mm^4
J_v = 68616. mm^4
y_g = 24.54 mm
N = 1780. N
T_y = -4005. N
M_x = -1962450. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 12. mm
v_m = 28.46 mm
$\sigma_m = N/A - Mv/J_u$ = 198.9 N/mm^2
x_c = 18. mm
y_c = 41. mm
v_c = 16.46 mm
$\sigma_c = N/A - Mv/J_u$ = 115.7 N/mm^2
τ_c = 7.385 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 116.4 N/mm^2
S^* = 6265. mm^3

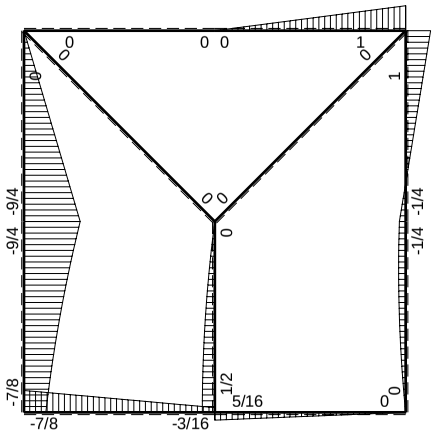

F
5/4F
E
5/4F
Fb
F
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E
G
9/4F
F
G
F
5/4F
G
½F
I
F
9/4Fb
9/4F
H
E
5/4F
Fb
F
I
H
15/8F
9/4Fb
11/16F
I
F
F
D
1/4F
1/4Fb
F
F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
A
F
1/2Fb
B
F
3/4F
C
A
B
7/8F
7/8Fb
11/16F
7/8F
3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
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5/16F


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-7/8
-7/8

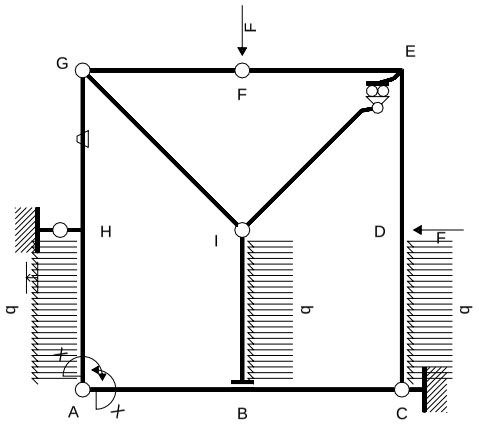

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7/8
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-3/4
11/16
-5/16

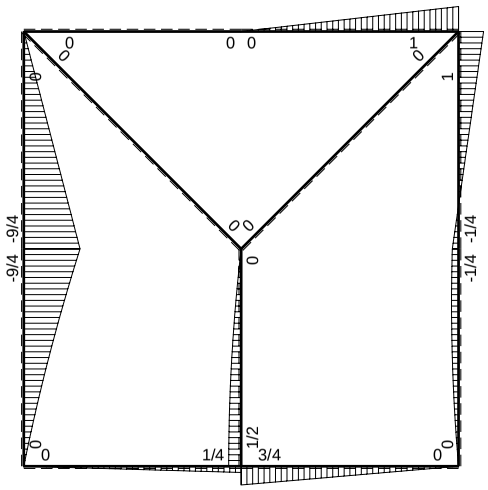
←□→ F

↑□↓ F

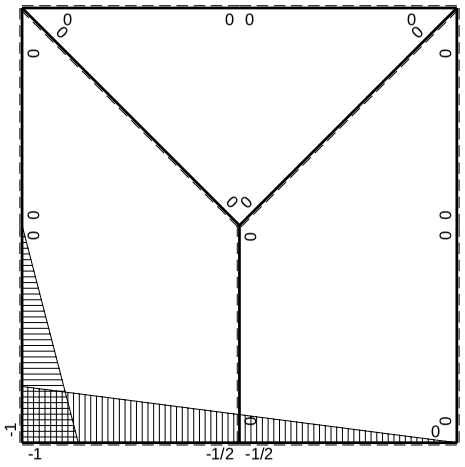

0
0 0
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1
0 0
-9/4
-9/4
-1/4
-1/4
0
-7/8
1/2
5/16
0
-7/8
-3/16

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 248738 CI04.xxxx.031

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PROCEDIMENTO E RISULTATI 248738 CI04.xxxx.031

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb+1/4Fx	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	-Fb/EJ	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b (-1/4\ x/b + 1/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/8\ x^2/b + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b (-1/8 + 1/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-1/8\ x + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b (-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-3/8\ b + 3/8\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-3/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b\ )\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

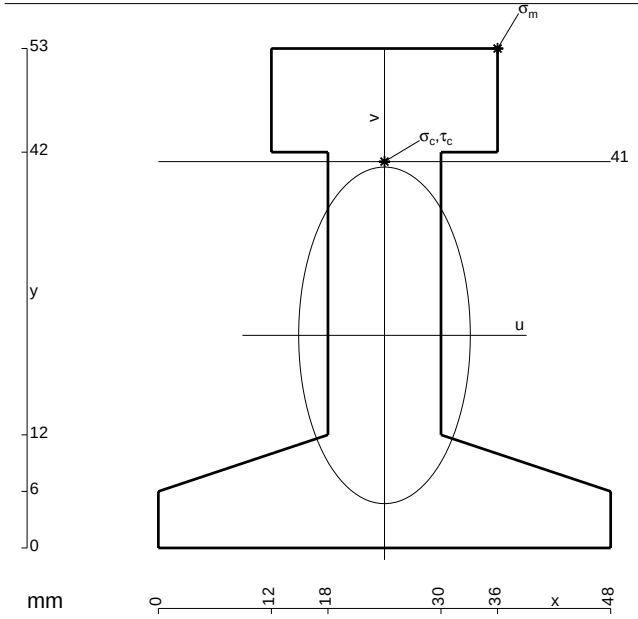
$L^{Xo}_{HA} = \int_o^b (9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (9/8\ b - 11/12\ b + 1/8\ b\ )\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

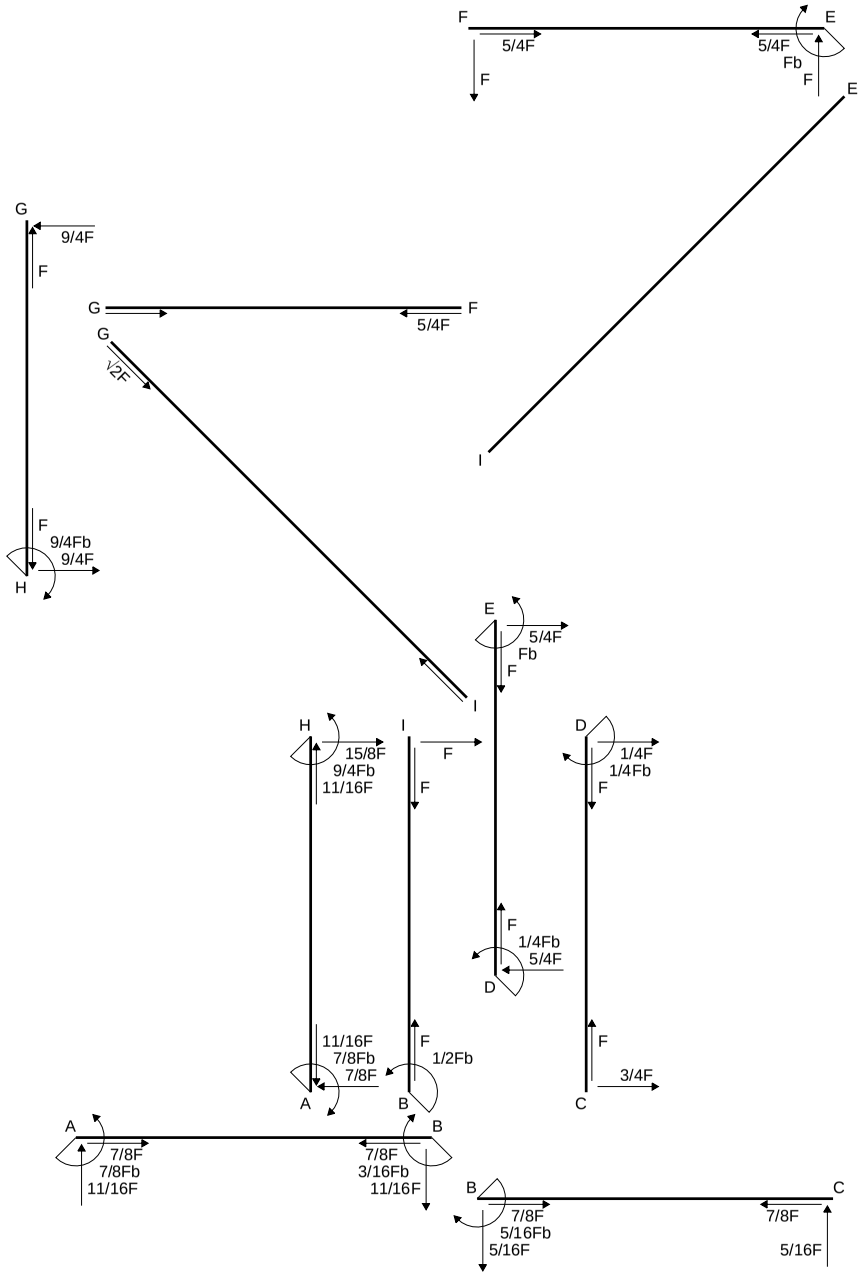
$L^{Xo}_{AH} = \int_o^b (7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

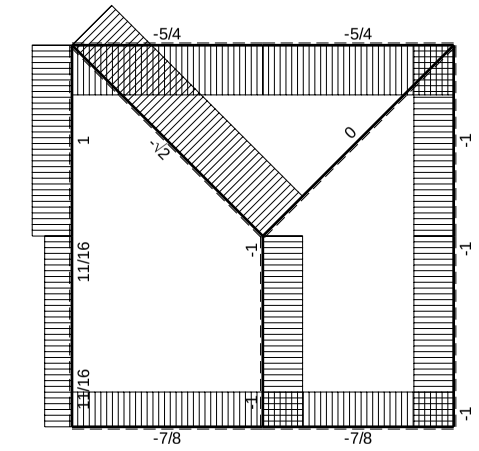
$= (7/8\ b - 5/12\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

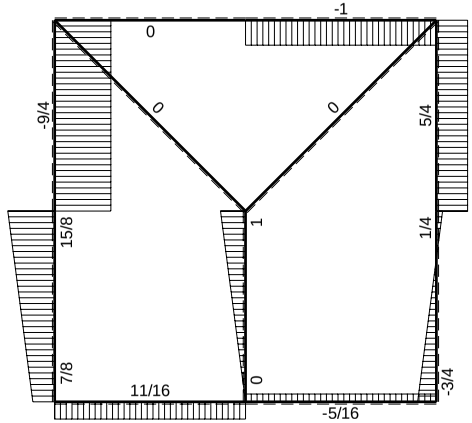
PROCEDIMENTO E RISULTATI 248738 CI04.xxxx.031



A = 1092. mm^2
J_u = 348585. mm^4
J_v = 90648. mm^4
y_g = 22.56 mm
N = 1990. N
T_y = -4478. N
M_x = -2373080. Nmm
x_m = 36. mm
y_m = 53. mm
u_m = 12. mm
v_m = 30.44 mm
$\sigma_m = N/A - Mv/J_u$ = 209. N/mm^2
x_c = 24. mm
y_c = 41. mm
v_c = 18.44 mm
$\sigma_c = N/A - Mv/J_u$ = 127.4 N/mm^2
τ_c = 7.291 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 128. N/mm^2
S^* = 6811. mm^3

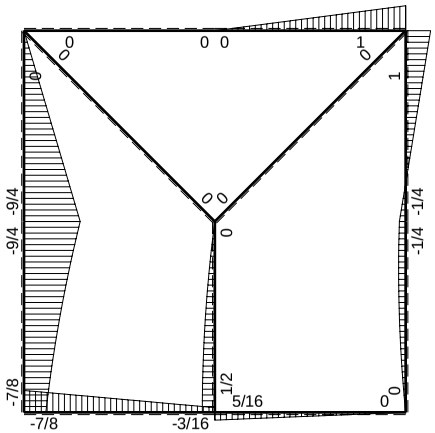

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Fb
F
I
H
15/8F
9/4Fb
11/16F
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F
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B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


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-7/8

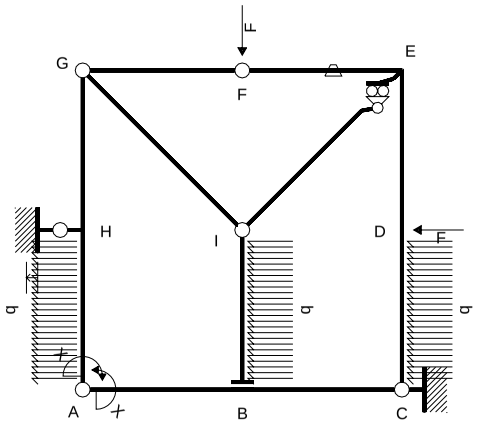

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7/8
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-3/4
11/16
-5/16

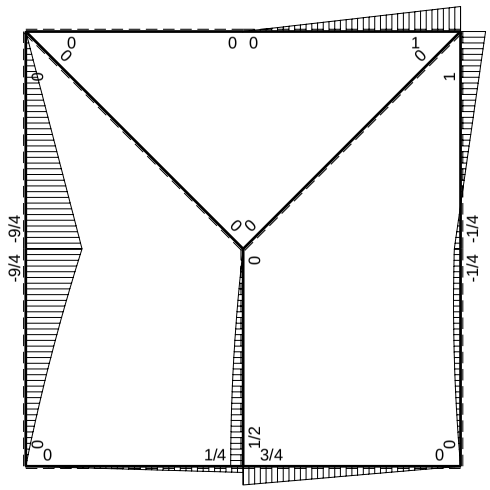
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F

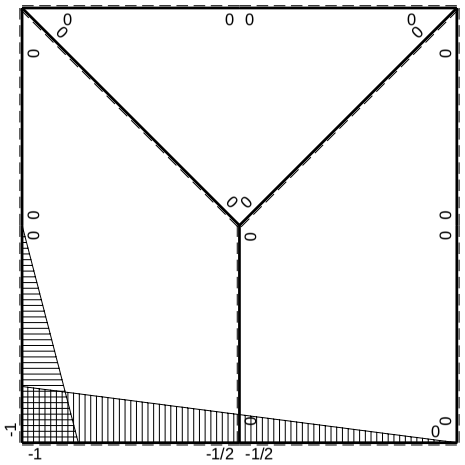

0
0 0
1
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1
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0
-9/4
-9/4
-1/4
-1/4
0
-7/8
1/2
5/16
0
-7/8
-3/16

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 269783 CI04.xxxx.032

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PROCEDIMENTO E RISULTATI 269783 CI04.xxxx.032

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb+1/4Fx	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	-Fb/EJ	0	0	0	0+0	0
FE b	0	-Fx	Fb/EJ	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

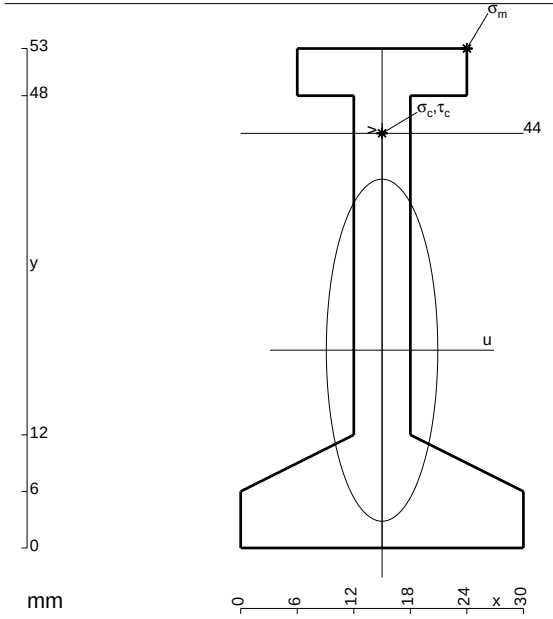
$$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

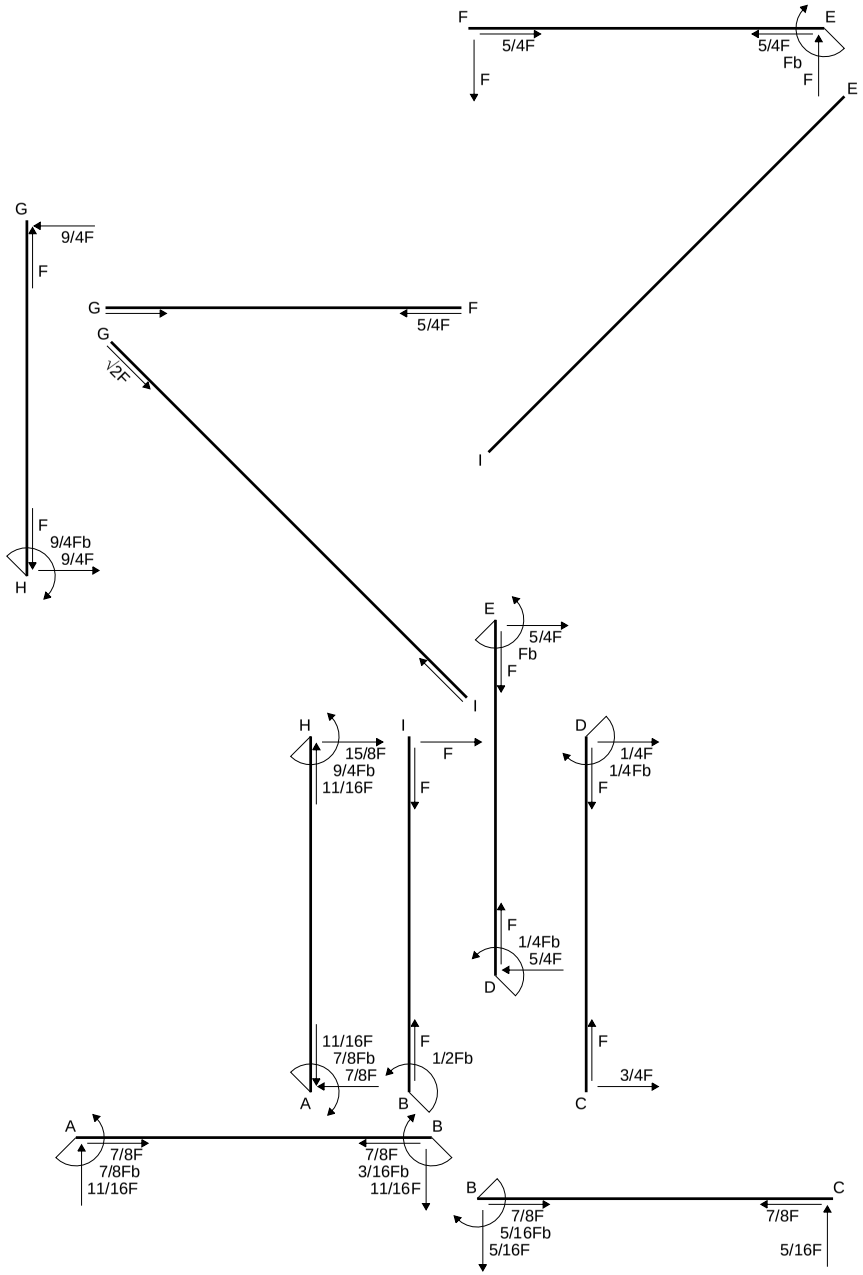
$$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

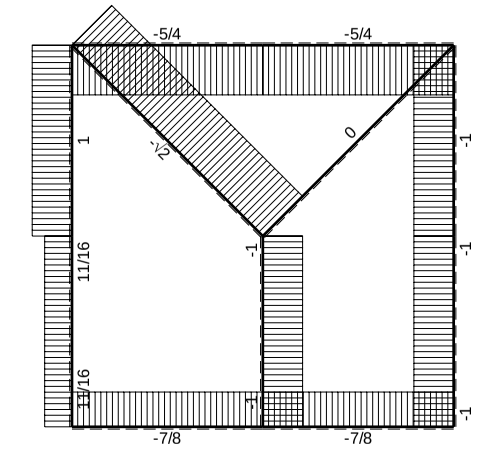
$$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

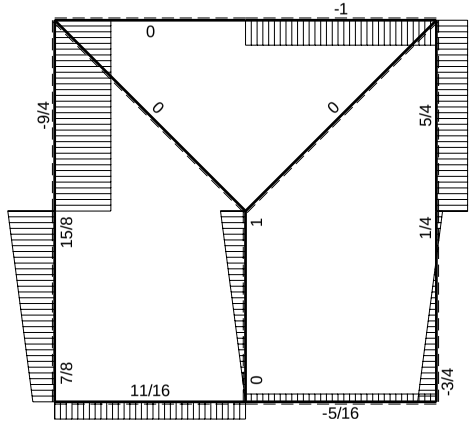
PROCEDIMENTO E RISULTATI 269783 CI04.xxxx.032



A = 594. mm^2
J_u = 195798. mm^4
J_v = 20790. mm^4
y_g = 20.98 mm
N = 1020. N
T_y = -2295. N
M_x = -1331100. Nmm
x_m = 24. mm
y_m = 53. mm
u_m = 9. mm
v_m = 32.02 mm
σ_m = N/A-Mv/J_u = 219.4 N/mm^2
x_c = 15. mm
y_c = 44. mm
v_c = 23.02 mm
σ_c = N/A-Mv/J_u = 158.2 N/mm^2
τ_c = 6.362 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 158.6 N/mm^2
S^* = 3257. mm^3

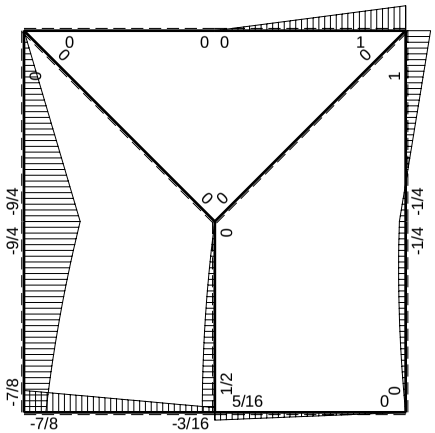

F
5/4F
E
5/4F
Fb
F
F
E
G
9/4F
F
G
F
5/4F
G
½F
I
F
9/4Fb
9/4F
H
E
5/4F
Fb
F
I
H
15/8F
9/4Fb
11/16F
I
F
F
D
1/4F
1/4Fb
F
F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
A
F
1/2Fb
B
F
3/4F
C
A
B
7/8F
7/8Fb
11/16F
7/8F
3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
-5/4
1
-1/2
0
-1
11/16
-1
-1
11/16
-1
-1
-7/8
-7/8

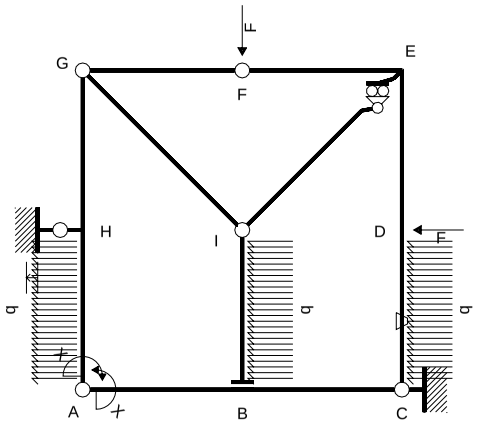

-1
0
-9/4
0
0
5/4
15/8
1
1/4
7/8
0
-3/4
11/16
-5/16

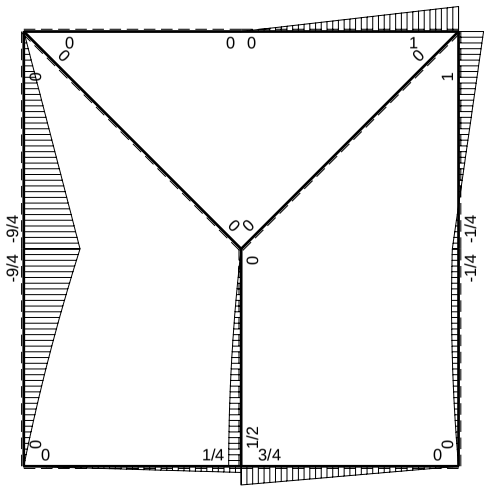
←□→ F

↑□↓ F

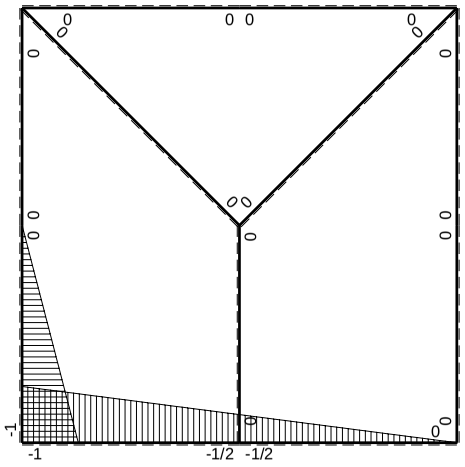

0
0 0
1
0
0
1
0 0
-9/4
-9/4
-1/4
-1/4
0
-7/8
1/2
5/16
0
-7/8
-3/16

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 248373 CI04.xxxx.033

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb+1/4Fx	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	Fb/EJ	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

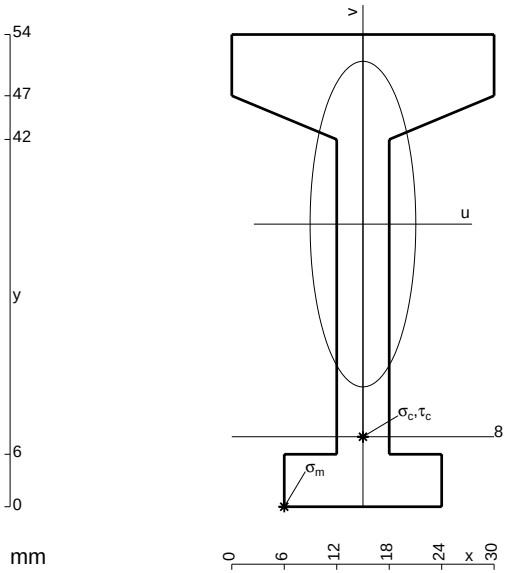
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

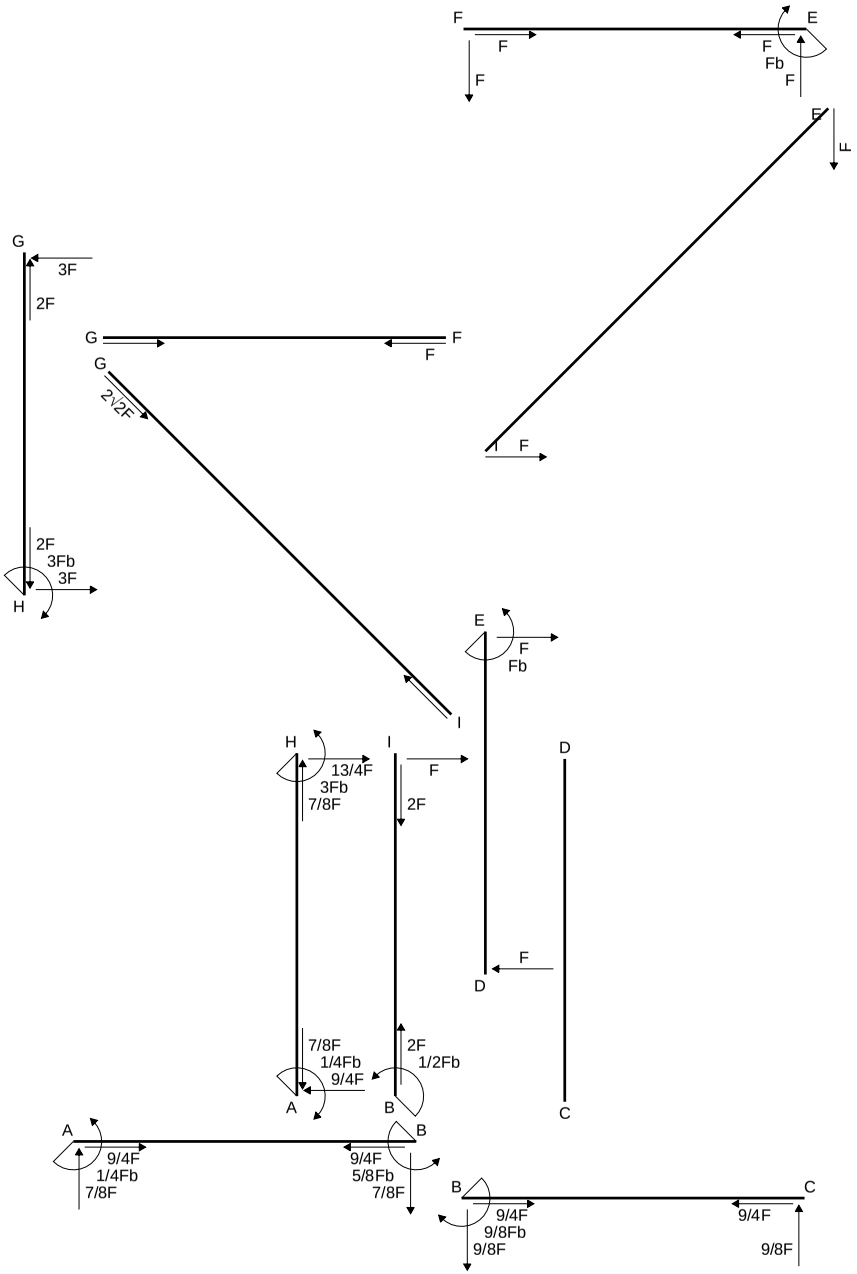
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

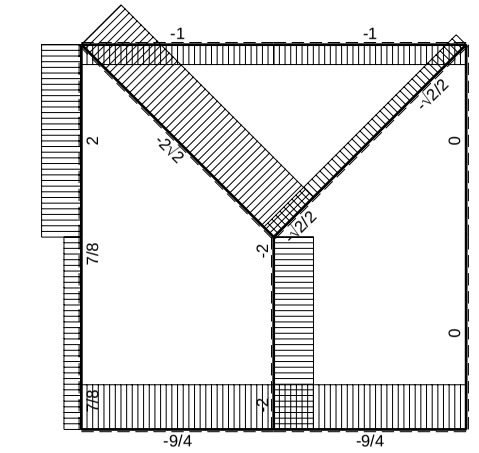
PROCEDIMENTO E RISULTATI 248373 CI04.xxxx.033

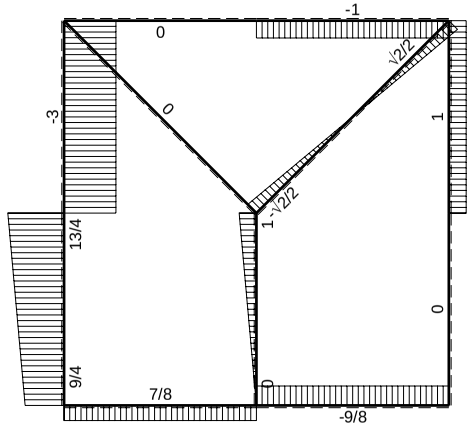


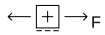
A = 624. mm^2
J_u = 216470. mm^4
J_v = 22824. mm^4
y_g = 32.32 mm
N = 1060. N
T_y = -2385. N
M_x = -1550250. Nmm
x_m = 6. mm
u_m = -9. mm
v_m = -32.32 mm
$\sigma_m = N/A - Mv/J_u$ = -229.8 N/mm^2
x_c = 15. mm
y_c = 8. mm
v_c = -24.32 mm
$\sigma_c = N/A - Mv/J_u$ = -172.5 N/mm^2
τ_c = 6.373 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 172.8 N/mm^2
S^* = 3470. mm^3

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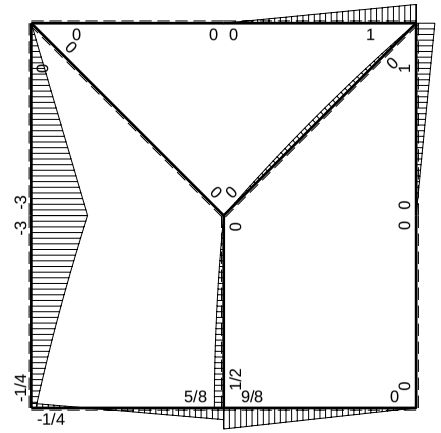

F
E
F
Fb
F
F
F
F
G
3F
2F
G
F
F
G
2√2F
F
2F
3Fb
3F
H
I
E
F
Fb
H
I
13/4F
3Fb
7/8F
F
2F
D
F
D
7/8F
1/4Fb
9/4F
2F
1/2Fb
A
B
C
A
B
9/4F
1/4Fb
7/8F
9/4F
5/8Fb
7/8F
B
C
9/4F
9/8Fb
9/8F
9/4F
9/8F


-1
-1
2
-√2/2
-√2/2
-√2/2
0
7/8
-2
0
7/8
-2
-9/4
-9/4

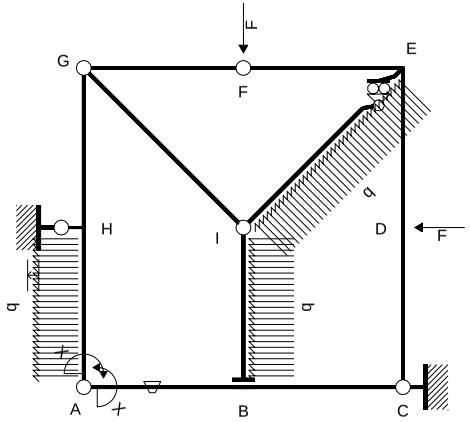

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0
√2/2
-3
0
1
-√2/2
13/4
0
9/4
7/8
-9/8

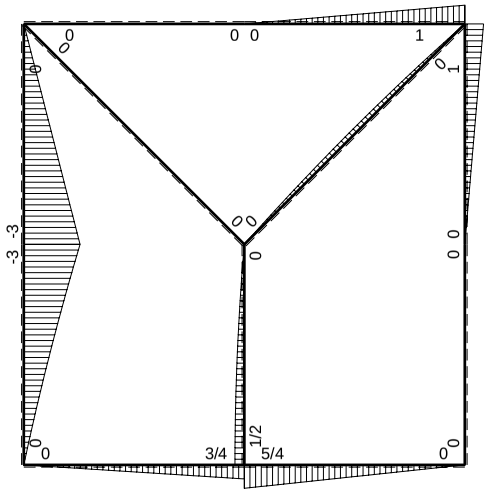

F


F

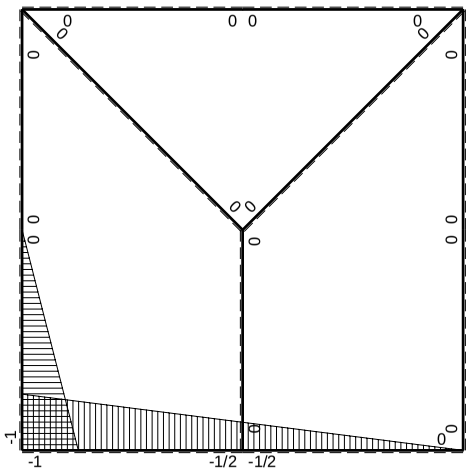

0
0 0
1
0
1
0 0
-3 -3
0
0 0
-1/4
5/8
1/2
9/8
0 0
-1/4


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264857 CI04.xxxx.034

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	-Fb/EJ	$-3/4Fx+3/8Fx^2/b$	Fb/EJ-1/2Fx/EJ	$1-x/b+1/4x^2/b^2$	$(-1/4+3/4)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-3/4Fb+3/4Fx	Fb/EJ	$-3/8Fb+3/8Fx^2/b$	1/2Fb/EJ+1/2Fx/EJ	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-5/4Fx	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1 - 1/2\ x/b\right)\ \theta\ \ dx$

$= \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(\ b - 1/4\ b\ \right)\ \theta\ \ = 1/2\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2 - 1/2\ x/b\right)\ \theta\ \ dx$

$= \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 1/2\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

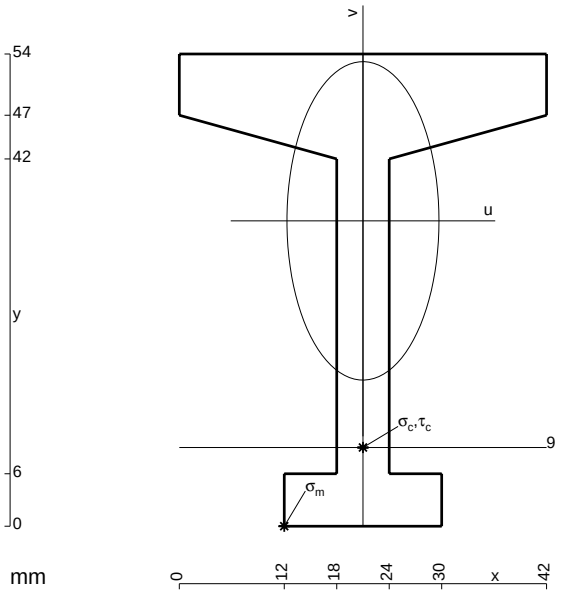
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

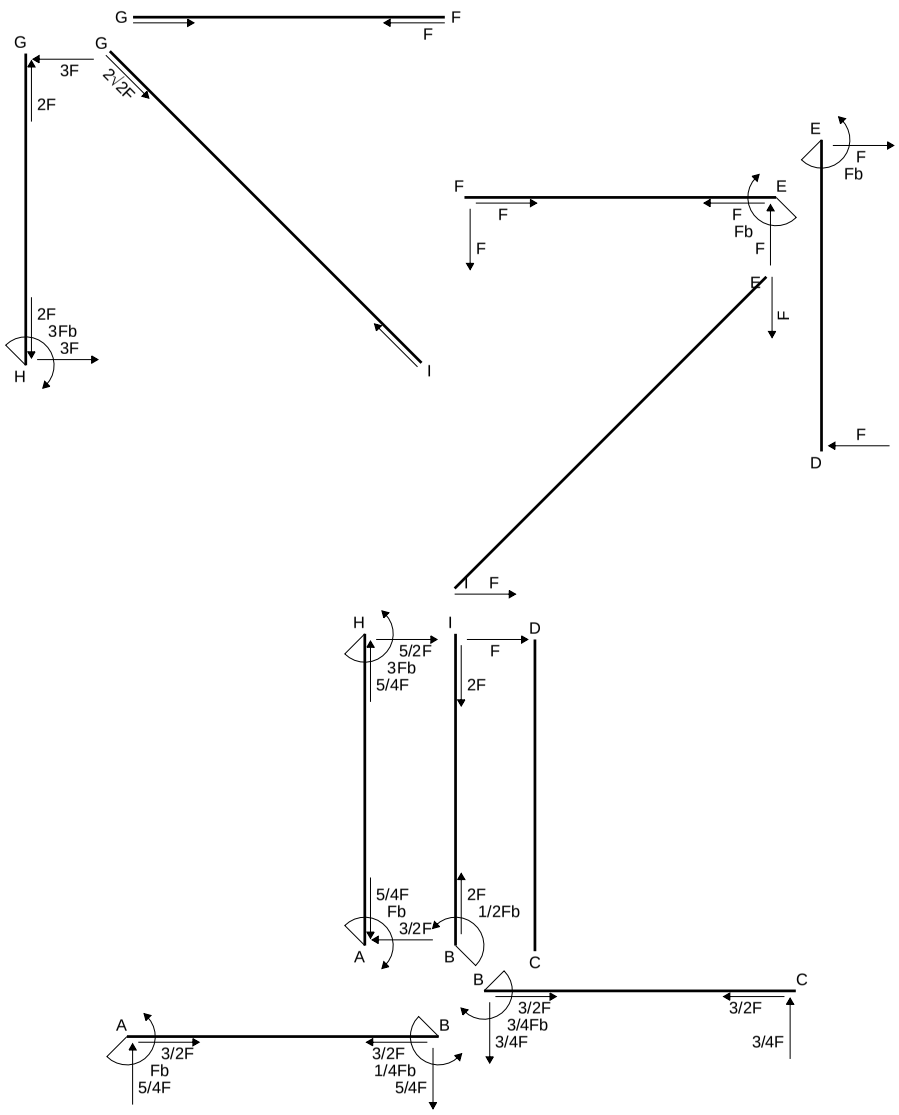
$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

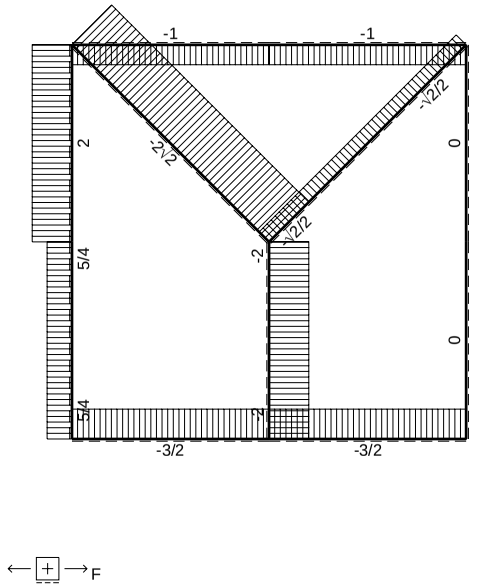
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

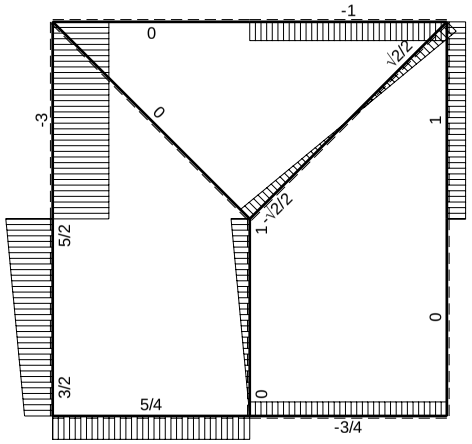
PROCEDIMENTO E RISULTATI 264857 CI04.xxxx.034



A = 738. mm^2
J_u = 244714. mm^4
J_v = 55782. mm^4
y_g = 34.92 mm
N = 1600. N
T_y = -2400. N
M_x = -1680000. Nmm
x_m = 12. mm
u_m = -9. mm
v_m = -34.92 mm
$\sigma_m = N/A - Mv/J_u$ = -237.6 N/mm^2
x_c = 21. mm
y_c = 9. mm
v_c = -25.92 mm
$\sigma_c = N/A - Mv/J_u$ = -175.8 N/mm^2
τ_c = 6.441 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 176.1 N/mm^2
S^* = 3941. mm^3

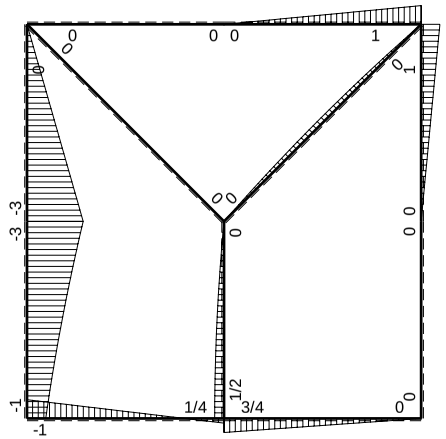

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2F
3Fb
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D
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H
I
D
5/2F
3Fb
5/4F
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2F
5/4F
Fb
3/2F
2F
1/2Fb
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A
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1/4Fb
5/4F


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-2
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-2
-3/2
-3/2

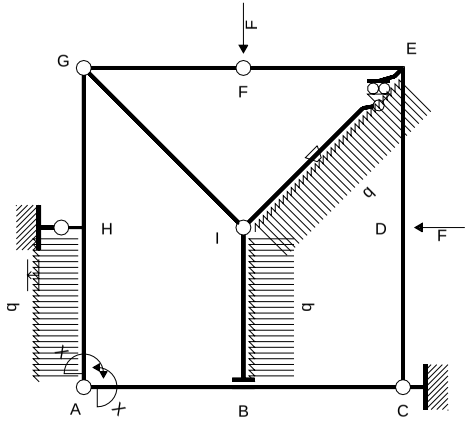

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1
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5/2
0
3/2
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0
-3/4

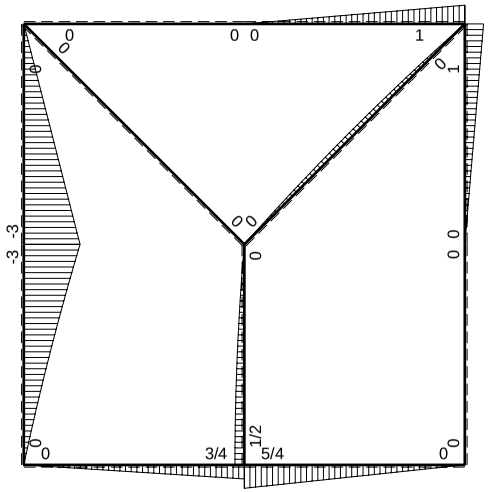
←□→ F

↑□↓ F

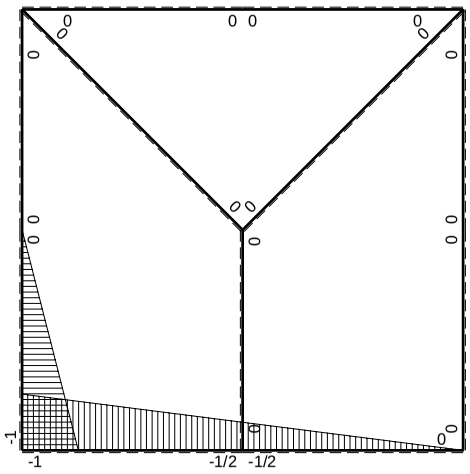

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0
0 0
-1
1/4
1/2
3/4
0
0
-1

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-5/4Fx	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

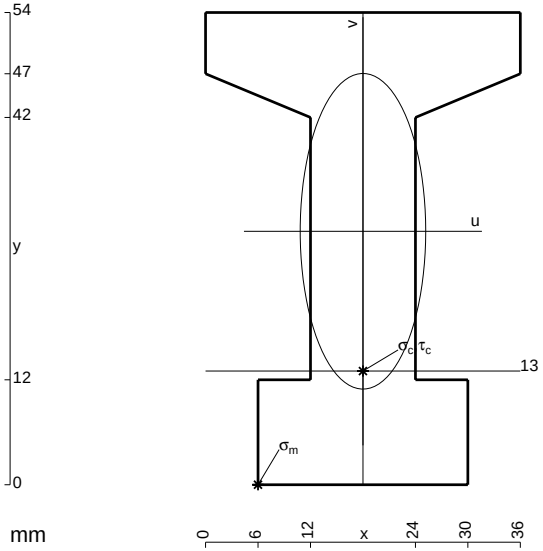
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

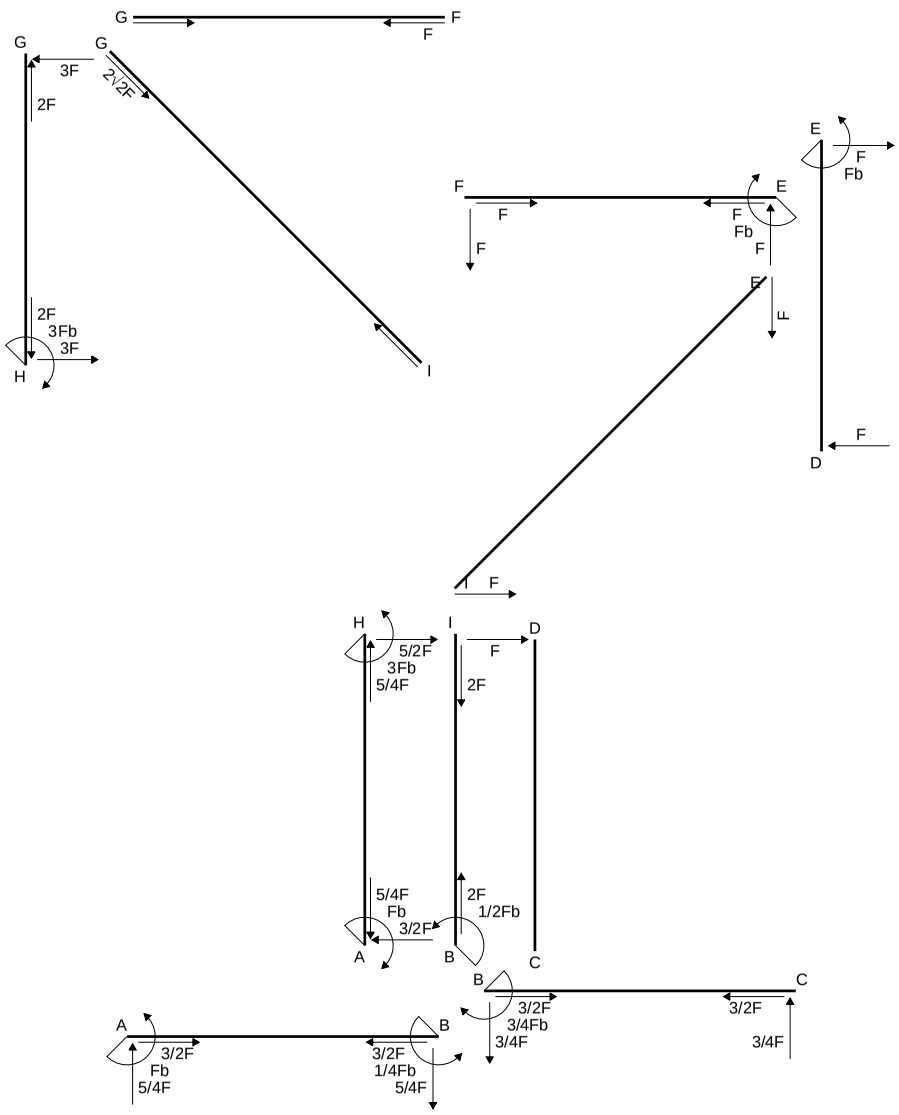
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

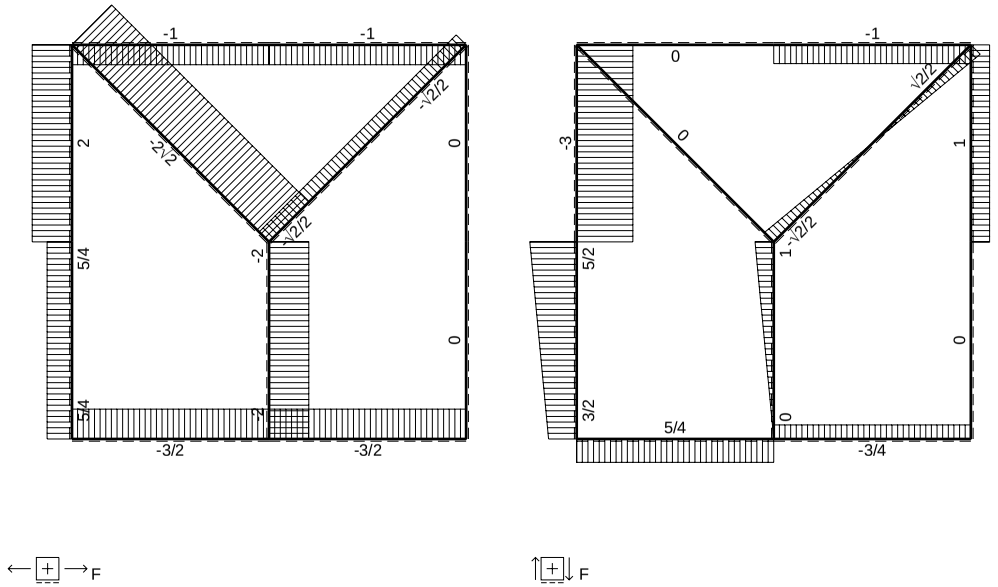
PROCEDIMENTO E RISULTATI 301451 CI04.xxxx.035

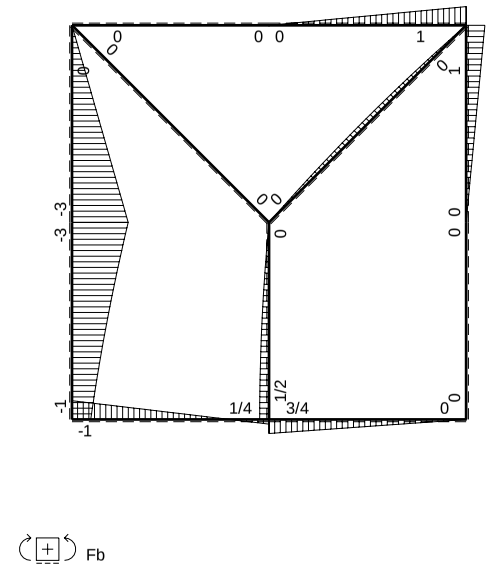


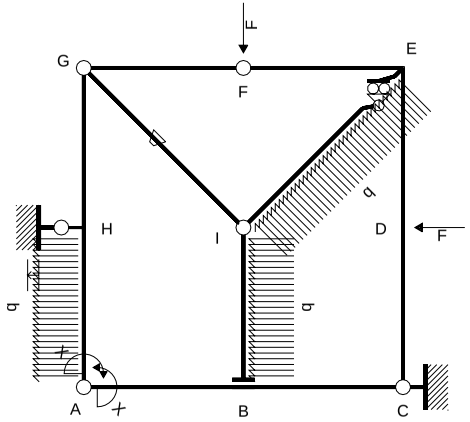
A = 1020. mm^2
J_u = 332394. mm^4
J_v = 52560. mm^4
y_g = 28.98 mm
N = 2040. N
T_y = -3060. N
M_x = -2295000. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.98 mm
$\sigma_m = N/A - Mv/J_u$ = -198.1 N/mm^2
x_c = 18. mm
y_c = 13. mm
v_c = -15.98 mm
$\sigma_c = N/A - Mv/J_u$ = -108.4 N/mm^2
τ_c = 5.23 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 108.7 N/mm^2
S^* = 6817. mm^3

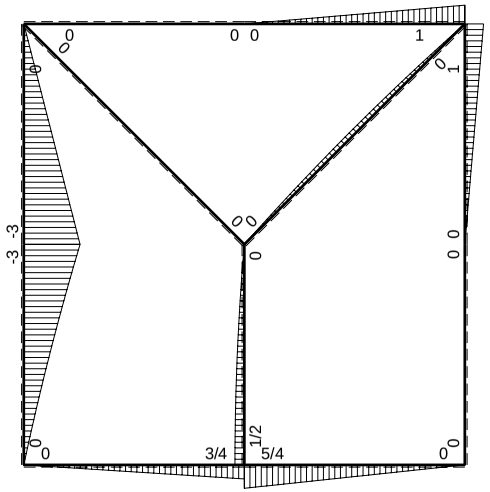
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Fb
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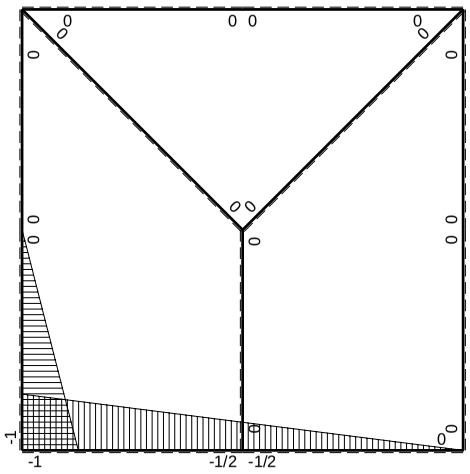

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-3/2
F
-1
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0
0
√2/2
-3
1
-√2/2
5/2
0
3/2
5/4
0
-3/4
F


0
0 0
1
0
0
1
0 0
-3 -3
0
0 0
-1
1/4
1/2
3/4
0
0
-1
Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-5/4Fx$	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

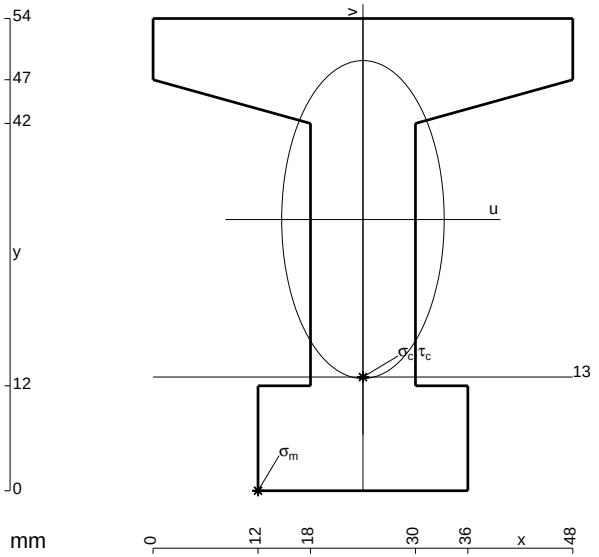
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

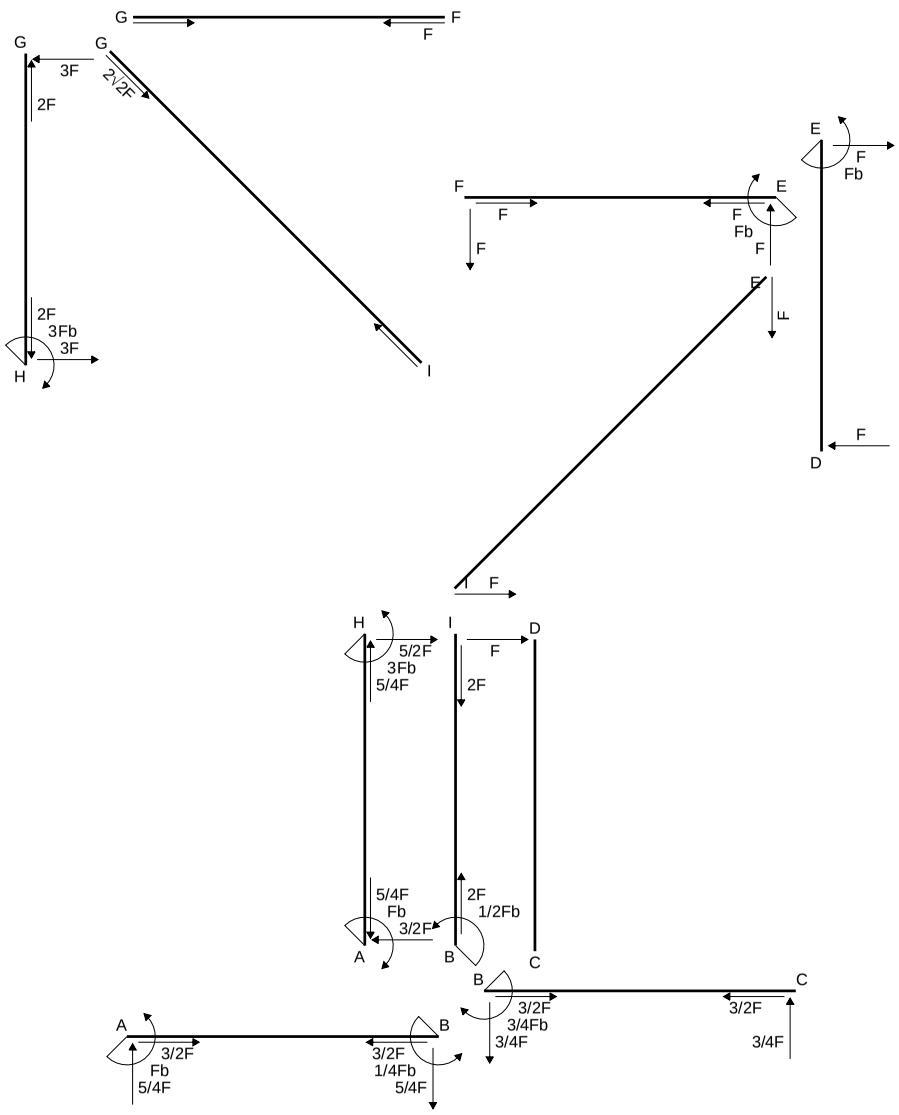
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

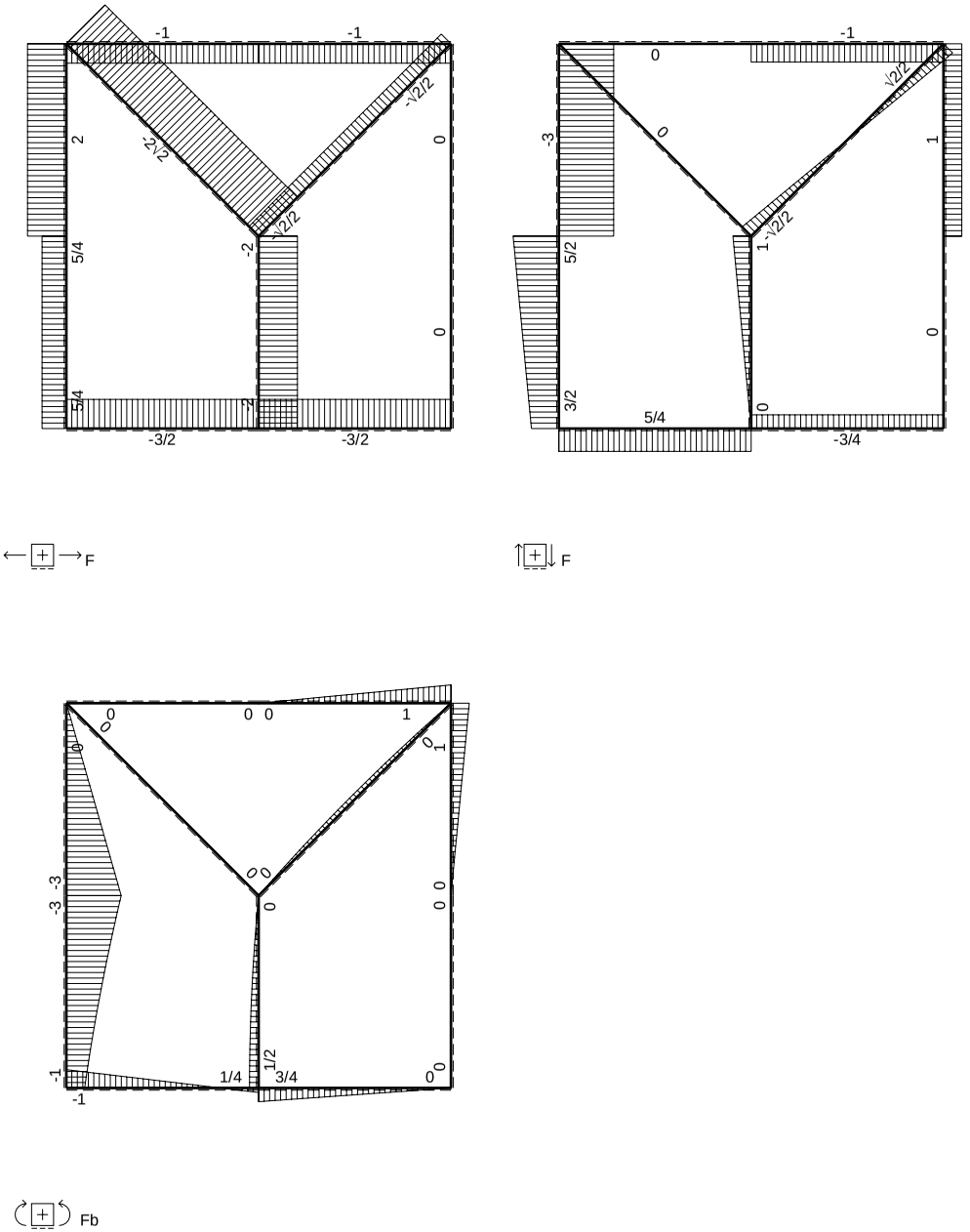
PROCEDIMENTO E RISULTATI 265095 CI04.xxxx.036

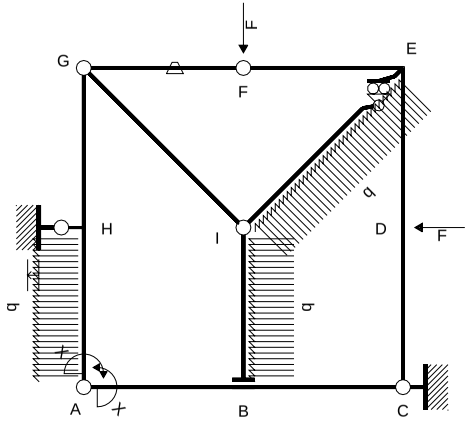


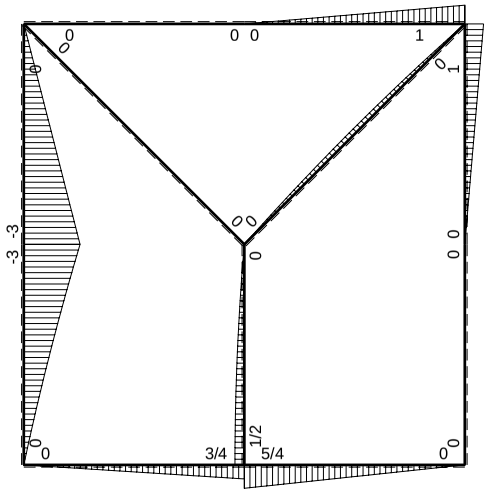
A = 1134. mm^2
J_u = 375027. mm^4
J_v = 97956. mm^4
y_g = 31.01 mm
N = 2120. N
T_y = -3180. N
M_x = -2544000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -31.01 mm
σ_m = N/A-Mv/J_u = -208.5 N/mm^2
x_c = 24. mm
y_c = 13. mm
v_c = -18.01 mm
σ_c = N/A-Mv/J_u = -120.3 N/mm^2
τ_c = 5.247 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 120.6 N/mm^2
S^* = 7425. mm^3

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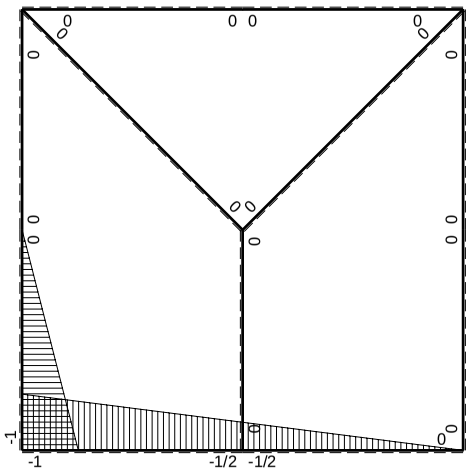

G
F
3F
2F
2√2F
2F
3Fb
3F
H
I
E
Fb
D
5/2F
3Fb
5/4F
5/4F
Fb
3/2F
1/2Fb
A
B
C
3/4Fb
3/4F
1/4Fb
5/4F


F
F
Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 270236 CI04.xxxx.037

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PROCEDIMENTO E RISULTATI 270236 CI04.xxxx.037

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-5/4Fx$	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	-Fb/EJ	0	0	0	0+0	0
GF b	0	0	Fb/EJ	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ Fb^2/EJ$

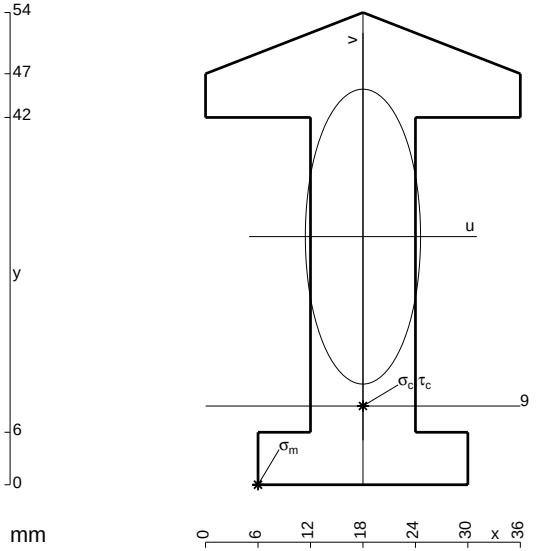
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ Fb^2/EJ$

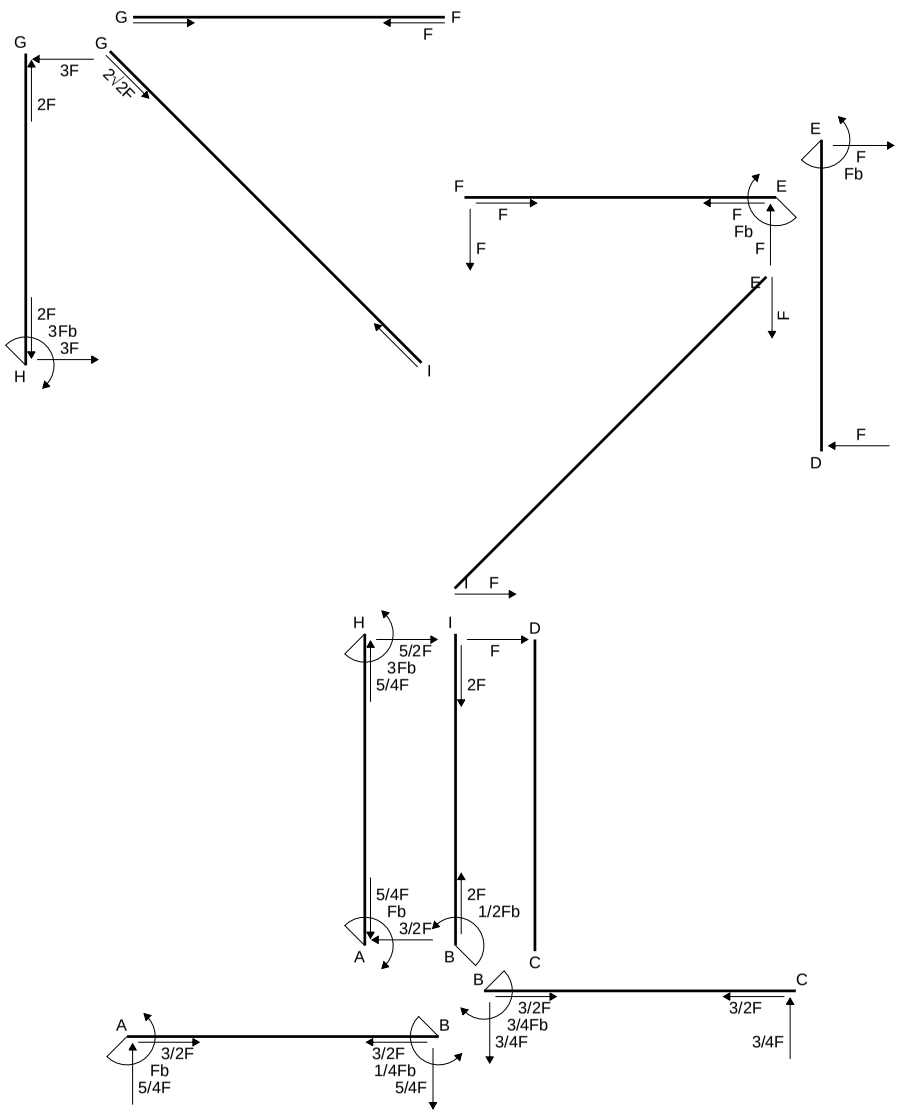
$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

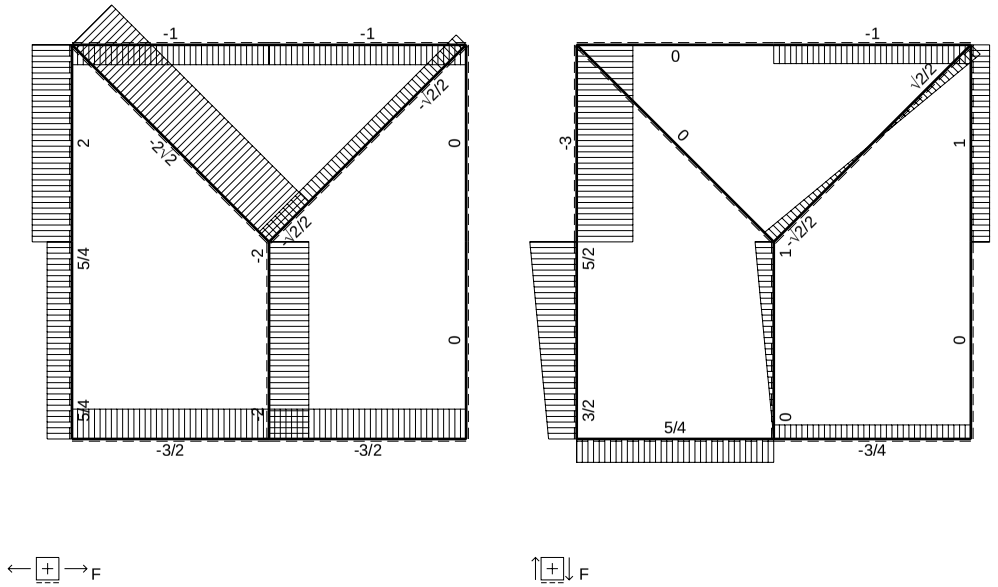
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ Fb^2/EJ$

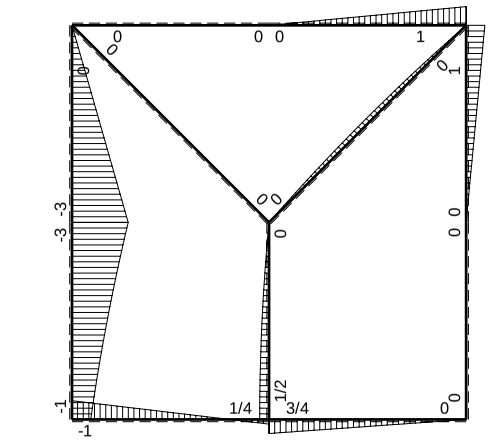
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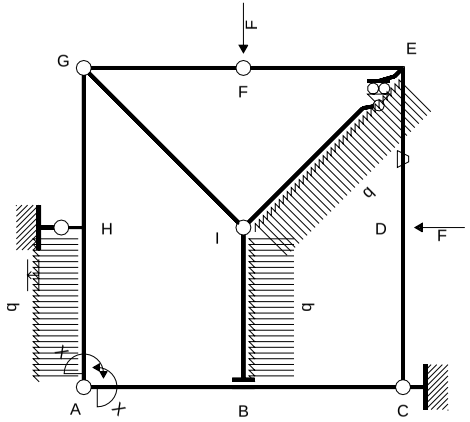


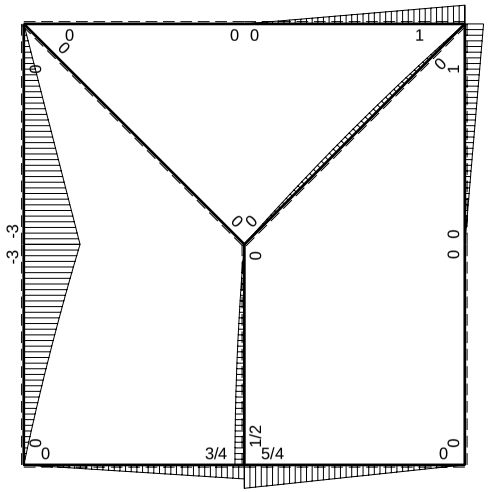
A = 882. mm^2
J_u = 250944. mm^4
J_v = 38340. mm^4
y_g = 28.37 mm
N = 1520. N
T_y = -2280. N
M_x = -1938000. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.37 mm
$\sigma_m = N/A - Mv/J_u$ = -217.4 N/mm^2
x_c = 18. mm
y_c = 9. mm
v_c = -19.37 mm
$\sigma_c = N/A - Mv/J_u$ = -147.9 N/mm^2
τ_c = 3.335 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 148. N/mm^2
S^* = 4405. mm^3


G
F
F
G
3F
2F
2√2F
2F
3Fb
3F
H
I
F
E
F
Fb
F
F
F
F
F
F
F
F
D
F
H
I
D
5/2F
3Fb
5/4F
F
2F
5/4F
Fb
3/2F
2F
1/2Fb
A
B
C
B
C
3/2F
3/4Fb
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3/2F
1/4Fb
5/4F

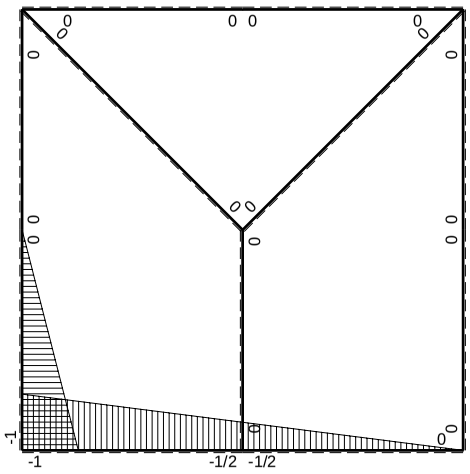

-1
-1
2
-√2/2
√2/2
0
5/4
-2
-2
0
5/4
-3/2
-3/2
-1
0
√2/2
-3
0
1
√2/2
5/2
1
0
3/2
5/4
0
-3/4


0
0 0
1
0
0
1
0 0
-3
-3
0
0 0
-1
1/4
1/2
3/4
0
0
-1





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-5/4Fx	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-Fb+Fx	Fb/EJ	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

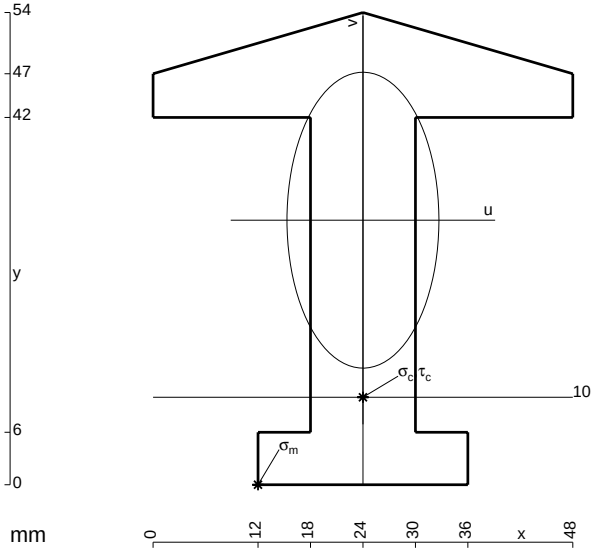
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

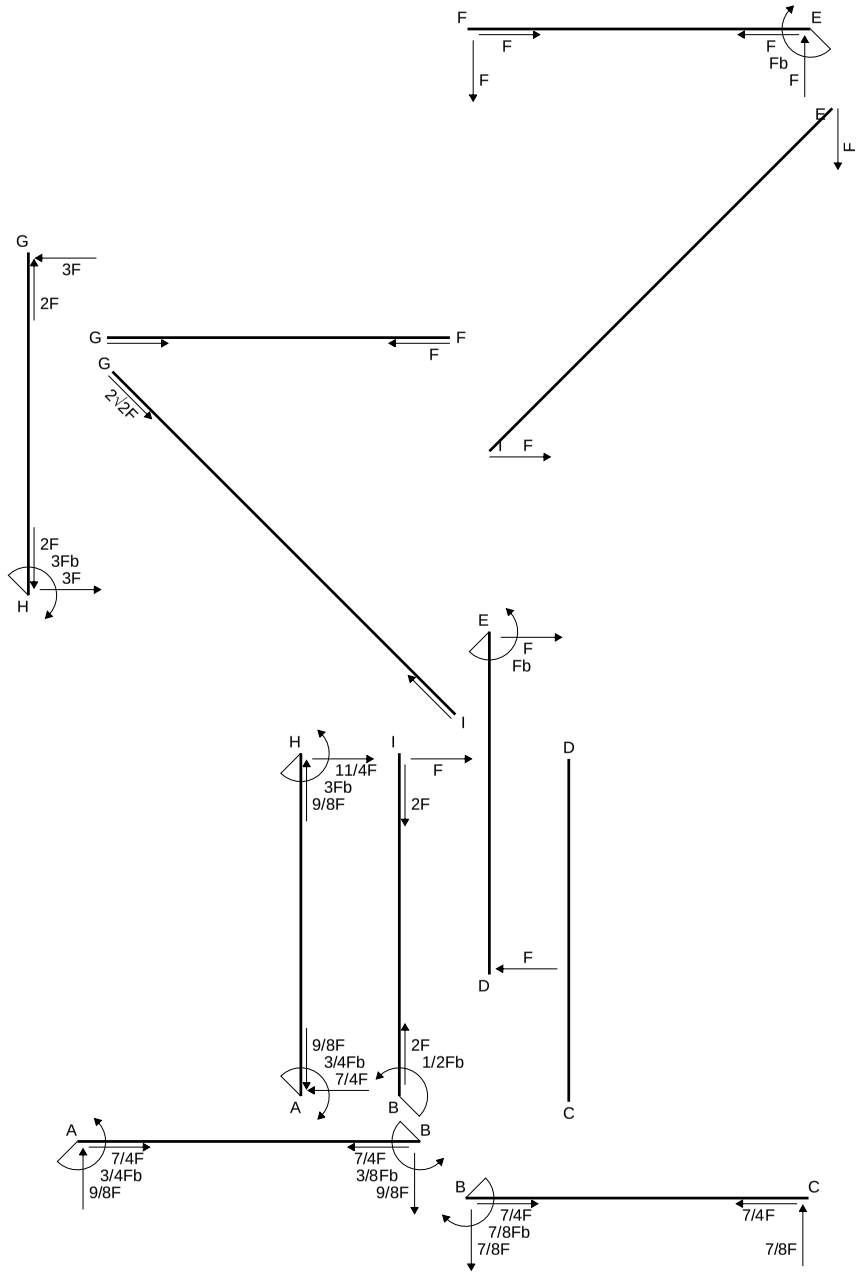
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

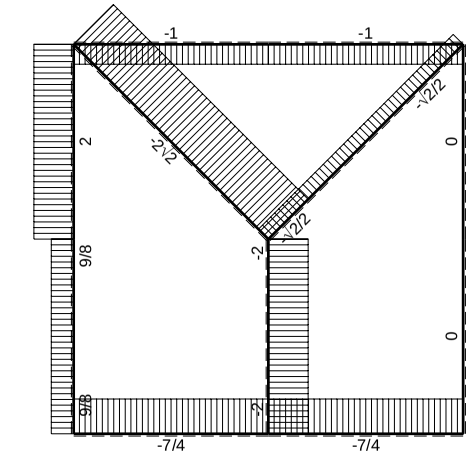
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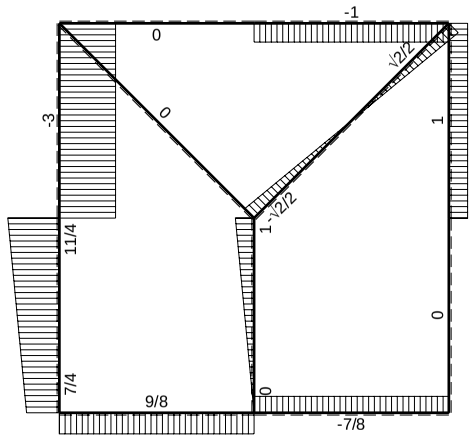


A = 984. mm^2
J_u = 281765. mm^4
J_v = 74304. mm^4
y_g = 30.25 mm
N = 1580. N
T_y = -2370. N
M_x = -2133000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.25 mm
$\sigma_m = N/A - Mv/J_u$ = -227.4 N/mm^2
x_c = 24. mm
y_c = 10. mm
v_c = -20.25 mm
$\sigma_c = N/A - Mv/J_u$ = -151.7 N/mm^2
τ_c = 3.499 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 151.8 N/mm^2
S^* = 4992. mm^3

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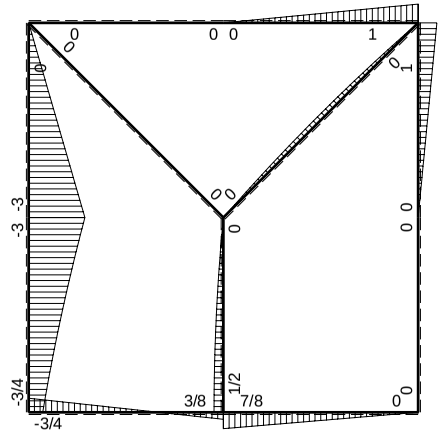

F
E
F
Fb
F
F
F
F
G
3F
2F
G
F
F
G
2√2F
F
2F
3Fb
3F
H
E
F
Fb
I
H
I
11/4F
3Fb
9/8F
F
2F
D
F
D
9/8F
3/4Fb
7/4F
2F
1/2Fb
A
B
C
A
B
7/4F
3/4Fb
9/8F
7/4F
3/8Fb
9/8F
B
C
7/4F
7/8Fb
7/8F
7/4F
7/8F


-1
-1
2
-2√2
-√2/2
-√2/2
0
9/8
-2
0
9/8
-7/4
-7/4

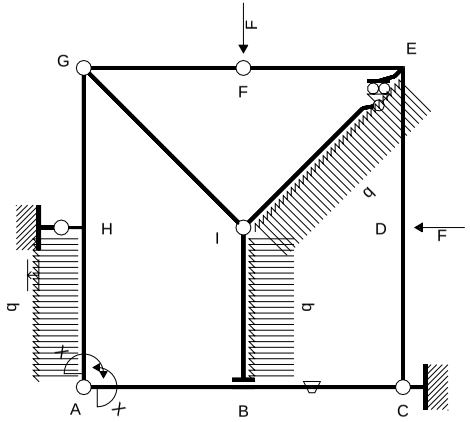

-1
0
√2/2
-3
0
1
1-√2/2
11/4
0
7/4
9/8
0
-7/8

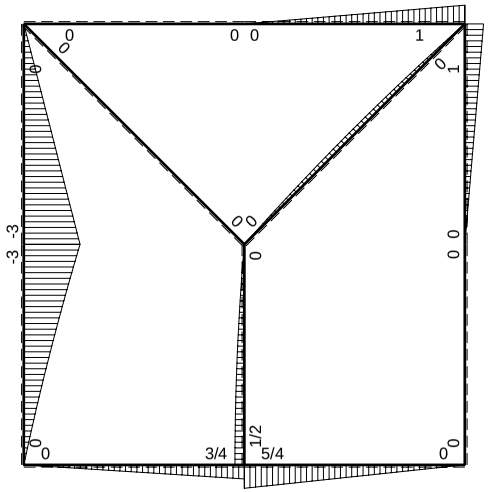
←□→ F

↑□↓ F

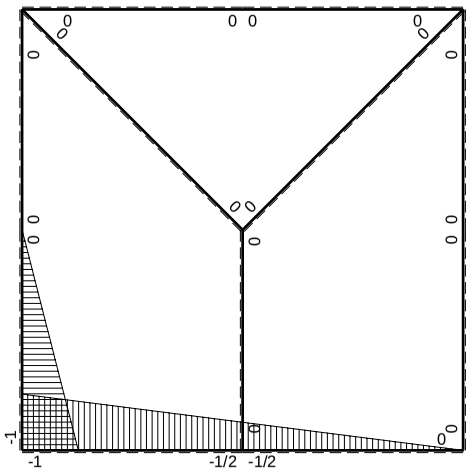

0
0 0
1
0
0
1
0 0
-3 -3
0
0 0
3/4
3/8
1/2
7/8
0
0
-3/4

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	-Fb/EJ	$-5/8Fb+5/4Fx-5/8Fx^2/b$	$1/2Fb/EJ-1/2Fx/EJ$	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-5/4Fx	Fb/EJ	$-5/8Fx^2/b$	1/2Fx/EJ	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1/2 - 1/2\ x/b\ \right)\ \theta\ \ dx$

$= \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 1/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2\ x/b\right)\ \theta\ \ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/4\ b\ \right)\ \theta\ \ = 1/24\ \ Fb^2/EJ$

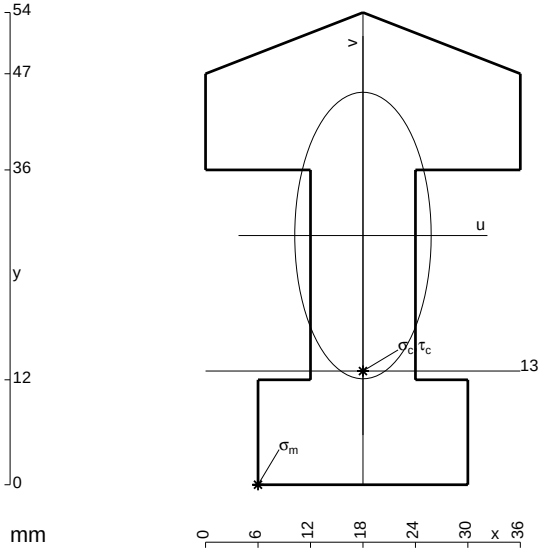
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

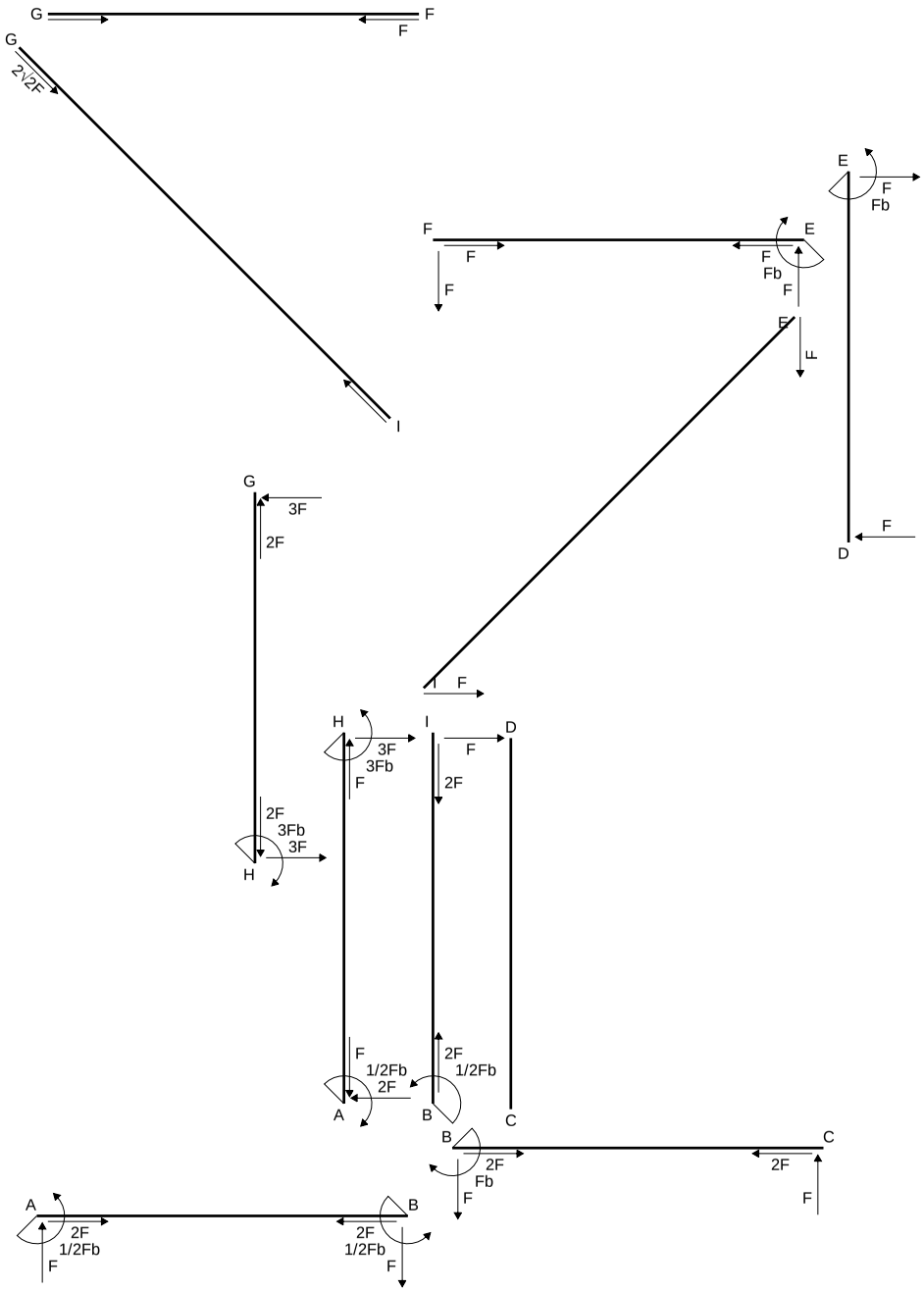
$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

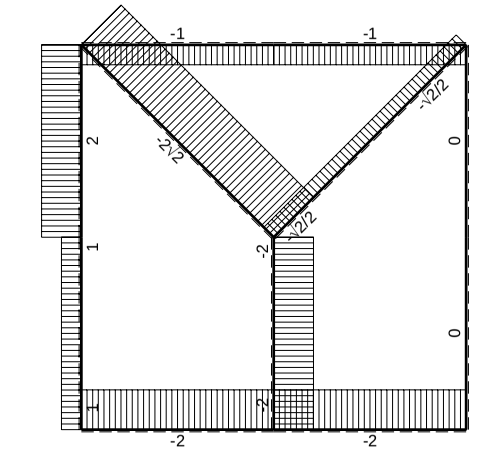
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

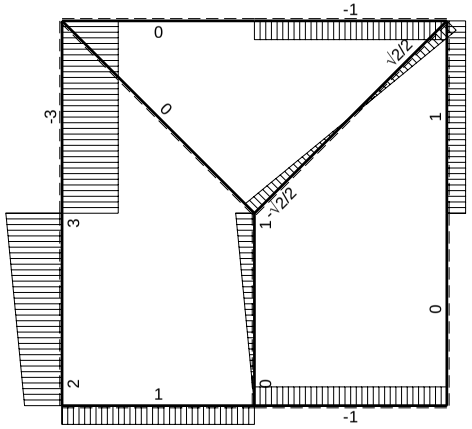
PROCEDIMENTO E RISULTATI 270578 CI04.xxxx.039



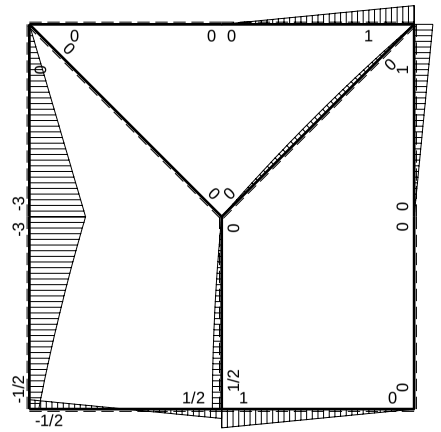
A = 1098. mm^2
J_u = 294859. mm^4
J_v = 66852. mm^4
y_g = 28.5 mm
N = 1740. N
T_y = -2610. N
M_x = -2479500. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.5 mm
$\sigma_m = N/A - Mv/J_u$ = -238.1 N/mm^2
x_c = 18. mm
y_c = 13. mm
v_c = -15.5 mm
$\sigma_c = N/A - Mv/J_u$ = -128.7 N/mm^2
τ_c = 4.921 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 129. N/mm^2
S^* = 6671. mm^3


G
F
F
G
2√2F
I
E
F
Fb
F
E
F
F
F
Fb
F
E
F
F
D
F
G
3F
2F
F
H
I
D
3F
3Fb
F
2F
F
2F
3Fb
3F
H
F
2F
A
B
C
F
1/2Fb
2F
2F
1/2Fb
B
C
2F
Fb
F
2F
F
A
B
2F
1/2Fb
F
2F
1/2Fb
F

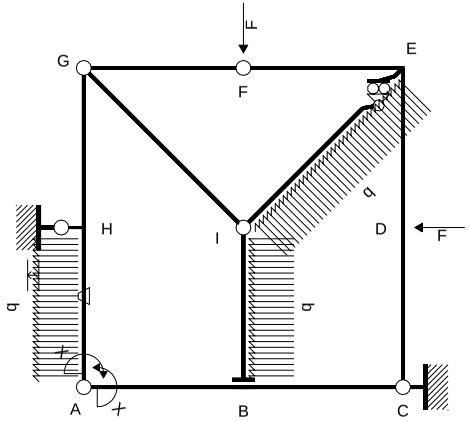

-1
-1
-√2/2
-√2/2
2
1
-2
-2
0
0
1
-2
-2
-2

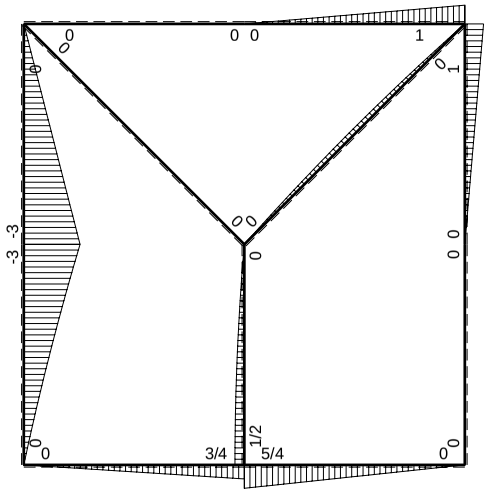

0
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√2/2
0
-3
1
-√2/2
3
0
2
1
D
-1

F F

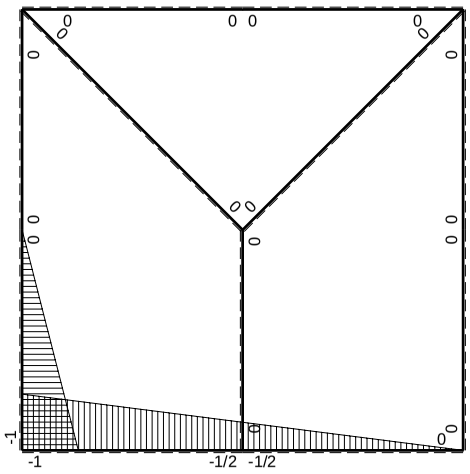

0
0 0
1
0
1
0
0
0
-3
-3
0 0
0
1/2
1/2
1
0 0
-1/2
-1/2

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264363 CI04.xxxx.040

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PROCEDIMENTO E RISULTATI 264363 CI04.xxxx.040

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-5/4Fx$	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	-Fb/EJ	$3Fx-7/2Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(11/24+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	Fb/EJ	$5/2Fx-2Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/2Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/2Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\ \theta\ dx$

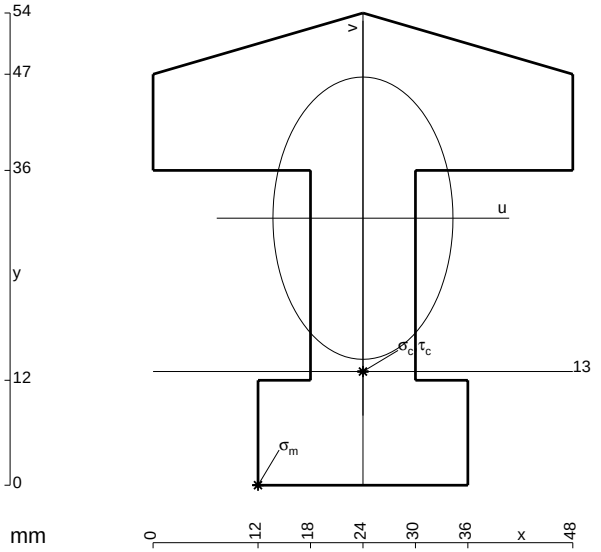
$= \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b\ \theta$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b\ \right)\ \theta\ \ = 23/24\ \ Fb^2/EJ$

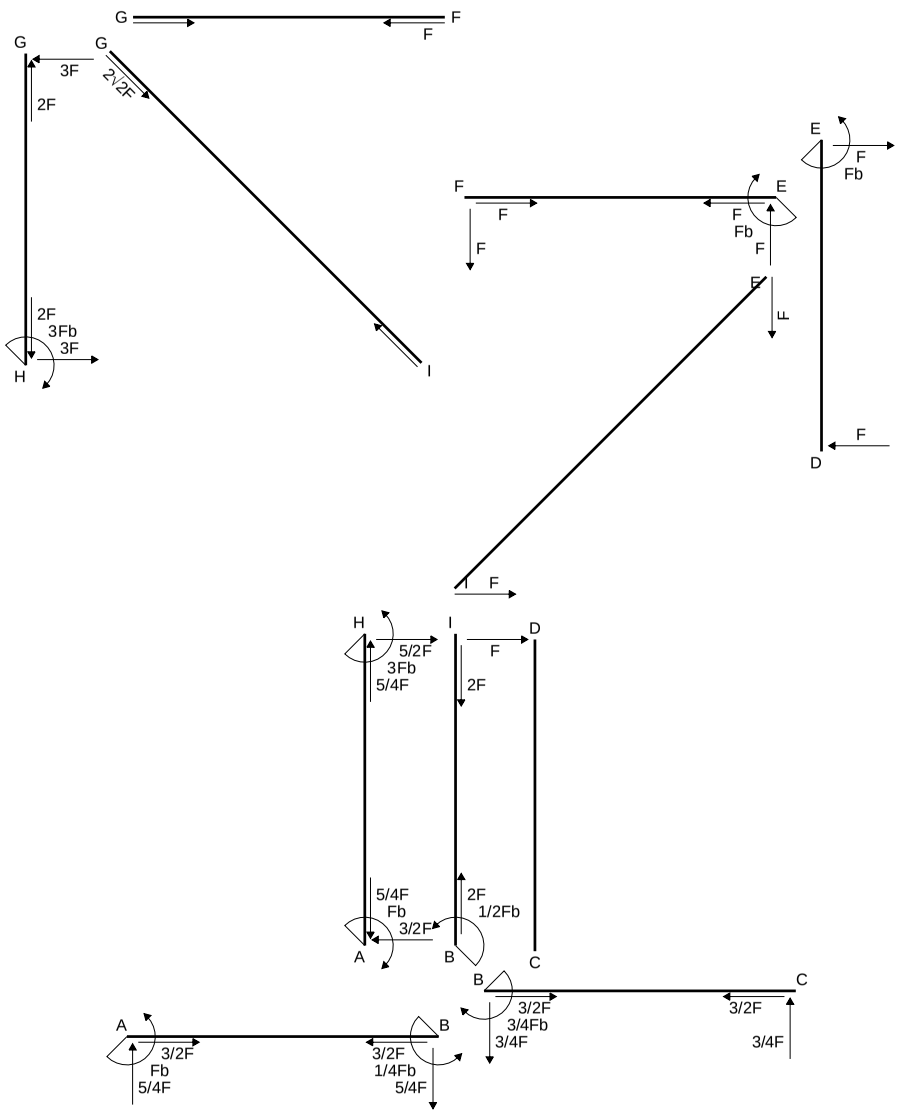
$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\ \theta\ dx$

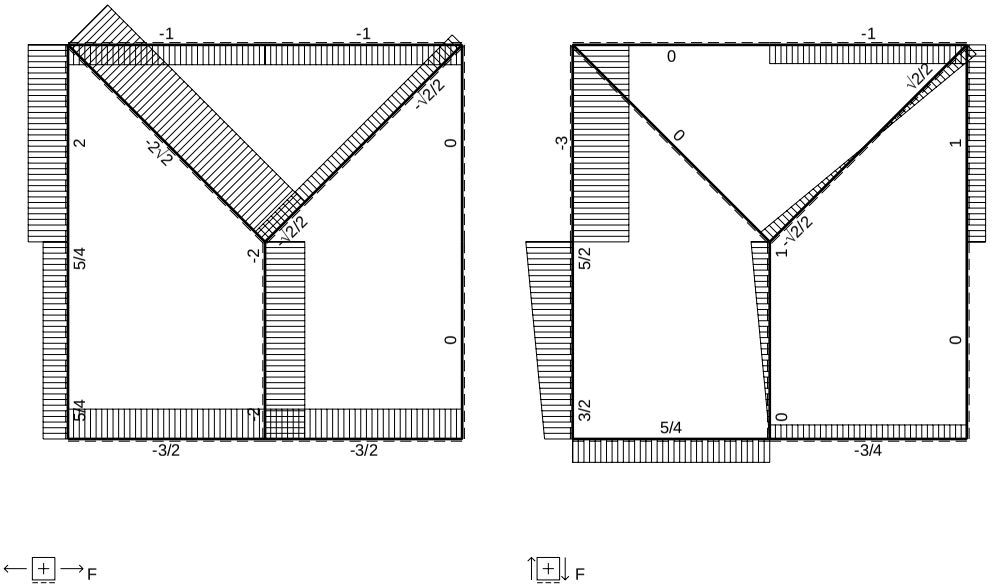
$= \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b\ \theta$

$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\ \theta\ \ = 23/24\ \ Fb^2/EJ$

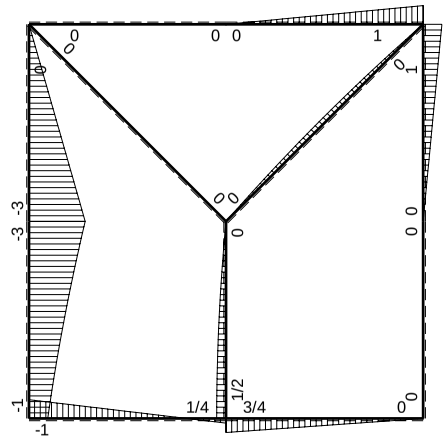


A = 1272. mm^2
J_u = 331576. mm^4
J_v = 134784. mm^4
y_g = 30.53 mm
N = 2920. N
T_y = -4380. N
M_x = -2190000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.53 mm
$\sigma_m = N/A - Mv/J_u$ = -199.4 N/mm^2
x_c = 24. mm
y_c = 13. mm
v_c = -17.53 mm
$\sigma_c = N/A - Mv/J_u$ = -113.5 N/mm^2
τ_c = 8.016 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 114.4 N/mm^2
S^* = 7282. mm^3

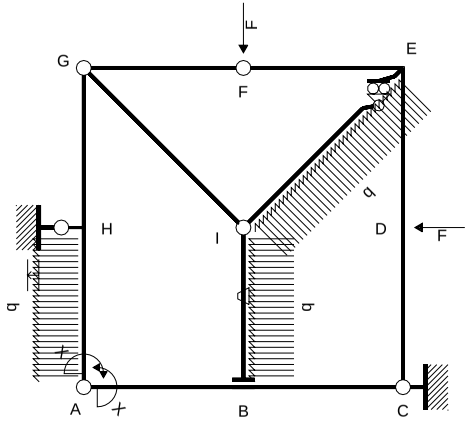

G
F
F
G
3F
2F
2√2F
2F
3Fb
3F
H
I
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E
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Fb
F
F
F
F
F
F
F
F
D
F
H
I
D
5/2F
3Fb
5/4F
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2F
5/4F
Fb
3/2F
2F
1/2Fb
A
B
C
B
C
3/2F
3/4Fb
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Fb
5/4F
3/2F
1/4Fb
5/4F

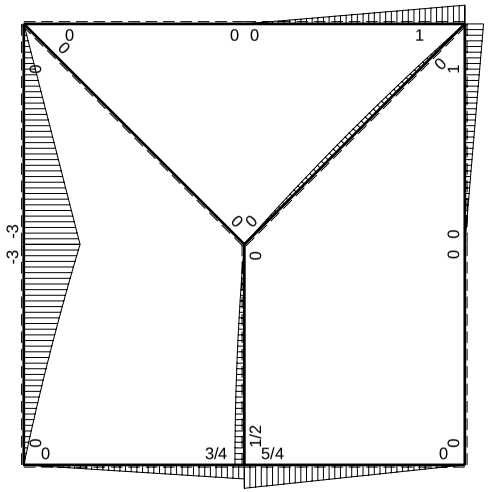

-1
-1
2
-2√2
-√2/2
0
5/4
-2
-√2/2
0
5/4
-2
-3/2
-3/2
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0
-3
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√2/2
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-√2/2
5/2
0
3/2
5/4
0
-3/4

F F

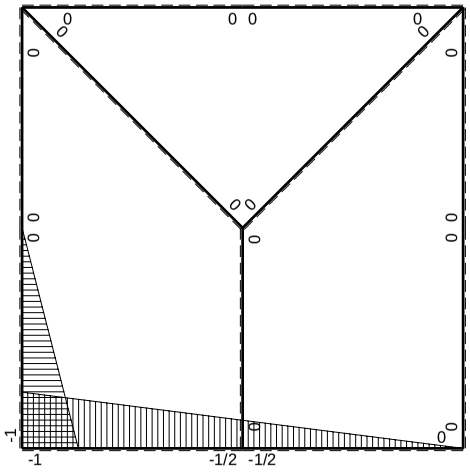

0
0 0
1
0
0
1
0 0
-3 -3
0
0 0
-1
1/4
1/2
3/4
0
0
-1

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 991322 CI04.xxxx.041

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PROCEDIMENTO E RISULTATI 991322 CI04.xxxx.041

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-5/4Fx$	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$$

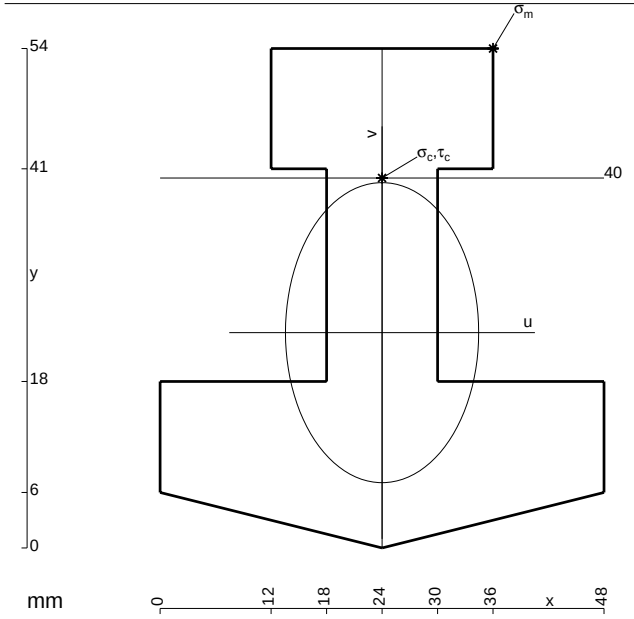
$$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$$

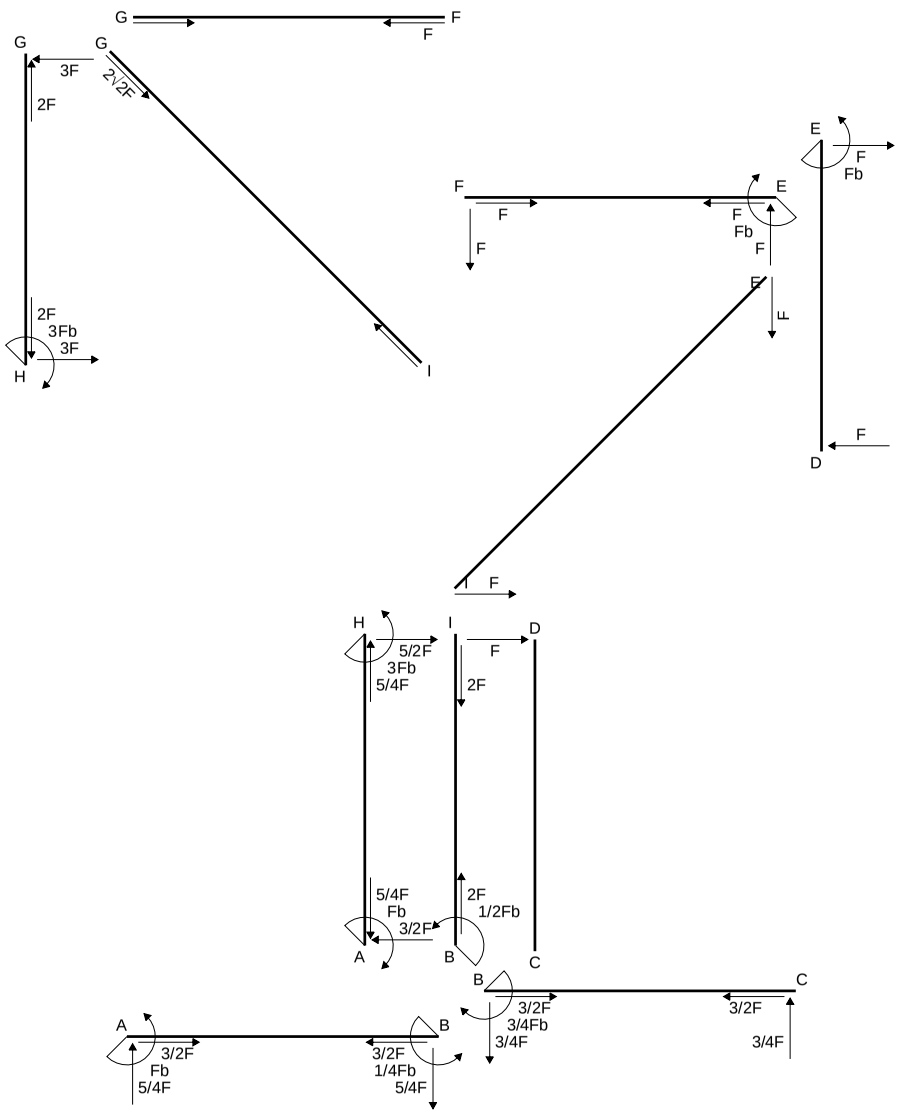
$$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

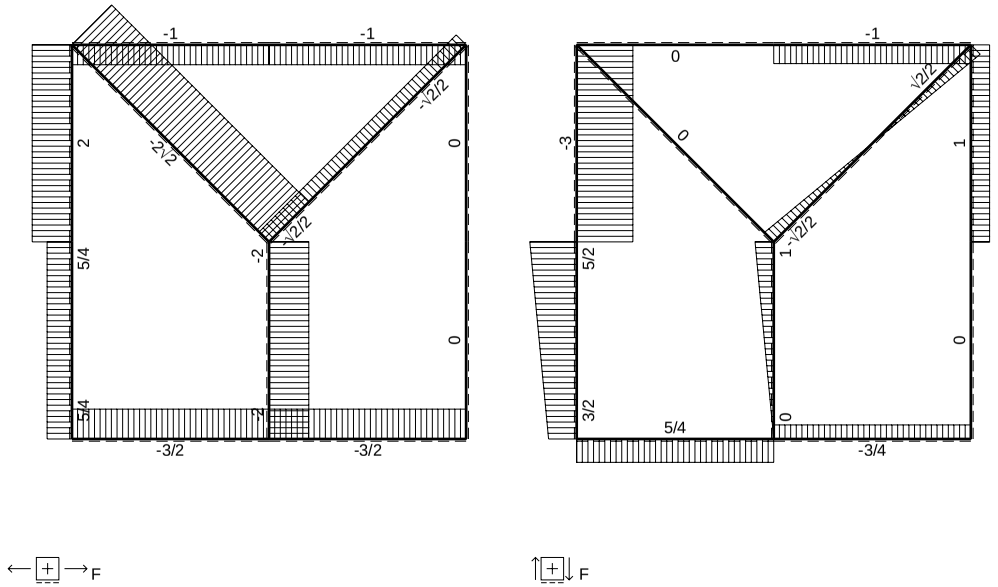
$$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$$

PROCEDIMENTO E RISULTATI 991322 CI04.xxxx.041

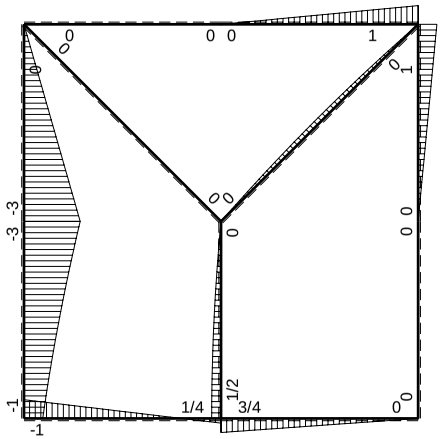


A = 1308. mm^2
J_u = 344278. mm^4
J_v = 142704. mm^4
y_g = 23.28 mm
N = 2820. N
T_y = -4230. N
M_x = -2326500. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 30.72 mm
$\sigma_m = N/A - Mv/J_u$ = 209.8 N/mm^2
x_c = 24. mm
y_c = 40. mm
v_c = 16.72 mm
$\sigma_c = N/A - Mv/J_u$ = 115.1 N/mm^2
τ_c = 7.949 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 116. N/mm^2
S^* = 7763. mm^3

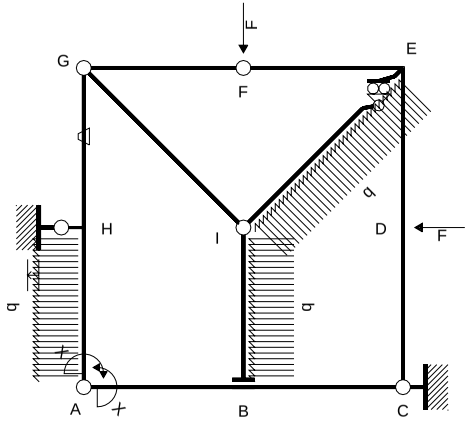

G
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2F
2√2F
2F
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3F
H
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Fb
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F
F
F
F
D
F
H
I
D
5/2F
3Fb
5/4F
F
2F
5/4F
Fb
3/2F
2F
1/2Fb
A
B
C
B
C
3/2F
3/4Fb
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B
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Fb
5/4F
3/2F
1/4Fb
5/4F

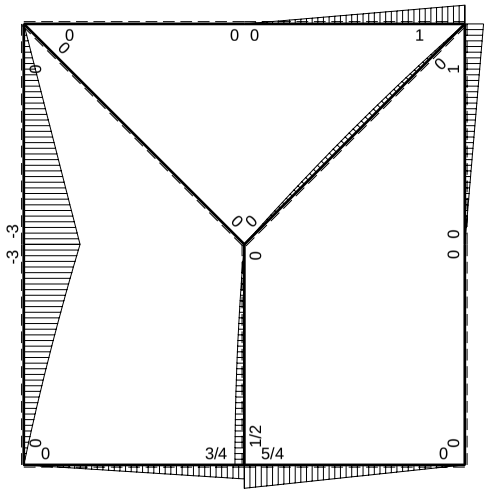

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5/4
-2
-√2/2
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5/4
-2
-3/2
-3/2
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-3
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√2/2
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-√2/2
5/2
0
3/2
5/4
0
-3/4

F F

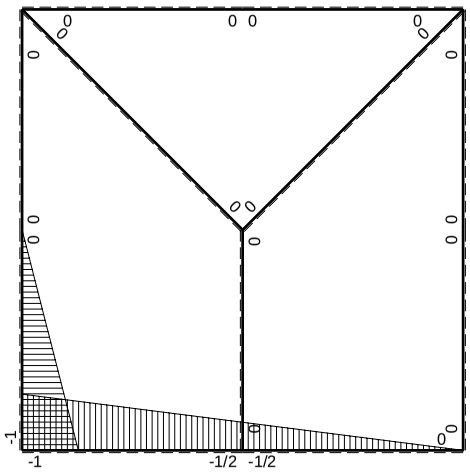

0
0 0
1
0
0
1
0 0
-3 -3
0
0 0
-1
1/4
1/2
3/4
0
0
-1

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 263623 CI04.xxxx.042

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PROCEDIMENTO E RISULTATI 263623 CI04.xxxx.042

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-5/4Fx$	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	-Fb/EJ	0	0	0	0+0	0
HG b	0	3Fb-3Fx	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$$

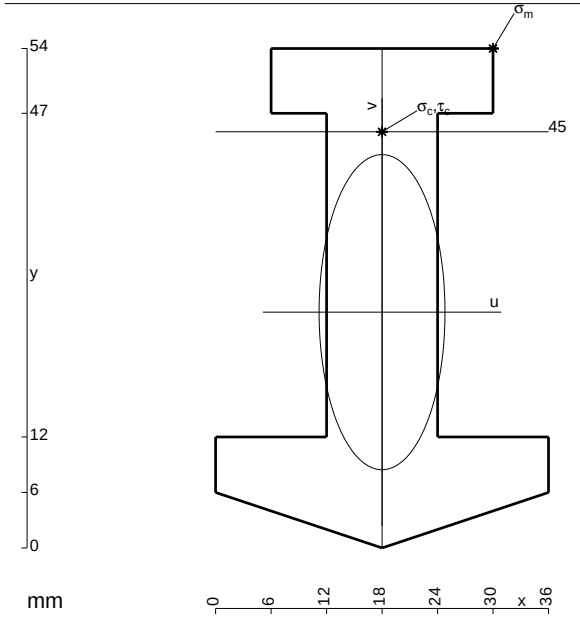
$$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$$

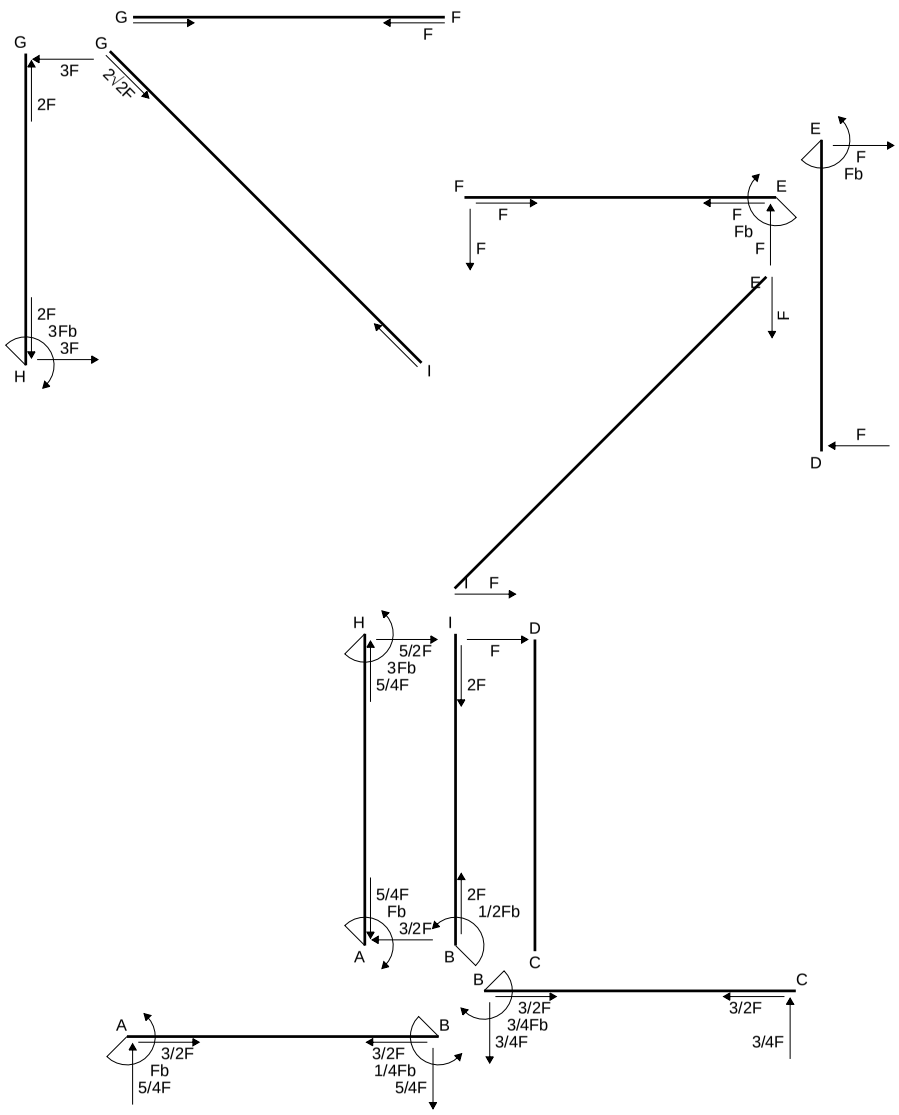
$$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

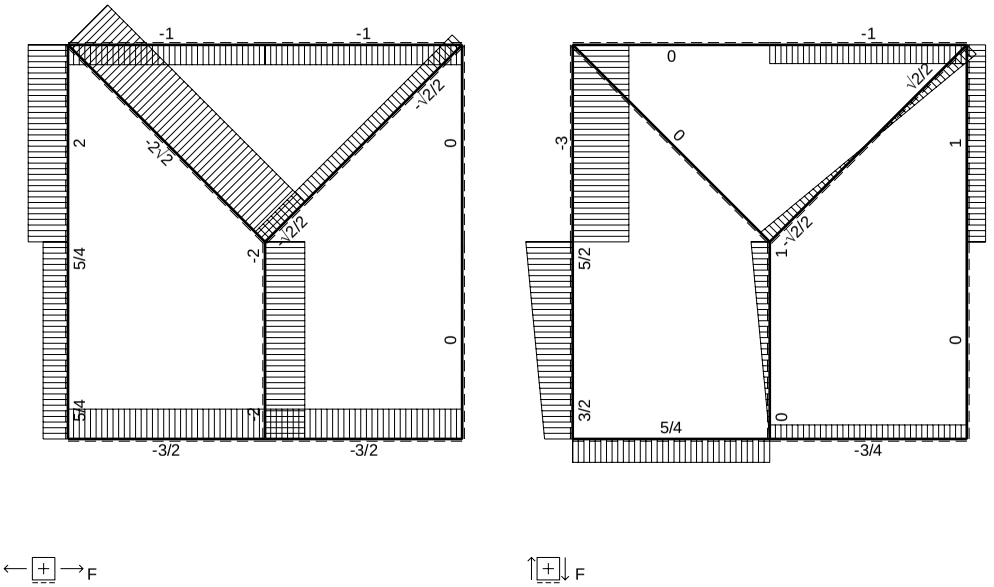
$$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$$

PROCEDIMENTO E RISULTATI 263623 CI04.xxxx.042

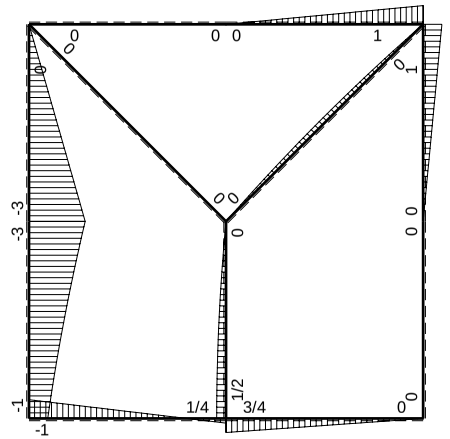


A = 912. mm^2
J_u = 264874. mm^4
J_v = 42264. mm^4
y_g = 25.49 mm
N = 2240. N
T_y = -3360. N
M_x = -2016000. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 28.51 mm
$\sigma_m = N/A - Mv/J_u$ = 219.4 N/mm^2
x_c = 18. mm
y_c = 45. mm
v_c = 19.51 mm
$\sigma_c = N/A - Mv/J_u$ = 150.9 N/mm^2
τ_c = 4.961 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 151.2 N/mm^2
S^* = 4693. mm^3

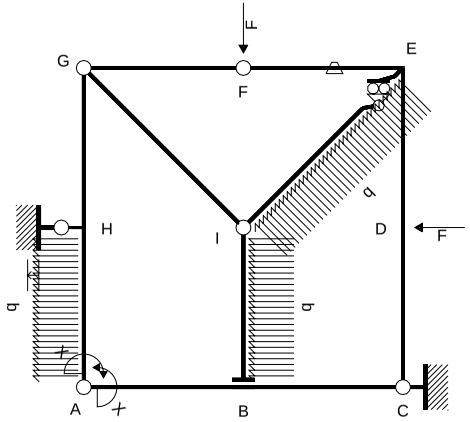

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3F
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B
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C
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3/4Fb
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5/4F

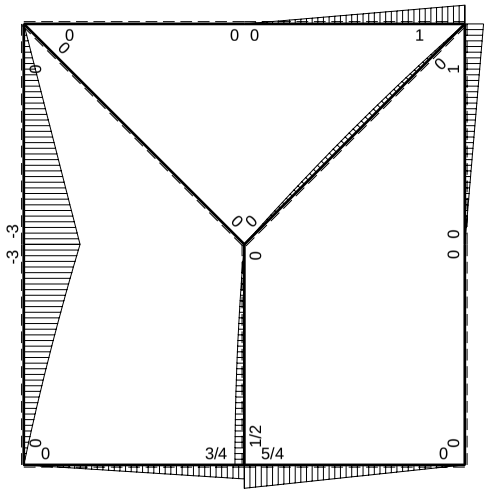

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-3/4

F F

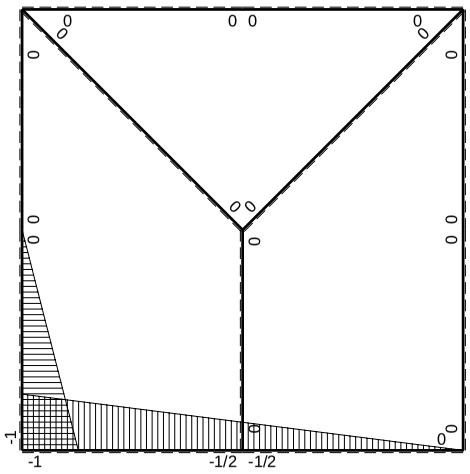

0
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1
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0
1
0 0
-3 -3
0
0 0
-1
1/4
1/2
3/4
0
0
-1

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 311832 CI04.xxxx.043

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PROCEDIMENTO E RISULTATI 311832 CI04.xxxx.043

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-5/4Fx	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	-Fb/EJ	0	0	0	0+0	0
FE b	0	-Fx	Fb/EJ	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

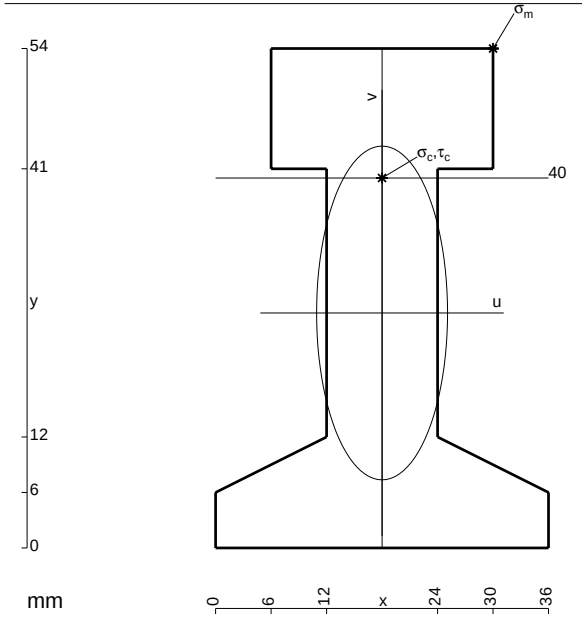
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

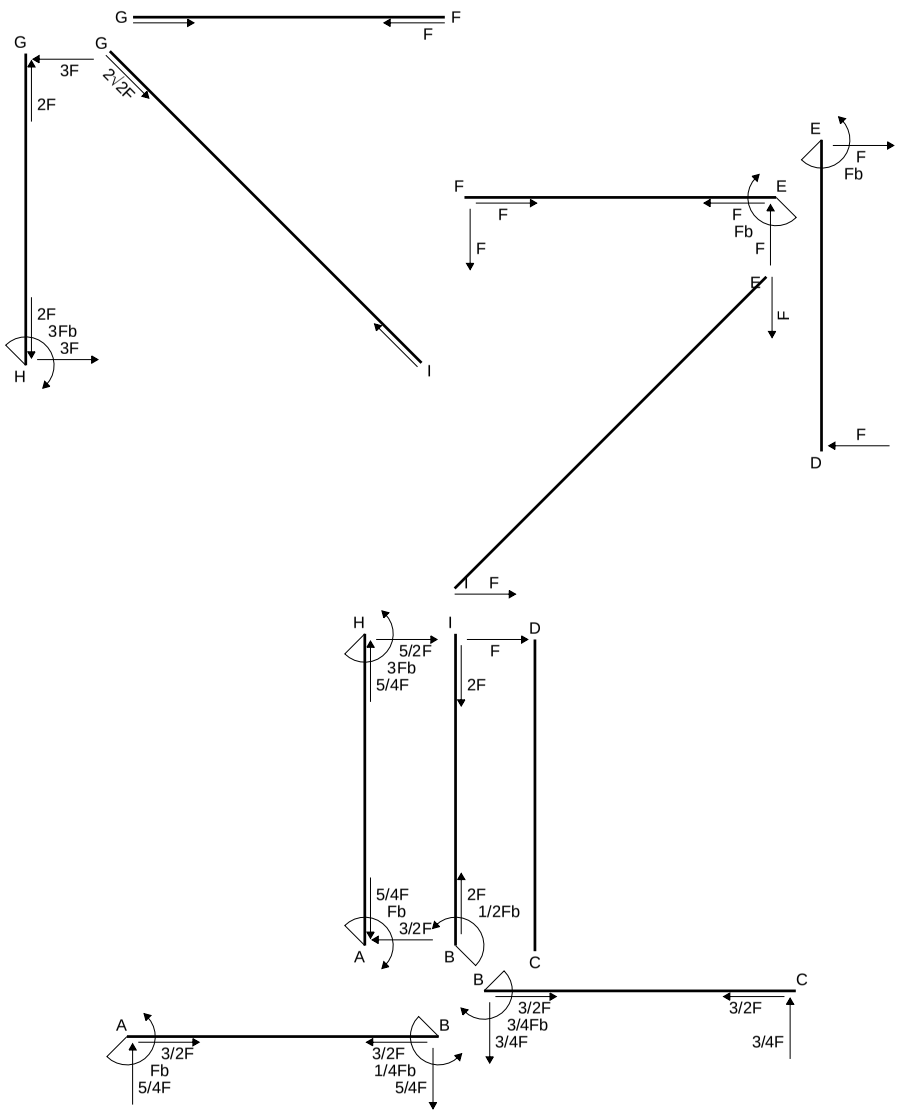
$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

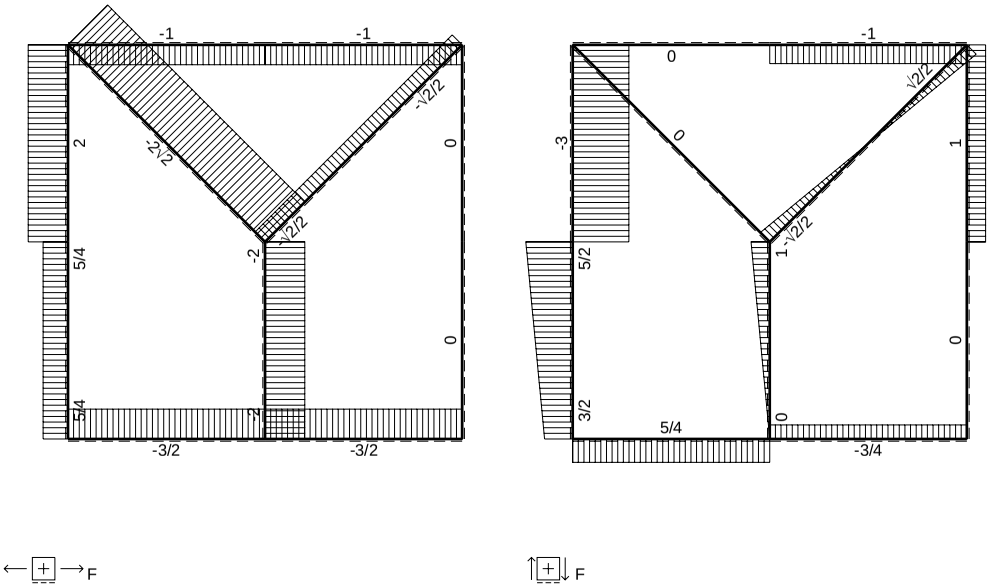
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

PROCEDIMENTO E RISULTATI 311832 CI04.xxxx.043

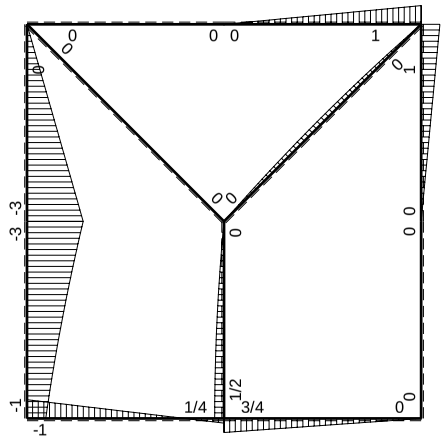


A = 1020. mm^2
J_u = 332140. mm^4
J_v = 51120. mm^4
y_g = 25.41 mm
N = 2700. N
T_y = -4050. N
M_x = -2632500. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 28.59 mm
$\sigma_m = N/A - Mv/J_u$ = 229.3 N/mm^2
x_c = 18. mm
y_c = 40. mm
v_c = 14.59 mm
$\sigma_c = N/A - Mv/J_u$ = 118.3 N/mm^2
τ_c = 7.189 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 119. N/mm^2
S^* = 7074. mm^3

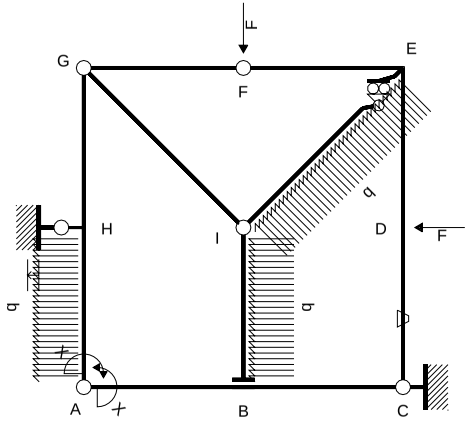

G
F
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G
3F
2F
2√2F
2F
3Fb
3F
H
I
F
E
F
Fb
F
F
F
F
F
F
F
F
D
F
H
I
D
5/2F
3Fb
5/4F
F
2F
5/4F
Fb
3/2F
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1/2Fb
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B
C
B
C
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3/4Fb
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3/2F
1/4Fb
5/4F

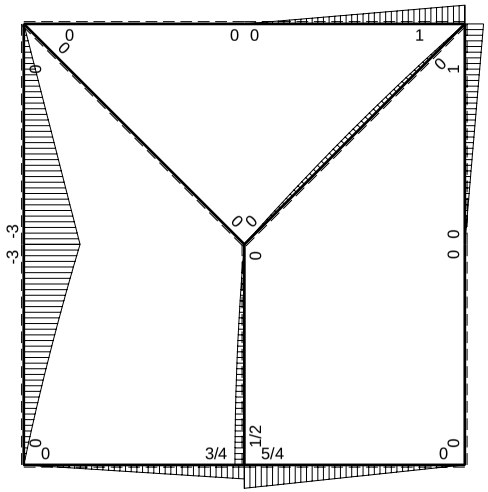

-1
-1
2
-√2/2
√2/2
0
5/4
-2
0
-3/2
-3/2
-1
0
√2/2
-3
0
1
5/2
1
-√2/2
0
3/2
5/4
0
-3/4

F F

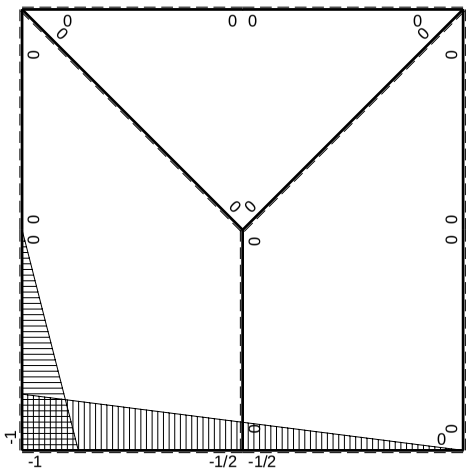

0
0 0
1
0
0
1
0 0
0
-3 -3
0
0 0
-1
1/4
1/2
3/4
0
0
-1

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 238953 CI04.xxxx.044

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-5/4Fx$	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	-Fb/EJ	0	0	0	0+0	0
DC b	0	0	Fb/EJ	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

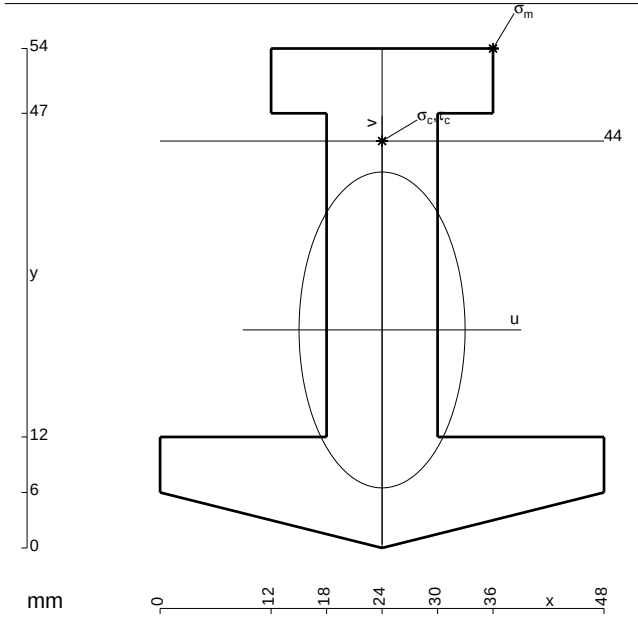
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

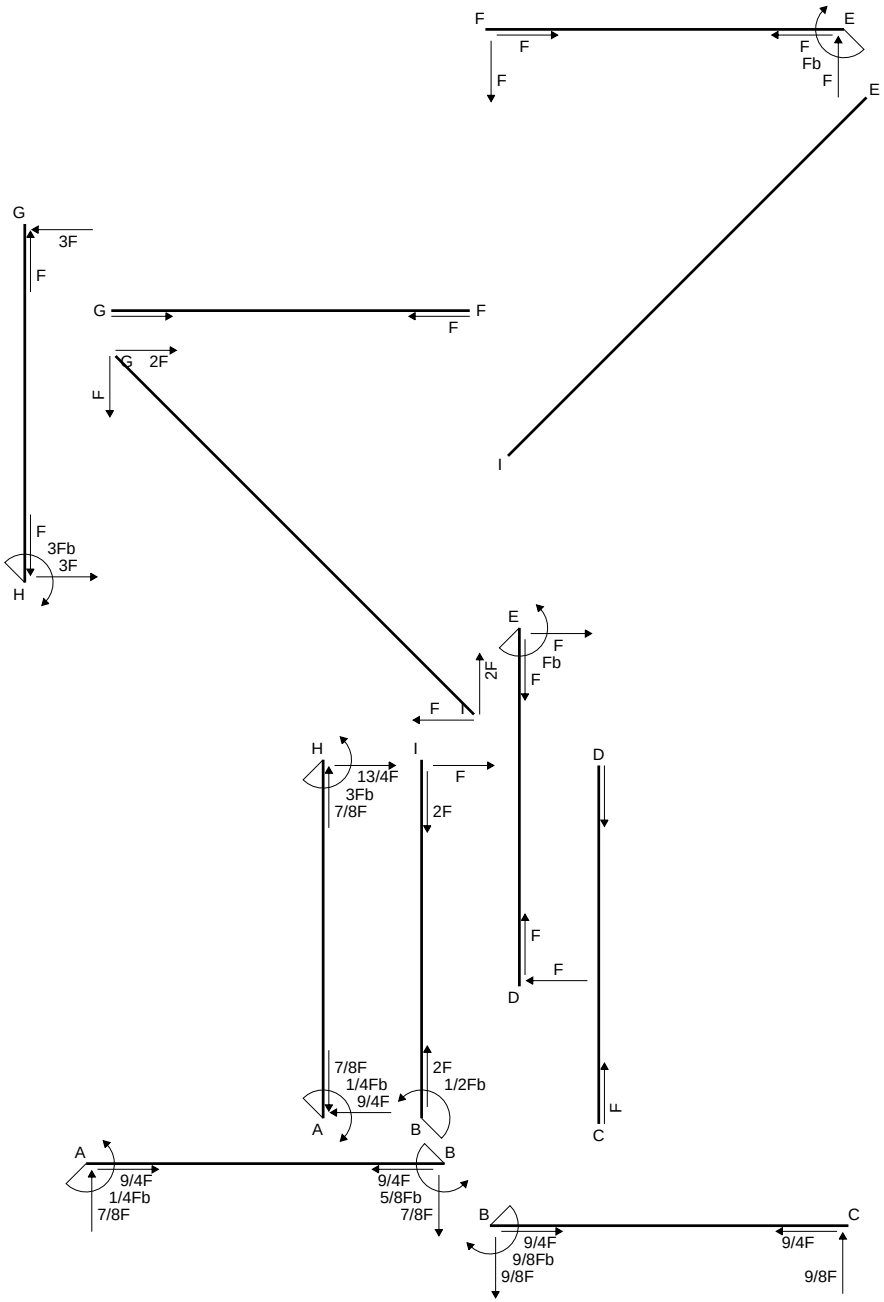
$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

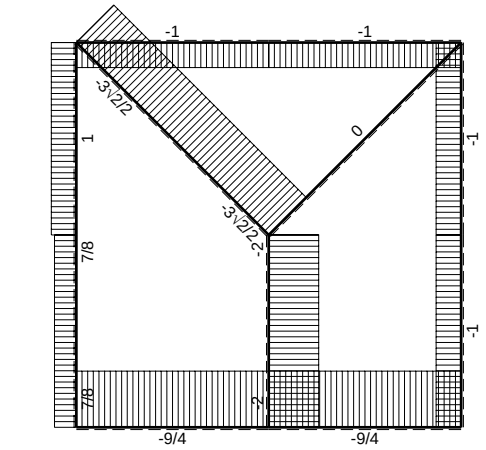
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

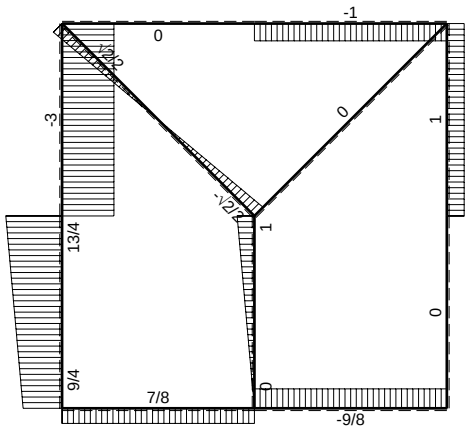
PROCEDIMENTO E RISULTATI 238953 CI04.xxxx.044

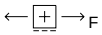


A = 1020. mm^2
J_u = 297608. mm^4
J_v = 82224. mm^4
y_g = 23.57 mm
N = 2200. N
T_y = -3300. N
M_x = -2310000. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 30.43 mm
$\sigma_m = N/A - Mv/J_u$ = 238.3 N/mm^2
x_c = 24. mm
y_c = 44. mm
v_c = 20.43 mm
$\sigma_c = N/A - Mv/J_u$ = 160.7 N/mm^2
τ_c = 4.91 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 161. N/mm^2
S^* = 5314. mm^3

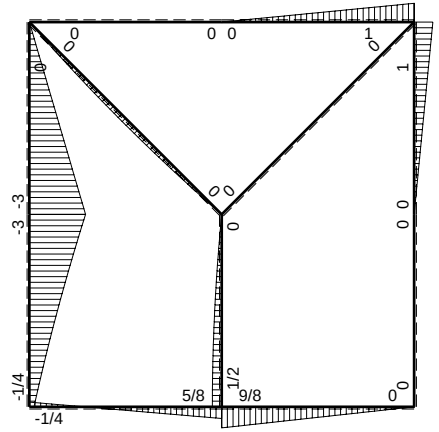

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Fb
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G 2F
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7/8F
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B
C
9/4F
9/8Fb
9/8F
9/4F
9/8F


-1
-1
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-9/4

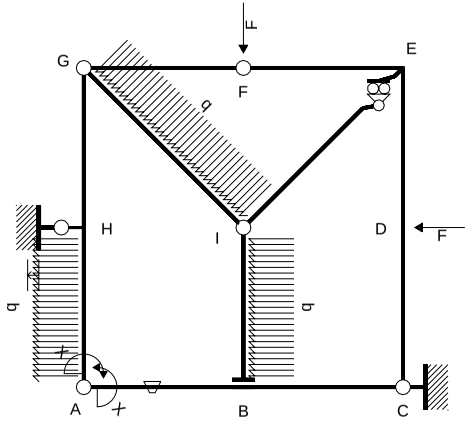

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0
9/4
7/8
0
-9/8

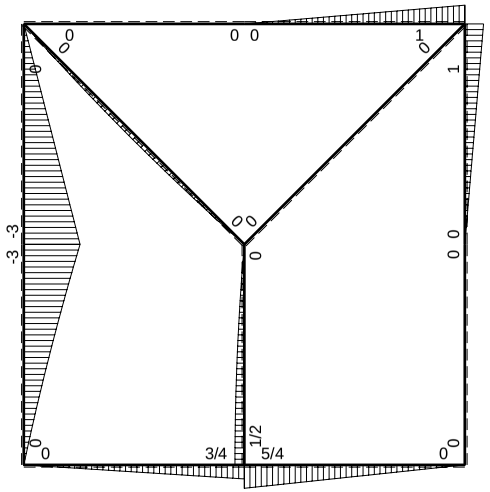

F


F

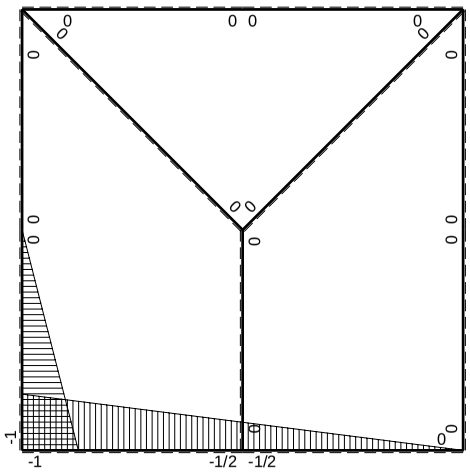

0
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1
0
0
1
0 0
-3 -3
0
0 0
-1/4
5/8
1/2
9/8
0
0
-1/4


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 267087 CI04.xxxx.045

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PROCEDIMENTO E RISULTATI 267087 CI04.xxxx.045

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	-Fb/EJ	$-3/4Fx+3/8Fx^2/b$	Fb/EJ-1/2Fx/EJ	$1-x/b+1/4x^2/b^2$	$(-1/4+3/4)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-3/4Fb+3/4Fx	Fb/EJ	$-3/8Fb+3/8Fx^2/b$	1/2Fb/EJ+1/2Fx/EJ	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-5/4Fx	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right) Fb\ 1/EJ\ dx + \int_o^b \left(1 - 1/2\ x/b\right)\theta\ dx$

$= \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b Fb\ 1/EJ\ + \left[\ x - 1/4\ x^2/b\ \right]_o^b \theta$

$= \left(-3/8\ b + 1/8\ b\ \right) Fb\ 1/EJ\ + \left(\ b - 1/4\ b\ \right)\theta\ \ = 1/2\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right) Fb\ 1/EJ\ dx + \int_o^b \left(-1/2 - 1/2\ x/b\right)\theta\ dx$

$= \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b Fb\ 1/EJ\ + \left[-1/2\ x - 1/4\ x^2/b\ \right]_o^b \theta$

$= \left(-3/8\ b + 1/8\ b\ \right) Fb\ 1/EJ\ + \left(-1/2\ b - 1/4\ b\ \right)\theta\ \ = 1/2\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right) Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right) Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right) Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b Fb\ 1/EJ$

$= \left(-5/24\ b\ \right) Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

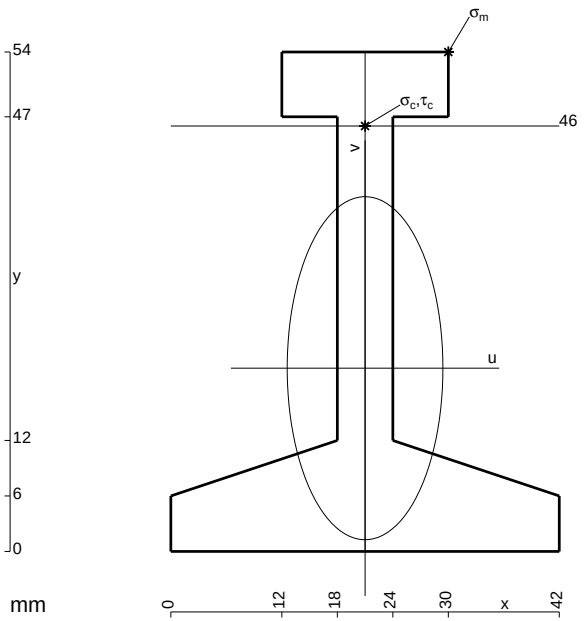
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

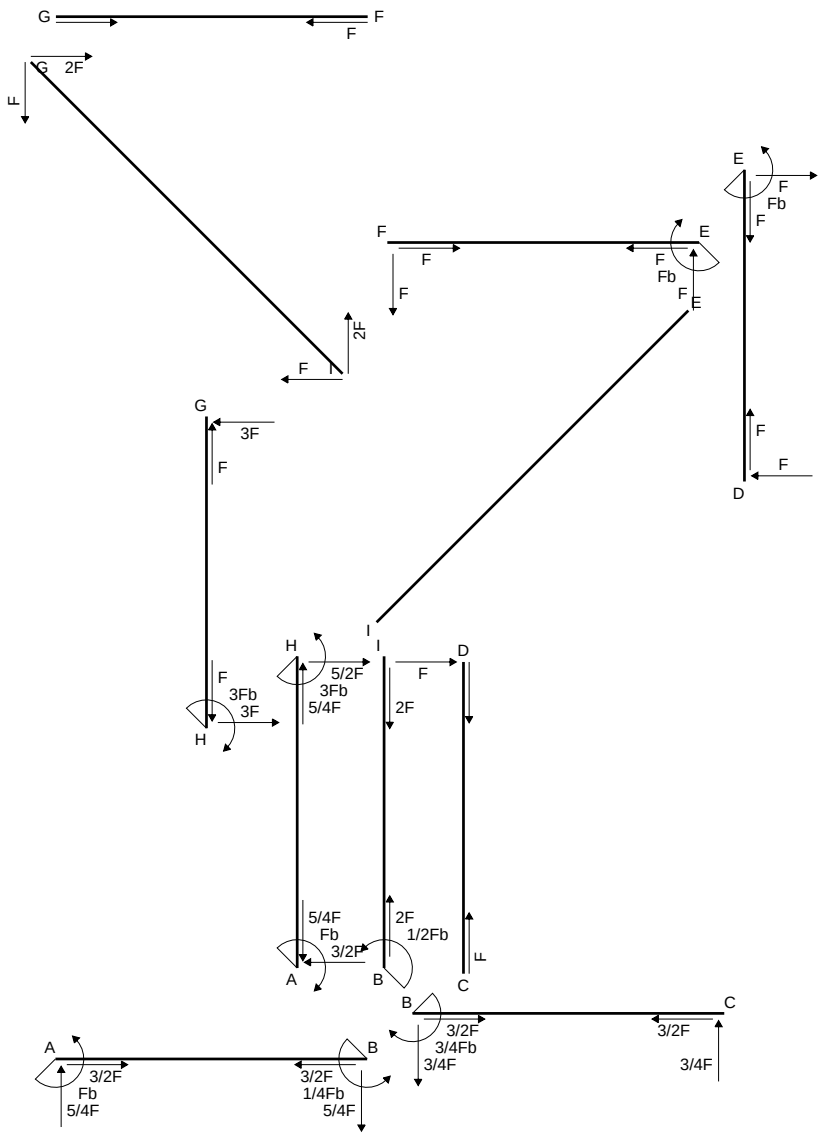
$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

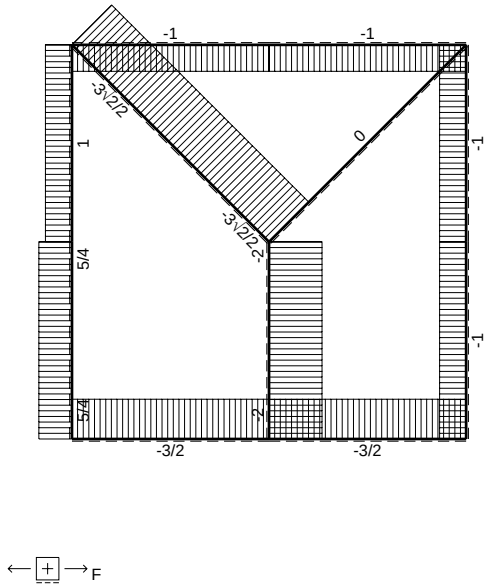
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

PROCEDIMENTO E RISULTATI 267087 CI04.xxxx.045

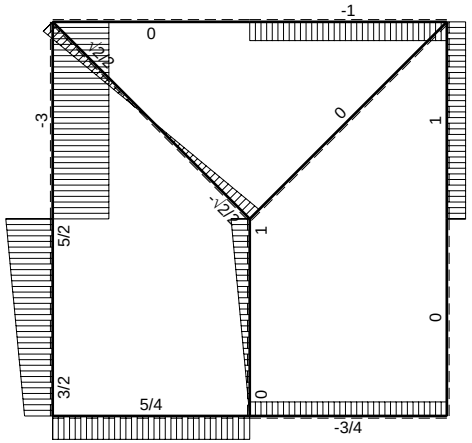


A = 732. mm^2
J_u = 251906. mm^4
J_v = 51876. mm^4
y_g = 19.81 mm
N = 650. N
T_y = -1950. N
M_x = -1462500. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 9. mm
v_m = 34.19 mm
$\sigma_m = N/A - Mv/J_u$ = 199.4 N/mm^2
x_c = 21. mm
y_c = 46. mm
v_c = 26.19 mm
$\sigma_c = N/A - Mv/J_u$ = 152.9 N/mm^2
τ_c = 5.195 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 153.2 N/mm^2
S^* = 4027. mm^3

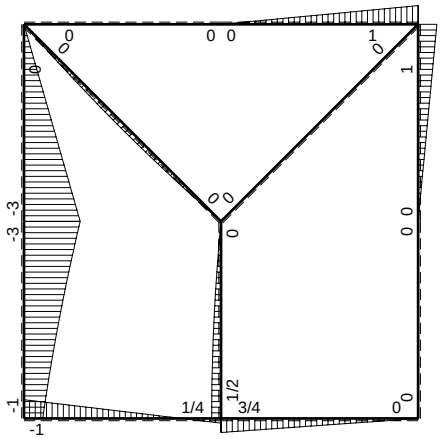

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3/2F
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A
3/2F
Fb
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B
3/2F
1/4Fb
5/4F


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-3/2
-3/2

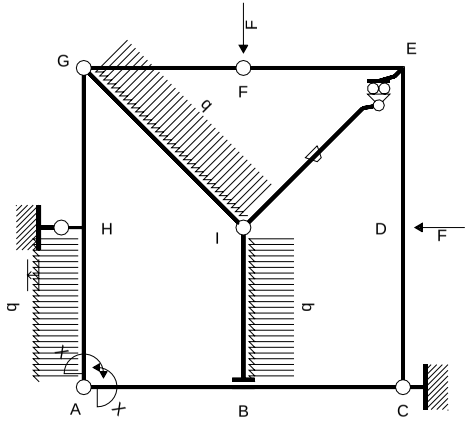
F

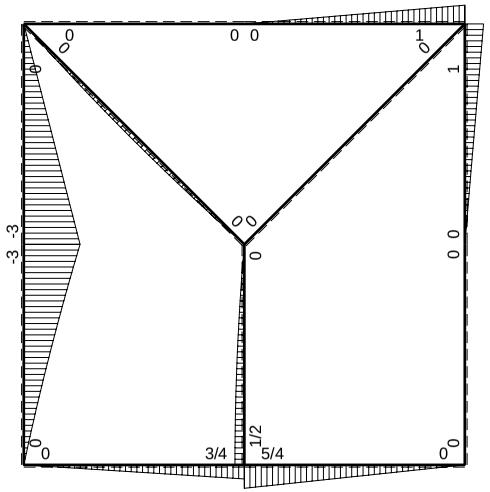

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√2/2
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3/2
0
5/4
0
-3/4

F

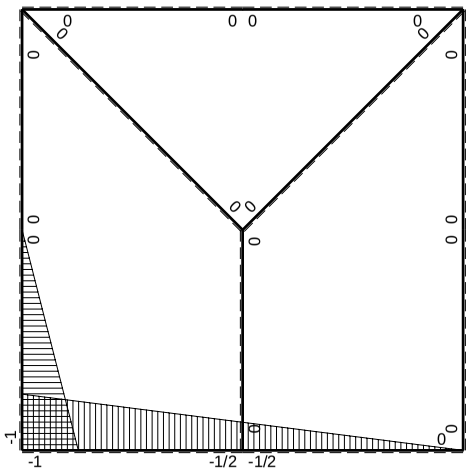

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0
0 0
-1
1/4
1/2
3/4
0
0
-1

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 265892 CI04.xxxx.046

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-5/4Fx$	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

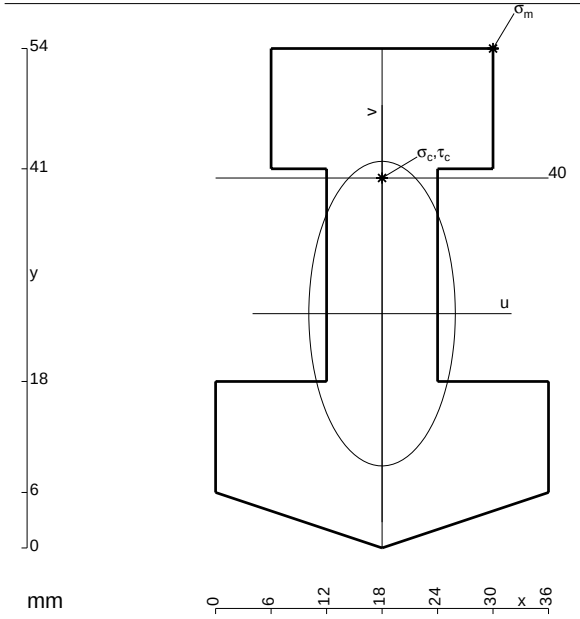
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

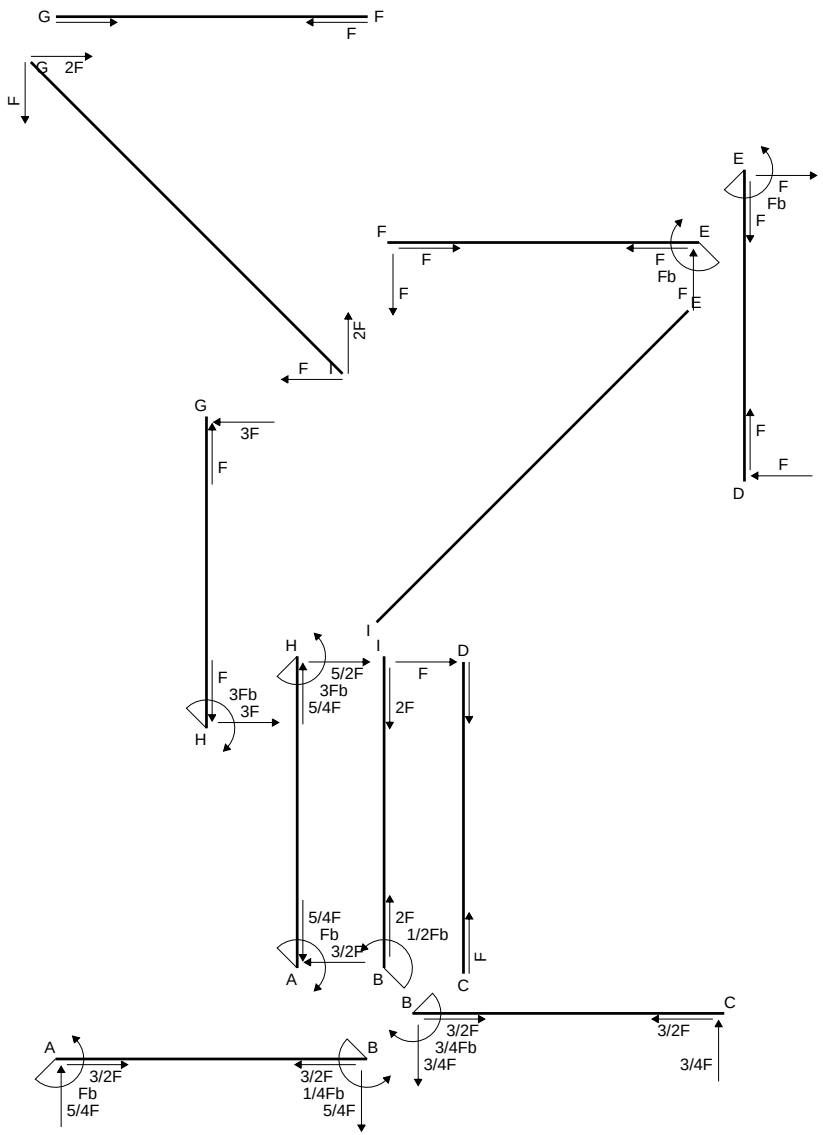
$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

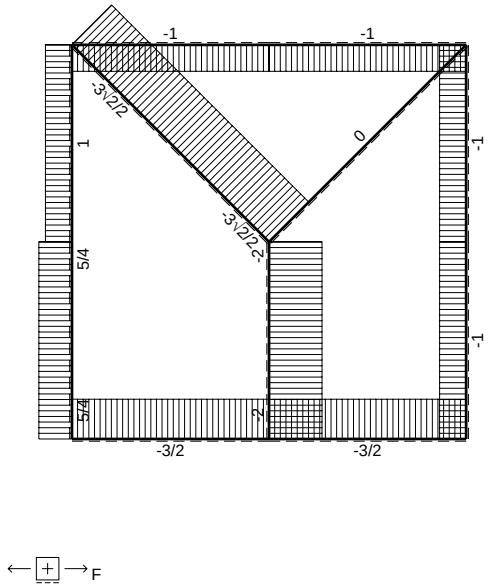
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

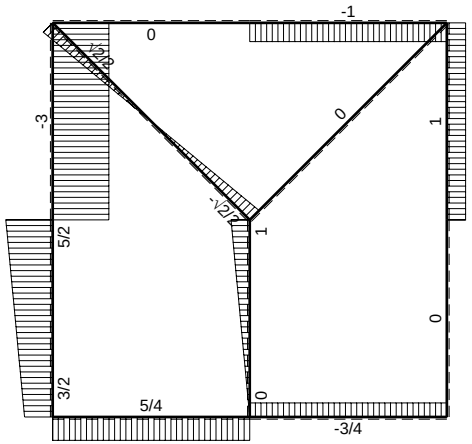
PROCEDIMENTO E RISULTATI 265892 CI04.xxxx.046



A = 1128. mm^2
J_u = 306009. mm^4
J_v = 70776. mm^4
y_g = 25.34 mm
N = 930. N
T_y = -2790. N
M_x = -2232000. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 28.66 mm
$\sigma_m = N/A - Mv/J_u$ = 209.9 N/mm^2
x_c = 18. mm
y_c = 40. mm
v_c = 14.66 mm
$\sigma_c = N/A - Mv/J_u$ = 107.8 N/mm^2
τ_c = 5.392 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 108.2 N/mm^2
S^* = 7097. mm^3

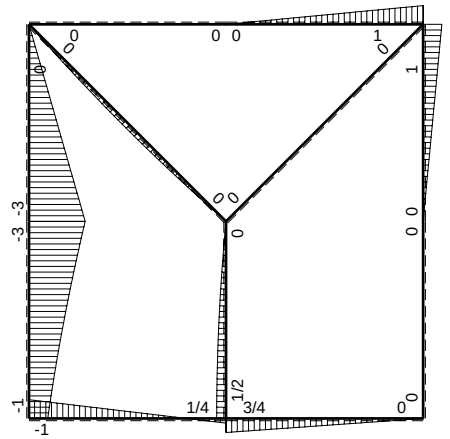

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B
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1/4Fb
5/4F


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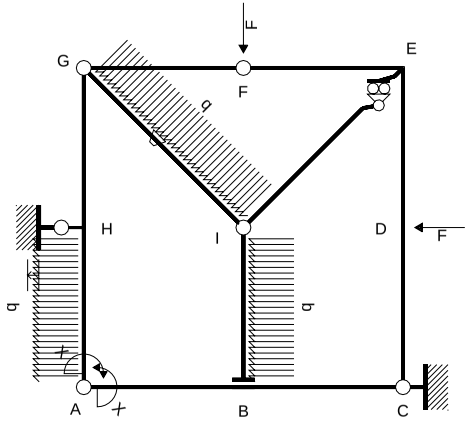

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0
-3/4

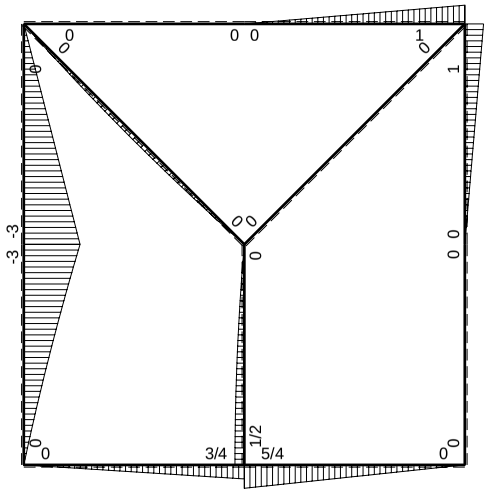
F


F

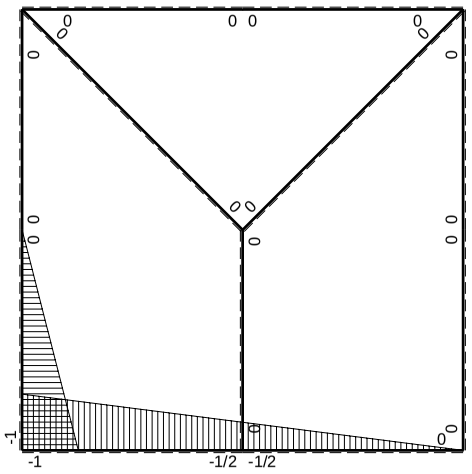

0
0 0
1
0
0
1
0 0
-3 -3
0
0 0
-1
1/4
1/2
3/4
0
0
-1


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264983 CI04.xxxx.047

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PROCEDIMENTO E RISULTATI 264983 CI04.xxxx.047

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-5/4Fx$	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	-Fb/EJ	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

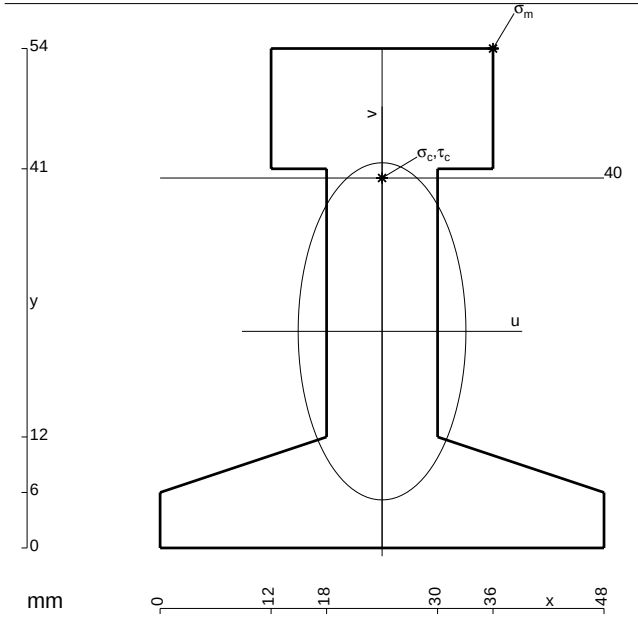
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

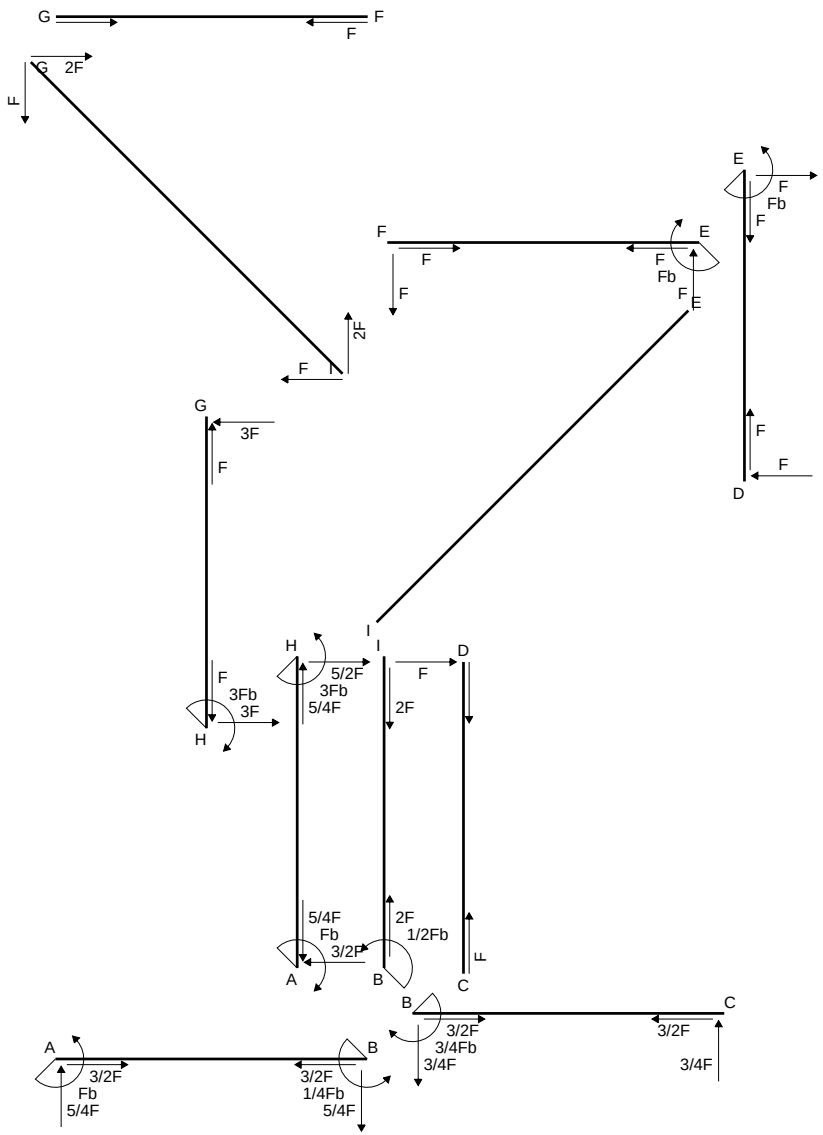
$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

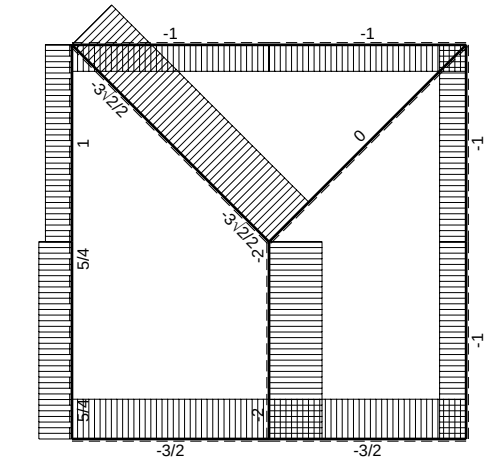
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

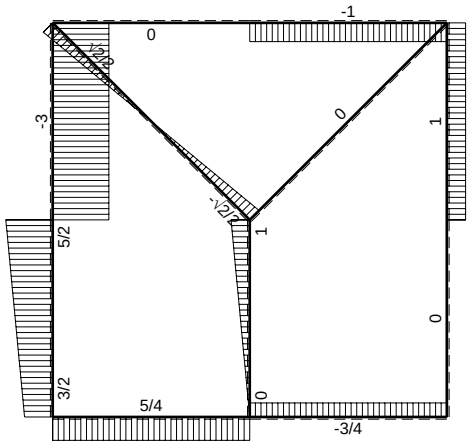
PROCEDIMENTO E RISULTATI 264983 CI04.xxxx.047

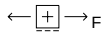


A = 1128. mm^2
J_u = 375033. mm^4
J_v = 92808. mm^4
y_g = 23.42 mm
N = 1050. N
T_y = -3150. N
M_x = -2677500. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 30.58 mm
$\sigma_m = N/A - Mv/J_u$ = 219.3 N/mm^2
x_c = 24. mm
y_c = 40. mm
v_c = 16.58 mm
$\sigma_c = N/A - Mv/J_u$ = 119.3 N/mm^2
τ_c = 5.402 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 119.7 N/mm^2
S^* = 7718. mm^3

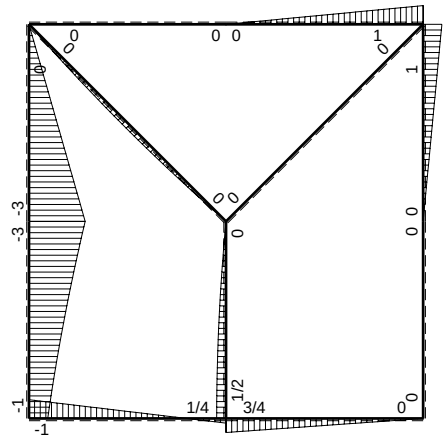

G
F
F
G
2F
F
F
2F
F
I
F
F
E
F
Fb
F
E
F
F
F
E
F
Fb
F
E
F
F
F
D
G
3F
F
F
3Fb
3F
H
H
I
I
5/2F
3Fb
5/4F
D
F
2F
5/4F
Fb
3/2F
A
2F
1/2Fb
B
F
C
B
C
3/2F
3/4Fb
3/4F
3/2F
3/4F
A
3/2F
Fb
5/4F
B
3/2F
1/4Fb
5/4F


-1
-1
-√2/2
1
0
-1
-√2/2
-2
5/4
-1
5/4
-2
-3/2
-3/2

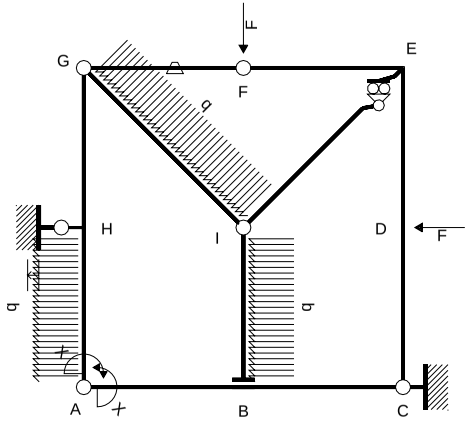

-1
0
√2/2
-3
0
1
√2/2
1
5/2
0
3/2
5/4
0
-3/4

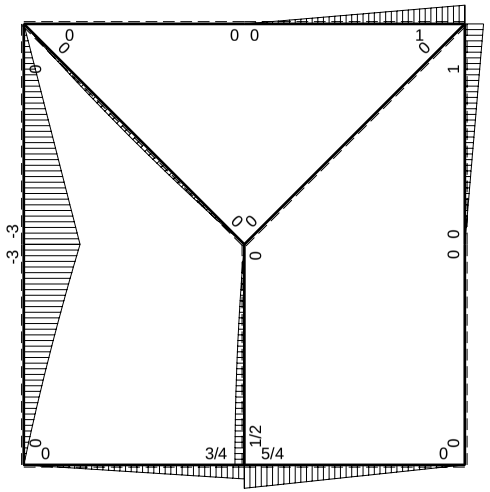

F


F

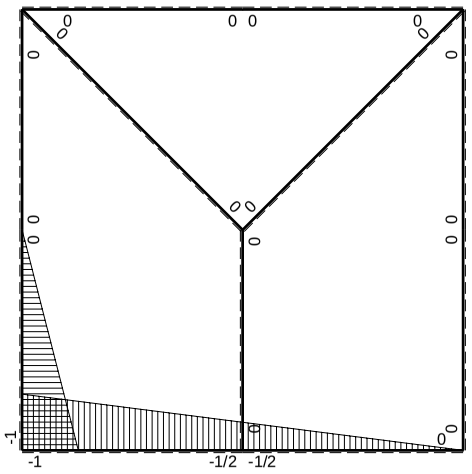

0
0 0
1
0
0
1
0 0
-3 -3
0
0 0
-1
1/4
1/2
3/4
0
0
-1


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 269177 CI04.xxxx.048

@ Adolfo Zavelani Rossi, Politecnico di Milano, vers.27.03.13 16.04.26

PROCEDIMENTO E RISULTATI 269177 CI04.xxxx.048

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-5/4Fx$	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	-Fb/EJ	0	0	0	0+0	0
GF b	0	0	Fb/EJ	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

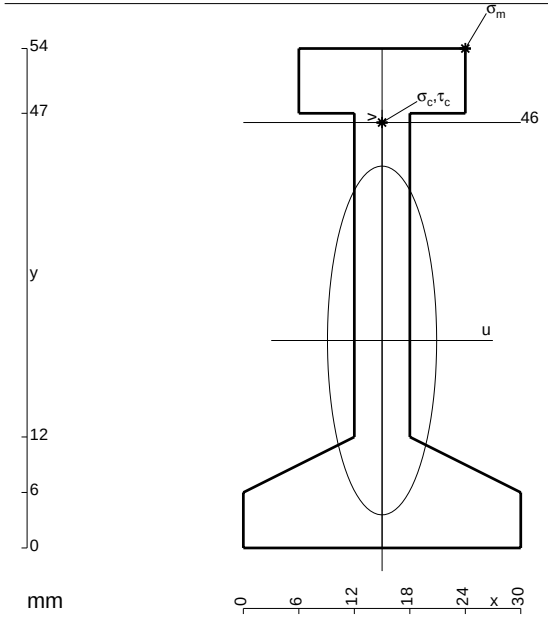
$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

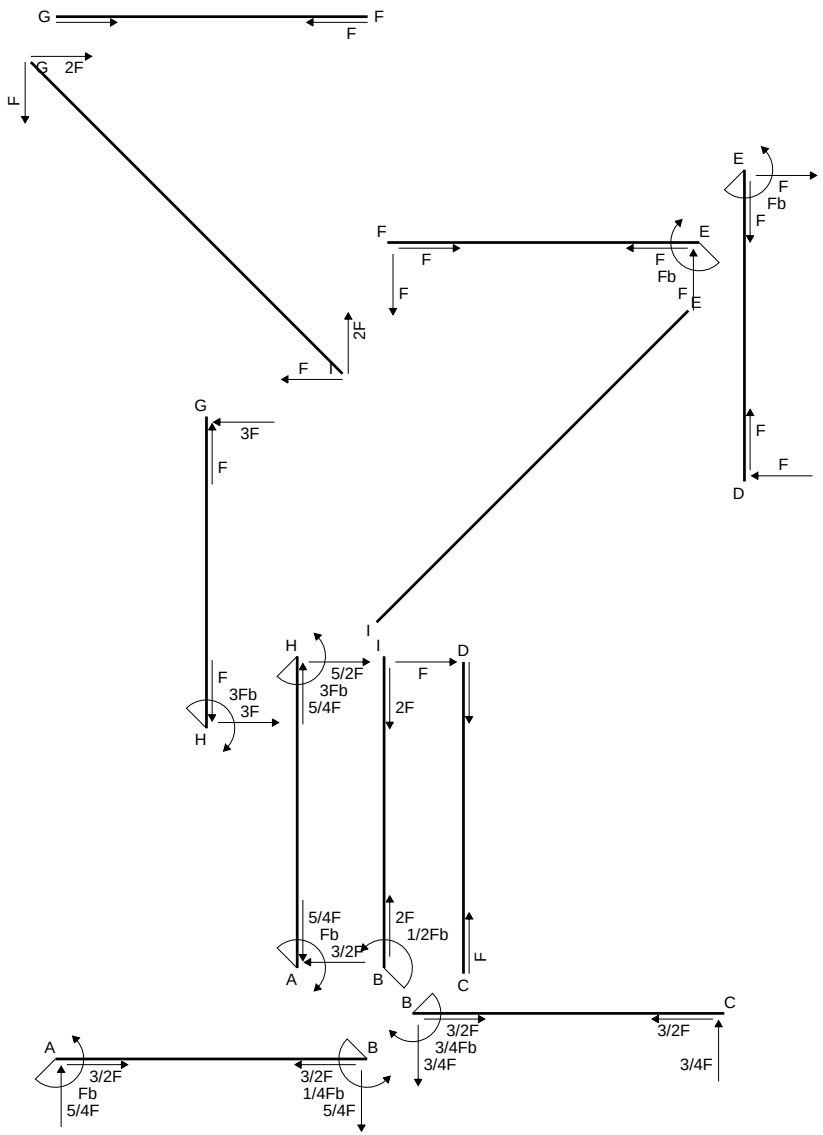
$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

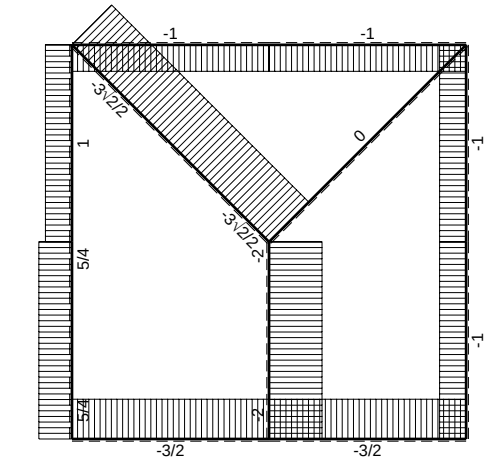
$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

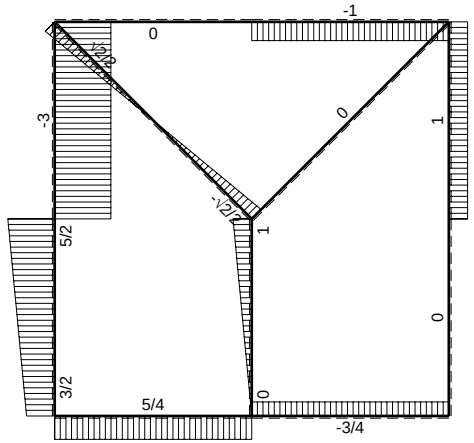


A = 624. mm^2
J_u = 221959. mm^4
J_v = 21744. mm^4
y_g = 22.43 mm
N = 590. N
T_y = -1770. N
M_x = -1593000. Nmm
x_m = 24. mm
y_m = 54. mm
u_m = 9. mm
v_m = 31.57 mm
$\sigma_m = N/A - Mv/J_u$ = 227.5 N/mm^2
x_c = 15. mm
y_c = 46. mm
v_c = 23.57 mm
$\sigma_c = N/A - Mv/J_u$ = 170.1 N/mm^2
τ_c = 4.892 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 170.3 N/mm^2
S^* = 3681. mm^3

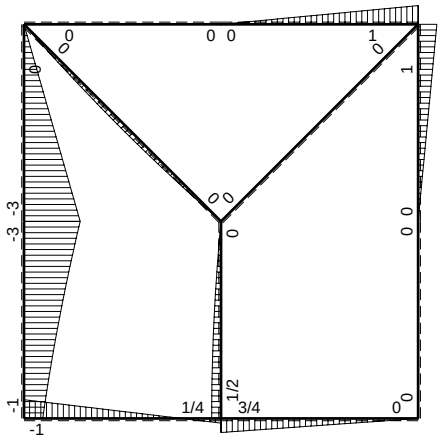

G
F
F
G
2F
F
2F
F
I
F
F
F
E
F
Fb
F
E
F
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F
Fb
F
E
F
F
F
D
G
3F
F
F
3Fb
3F
H
H
I
5/2F
3Fb
5/4F
I
2F
D
F
5/4F
Fb
3/2F
A
2F
1/2Fb
B
F
C
B
C
3/2F
3/4Fb
3/4F
3/2F
3/4F
A
3/2F
Fb
5/4F
B
3/2F
1/4Fb
5/4F


-1
-1
-√2/2
1
0
-1
-√2/2
-2
5/4
-1
5/4
-2
-3/2
-3/2

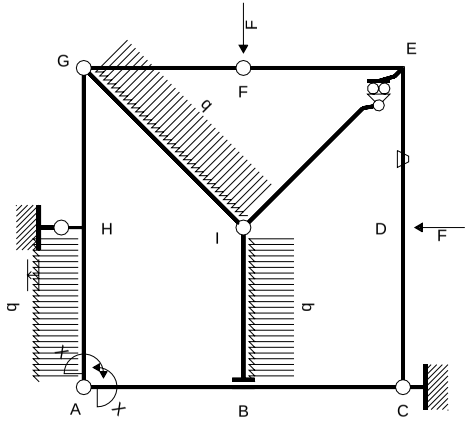
F

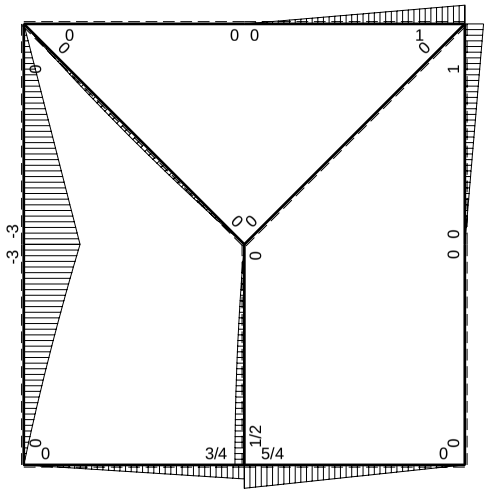

-1
0
√2/2
-3
0
1
-√2/2
1
5/2
0
3/2
0
5/4
-3/4

F

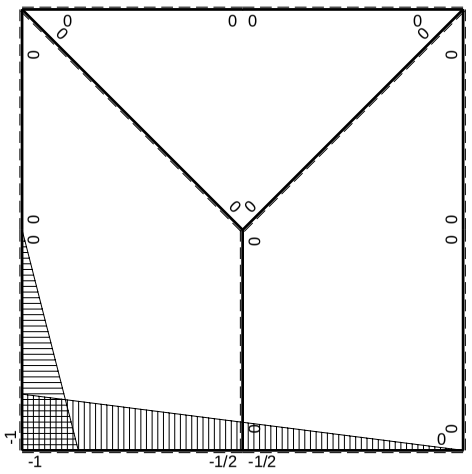

0
0 0
1
0
0
1
0 0
-3 -3
0
0 0
-1
1/4
1/2
3/4
0
0
-1

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-5/4Fx	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-Fb+Fx	Fb/EJ	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

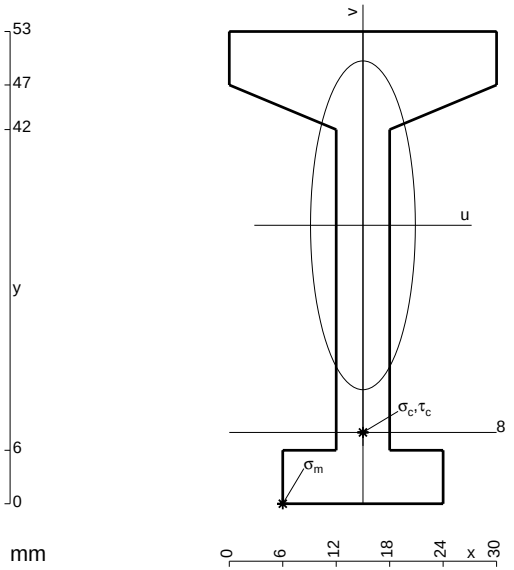
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

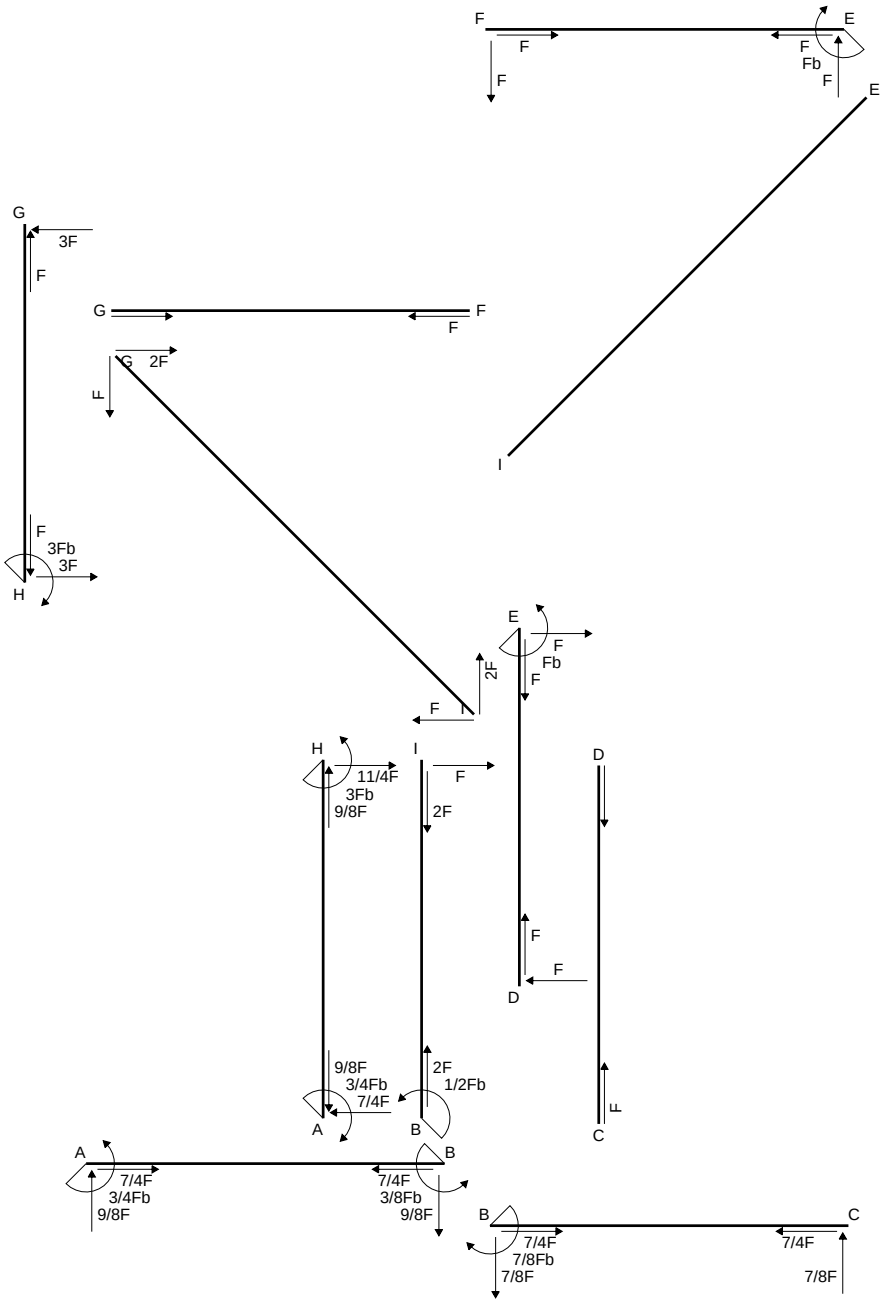
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

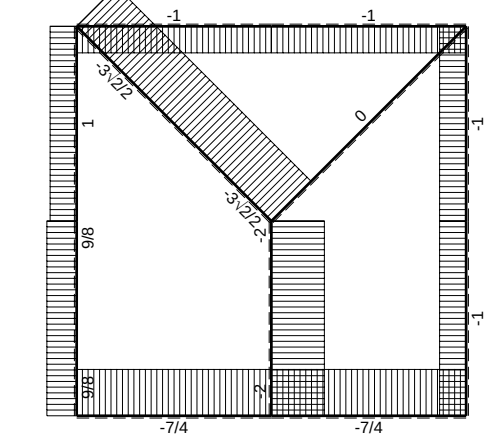
PROCEDIMENTO E RISULTATI 265373 CI04.xxxx.049

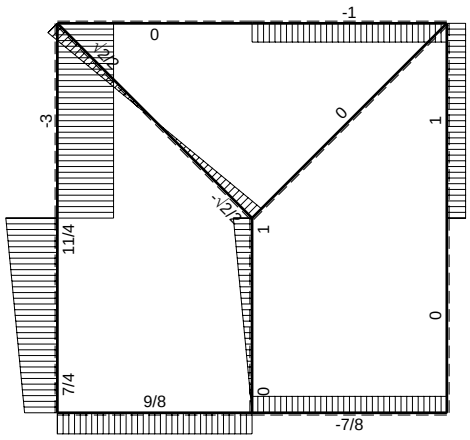


A = 594. mm^2
J_u = 202331. mm^4
J_v = 20574. mm^4
y_g = 31.25 mm
N = 550. N
T_y = -1650. N
M_x = -1534500. Nmm
x_m = 6. mm
u_m = -9. mm
v_m = -31.25 mm
$\sigma_m = N/A - Mv/J_u$ = -236.1 N/mm^2
x_c = 15. mm
y_c = 8. mm
v_c = -23.25 mm
$\sigma_c = N/A - Mv/J_u$ = -175.4 N/mm^2
τ_c = 4.542 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 175.6 N/mm^2
S^* = 3342. mm^3

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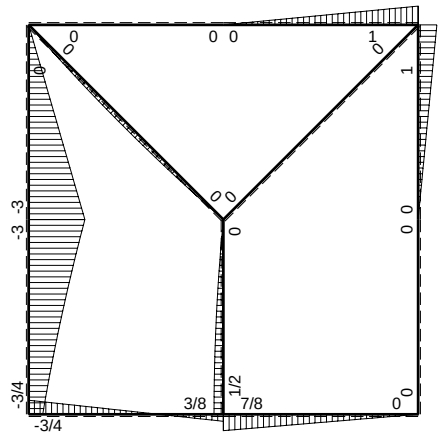

F
F
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E
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Fb
F
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I
G
3F
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G
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F
G
2F
F
F
3Fb
3F
H
E
F
Fb
F
2F
F
I
H
11/4F
3Fb
9/8F
I
F
2F
D
F
F
D
9/8F
3/4Fb
7/4F
2F
1/2Fb
A
B
C
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A
7/4F
3/4Fb
9/8F
B
7/4F
3/8Fb
9/8F
B
7/4F
7/8Fb
7/8F
C
7/4F
7/8F


-1
-1
-3√2/2
1
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-1
-3√2/2
-2
9/8
9/8
-2
-7/4
-7/4

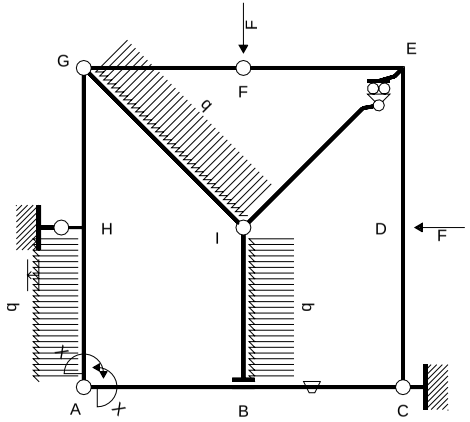

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0
√2/2
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0
1
-√2/2
1
11/4
0
7/4
9/8
0
-7/8

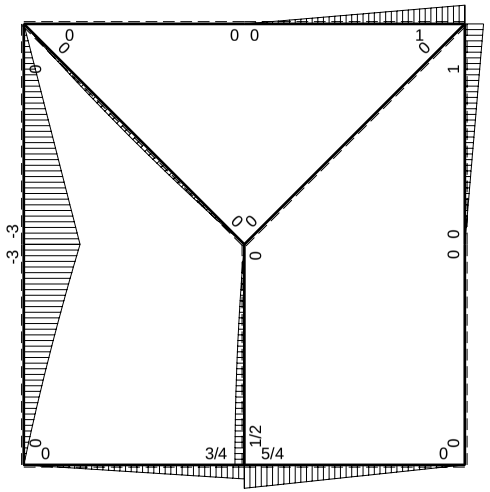
←□→ F

↑□↓ F

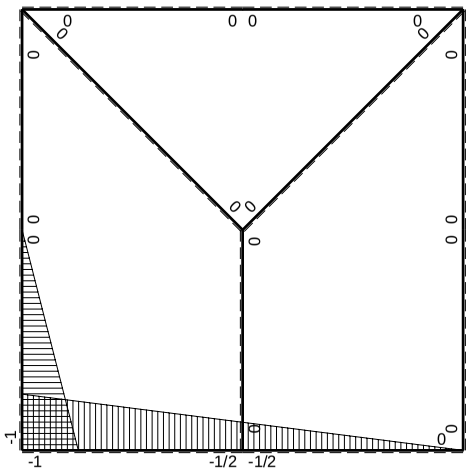

0
0 0
1
0
0
1
0 0
-3 -3
0
0 0
-3/4
3/8
1/2
7/8
0
0
-3/4

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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PROCEDIMENTO E RISULTATI 266093 CI04.xxxx.050

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-3/4Fb+3/4Fx	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	-Fb/EJ	$-5/8Fb+5/4Fx-5/8Fx^2/b$	$1/2Fb/EJ-1/2Fx/EJ$	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-5/4Fx	Fb/EJ	$-5/8Fx^2/b$	$1/2Fx/EJ$	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1/2 - 1/2\ x/b\ \right)\ \theta\ \ dx$

$= \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 1/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2\ x/b\ \right)\ \theta\ \ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/4\ b\ \right)\ \theta\ \ = 1/24\ \ Fb^2/EJ$

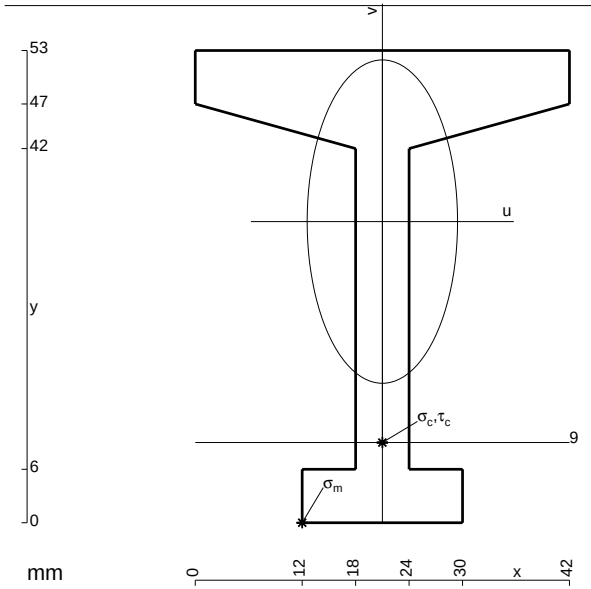
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

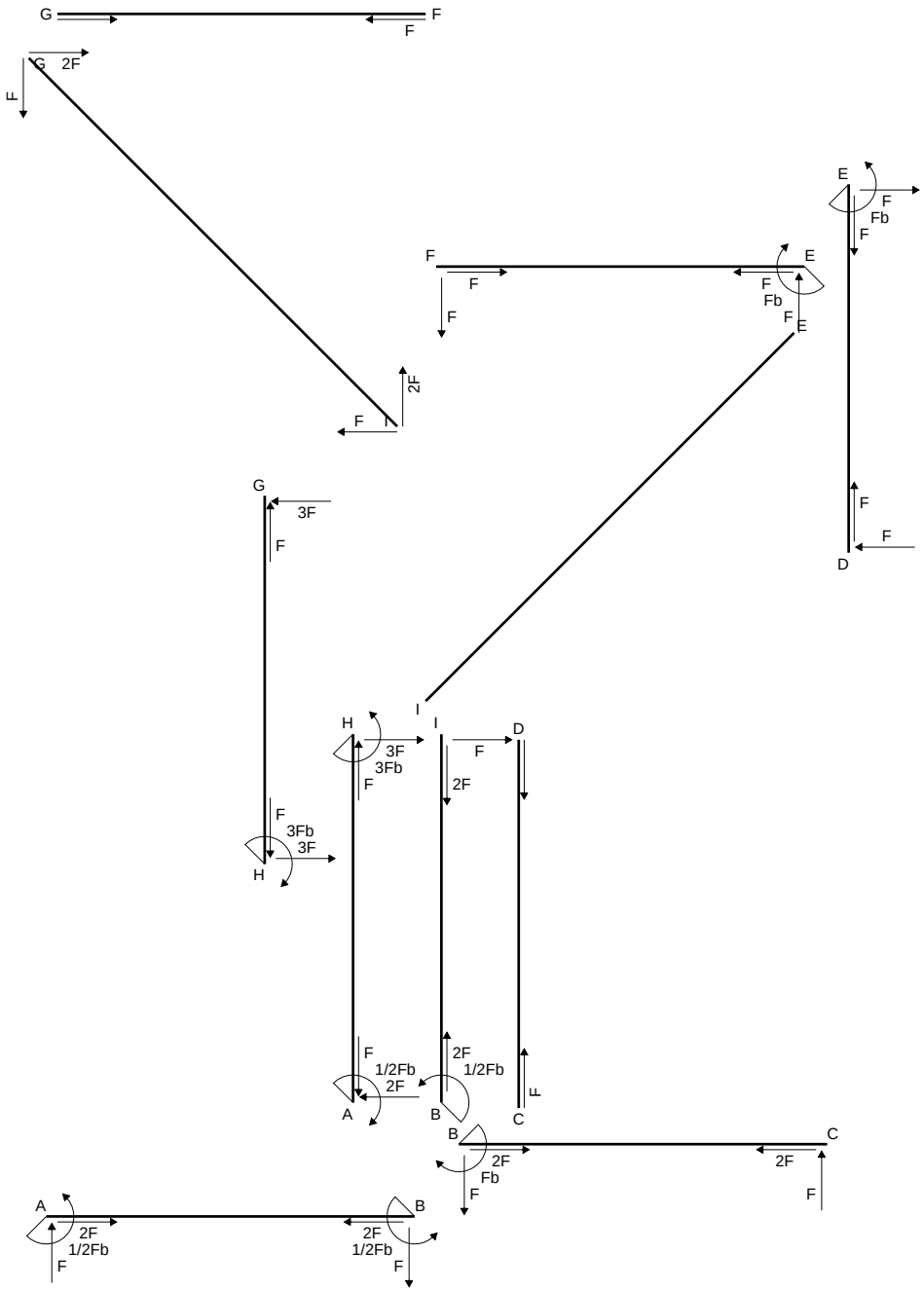
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

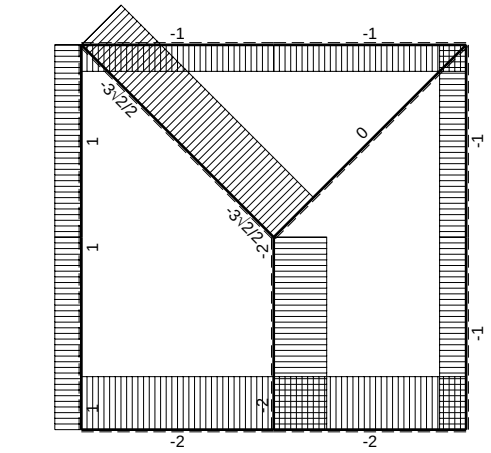
PROCEDIMENTO E RISULTATI 266093 CI04.xxxx.050



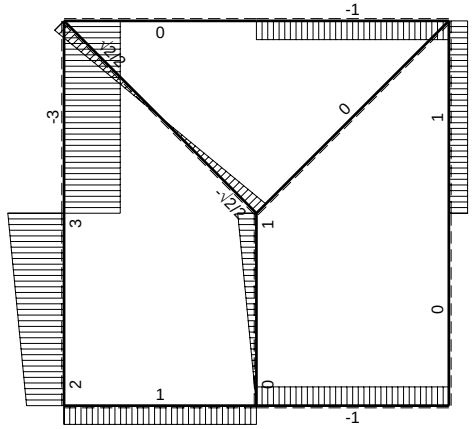
A = 696. mm^2
J_u = 229334. mm^4
J_v = 49608. mm^4
y_g = 33.8 mm
N = 920. N
T_y = -2760. N
M_x = -1352400. Nmm
x_m = 12. mm
u_m = -9. mm
v_m = -33.8 mm
$\sigma_m = N/A - Mv/J_u$ = -198. N/mm^2
x_c = 21. mm
y_c = 9. mm
v_c = -24.8 mm
$\sigma_c = N/A - Mv/J_u$ = -144.9 N/mm^2
τ_c = 7.621 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 145.5 N/mm^2
S^* = 3799. mm^3

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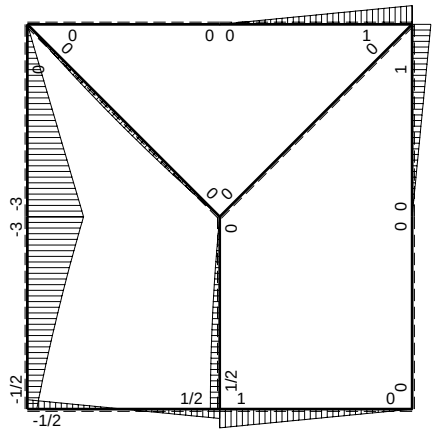

G
F
F
G
2F
F
F
F
E
F
Fb
F
E
F
F
F
F
2F
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F
F
D
G
3F
F
H
I
I
D
H
3F
3Fb
F
F
2F
F
3Fb
3F
H
A
B
C
F
1/2Fb
2F
2F
1/2Fb
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B
C
2F
Fb
F
2F
F
A
B
2F
1/2Fb
F
2F
1/2Fb
F


-1
-1
-3√2/2
1
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-1
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-3√2/2
-2
-1
1
2
-2
-2

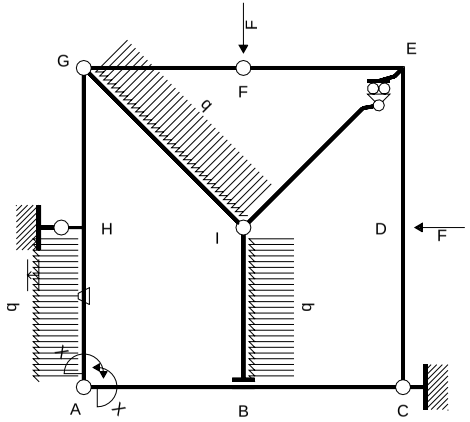
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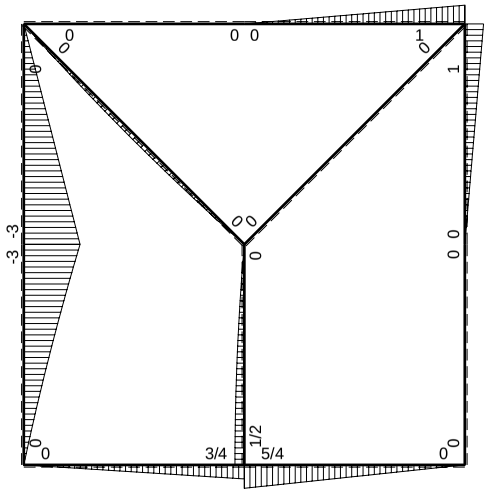

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0
√2/2
-3
0
1
-√2/2
3
1
2
1
0
-1

F

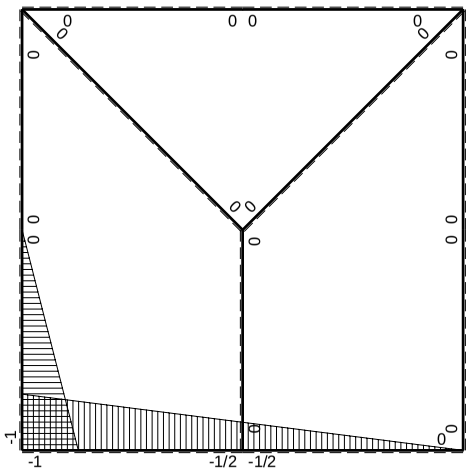

0
0 0
1
0
0
1
0 0
-3 -3
0
0 0
1/2
1/2
1
0
0
-1/2
-1/2

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 310123 CI04.xxxx.051

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-5/4Fx$	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	-Fb/EJ	$3Fx-7/2Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(11/24+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	Fb/EJ	$5/2Fx-2Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/2Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/2Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\ \theta\ dx$

$= \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b\ \theta$

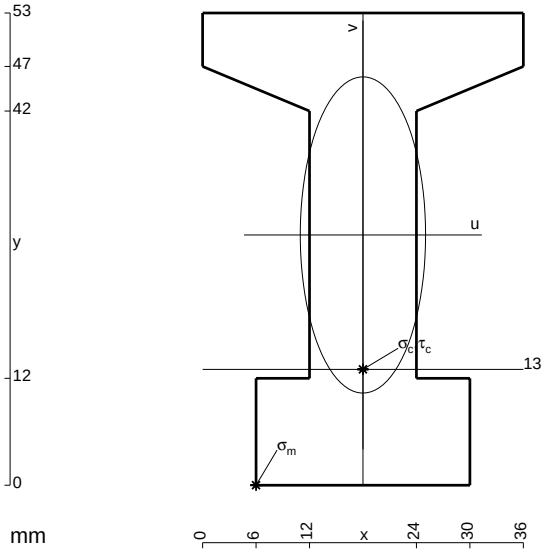
$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b\ \right)\ \theta\ \ = 23/24\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\ \theta\ dx$

$= \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b\ \theta$

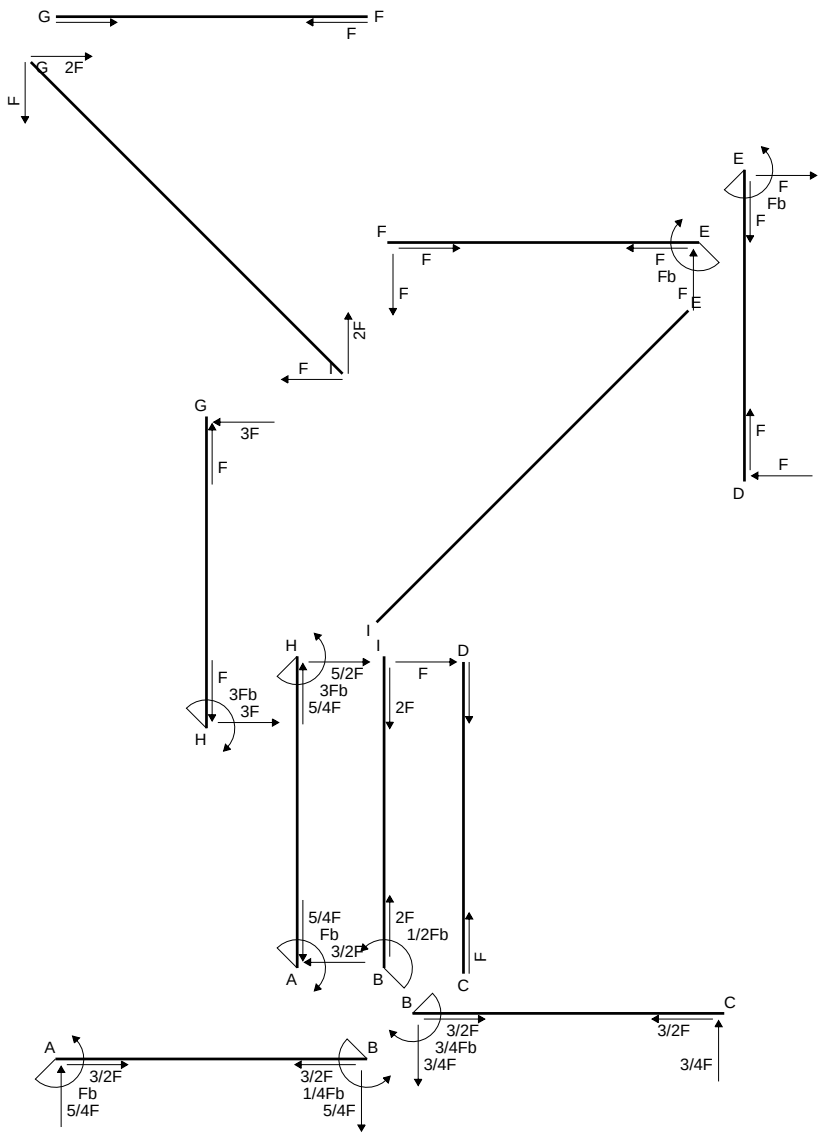
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\ \theta\ \ = 23/24\ \ Fb^2/EJ$

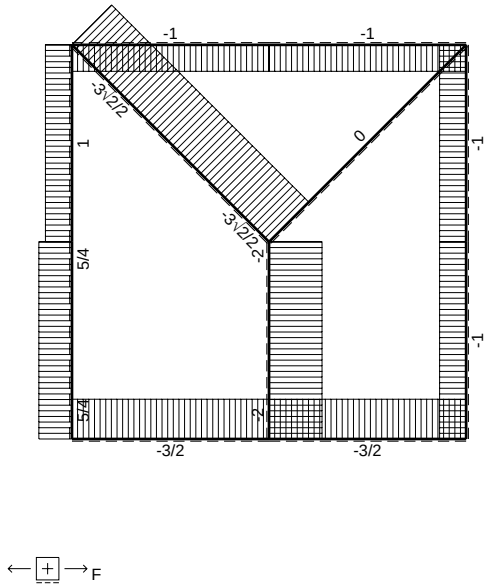
PROCEDIMENTO E RISULTATI 310123 CI04.xxxx.051



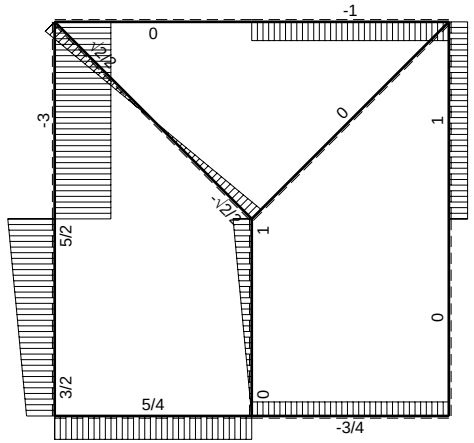
A = 984. mm^2
J_u = 309962. mm^4
J_v = 48672. mm^4
y_g = 28.09 mm
N = 1460. N
T_y = -4380. N
M_x = -2321400. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.09 mm
$\sigma_m = N/A - Mv/J_u$ = -208.9 N/mm^2
x_c = 18. mm
y_c = 13. mm
v_c = -15.09 mm
$\sigma_c = N/A - Mv/J_u$ = -111.5 N/mm^2
τ_c = 7.711 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 112.3 N/mm^2
S^* = 6548. mm^3

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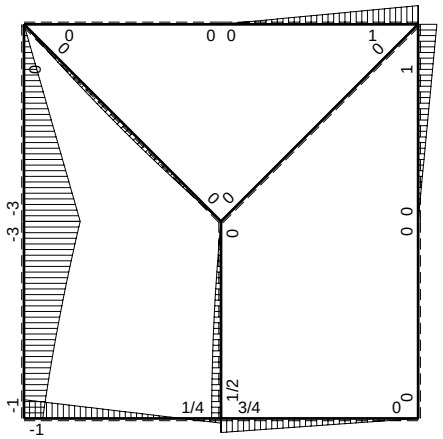

G
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I
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Fb
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Fb
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D
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D
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A
B
3/2F
Fb
5/4F
3/2F
1/4Fb
5/4F


-1
-1
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-√2/2
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5/4
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-3/2

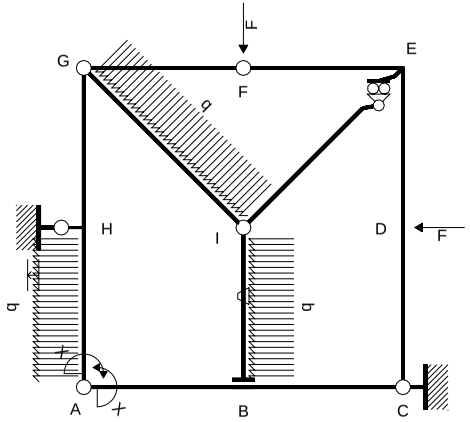
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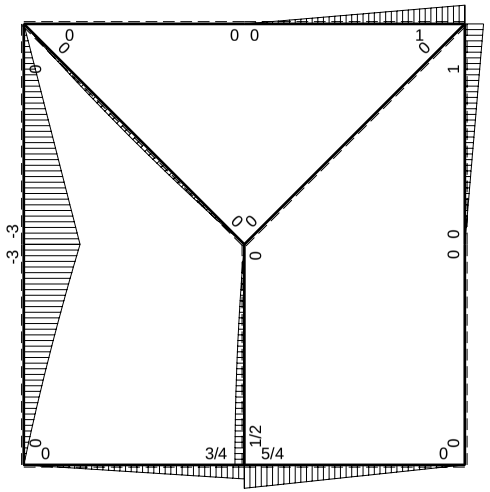

-1
0
-√2/2
-3
0
1
-√2/2
1
5/2
0
3/2
0
5/4
-3/4

F

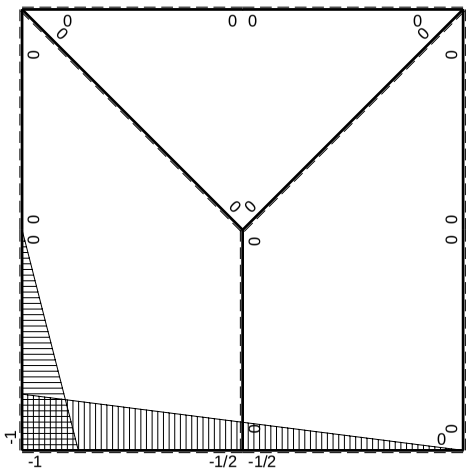

0
0 0
1
0
0
1
0 0
-3 -3
0
0 0
1/4
1/2
3/4
0
0
-1
-1

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264851 CI04.xxxx.052

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PROCEDIMENTO E RISULTATI 264851 CI04.xxxx.052

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-5/4Fx$	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b (-3/4\ x/b + 3/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-3/8\ x^2/b + 1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-3/8\ b + 1/8\ b)\ Fb\ 1/EJ\ = -1/4\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b (-3/8 + 3/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-3/8\ x + 1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-3/8\ b + 1/8\ b)\ Fb\ 1/EJ\ = -1/4\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b (-5/8 + 5/4\ x/b - 5/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-5/8\ b + 5/8\ b - 5/24\ b)\ Fb\ 1/EJ\ = -5/24\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-5/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-5/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-5/24\ b)\ Fb\ 1/EJ\ = -5/24\ Fb^2/EJ$

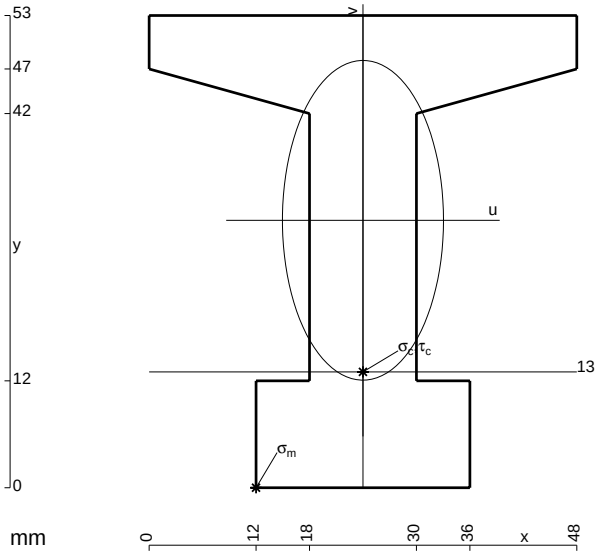
$L^{Xo}_{HA} = \int_o^b (3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (3/2\ b - 7/6\ b + 1/8\ b)\ Fb\ 1/EJ\ = 11/24\ Fb^2/EJ$

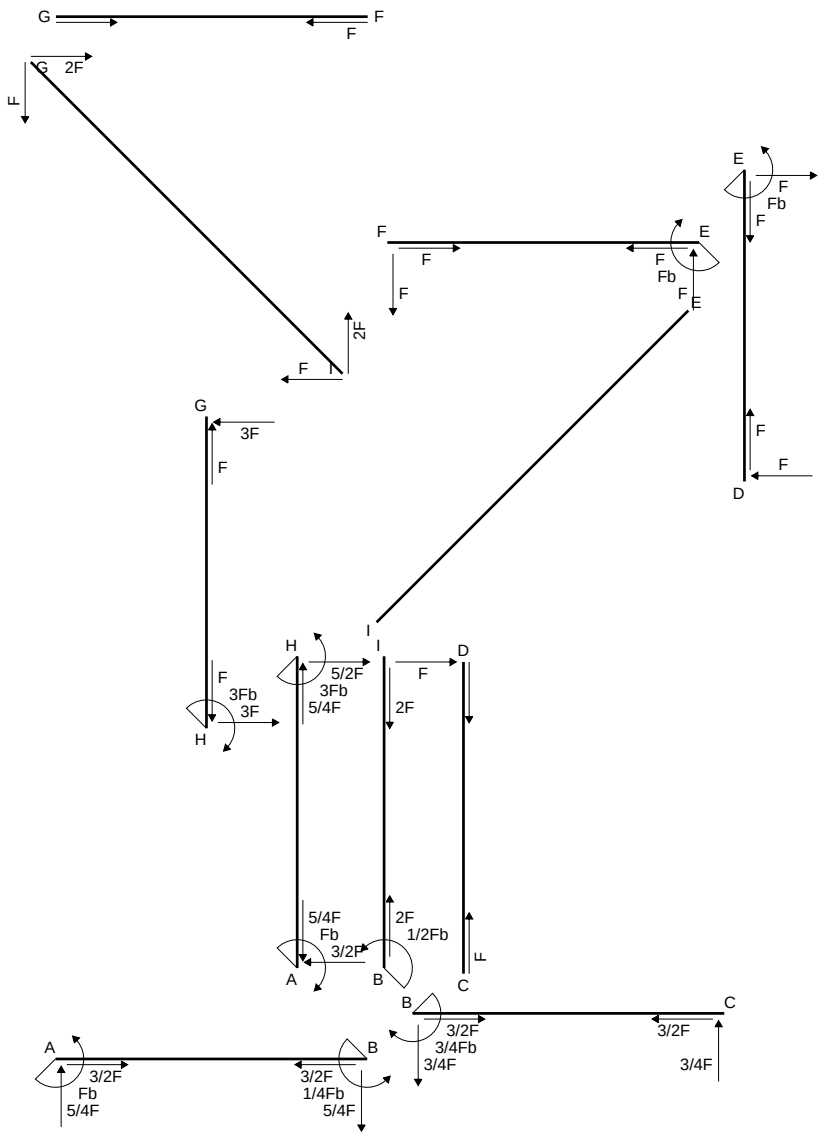
$L^{Xo}_{AH} = \int_o^b (5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

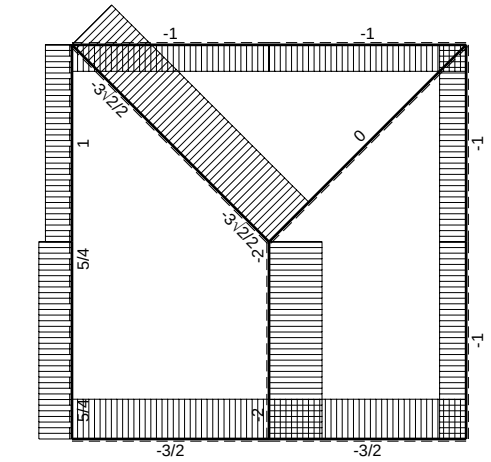
$= (5/4\ b - 2/3\ b - 1/8\ b)\ Fb\ 1/EJ\ = 11/24\ Fb^2/EJ$

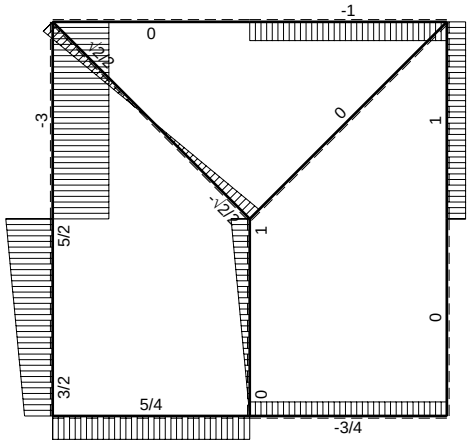
PROCEDIMENTO E RISULTATI 264851 CI04.xxxx.052

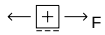


A = 1086. mm^2
J_u = 349673. mm^4
J_v = 88740. mm^4
y_g = 30.02 mm
N = 1480. N
T_y = -4440. N
M_x = -2575200. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.02 mm
$\sigma_m = N/A - Mv/J_u$ = -219.7 N/mm^2
x_c = 24. mm
y_c = 13. mm
v_c = -17.02 mm
$\sigma_c = N/A - Mv/J_u$ = -124. N/mm^2
τ_c = 7.541 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 124.6 N/mm^2
S^* = 7127. mm^3

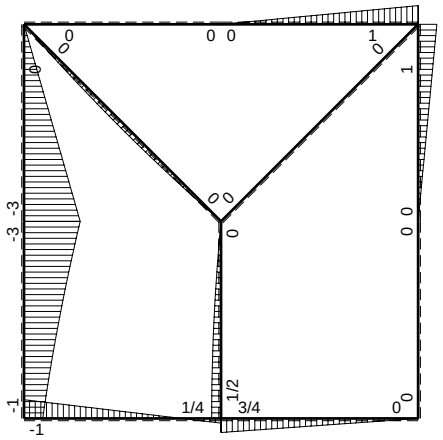

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3Fb
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3Fb
3F
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H
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3/4F
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3/2F
Fb
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3/2F
1/4Fb
5/4F


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-2
-3/2
-3/2

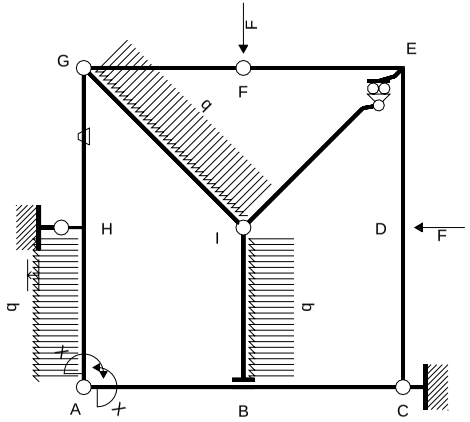

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3/2
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-3/4

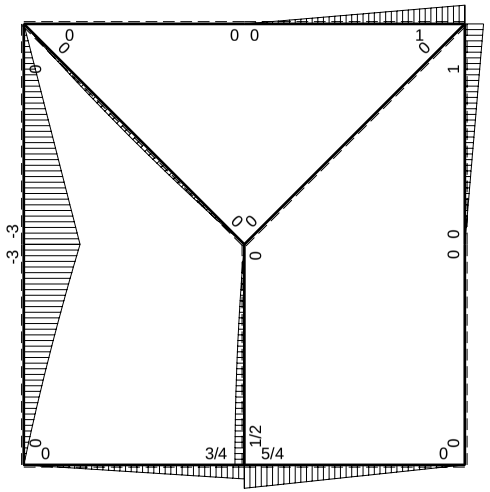

F


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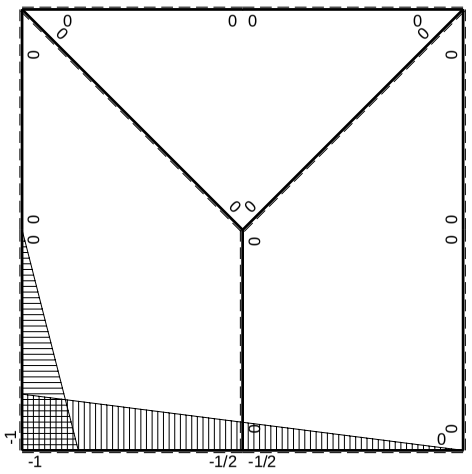

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-1
1/4
1/2
3/4
0
0
-1


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 267850 CI04.xxxx.053

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-5/4Fx$	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	-Fb/EJ	0	0	0	0+0	0
HG b	0	3Fb-3Fx	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

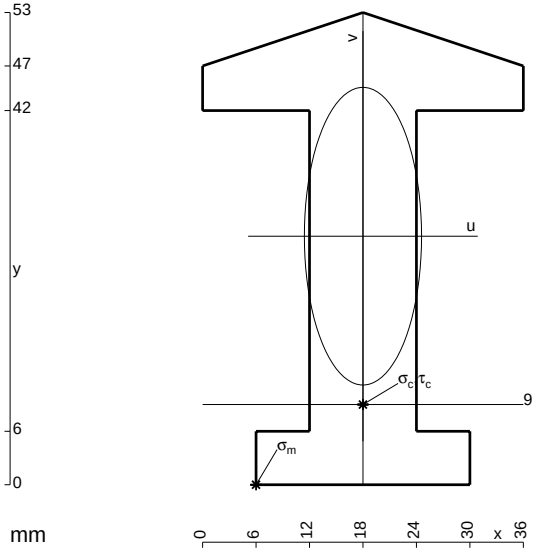
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

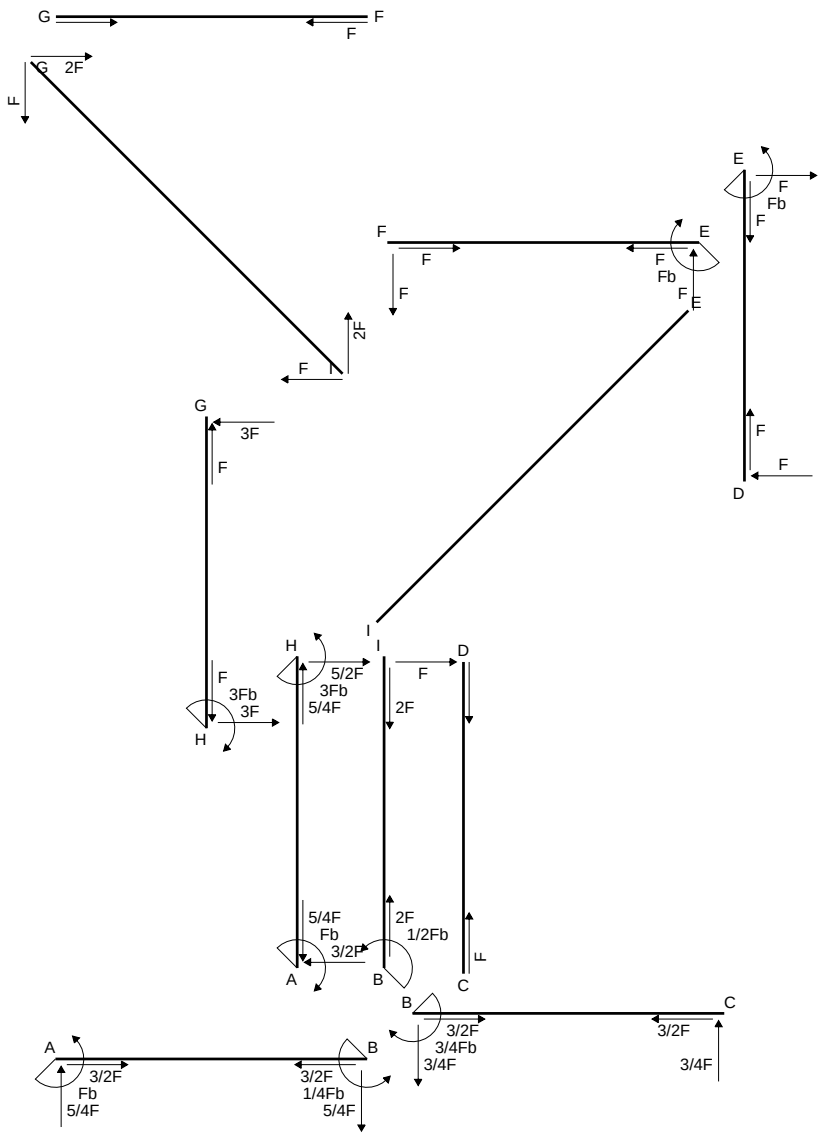
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

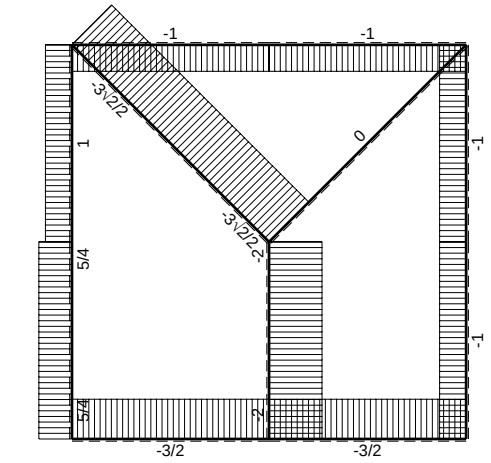
PROCEDIMENTO E RISULTATI 267850 CI04.xxxx.053

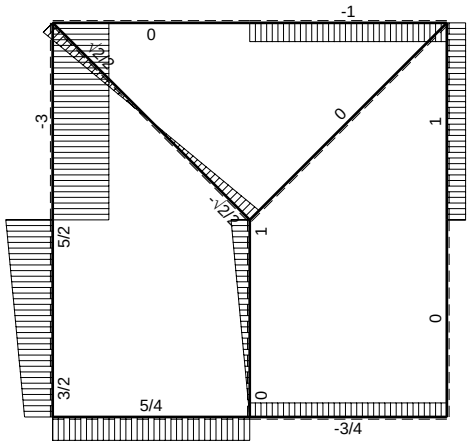


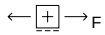
A = 864. mm^2
J_u = 241215. mm^4
J_v = 37368. mm^4
y_g = 27.9 mm
N = 1050. N
T_y = -3150. N
M_x = -1984500. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -27.9 mm
$\sigma_m = N/A - Mv/J_u$ = -228.3 N/mm^2
x_c = 18. mm
y_c = 9. mm
v_c = -18.9 mm
$\sigma_c = N/A - Mv/J_u$ = -154.2 N/mm^2
τ_c = 4.7 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 154.5 N/mm^2
S^* = 4319. mm^3

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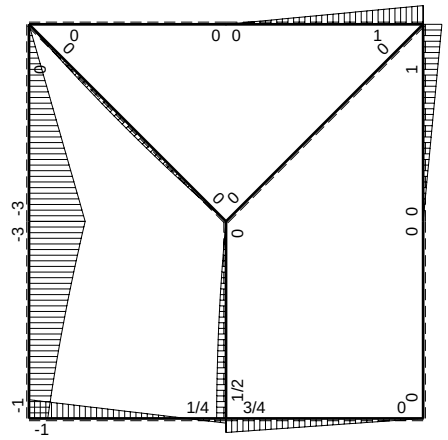

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1/4Fb
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-3/2

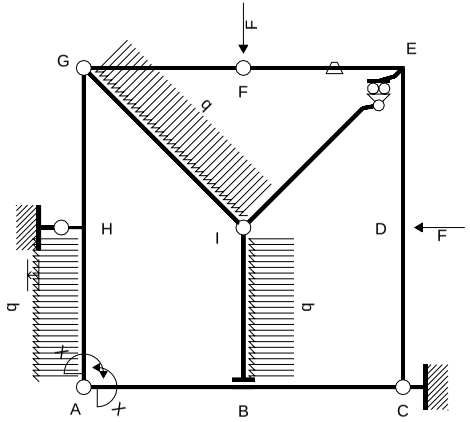

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-3/4

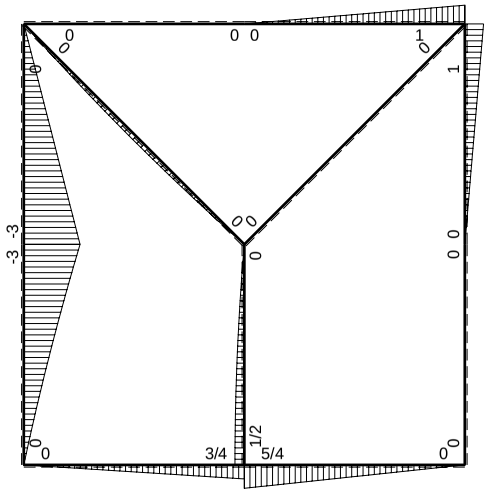

F


F

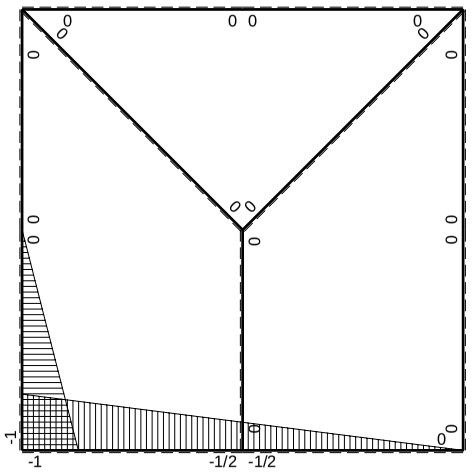

0
0 0
1
0
0
1
0 0
-3 -3
0
0 0
-1
1/4
1/2
3/4
0
0
-1


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 267178 CI04.xxxx.054

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-5/4Fx	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	-Fb/EJ	0	0	0	0+0	0
FE b	0	-Fx	Fb/EJ	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

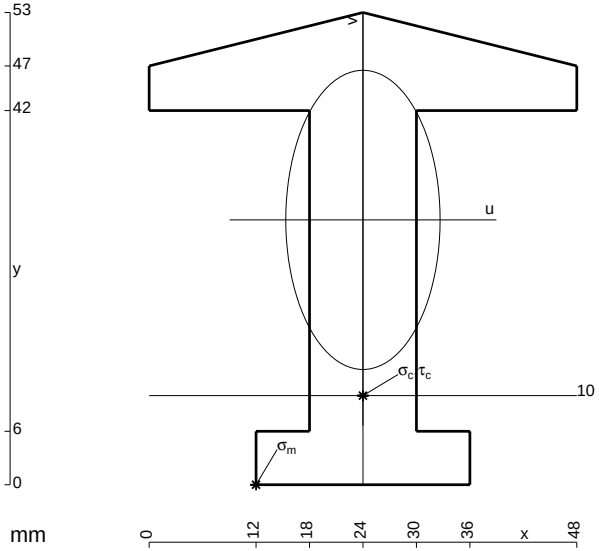
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

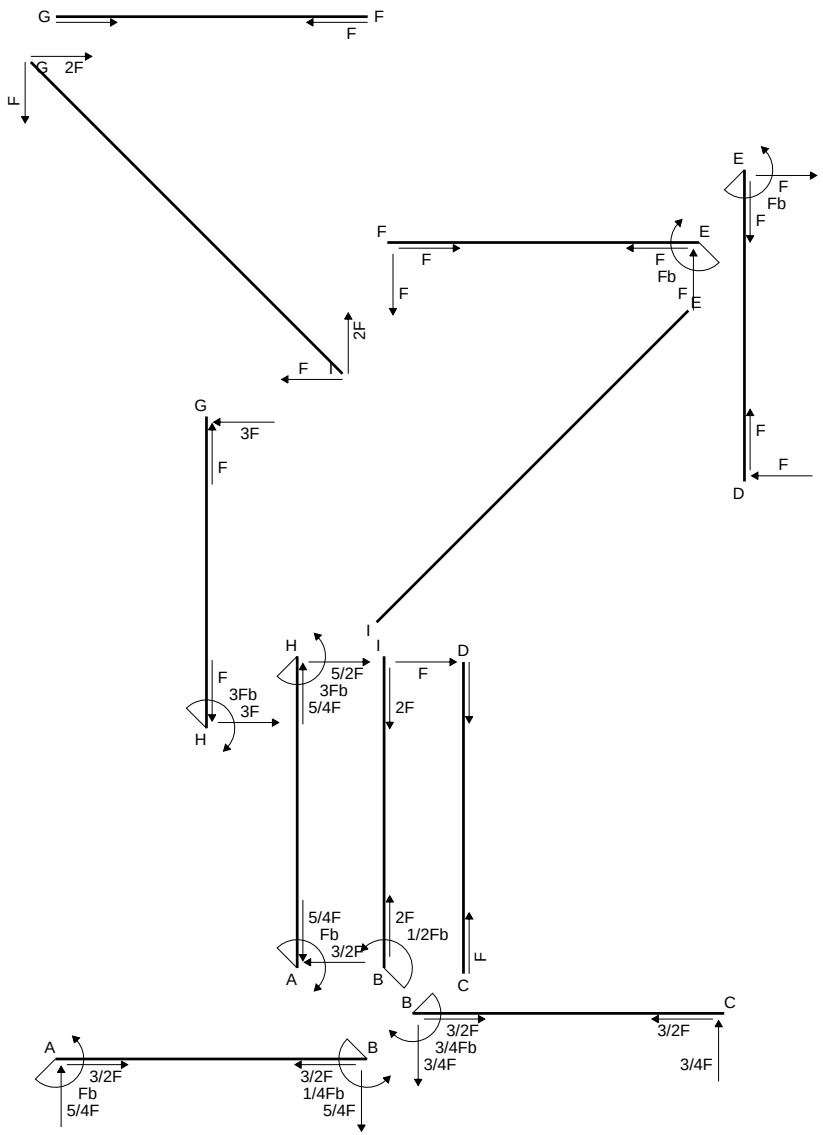
$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

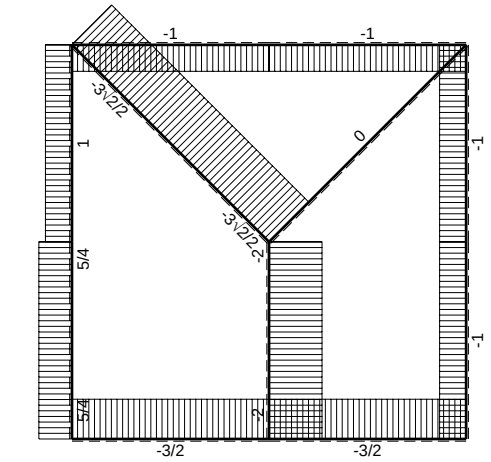
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

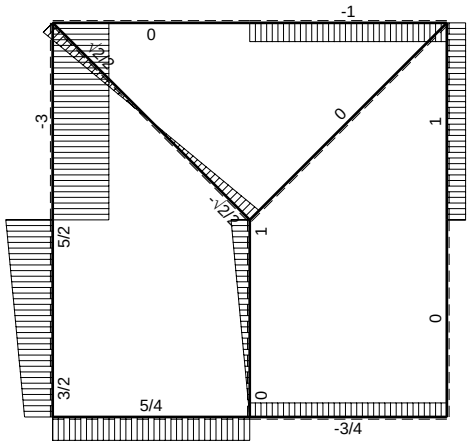
PROCEDIMENTO E RISULTATI 267178 CI04.xxxx.054



A = 960. mm^2
J_u = 270775. mm^4
J_v = 72000. mm^4
y_g = 29.73 mm
N = 1070. N
T_y = -3210. N
M_x = -2182800. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -29.73 mm
$\sigma_m = N/A - Mv/J_u$ = -238.5 N/mm^2
x_c = 24. mm
y_c = 10. mm
v_c = -19.73 mm
$\sigma_c = N/A - Mv/J_u$ = -157.9 N/mm^2
τ_c = 4.832 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 158.1 N/mm^2
S^* = 4891. mm^3

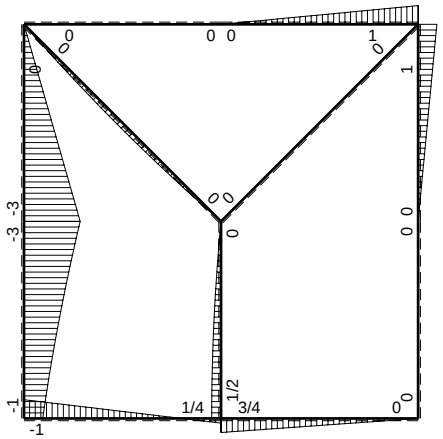

G
F
F
G
2F
F
F
2F
F
I
F
F
E
F
Fb
F
E
F
F
F
E
F
Fb
F
E
F
F
F
D
G
3F
F
I
H
5/2F
3Fb
5/4F
I
D
F
2F
F
3Fb
3F
H
5/4F
Fb
3/2F
2F
1/2Fb
A
B
C
F
B
C
3/2F
3/4Fb
3/4F
3/2F
3/4F
A
B
3/2F
Fb
5/4F
3/2F
1/4Fb
5/4F


-1
-1
-√2/2
1
0
-1
-√2/2
-2
5/4
5/4
-2
-1
-3/2
-3/2

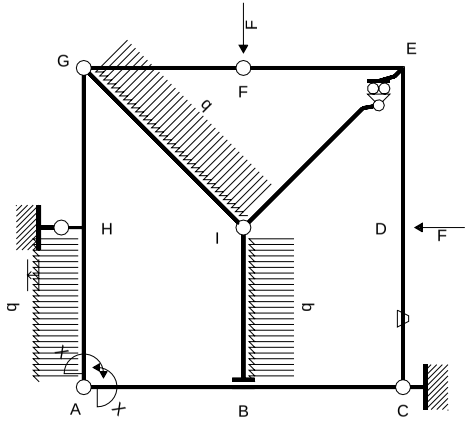

-1
0
√2/2
-3
0
1
√2/2
1
5/2
0
3/2
5/4
0
-3/4

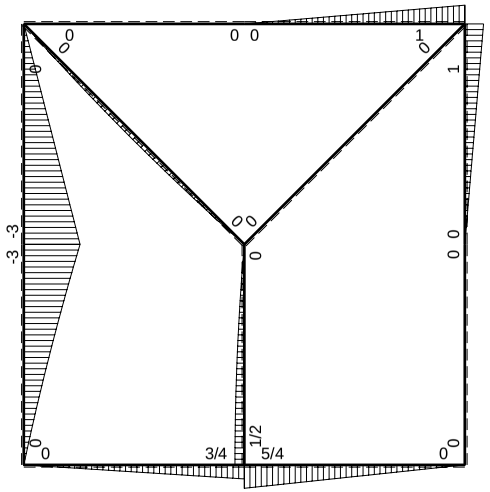
F

F

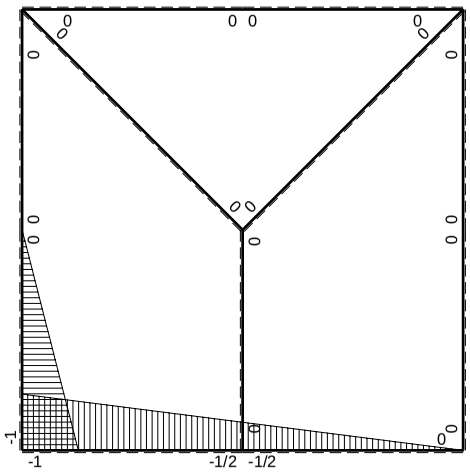

0
0 0
1
0
0
1
0 0
-3 -3
0
0 0
-1
1/4
1/2
3/4
0
0
-1

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 263281 CI04.xxxx.055

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PROCEDIMENTO E RISULTATI 263281 CI04.xxxx.055

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx	0	$-3/4Fx+3/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/4+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-3/4Fb+3/4Fx$	0	$-3/8Fb+3/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	5/4Fb-5/4Fx	0	$-5/8Fb+5/4Fx-5/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-5/24+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-5/4Fx	0	$-5/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	-Fb/EJ	0	0	0	0+0	0
DC b	0	0	Fb/EJ	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3Fx	0	0	0	0	0+0	0
HG b	0	3Fb-3Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3Fb+7/2Fx-1/2qx^2$	0	$3Fx-7/2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(11/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/2Fx+1/2qx^2$	0	$5/2Fx-2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-3/8 + 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/4\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-5/8 + 5/4\ x/b - 5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/8\ x + 5/8\ x^2/b - 5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/8\ b + 5/8\ b - 5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-5/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-5/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-5/24\ b\ \right)\ Fb\ 1/EJ\ = -5/24\ \ Fb^2/EJ$

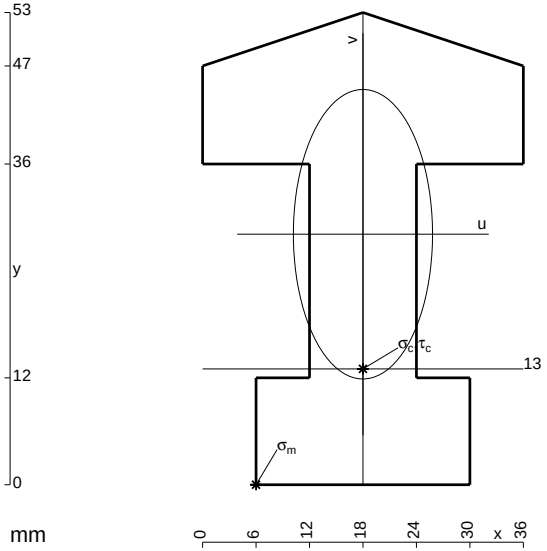
$L^{Xo}_{HA} = \int_o^b \left(3\ x/b - 7/2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/2\ x^2/b - 7/6\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/2\ b - 7/6\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

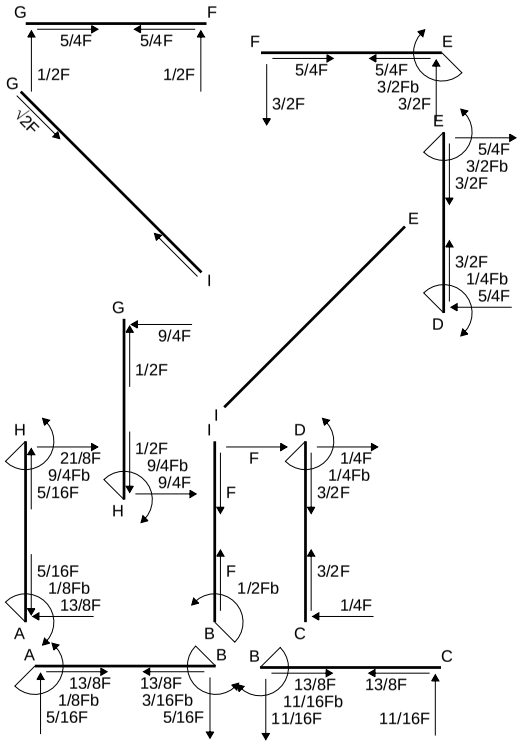
$L^{Xo}_{AH} = \int_o^b \left(5/2\ x/b - 2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - 2/3\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

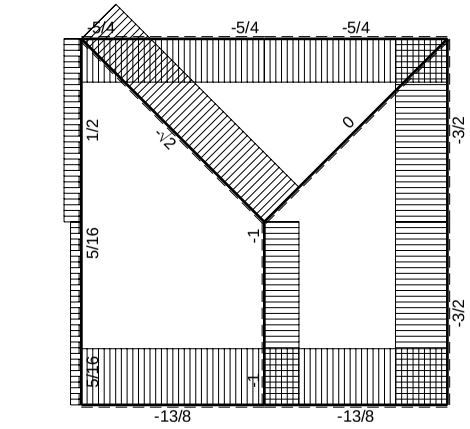
$= \left(5/4\ b - 2/3\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 11/24\ \ Fb^2/EJ$

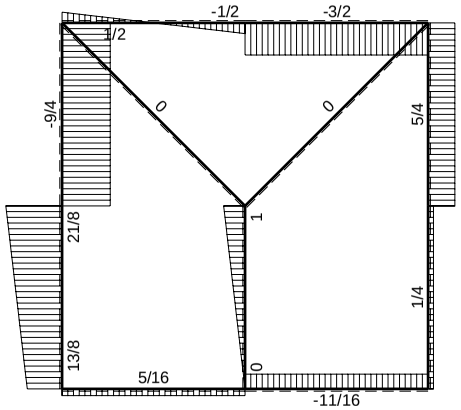
PROCEDIMENTO E RISULTATI 263281 CI04.xxxx.055



A = 1080. mm^2
J_u = 285273. mm^4
J_v = 65880. mm^4
y_g = 28.12 mm
N = 930. N
T_y = -2790. N
M_x = -2036700. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.12 mm
$\sigma_m = N/A - Mv/J_u$ = -199.9 N/mm^2
x_c = 18. mm
y_c = 13. mm
v_c = -15.12 mm
$\sigma_c = N/A - Mv/J_u$ = -107.1 N/mm^2
τ_c = 5.344 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 107.5 N/mm^2
S^* = 6557. mm^3

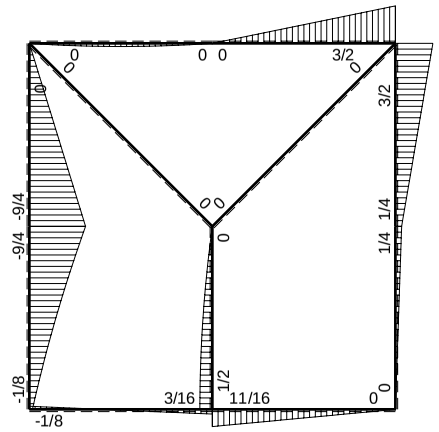

G
F
5/4F
5/4F
1/2F
1/2F
G
√2F
I
F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
E
5/4F
3/2Fb
3/2F
E
3/2F
1/4Fb
5/4F
D
G
9/4F
1/2F
I
H
21/8F
9/4Fb
5/16F
1/2F
9/4Fb
9/4F
H
I
F
D
1/4F
1/4Fb
3/2F
F
F
1/2Fb
3/2F
1/4F
5/16F
1/8Fb
13/8F
A
B
C
A
B
B
C
13/8F
1/8Fb
5/16F
13/8F
3/16Fb
5/16F
13/8F
11/16Fb
11/16F
13/8F
11/16F


-5/4
-5/4
-5/4
1/2
√2
0
-3/2
5/16
-1
-3/2
5/16
-1
-13/8
-13/8

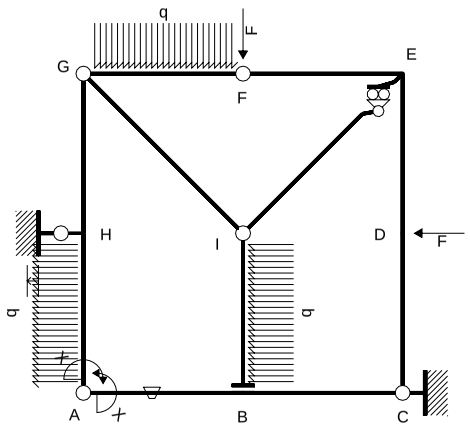

-1/2
-3/2
1/2
-9/4
0
0
5/4
1
21/8
1/4
13/8
5/16
0
-11/16

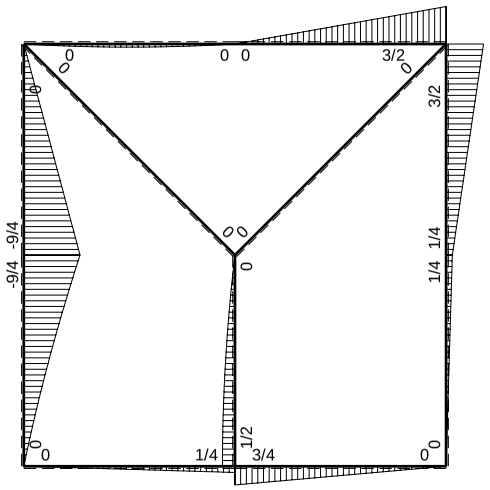
←□→ F

↑□↓ F

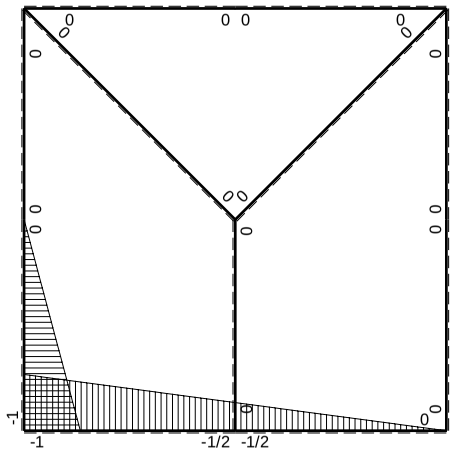

0
0 0
3/2
0
0
3/2
0 0
0
-9/4
-9/4
1/4
1/4
0
-1/8
3/16
1/2
11/16
0
0
-1/8

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	-Fb/EJ	-1/4Fx+1/8Fx^2/b	Fb/EJ-1/2Fx/EJ	1-x/b+1/4x^2/b^2	(-1/12+3/4)Fb^2/EJ	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb+1/4Fx	Fb/EJ	-1/8Fb+1/8Fx^2/b	1/2Fb/EJ+1/2Fx/EJ	1/4+1/2x/b+1/4x^2/b^2		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	-3/8Fb+3/4Fx-3/8Fx^2/b	0	1/4-1/2x/b+1/4x^2/b^2	(-1/8+0)Fb^2/EJ	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	-3/8Fx^2/b	0	1/4x^2/b^2		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	-1/2Fx+1/2qx^2	0	0	0	0	0+0	0
GF b	0	1/2Fx-1/2qx^2	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	Fx-1/2qx^2	0	0	0	0	0+0	0
BI b	0	-1/2Fb+1/2qx^2	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	-9/4Fb+11/4Fx-1/2qx^2	0	9/4Fx-11/4Fx^2/b+1/2qx^3/b	0	x^2/b^2	(1/3+0)Fb^2/EJ	1/3Xb/EJ
AH b	1-x/b	7/4Fx+1/2qx^2	0	7/4Fx-5/4Fx^2/b-1/2qx^3/b	0	1-2x/b+x^2/b^2		
H	cedimento nodo $-H_{1H}u_H$						-Fb^2/EJ	
	totali						-1/8Fb^2/EJ	Xb/EJ
	iperstatica $X=W_{AB}$						1/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1 - 1/2\ x/b\right)\ \theta\ \ dx$

$= \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ + \left(\ b - 1/4\ b\ \right)\ \theta\ \ = 2/3\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2 - 1/2\ x/b\right)\ \theta\ \ dx$

$= \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 2/3\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

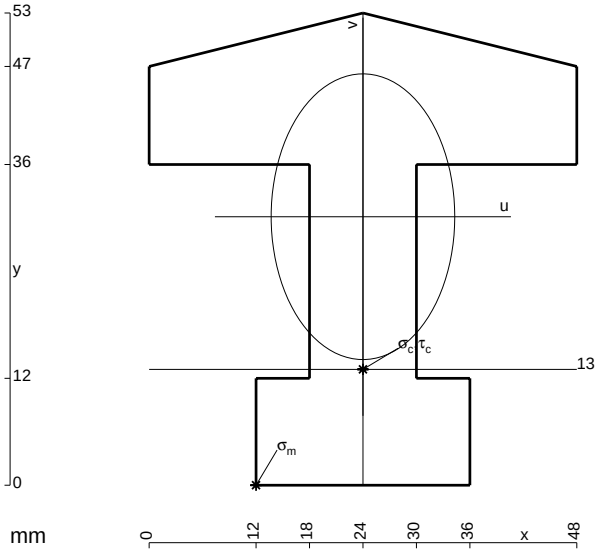
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

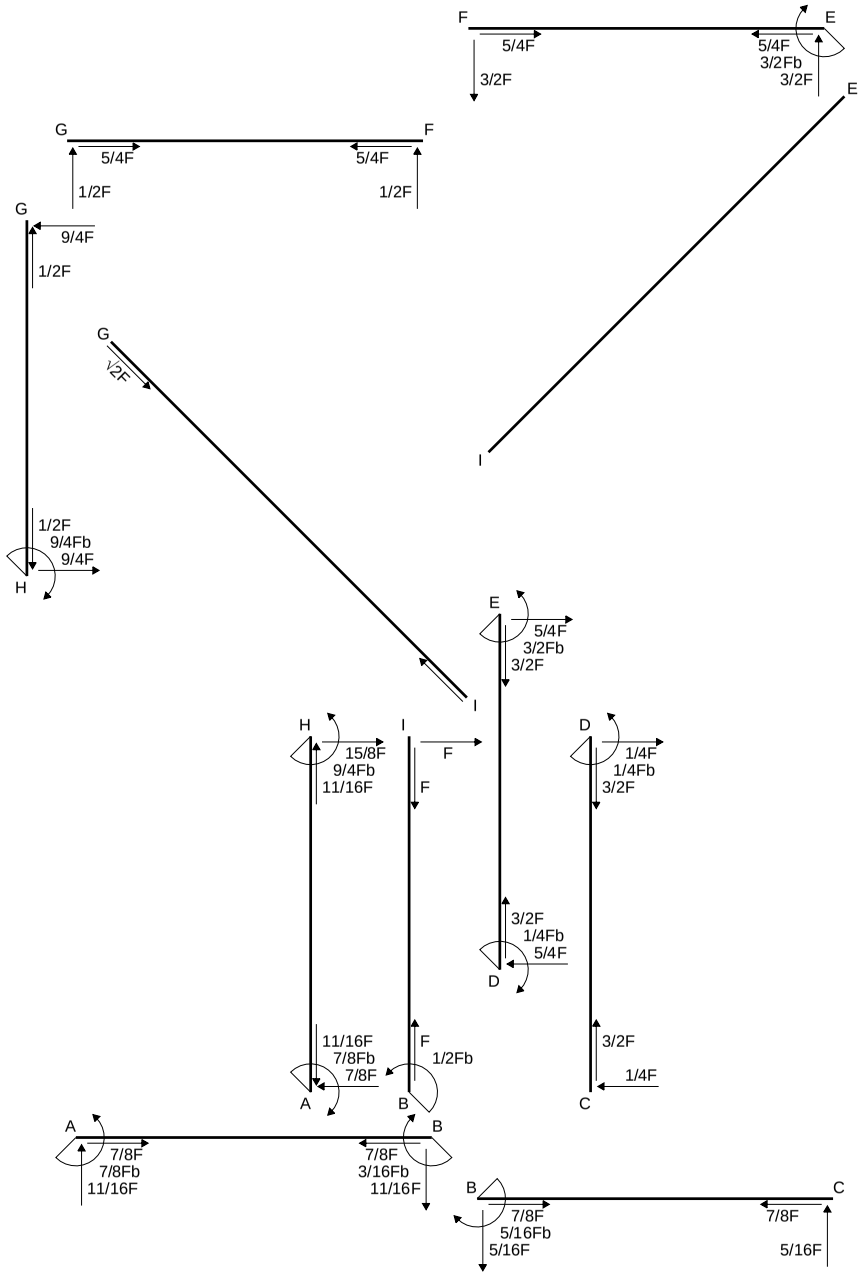
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

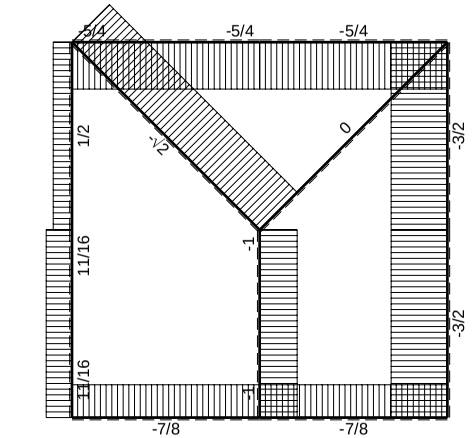
PROCEDIMENTO E RISULTATI 253104 CI04.xxxx.056

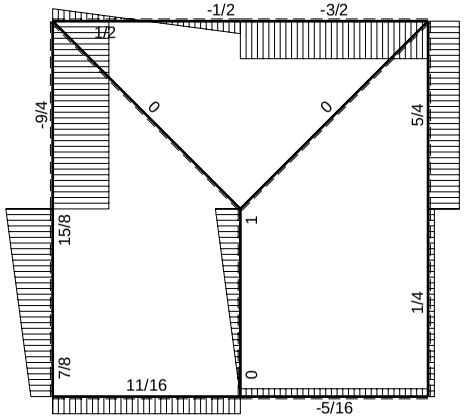


A = 1248. mm^2
J_u = 320937. mm^4
J_v = 132480. mm^4
y_g = 30.13 mm
N = 635. N
T_y = -2858. N
M_x = -2228850. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.13 mm
$\sigma_m = N/A - Mv/J_u$ = -208.8 N/mm^2
x_c = 24. mm
y_c = 13. mm
v_c = -17.13 mm
$\sigma_c = N/A - Mv/J_u$ = -118.5 N/mm^2
τ_c = 5.314 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 118.8 N/mm^2
S^* = 7162. mm^3

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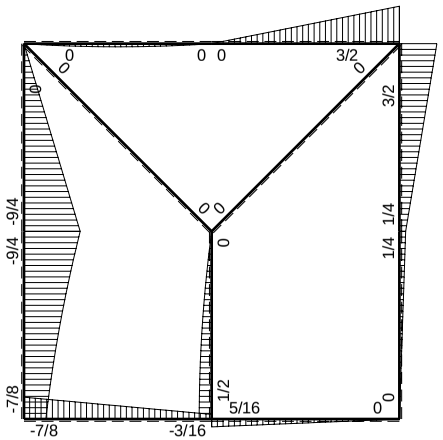

F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
E
G
F
5/4F
5/4F
1/2F
1/2F
G
9/4F
1/2F
G
1/2F
I
1/2F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
3/2F
I
H
I
D
15/8F
9/4Fb
11/16F
F
F
1/4F
1/4Fb
3/2F
3/2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
F
1/2Fb
3/2F
1/4F
A
B
C
A
B
7/8F
7/8Fb
11/16F
7/8F
3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
-5/4
-5/4
1/2
-1/2
0
-3/2
11/16
-1
-3/2
11/16
-1
-7/8
-7/8

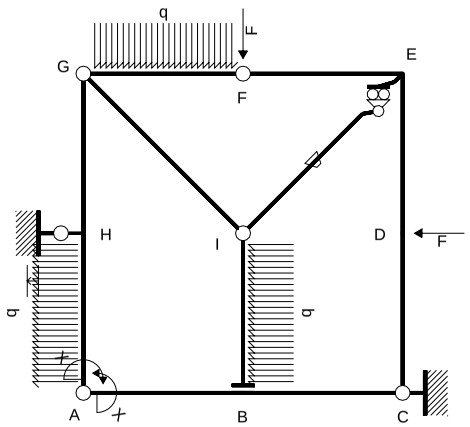

-1/2
-3/2
1/2
-9/4
0
0
5/4
15/8
1
1/4
7/8
11/16
0
-5/16

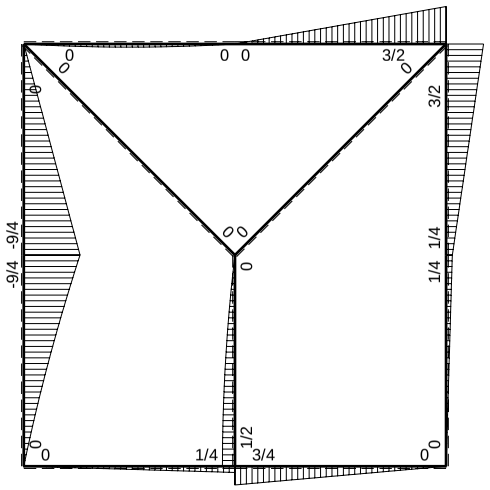
F

F

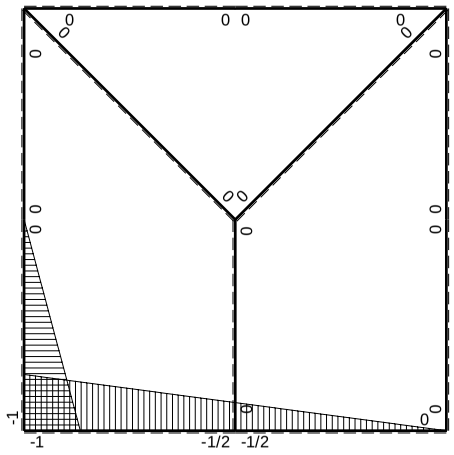

0
0 0
3/2
0
0
3/2
0 0
-9/4
-9/4
1/4
1/4
0
-7/8
1/2
5/16
0
0
-7/8
-3/16

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 992702 CI04.xxxx.057

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

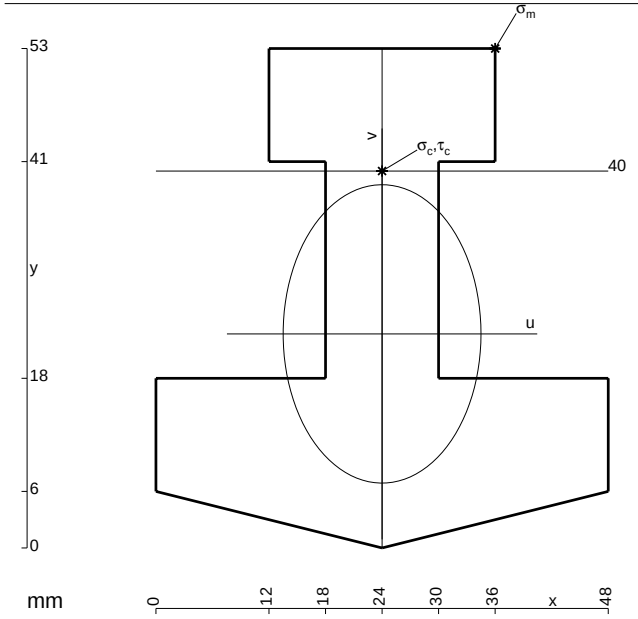
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

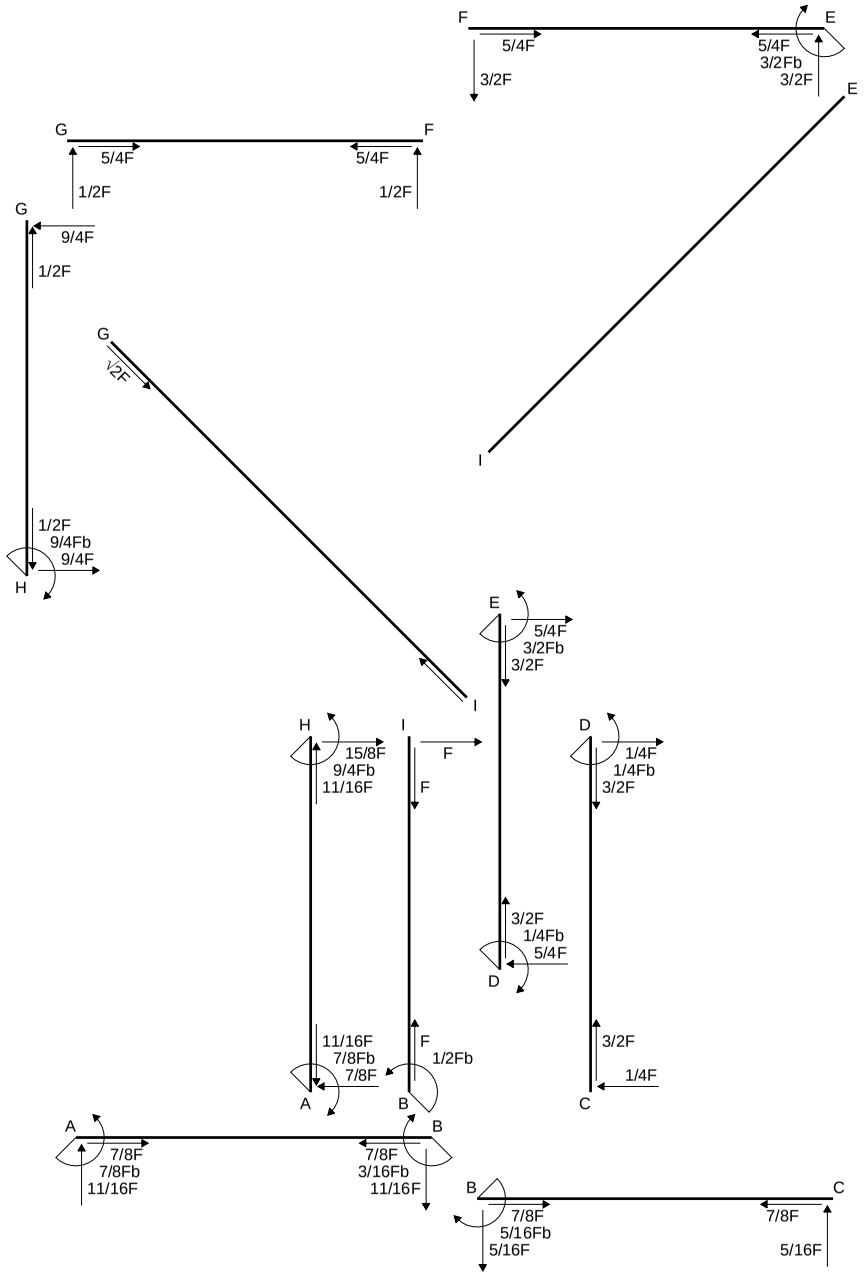
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

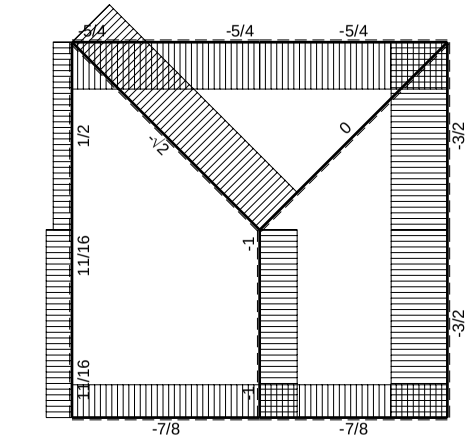
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

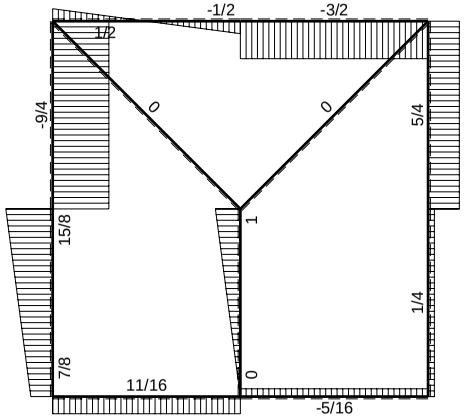
PROCEDIMENTO E RISULTATI 992702 CI04.xxxx.057

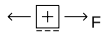


A = 1284. mm^2
J_u = 321948. mm^4
J_v = 141552. mm^4
y_g = 22.72 mm
N = 620. N
T_y = -2790. N
M_x = -2315700. Nmm
x_m = 36. mm
y_m = 53. mm
u_m = 12. mm
v_m = 30.28 mm
$\sigma_m = N/A - Mv/J_u$ = 218.3 N/mm^2
x_c = 24. mm
y_c = 40. mm
v_c = 17.28 mm
$\sigma_c = N/A - Mv/J_u$ = 124.8 N/mm^2
τ_c = 5.205 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 125.1 N/mm^2
S^* = 7208. mm^3

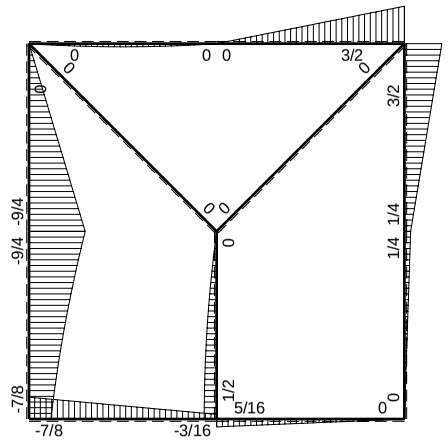

F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
E
G
F
5/4F
5/4F
1/2F
1/2F
G
9/4F
1/2F
G
½F
I
1/2F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
3/2F
I
H
I
D
15/8F
9/4Fb
11/16F
F
F
1/4F
1/4Fb
3/2F
3/2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
F
1/2Fb
3/2F
1/4F
A
B
C
A
B
7/8F
7/8Fb
11/16F
7/8F
3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
-5/4
-5/4
1/2
½
0
-3/2
11/16
-1
-3/2
11/16
-1
-7/8
-7/8

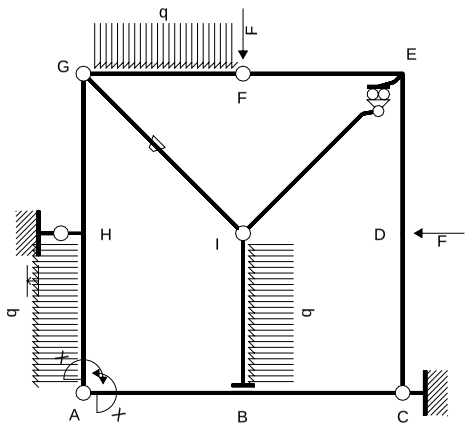

-1/2
-3/2
1/2
-9/4
0
0
5/4
15/8
1
1/4
7/8
0
11/16
-5/16

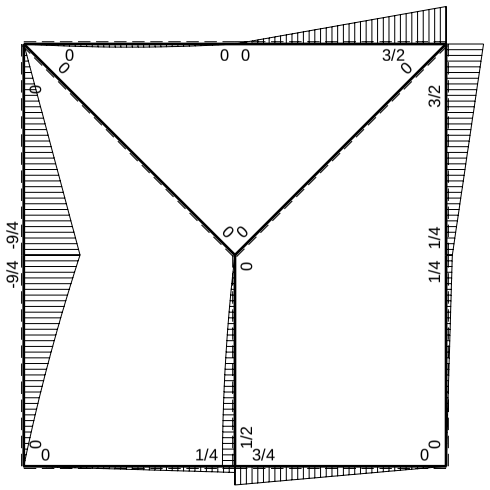

F


F

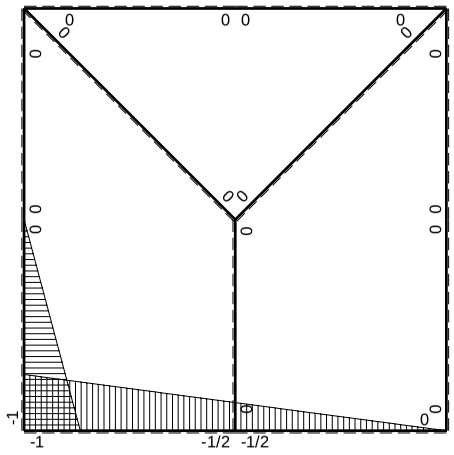

0
0 0
3/2
0
0
3/2
-9/4
0
0
-9/4
-9/4
1/4
1/4
0
-7/8
1/2
5/16
0
0
-7/8
-3/16


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 215079 CI04.xxxx.058

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

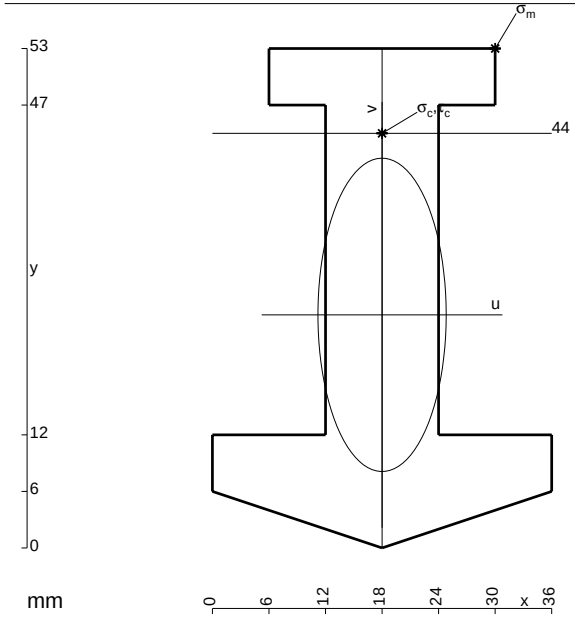
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

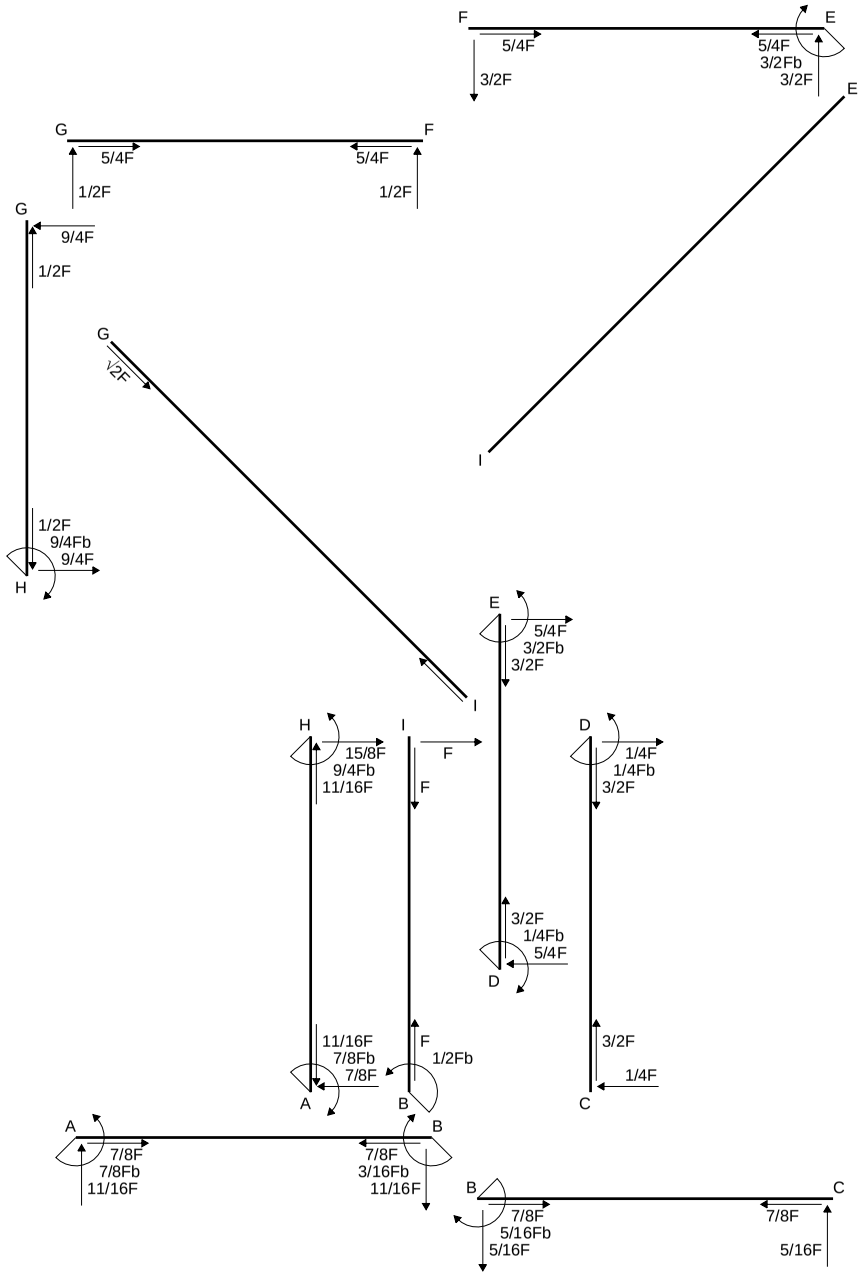
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

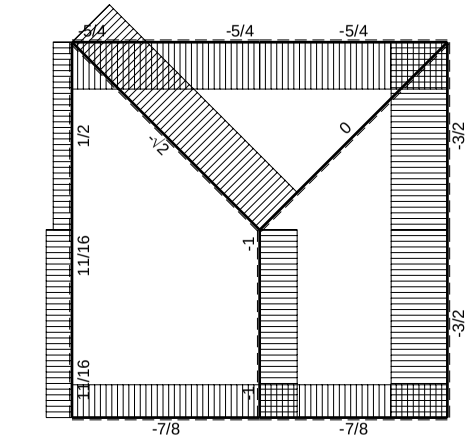
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

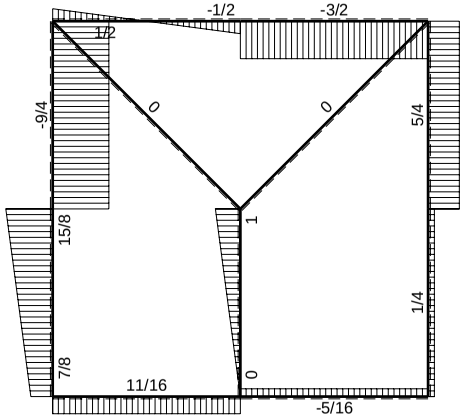
PROCEDIMENTO E RISULTATI 215079 CI04.xxxx.058



A = 888. mm^2
J_u = 245538. mm^4
J_v = 41112. mm^4
y_g = 24.74 mm
N = 500. N
T_y = -2250. N
M_x = -1980000. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 12. mm
v_m = 28.26 mm
$\sigma_m = N/A - Mv/J_u$ = 228.5 N/mm^2
x_c = 18. mm
y_c = 44. mm
v_c = 19.26 mm
$\sigma_c = N/A - Mv/J_u$ = 155.9 N/mm^2
τ_c = 3.349 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 156. N/mm^2
S^* = 4385. mm^3

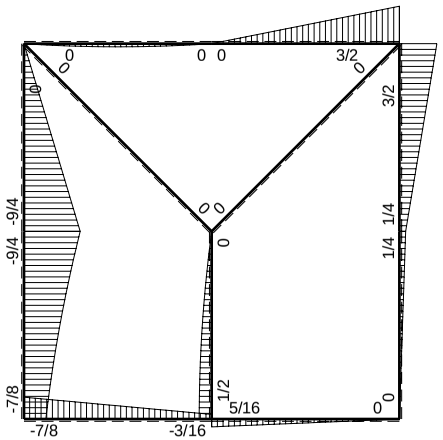

F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
E
G
F
5/4F
5/4F
1/2F
1/2F
G
9/4F
1/2F
G
½F
I
1/2F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
3/2F
I
H
I
D
15/8F
9/4Fb
11/16F
F
F
1/4F
1/4Fb
3/2F
3/2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
F
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3/2F
1/4F
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B
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B
7/8F
7/8Fb
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3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
-5/4
-5/4
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½
0
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11/16
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-3/2
11/16
-1
-7/8
-7/8

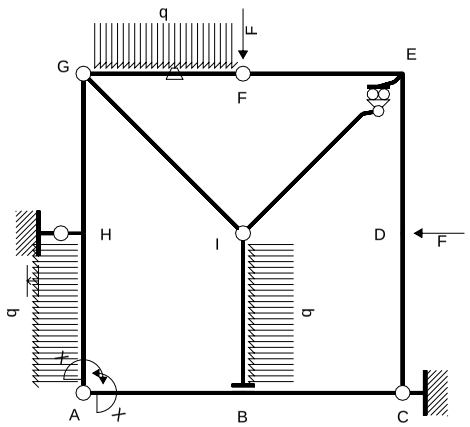

-1/2
-3/2
1/2
-9/4
0
0
5/4
15/8
1
1/4
7/8
11/16
0
-5/16

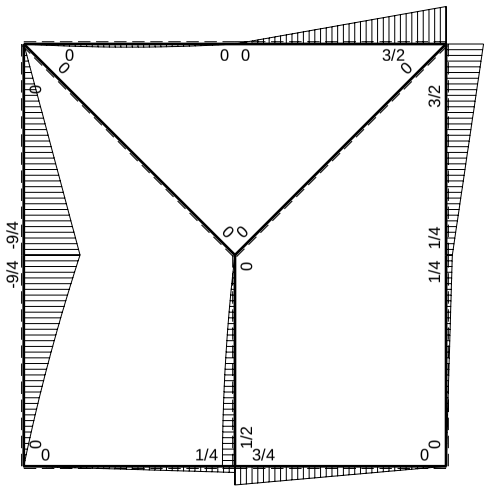
←+→ F

↑+↓ F

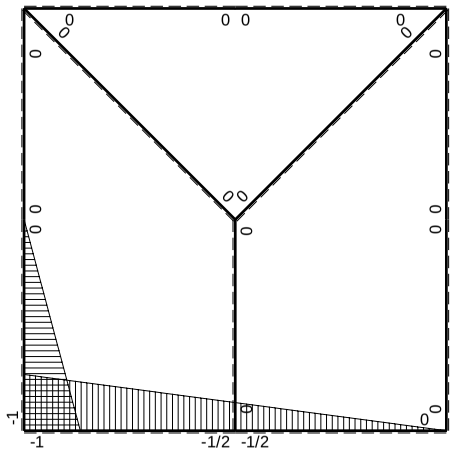

0
0 0
3/2
0
0
3/2
-9/4
0 0
1/4
-9/4
0
1/4
1/2
-7/8
5/16
0
0
-7/8
-3/16

↻+↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 266797 CI04.xxxx.059

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	Fb/EJ	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

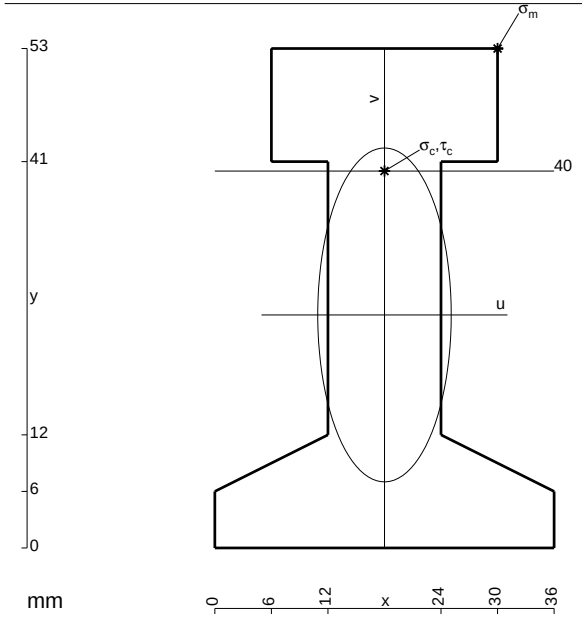
$$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

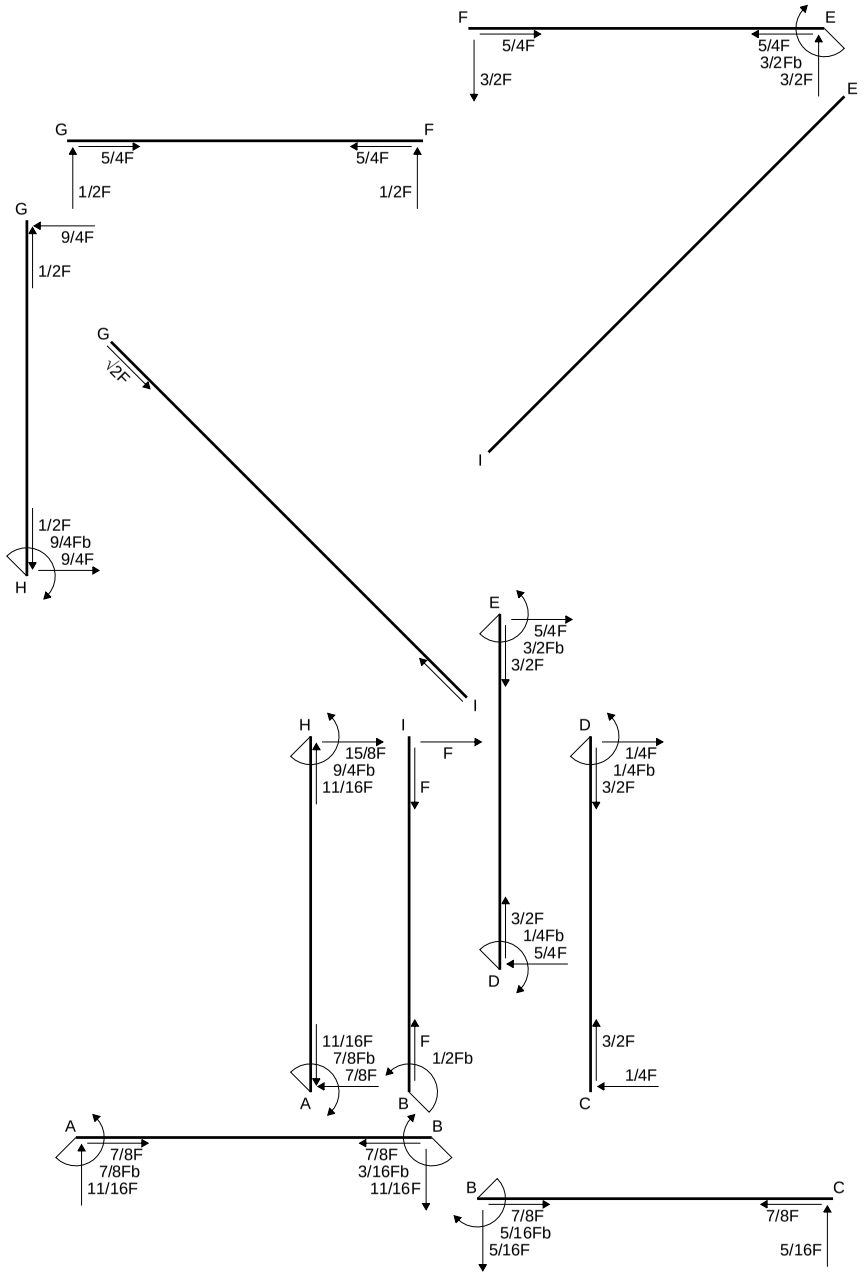
$$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

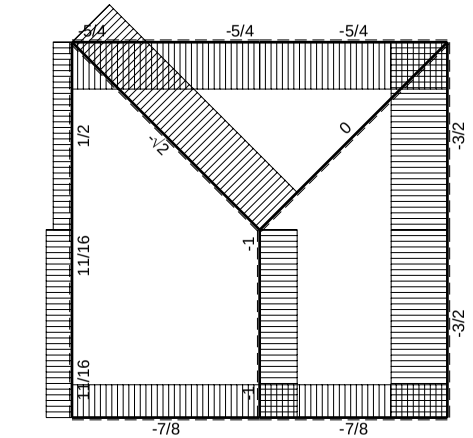
$$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

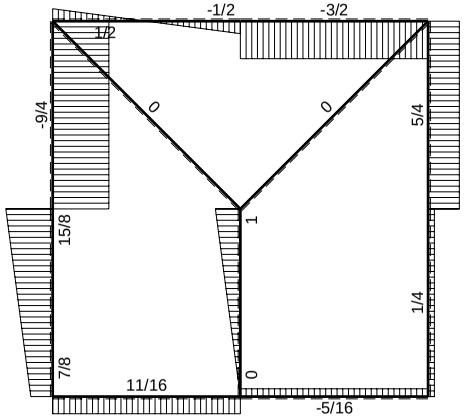
PROCEDIMENTO E RISULTATI 266797 CI04.xxxx.059

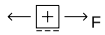


A = 996. mm^2
J_u = 312739. mm^4
J_v = 49968. mm^4
y_g = 24.73 mm
N = 630. N
T_y = -2835. N
M_x = -2636550. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 12. mm
v_m = 28.27 mm
$\sigma_m = N/A - Mv/J_u$ = 239. N/mm^2
x_c = 18. mm
y_c = 40. mm
v_c = 15.27 mm
$\sigma_c = N/A - Mv/J_u$ = 129.4 N/mm^2
τ_c = 4.988 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 129.7 N/mm^2
S^* = 6603. mm^3

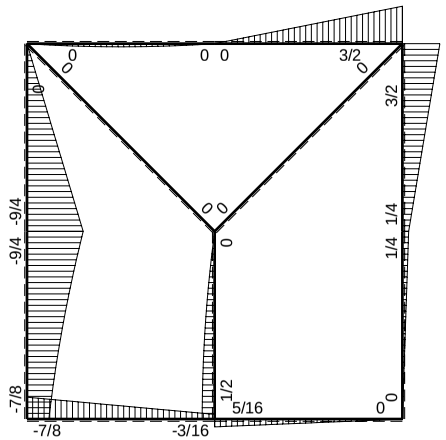

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3/2F
3/2F
E
G
F
5/4F
5/4F
1/2F
1/2F
G
9/4F
1/2F
G
½F
I
1/2F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
3/2F
I
H
I
D
15/8F
9/4Fb
11/16F
F
F
1/4F
1/4Fb
3/2F
3/2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
F
1/2Fb
3/2F
1/4F
A
B
C
A
B
7/8F
7/8Fb
11/16F
7/8F
3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
-5/4
-5/4
1/2
½
0
-3/2
11/16
-1
-3/2
11/16
-1
-7/8
-7/8

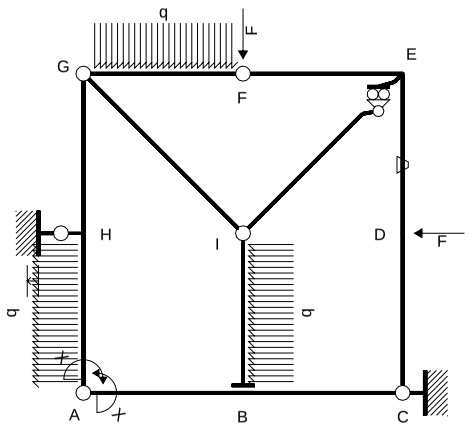

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-3/2
1/2
-9/4
0
0
5/4
15/8
1
1/4
7/8
0
11/16
0
-5/16

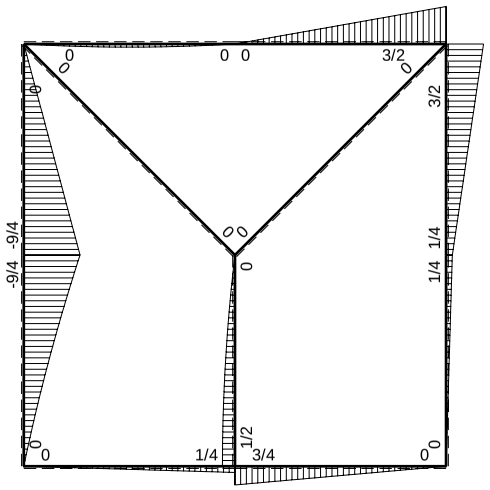

F


F

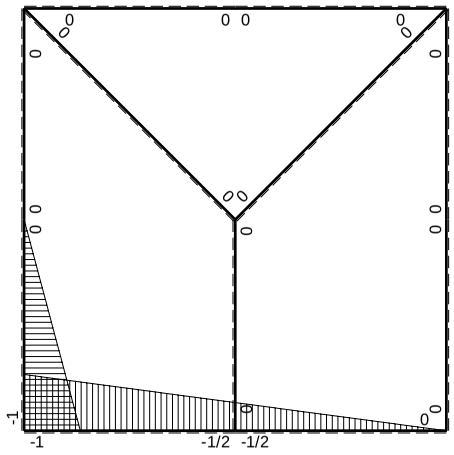

0
0 0
3/2
0
0
3/2
0
0
-9/4
-9/4
0
1/4
1/4
0
-7/8
1/2
5/16
0
0
-7/8
-3/16


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 268175 CI04.xxxx.060

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	Fb/EJ	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

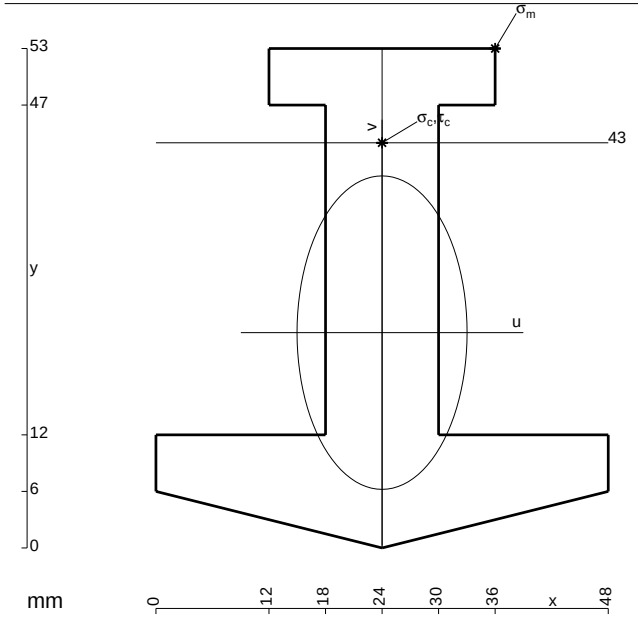
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

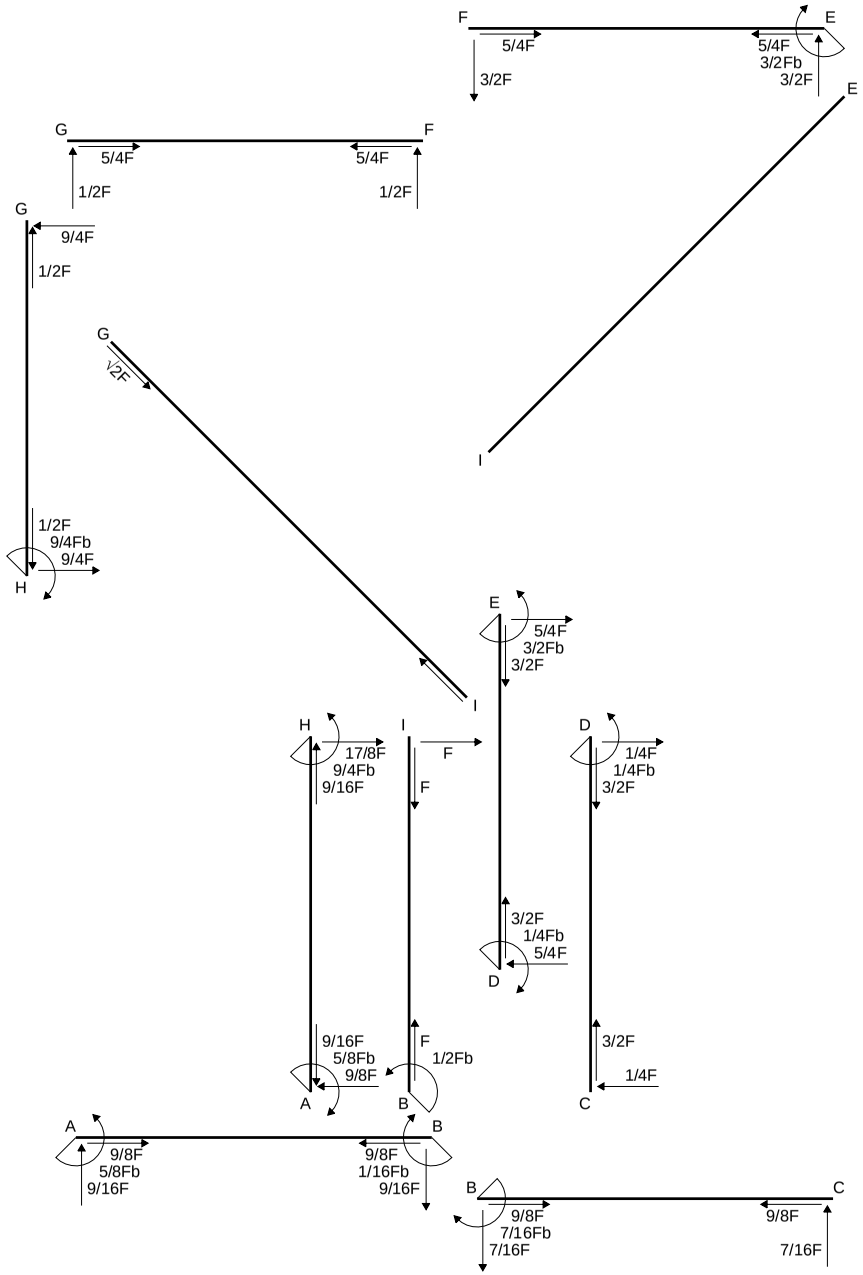
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

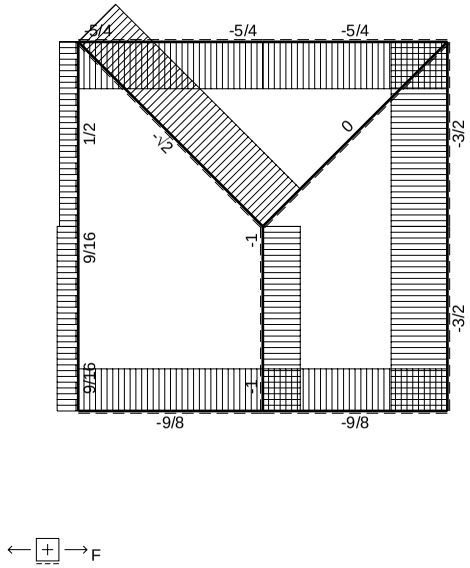
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

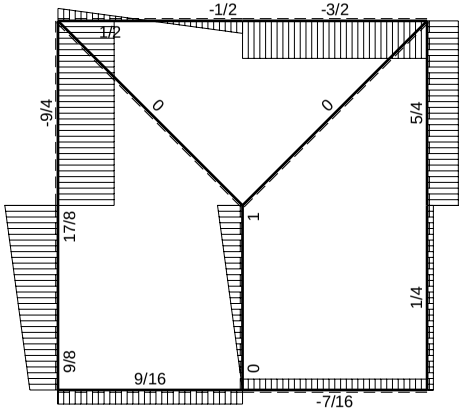
PROCEDIMENTO E RISULTATI 268175 CI04.xxxx.060



A = 996. mm^2
J_u = 275589. mm^4
J_v = 81072. mm^4
y_g = 22.85 mm
N = 825. N
T_y = -3713. N
M_x = -1819130. Nmm
x_m = 36. mm
y_m = 53. mm
u_m = 12. mm
v_m = 30.15 mm
$\sigma_m = N/A - Mv/J_u$ = 199.8 N/mm^2
x_c = 24. mm
y_c = 43. mm
v_c = 20.15 mm
$\sigma_c = N/A - Mv/J_u$ = 133.8 N/mm^2
τ_c = 5.583 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 134.2 N/mm^2
S^* = 4973. mm^3

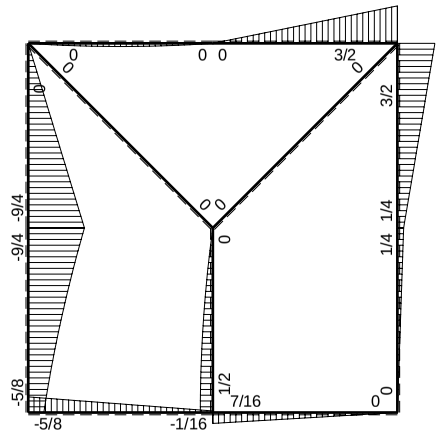

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3/2F
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E
G
F
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5/4F
1/2F
1/2F
G
9/4F
1/2F
G
½F
I
1/2F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
3/2F
I
H
I
D
17/8F
9/4Fb
9/16F
F
F
1/4F
1/4Fb
3/2F
3/2F
1/4Fb
5/4F
D
9/16F
5/8Fb
9/8F
F
1/2Fb
3/2F
1/4F
A
B
C
A
B
9/8F
5/8Fb
9/16F
9/8F
1/16Fb
9/16F
B
C
9/8F
7/16Fb
7/16F
9/8F
7/16F


-5/4
-5/4
-5/4
1/2
-½
0
-3/2
9/16
-1
-3/2
9/16
-1
-9/8
-9/8

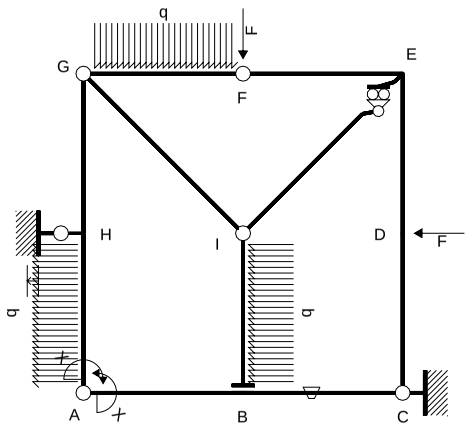

-1/2
-3/2
½
-9/4
0
0
5/4
17/8
1
9/8
9/16
0
1/4
-7/16

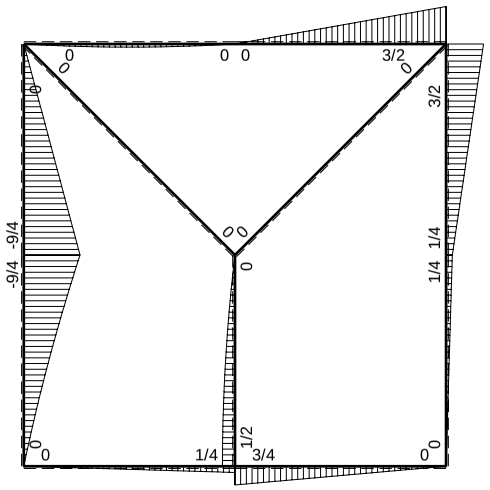
←□→ F

↑□↓ F

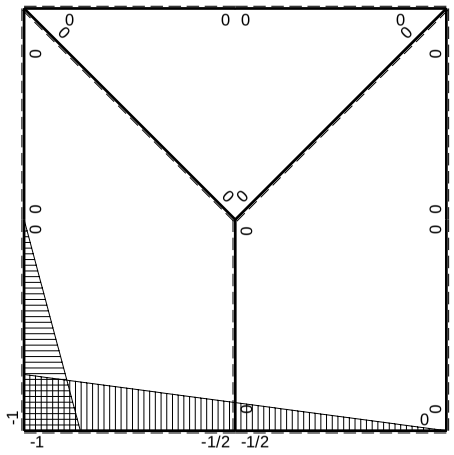

0
0 0
3/2
0
0
3/2
-9/4
0 0
-9/4
1/4
1/4
0
-5/8
1/2
7/16
0 0
-5/8
-1/16

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264259 CI04.xxxx.061

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	-Fb/EJ	$-3/8Fb+3/4Fx-3/8Fx^2/b$	$1/2Fb/EJ-1/2Fx/EJ$	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	Fb/EJ	$-3/8Fx^2/b$	1/2Fx/EJ	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1/2 - 1/2\ x/b\ \right)\ \theta\ \ dx$

$= \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x - 1/4\ x^2/b\right]_o^b\ \theta$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2\ x/b\ \right)\ \theta\ \ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/4\ b\ \right)\ \theta\ \ = 1/8\ \ Fb^2/EJ$

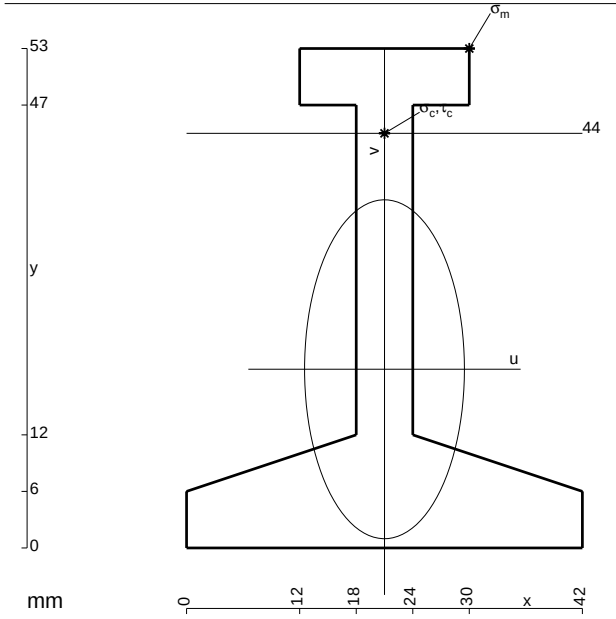
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

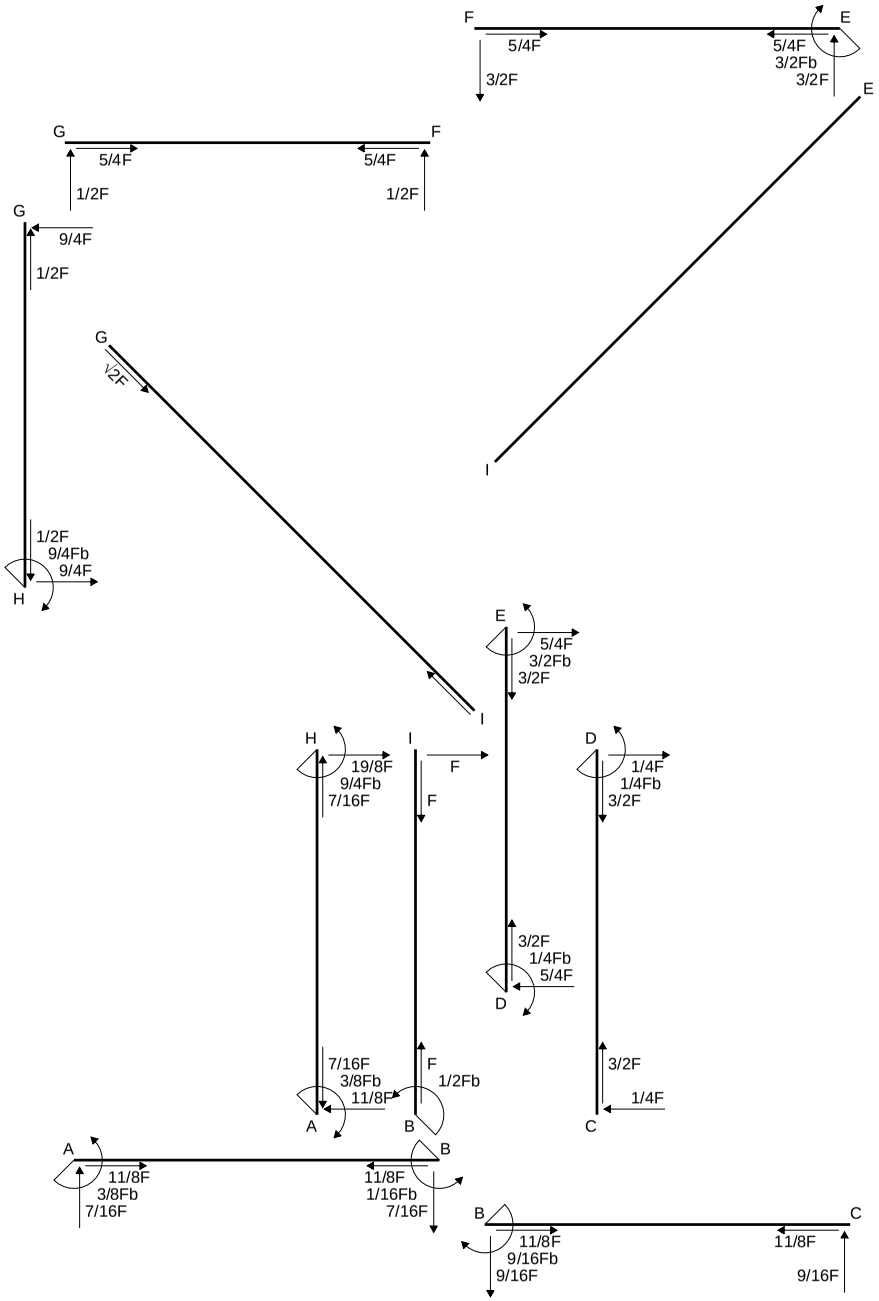
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

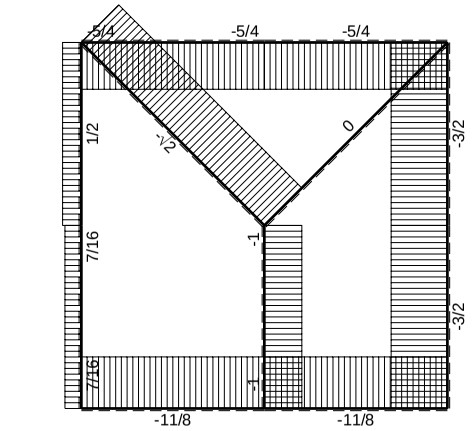
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

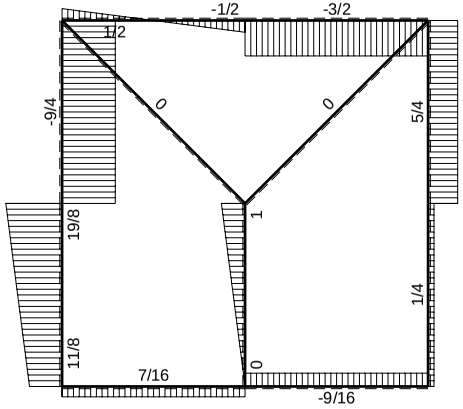
PROCEDIMENTO E RISULTATI 264259 CI04.xxxx.061

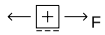


A = 714. mm^2
J_u = 230961. mm^4
J_v = 51390. mm^4
y_g = 18.96 mm
N = 595. N
T_y = -2678. N
M_x = -1419080. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 9. mm
v_m = 34.04 mm
$\sigma_m = N/A - Mv/J_u$ = 210. N/mm^2
x_c = 21. mm
y_c = 44. mm
v_c = 25.04 mm
$\sigma_c = N/A - Mv/J_u$ = 154.7 N/mm^2
τ_c = 7.4 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 155.2 N/mm^2
S^* = 3830. mm^3

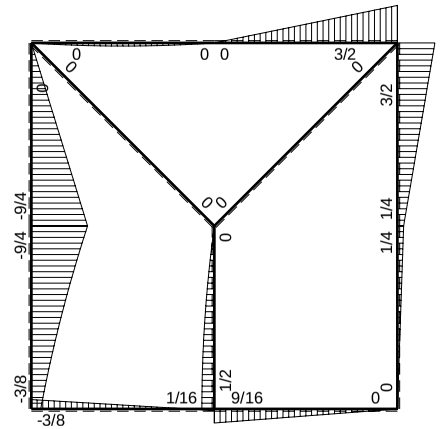

F
5/4F
E
5/4F
3/2Fb
3/2F
3/2F
G
5/4F
F
5/4F
1/2F
1/2F
G
9/4F
1/2F
G
√2F
I
E
1/2F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
3/2F
I
H
19/8F
9/4Fb
7/16F
I
F
F
D
1/4F
1/4Fb
3/2F
3/2F
1/4Fb
5/4F
D
7/16F
3/8Fb
11/8F
F
1/2Fb
3/2F
1/4F
A
B
C
A
11/8F
3/8Fb
7/16F
B
11/8F
1/16Fb
7/16F
B
11/8F
9/16Fb
9/16F
C
11/8F
9/16F


5/4
-5/4
-5/4
1/2
-1/2
0
-3/2
7/16
-1
-3/2
7/16
-1
-11/8
-11/8

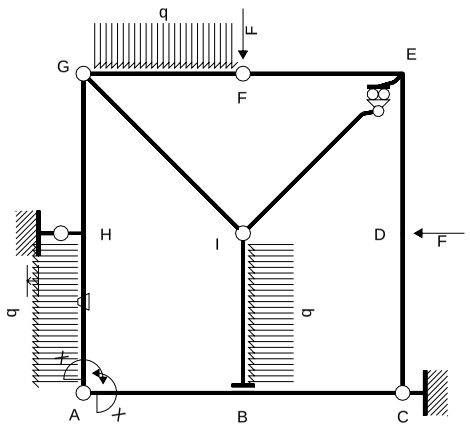

-1/2
-3/2
1/2
-9/4
0
0
5/4
19/8
1
1/4
11/8
7/16
0
-9/16

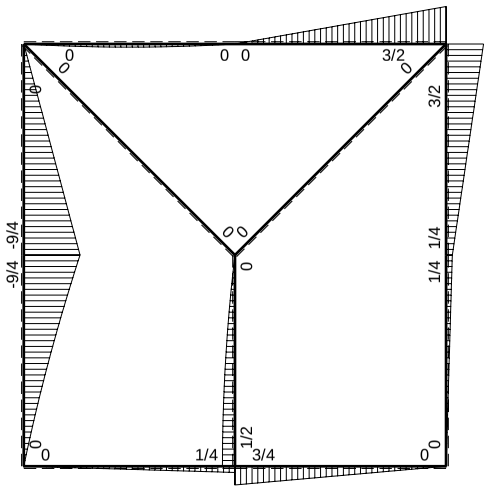

F


F

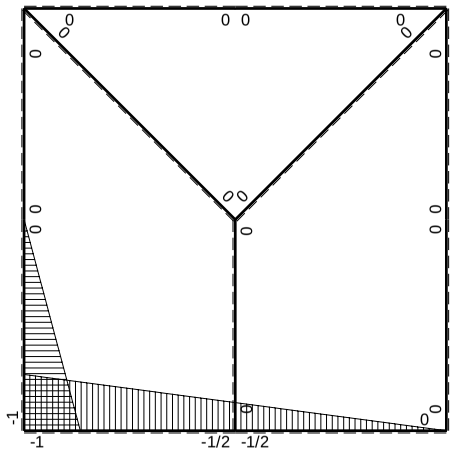

0
0 0
3/2
0
0
3/2
0
0
-9/4
-9/4
1/4
1/4
0
-3/8
1/16
-1/2
9/16
0
0
-3/8


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	-Fb/EJ	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(1/3+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	Fb/EJ	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\ \right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\ \theta\ \ dx$

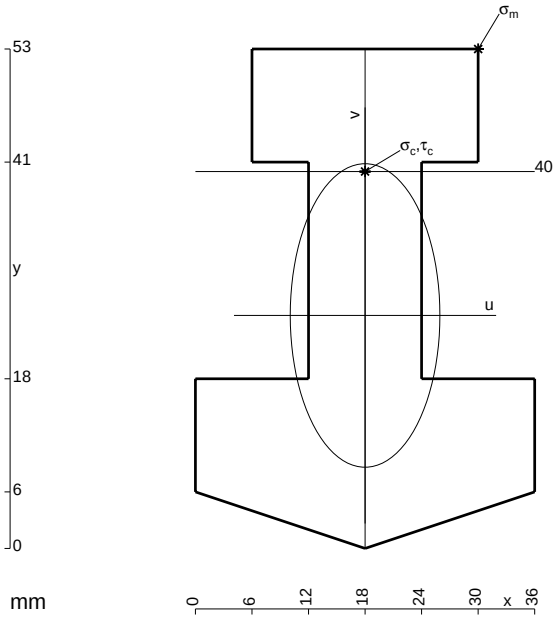
$= \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b\ \theta$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b\ \right)\ \theta\ \ = 5/6\ \ Fb^2/EJ$

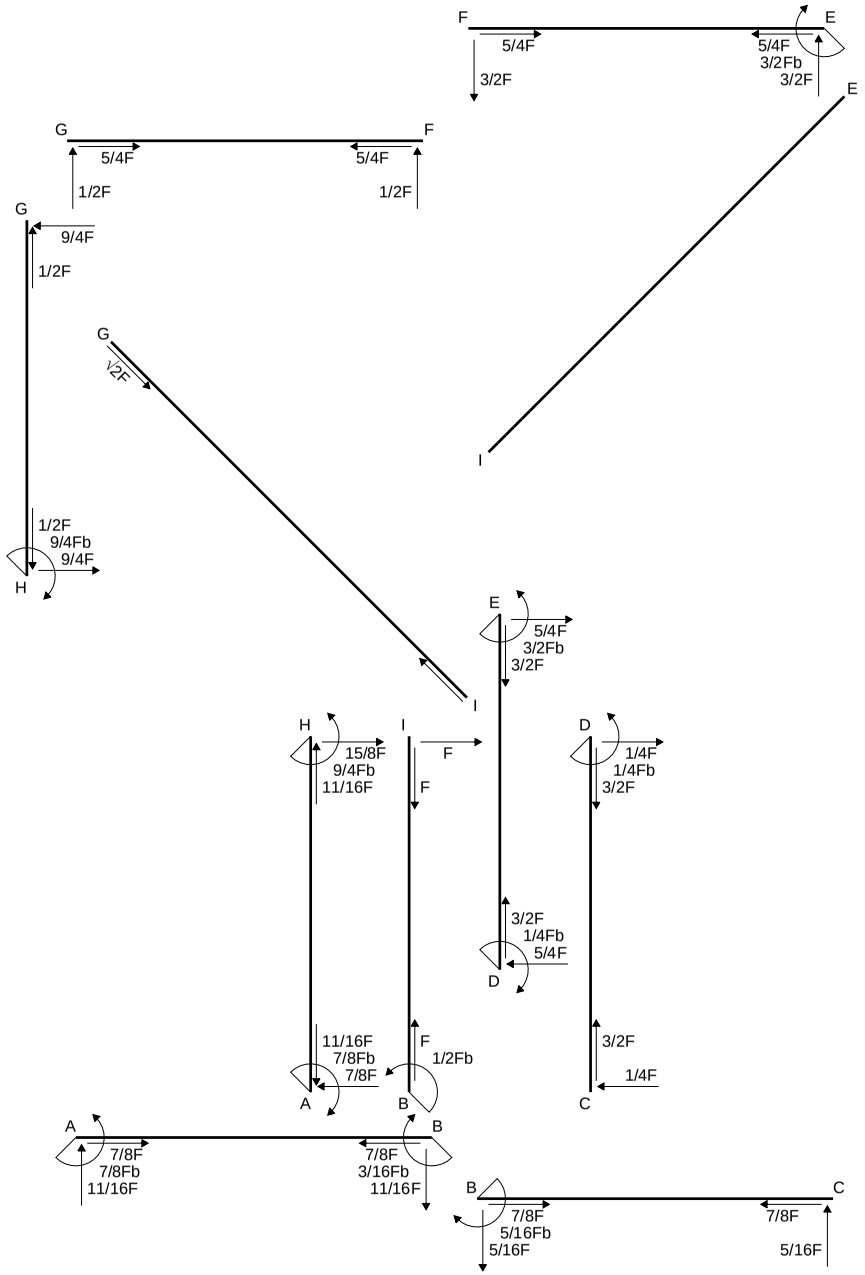
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\ \theta\ \ dx$

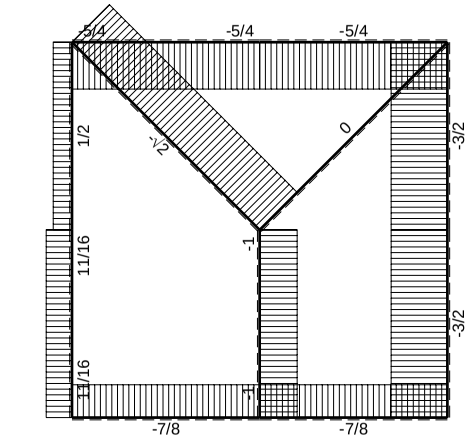
$= \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b\ \theta$

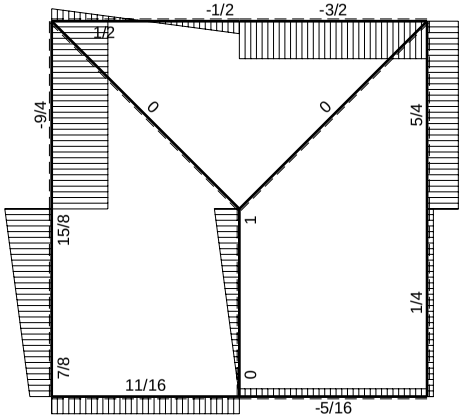
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\ \theta\ \ = 5/6\ \ Fb^2/EJ$



A = 1104. mm^2
J_u = 286555. mm^4
J_v = 69624. mm^4
y_g = 24.72 mm
N = 850. N
T_y = -3825. N
M_x = -2218500. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 12. mm
v_m = 28.28 mm
$\sigma_m = N/A - Mv/J_u$ = 219.7 N/mm^2
x_c = 18. mm
y_c = 40. mm
v_c = 15.28 mm
$\sigma_c = N/A - Mv/J_u$ = 119. N/mm^2
τ_c = 7.347 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 119.7 N/mm^2
S^* = 6605. mm^3

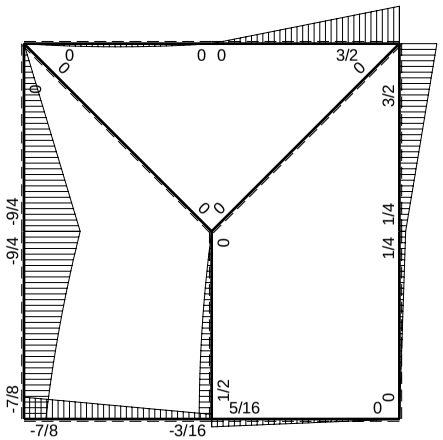

F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
E
G
F
5/4F
5/4F
1/2F
1/2F
G
9/4F
1/2F
G
½F
I
1/2F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
3/2F
I
H
I
D
15/8F
9/4Fb
11/16F
F
F
1/4F
1/4Fb
3/2F
3/2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
F
1/2Fb
3/2F
1/4F
A
B
C
A
B
7/8F
7/8Fb
11/16F
7/8F
3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
-5/4
-5/4
1/2
-½
0
-3/2
11/16
-1
-3/2
11/16
-1
-7/8
-7/8

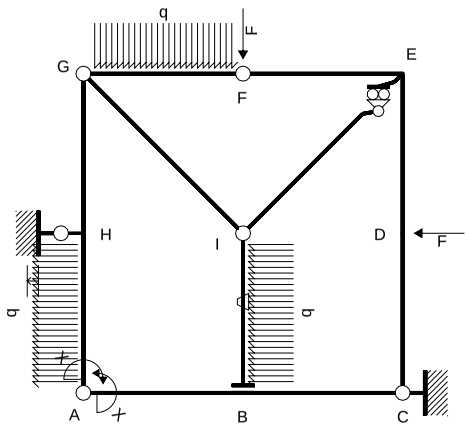

-1/2
-3/2
1/2
-9/4
0
0
5/4
15/8
1
1/4
7/8
11/16
0
-5/16

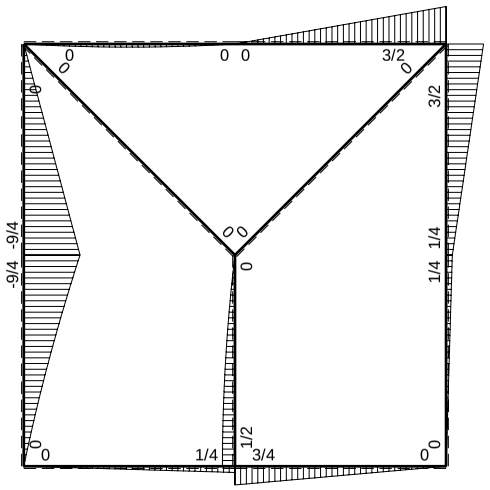
←□→ F

↑□↓ F

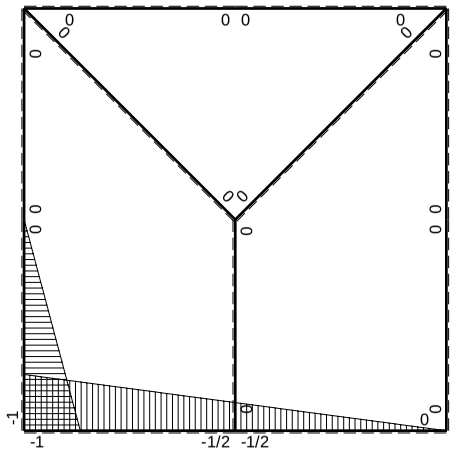

0
0 0
3/2
0
0
3/2
-9/4
0 0
-9/4
1/4
1/4
0
-7/8
1/2
5/16
0
0
-7/8
-3/16

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 308763 CI04.xxxx.063

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b (-1/4\ x/b + 1/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/8\ x^2/b + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b (-1/8 + 1/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/8\ x + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b (-3/8 + 3/4\ x/b - 3/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-3/8\ b + 3/8\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-3/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b\ )\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

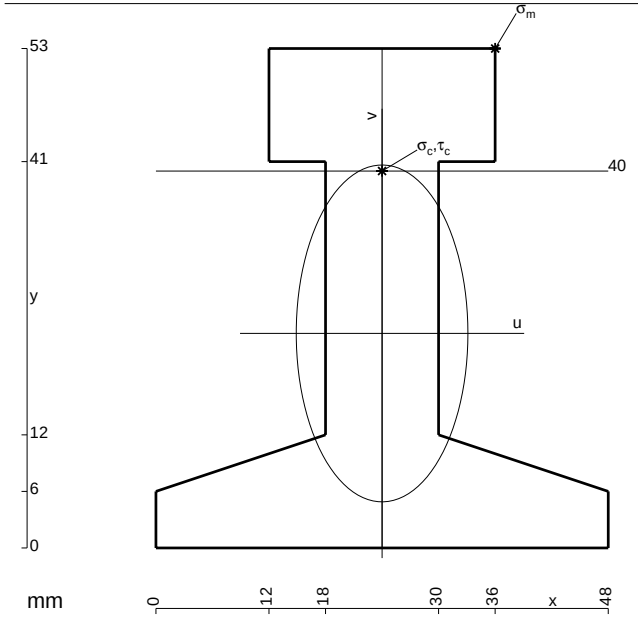
$L^{Xo}_{HA} = \int_o^b (9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (9/8\ b - 11/12\ b + 1/8\ b\ )\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

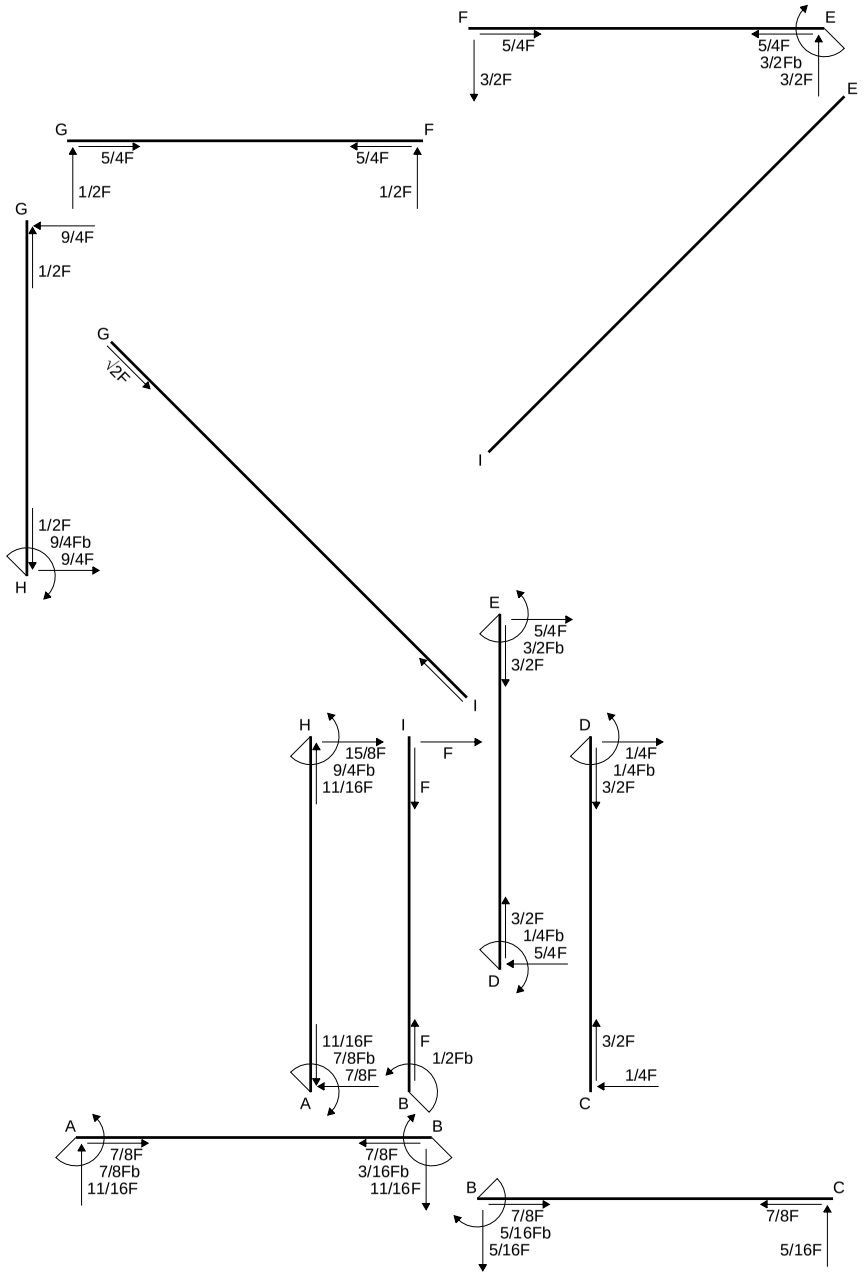
$L^{Xo}_{AH} = \int_o^b (7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

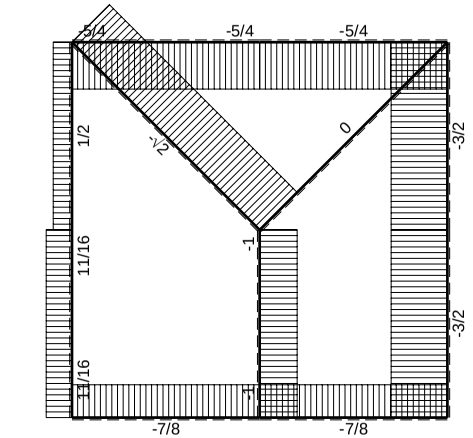
$= (7/8\ b - 5/12\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

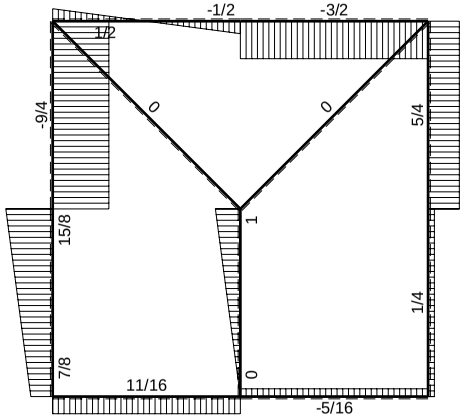
PROCEDIMENTO E RISULTATI 308763 CI04.xxxx.063



A = 1104. mm^2
J_u = 352844. mm^4
J_v = 91656. mm^4
y_g = 22.77 mm
N = 940. N
T_y = -4230. N
M_x = -2664900. Nmm
x_m = 36. mm
y_m = 53. mm
u_m = 12. mm
v_m = 30.23 mm
$\sigma_m = N/A - Mv/J_u$ = 229.2 N/mm^2
x_c = 24. mm
y_c = 40. mm
v_c = 17.23 mm
$\sigma_c = N/A - Mv/J_u$ = 131. N/mm^2
τ_c = 7.185 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 131.6 N/mm^2
S^* = 7192. mm^3

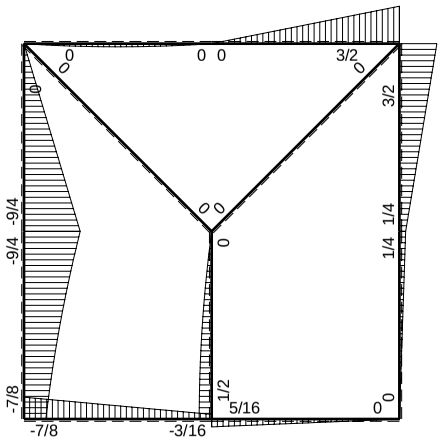

F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
E
G
F
5/4F
5/4F
1/2F
1/2F
G
9/4F
1/2F
G
½F
I
1/2F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
3/2F
I
H
I
D
15/8F
9/4Fb
11/16F
F
F
1/4F
1/4Fb
3/2F
3/2F
1/4Fb
5/4F
D
11/16F
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7/8F
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1/4F
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B
C
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B
7/8F
7/8Fb
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11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
-5/4
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½
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11/16
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-3/2
11/16
-1
-7/8
-7/8

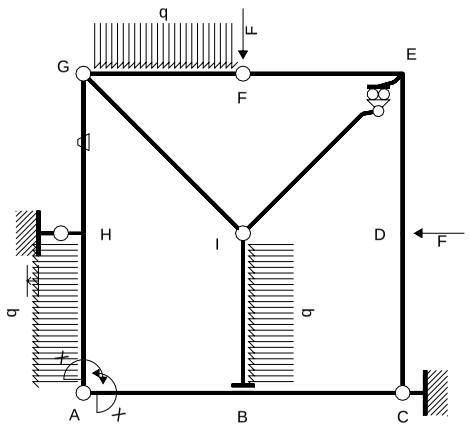

-1/2
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-9/4
0
0
5/4
15/8
1
1/4
7/8
11/16
0
-5/16

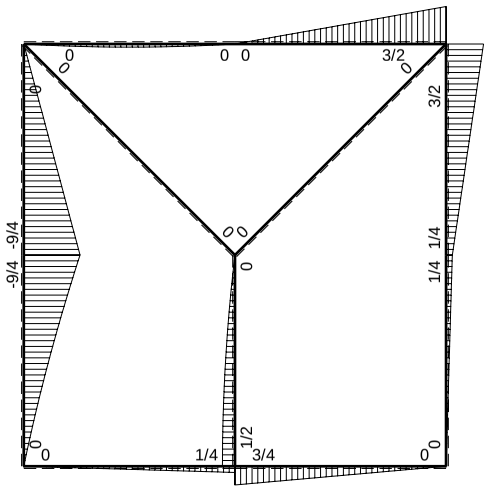
←+→ F

↑+↓ F

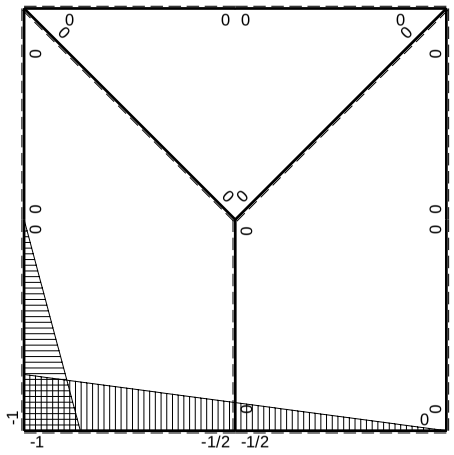

0
0 0
3/2
0
0
3/2
-9/4
0 0
-9/4
1/4
1/4
0
-7/8
1/2
5/16
0
0
-7/8
-3/16

↻+↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 239027 CI04.xxxx.064

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PROCEDIMENTO E RISULTATI 239027 CI04.xxxx.064

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	-9/4Fx	-Fb/EJ	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

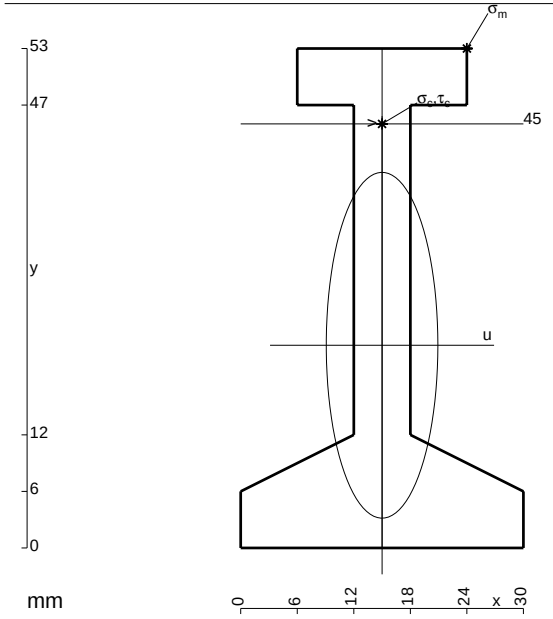
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

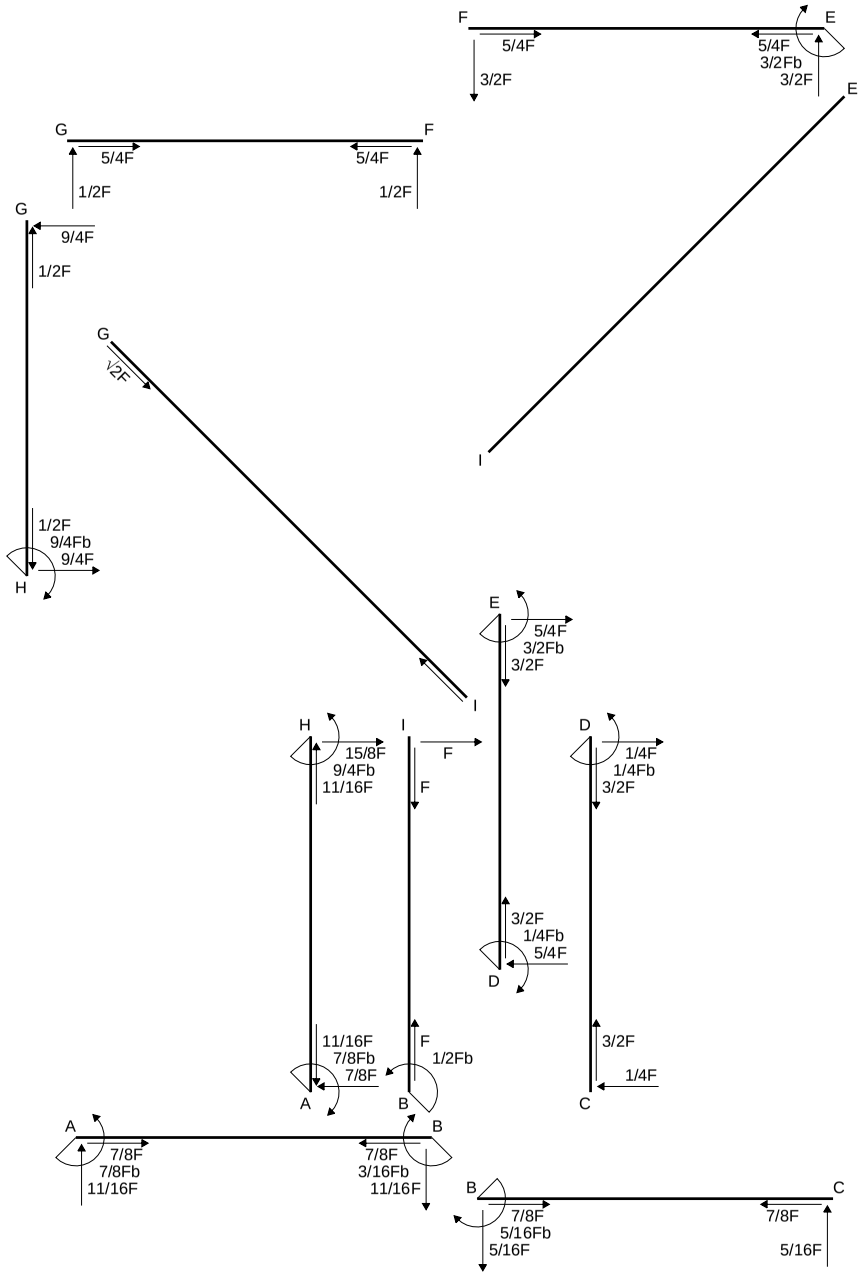
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

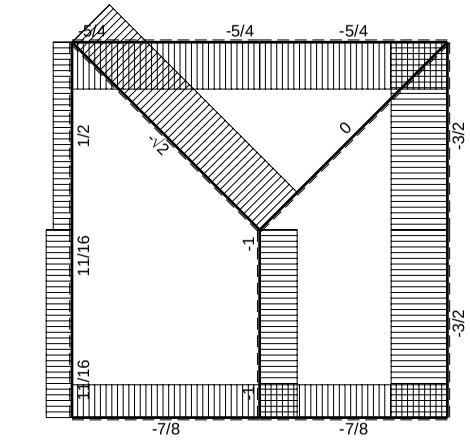
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

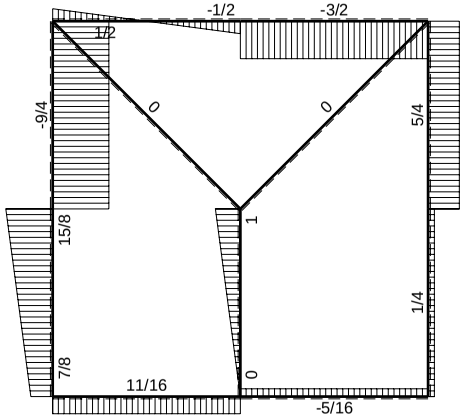
PROCEDIMENTO E RISULTATI 239027 CI04.xxxx.064



A = 606. mm^2
J_u = 204068. mm^4
J_v = 21258. mm^4
y_g = 21.51 mm
N = 505. N
T_y = -2273. N
M_x = -1545300. Nmm
x_m = 24. mm
y_m = 53. mm
u_m = 9. mm
v_m = 31.49 mm
$\sigma_m = N/A - Mv/J_u$ = 239.3 N/mm^2
x_c = 15. mm
y_c = 45. mm
v_c = 23.49 mm
$\sigma_c = N/A - Mv/J_u$ = 178.7 N/mm^2
τ_c = 6.256 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 179. N/mm^2
S^* = 3371. mm^3

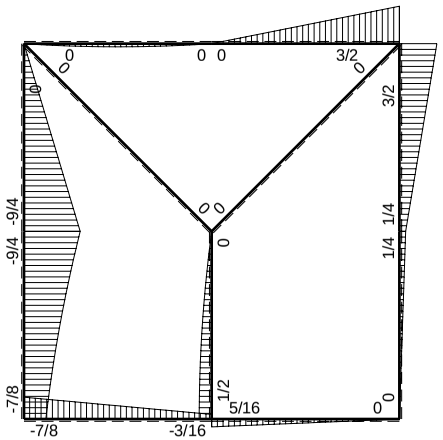

F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
E
G
F
5/4F
5/4F
1/2F
1/2F
G
9/4F
1/2F
G
½F
I
1/2F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
3/2F
I
H
I
D
15/8F
9/4Fb
11/16F
F
F
1/4F
1/4Fb
3/2F
3/2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
F
1/2Fb
3/2F
1/4F
A
B
C
A
B
7/8F
7/8Fb
11/16F
7/8F
3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
-5/4
-5/4
1/2
½
0
-3/2
11/16
-1
-3/2
11/16
-1
-7/8
-7/8

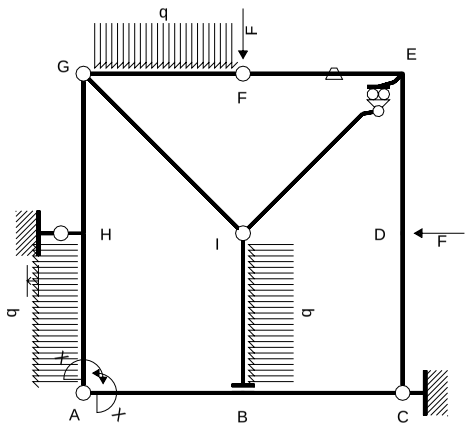

-1/2
-3/2
1/2
-9/4
0
0
5/4
15/8
1
1/4
7/8
11/16
0
-5/16

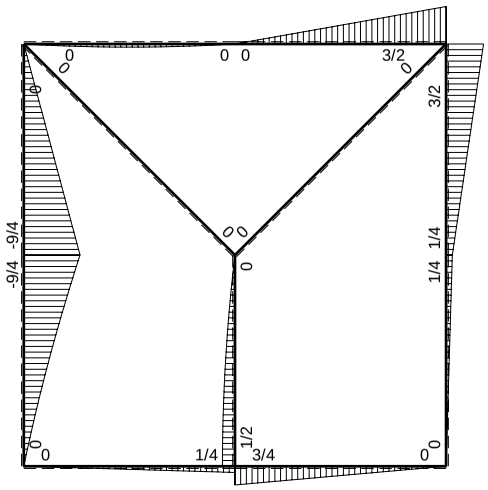
←□→ F

↑□↓ F

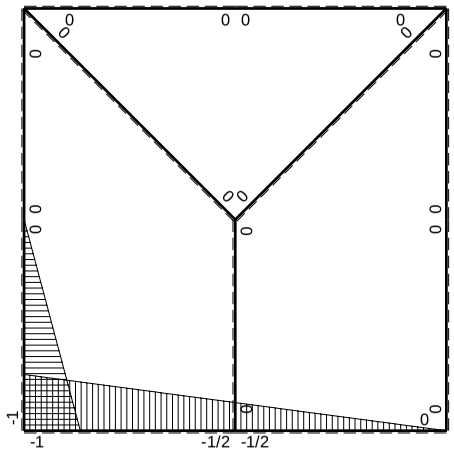

0
0 0
3/2
0
0
3/2
-9/4
0 0
-9/4
1/4
1/4
0
-7/8
1/2
5/16
0
0
-7/8
-3/16

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 269546 CI04.xxxx.065

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	-Fb/EJ	0	0	0	0+0	0
FE b	0	-3/2Fx	Fb/EJ	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

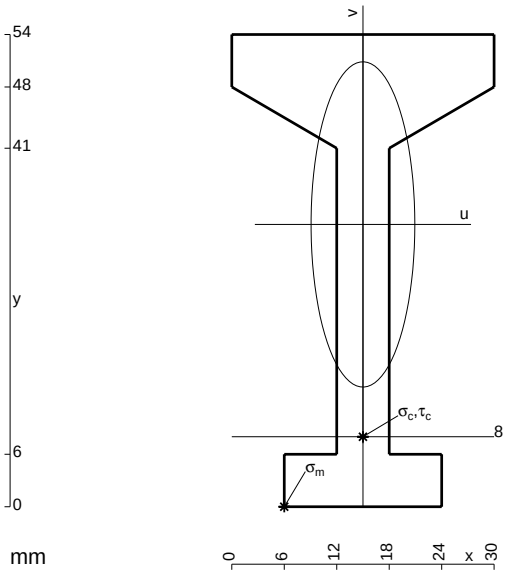
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

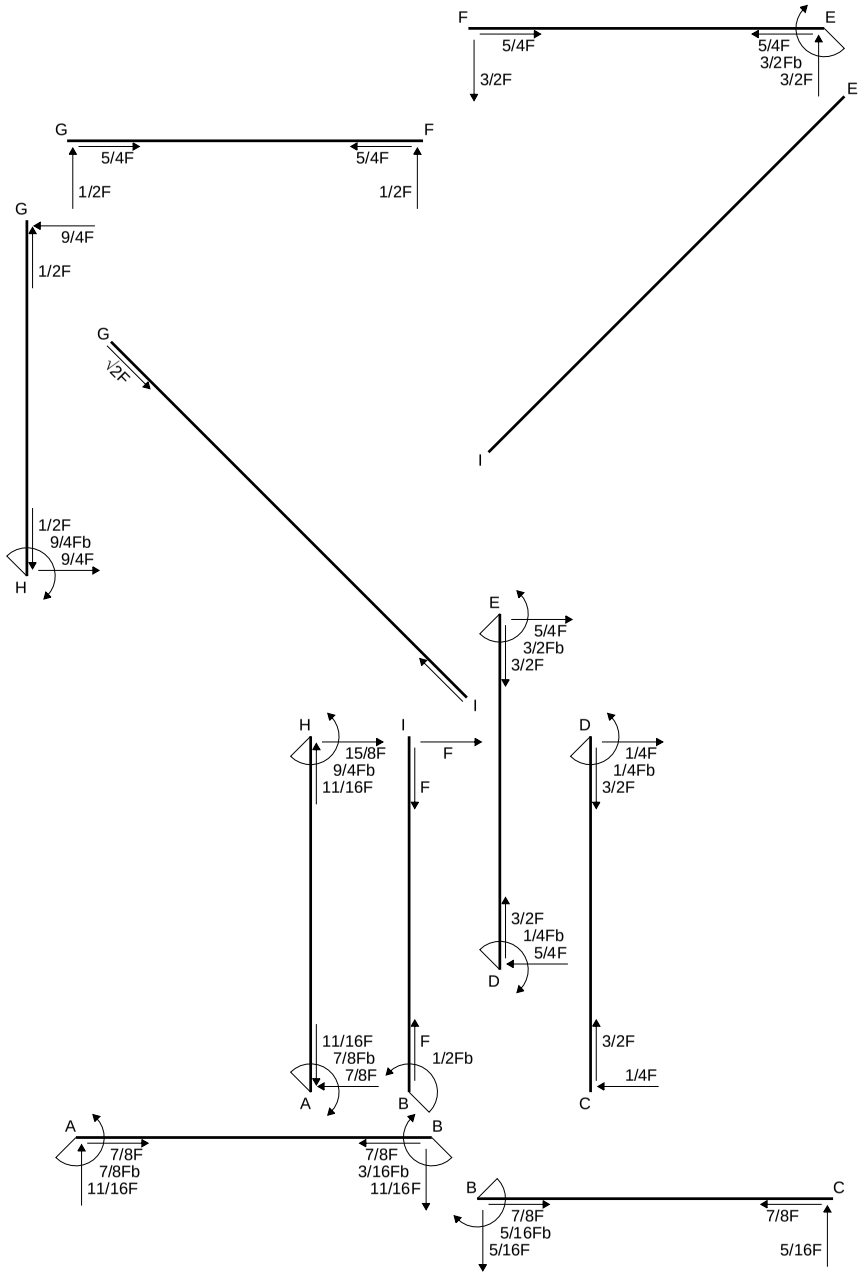
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

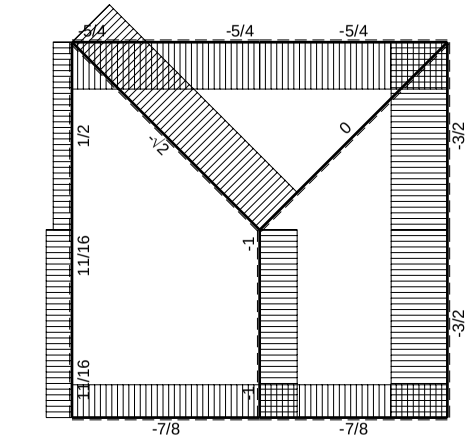
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

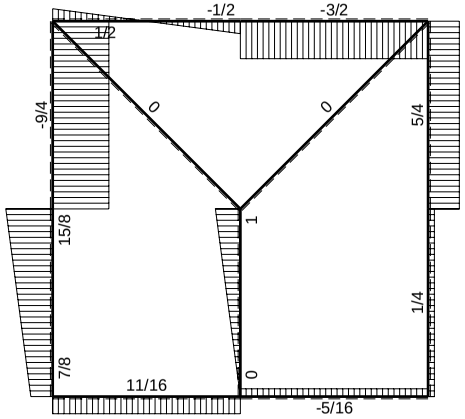
PROCEDIMENTO E RISULTATI 269546 CI04.xxxx.065



A = 624. mm^2
J_u = 215884. mm^4
J_v = 21960. mm^4
y_g = 32.28 mm
N = 395. N
T_y = -1778. N
M_x = -1333130. Nmm
x_m = 6. mm
u_m = -9. mm
v_m = -32.28 mm
$\sigma_m = N/A - Mv/J_u$ = -198.7 N/mm^2
x_c = 15. mm
y_c = 8. mm
v_c = -24.28 mm
$\sigma_c = N/A - Mv/J_u$ = -149.3 N/mm^2
τ_c = 4.756 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 149.5 N/mm^2
S^* = 3466. mm^3

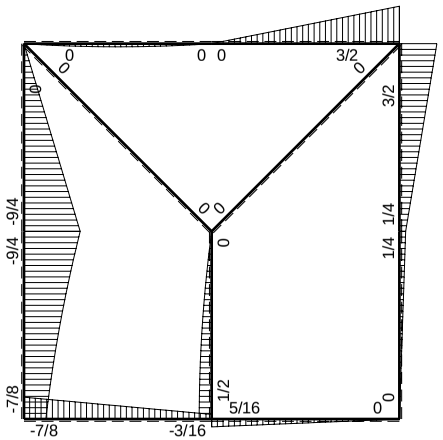

F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
E
G
F
5/4F
5/4F
1/2F
1/2F
G
9/4F
1/2F
G
½F
I
1/2F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
3/2F
I
H
I
D
15/8F
9/4Fb
11/16F
F
F
1/4F
1/4Fb
3/2F
3/2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
F
1/2Fb
3/2F
1/4F
A
B
C
A
B
7/8F
7/8Fb
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3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
-5/4
-5/4
1/2
½
0
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11/16
-1
-3/2
11/16
-1
-7/8
-7/8

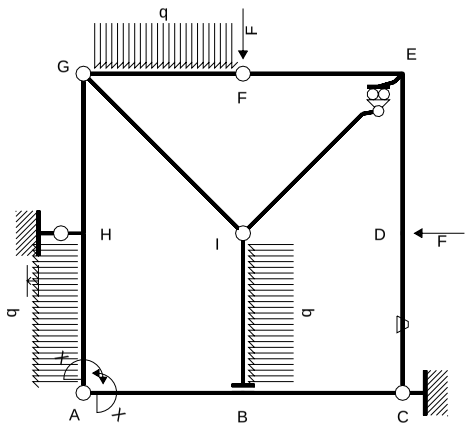

-1/2
-3/2
1/2
-9/4
0
0
5/4
15/8
1
1/4
7/8
11/16
0
-5/16

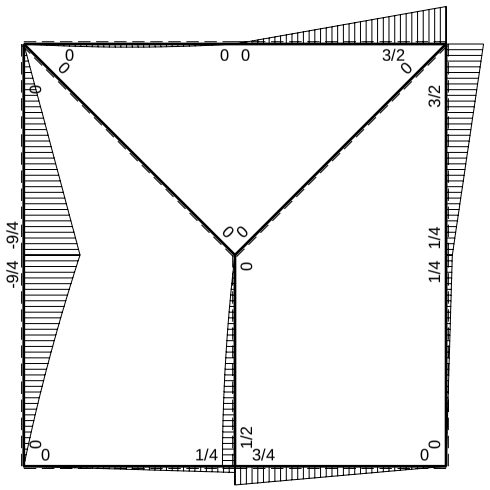
←□→ F

↑□↓ F

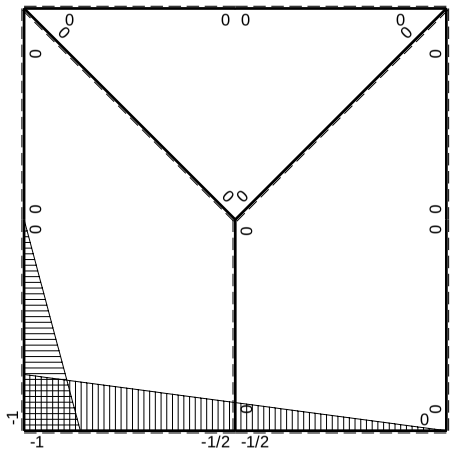

0
0 0
3/2
0
0
3/2
-9/4
0 0
-9/4
1/4
1/4
0
-7/8
1/2
5/16
0
0
-7/8
-3/16

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 981229 CI04.xxxx.066

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PROCEDIMENTO E RISULTATI 981229 CI04.xxxx.066

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	-Fb/EJ	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	Fb/EJ	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

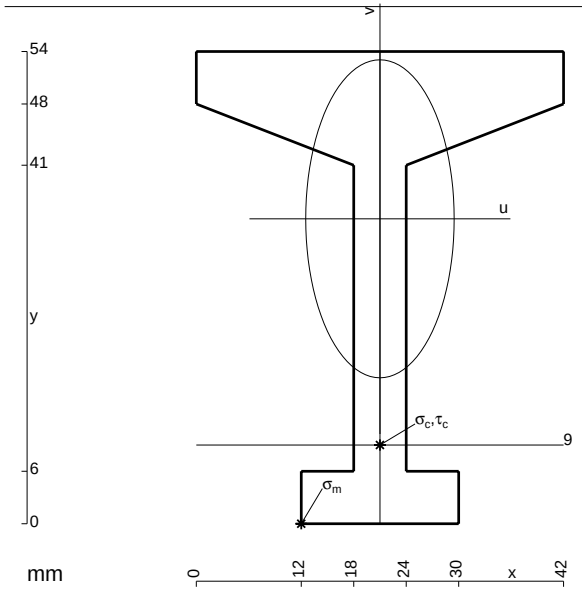
$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

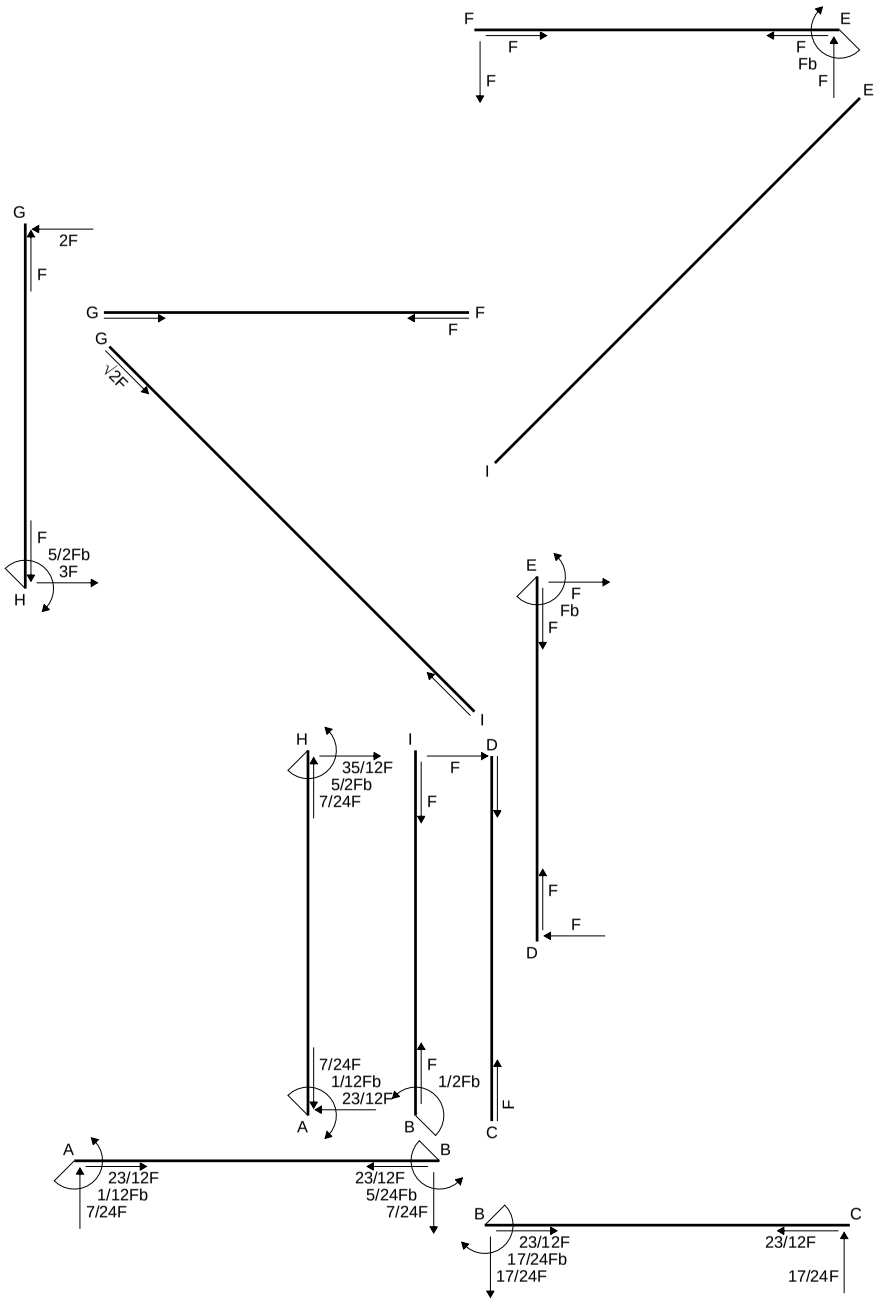
$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

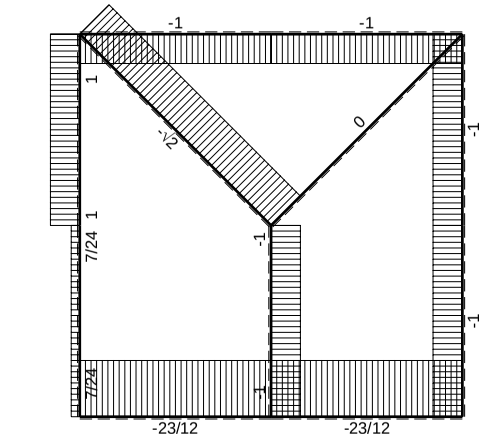
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

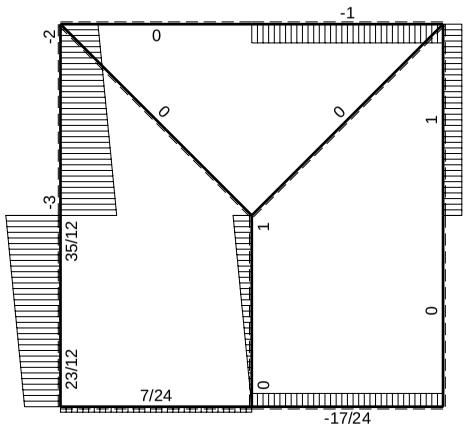
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

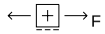


A = 738. mm^2
J_u = 244023. mm^4
J_v = 53190. mm^4
y_g = 34.87 mm
N = 405. N
T_y = -1823. N
M_x = -1458000. Nmm
x_m = 12. mm
u_m = -9. mm
v_m = -34.87 mm
$\sigma_m = N/A - Mv/J_u$ = -207.8 N/mm^2
x_c = 21. mm
y_c = 9. mm
v_c = -25.87 mm
$\sigma_c = N/A - Mv/J_u$ = -154. N/mm^2
τ_c = 4.898 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 154.3 N/mm^2
S^* = 3935. mm^3

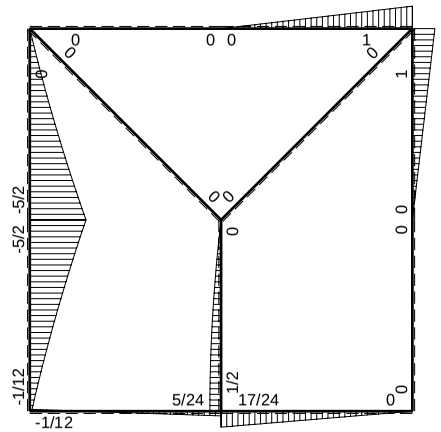

F
F
F
E
F
Fb
F
E
G
2F
F
G
F
F
G
√2F
I
F
5/2Fb
3F
H
E
F
Fb
F
I
H
35/12F
5/2Fb
7/24F
I
F
F
D
F
F
D
7/24F
1/12Fb
23/12F
A
F
1/2Fb
B
F
C
A
23/12F
1/12Fb
7/24F
B
23/12F
5/24Fb
7/24F
B
23/12F
17/24Fb
17/24F
C
23/12F
17/24F


-1
-1
1
-1/2
0
-1
7/24
1
-1
-1
-1
7/24
-1
-23/12
-23/12

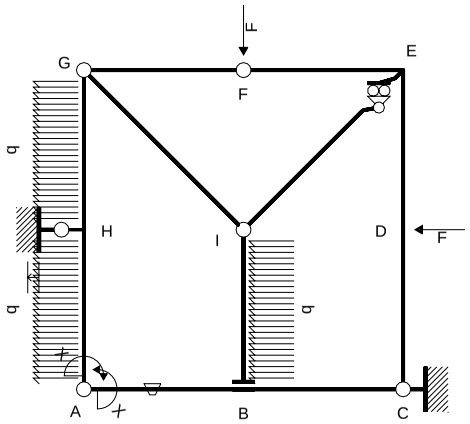

-2
0
-1
0
0
1
-3
35/12
1
23/12
0
7/24
0
-17/24

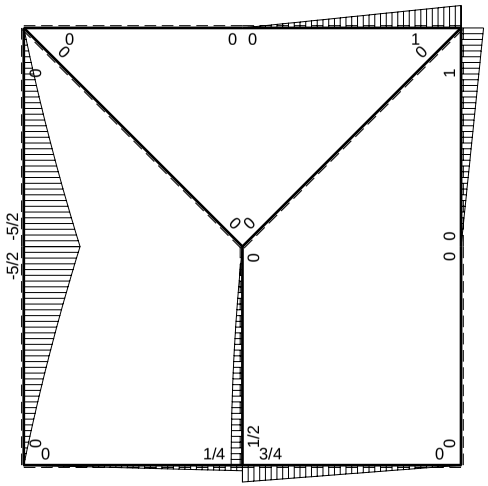

F


F

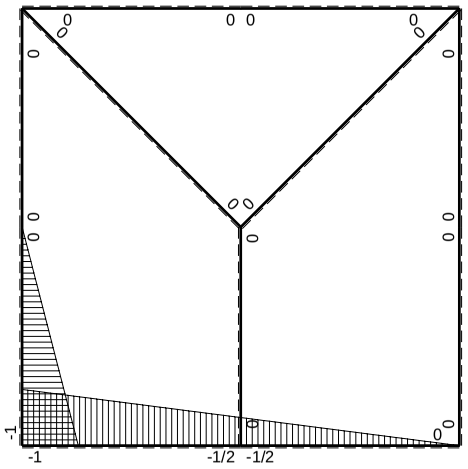

0
0 0
1
0
0
1
0
0 0
-5/2
-5/2
0
0 0
-1/12
5/24
1/2
17/24
0
0
-1/12


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 268131 CI04.xxxx.067

@ Adolfo Zavelani Rossi, Politecnico di Milano, vers.27.03.13 16.04.26

PROCEDIMENTO E RISULTATI 268131 CI04.xxxx.067

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	-Fb/EJ	-1/4Fx+1/8Fx^2/b	Fb/EJ-1/2Fx/EJ	1-x/b+1/4x^2/b^2	(-1/12+3/4)Fb^2/EJ	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb+1/4Fx	Fb/EJ	-1/8Fb+1/8Fx^2/b	1/2Fb/EJ+1/2Fx/EJ	1/4+1/2x/b+1/4x^2/b^2		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	-3/8Fb+3/4Fx-3/8Fx^2/b	0	1/4-1/2x/b+1/4x^2/b^2	(-1/8+0)Fb^2/EJ	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	-3/8Fx^2/b	0	1/4x^2/b^2		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-2Fx-1/2qx^2	0	0	0	0	0+0	0
HG b	0	5/2Fb-3Fx+1/2qx^2	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	Fx-1/2qx^2	0	0	0	0	0+0	0
BI b	0	-1/2Fb+1/2qx^2	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	-5/2Fb+3Fx-1/2qx^2	0	5/2Fx-3Fx^2/b+1/2qx^3/b	0	x^2/b^2	(3/8+0)Fb^2/EJ	1/3Xb/EJ
AH b	1-x/b	2Fx+1/2qx^2	0	2Fx-3/2Fx^2/b-1/2qx^3/b	0	1-2x/b+x^2/b^2		
H	cedimento nodo $-H_{1H}u_H$						-Fb^2/EJ	
	totali						-1/12Fb^2/EJ	Xb/EJ
	iperstatica $X=W_{AB}$						1/12Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1 - 1/2\ x/b\right)\ \theta\ \ dx$

$= \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ + \left(\ b - 1/4\ b\ \right)\ \theta\ \ = 2/3\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2 - 1/2\ x/b\right)\ \theta\ \ dx$

$= \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 2/3\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

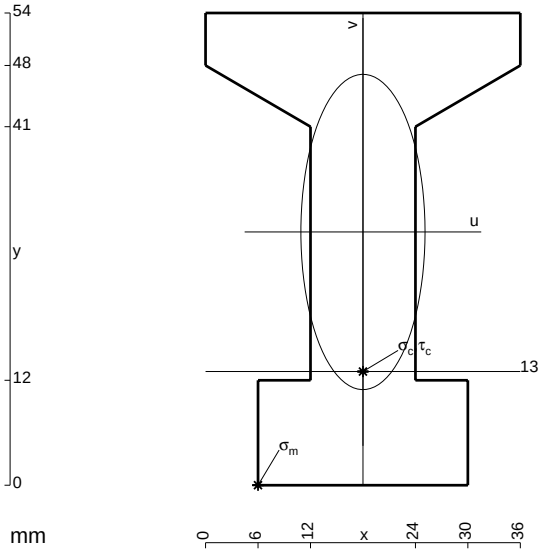
$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

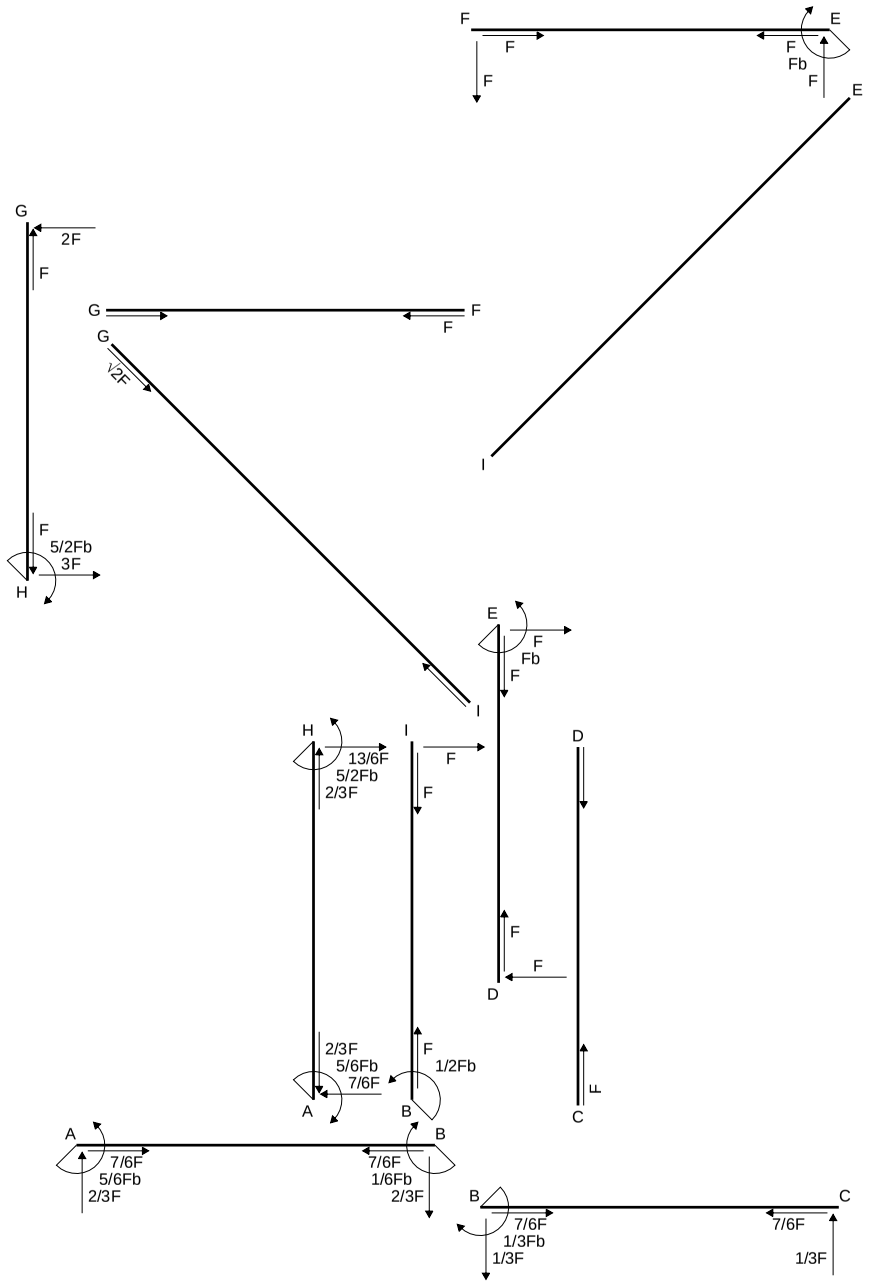
$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

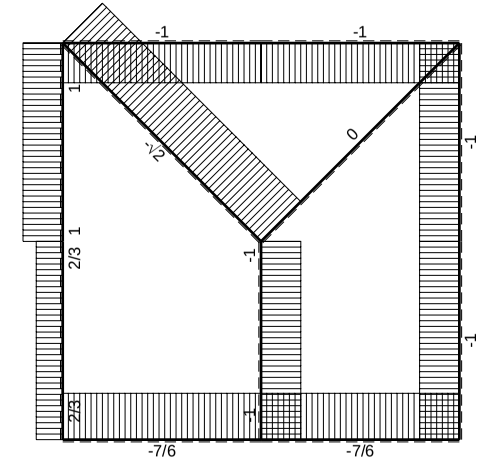
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

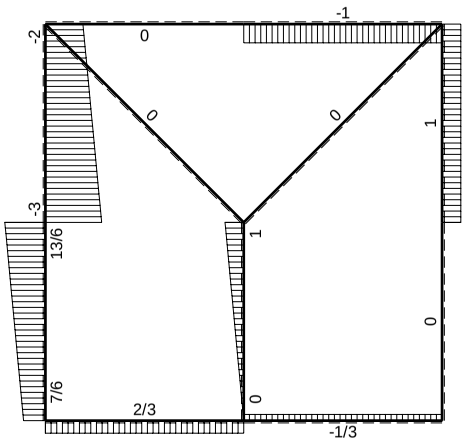
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

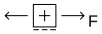


A = 1020. mm^2
J_u = 331648. mm^4
J_v = 51408. mm^4
y_g = 28.96 mm
N = 1190. N
T_y = -3570. N
M_x = -2528750. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.96 mm
$\sigma_m = N/A - Mv/J_u$ = -219.7 N/mm^2
x_c = 18. mm
y_c = 13. mm
v_c = -15.96 mm
$\sigma_c = N/A - Mv/J_u$ = -120.5 N/mm^2
τ_c = 6.109 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 121. N/mm^2
S^* = 6810. mm^3

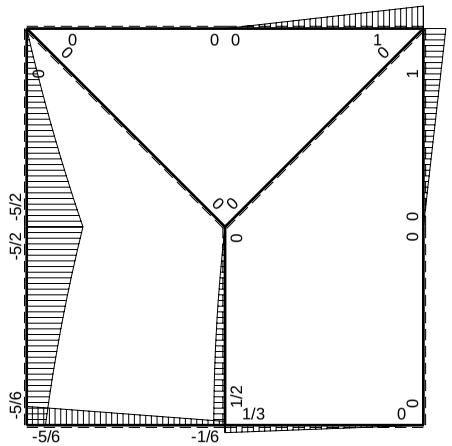

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2/3F
B
C
7/6F
1/3Fb
1/3F
7/6F
1/3F


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-7/6

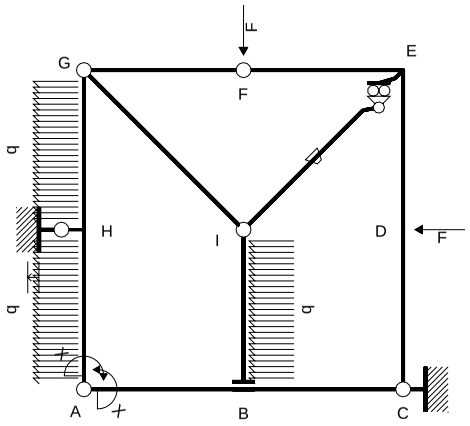

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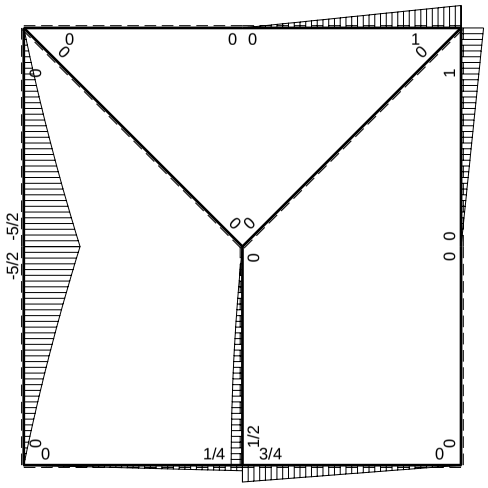

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F

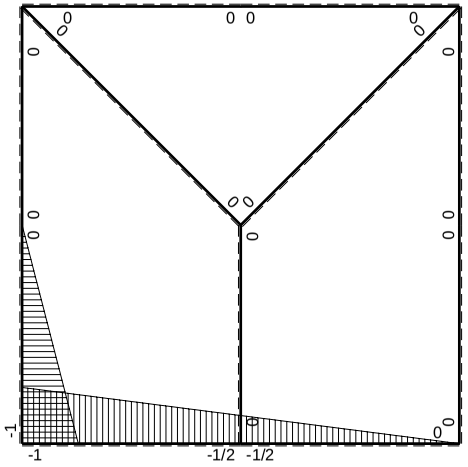

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0 0
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1/3
0
0
-5/6
-1/6


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 263971 CI04.xxxx.068

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

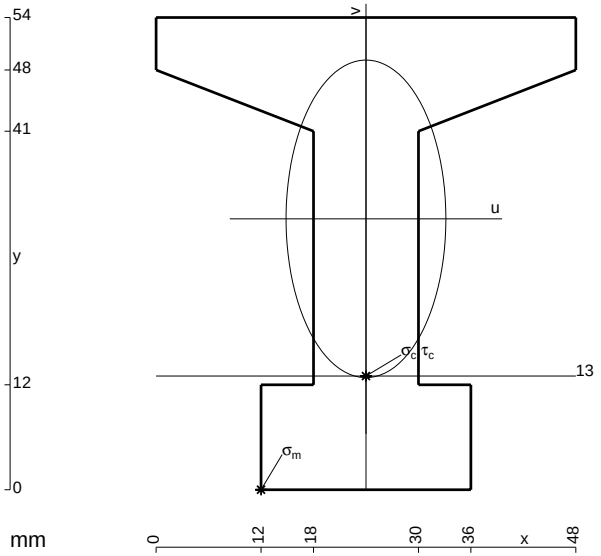
$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

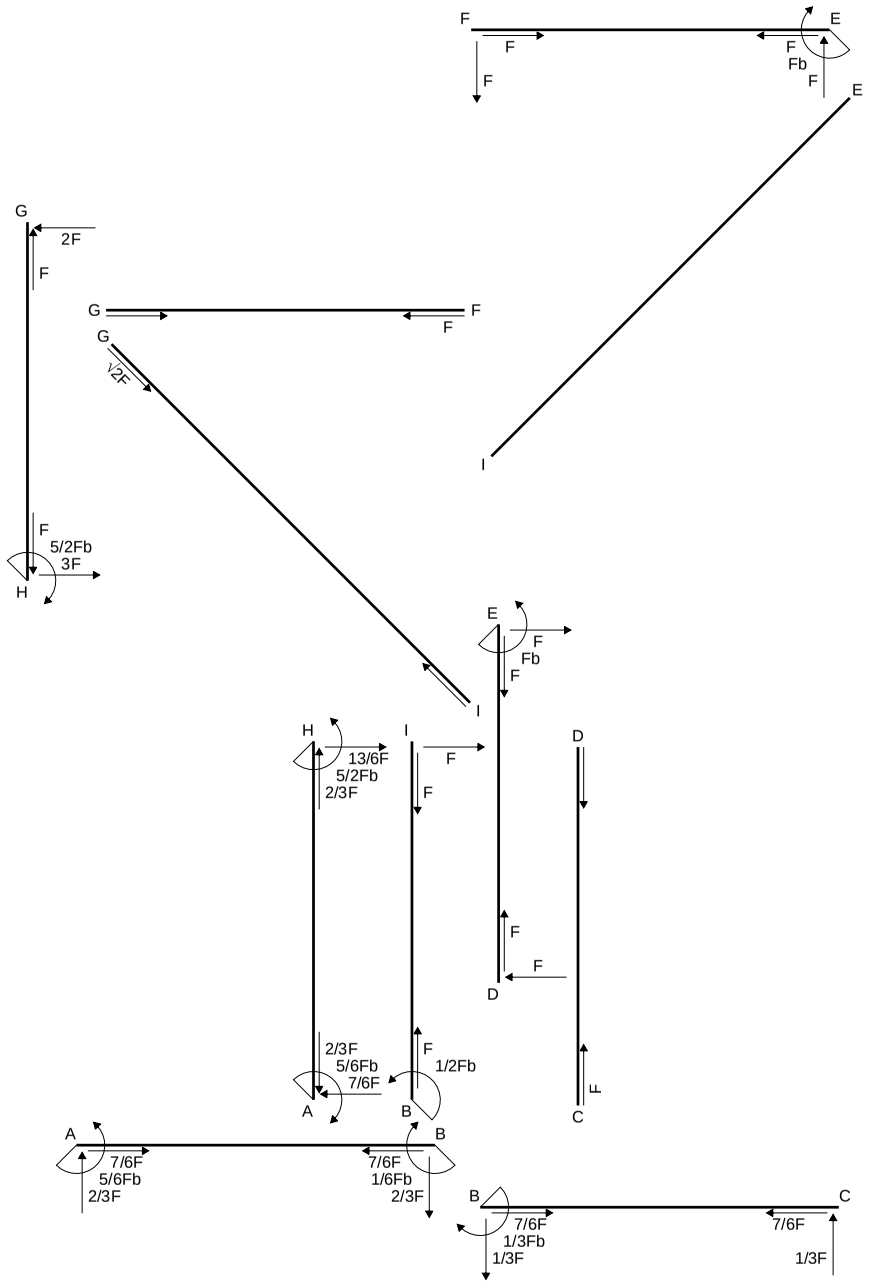
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

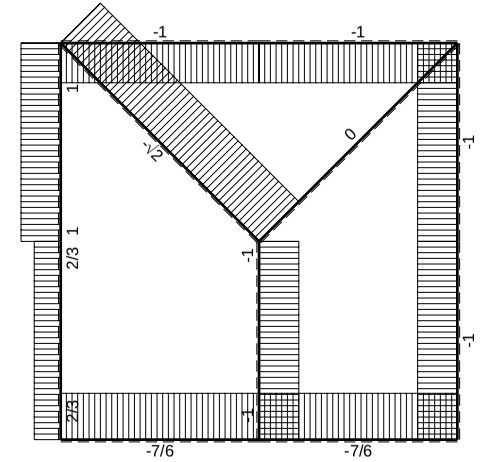
PROCEDIMENTO E RISULTATI 263971 CI04.xxxx.068

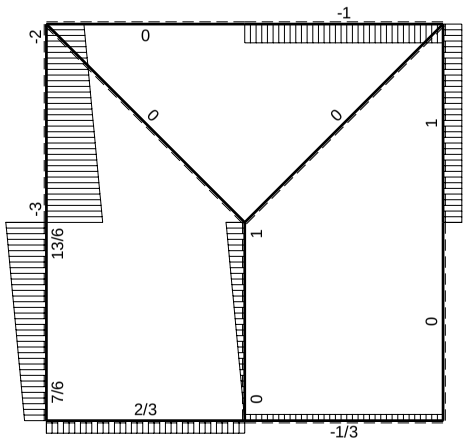


A = 1134. mm^2
J_u = 374055. mm^4
J_v = 94716. mm^4
y_g = 30.98 mm
N = 1240. N
T_y = -3720. N
M_x = -2790000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.98 mm
$\sigma_m = N/A - Mv/J_u$ = -230. N/mm^2
x_c = 24. mm
y_c = 13. mm
v_c = -17.98 mm
$\sigma_c = N/A - Mv/J_u$ = -133. N/mm^2
τ_c = 6.146 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 133.4 N/mm^2
S^* = 7416. mm^3

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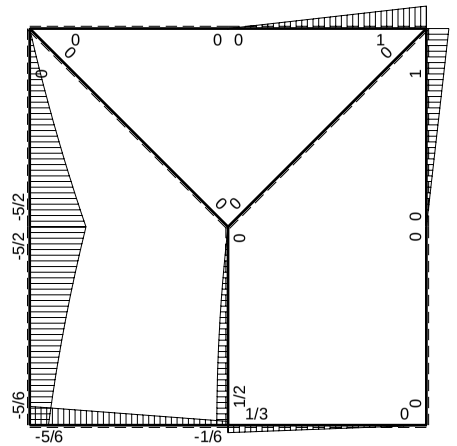

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D
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B
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2/3F
B
C
7/6F
1/3Fb
1/3F
7/6F
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-7/6
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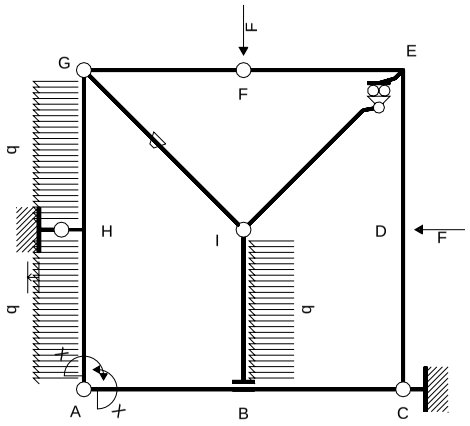

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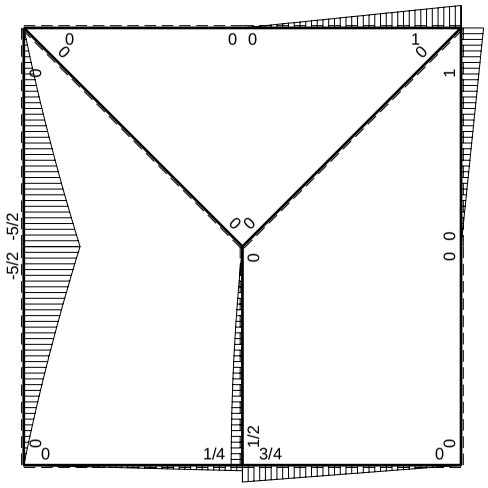
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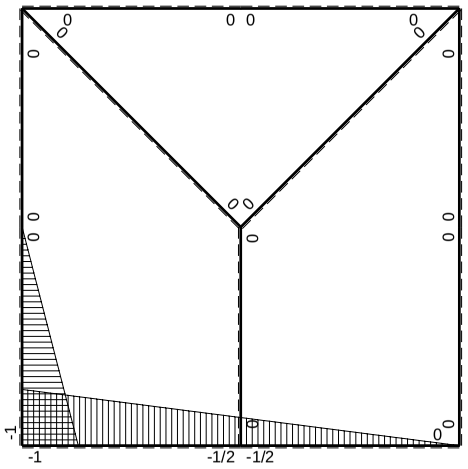

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1/2
1/3
0
0
-5/6
-1/6

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 247885 CI04.xxxx.069

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PROCEDIMENTO E RISULTATI 247885 CI04.xxxx.069

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-3/4Fx$	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

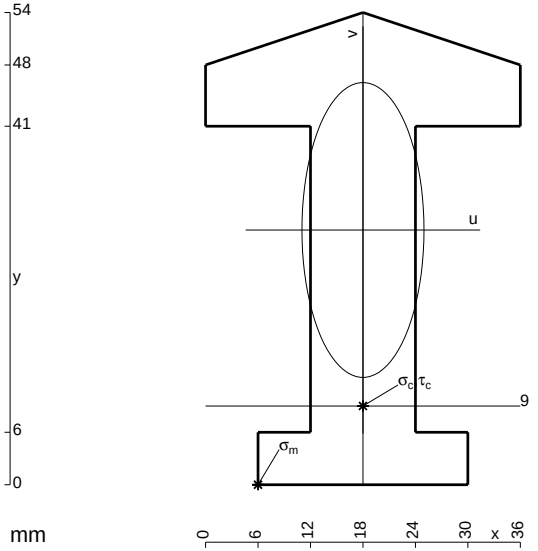
$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

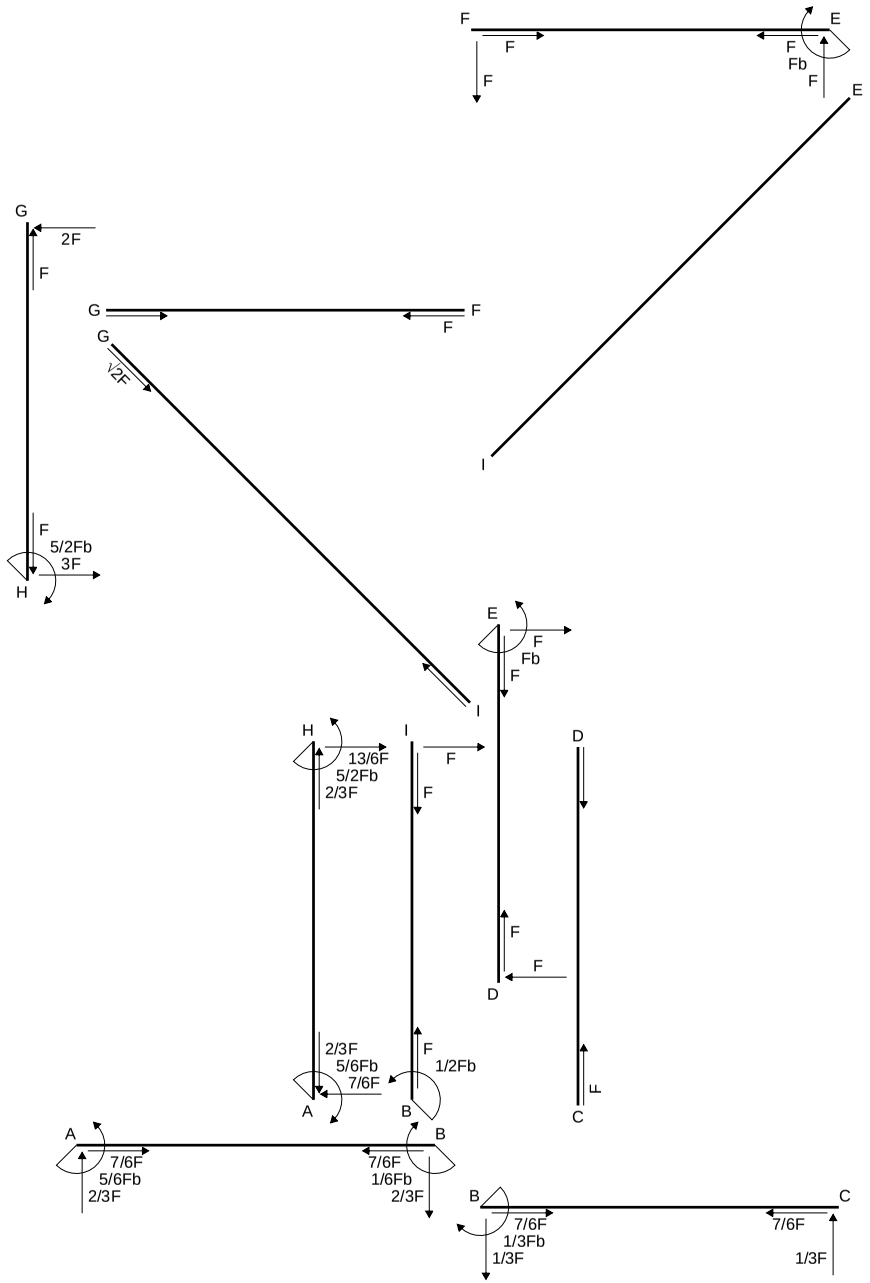
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

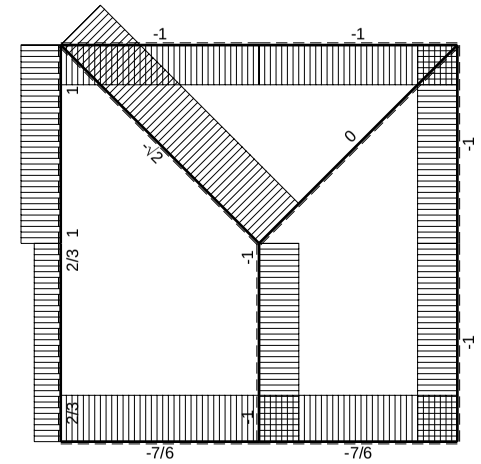
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

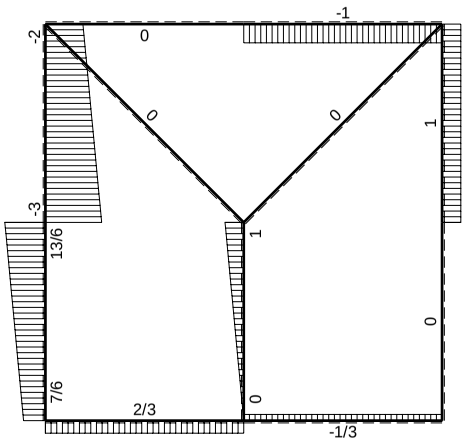
PROCEDIMENTO E RISULTATI 247885 CI04.xxxx.069



A = 924. mm^2
J_u = 262756. mm^4
J_v = 45000. mm^4
y_g = 29.13 mm
N = 910. N
T_y = -2730. N
M_x = -2161250. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -29.13 mm
$\sigma_m = N/A - Mv/J_u$ = -238.6 N/mm^2
x_c = 18. mm
y_c = 9. mm
v_c = -20.13 mm
$\sigma_c = N/A - Mv/J_u$ = -164.6 N/mm^2
τ_c = 3.932 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 164.7 N/mm^2
S^* = 4541. mm^3

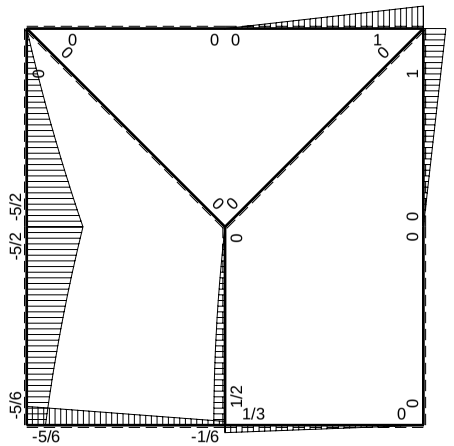

F
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2F
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G
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F
G
½F
I
F
5/2Fb
3F
H
E
F
Fb
F
I
H
13/6F
5/2Fb
2/3F
I
F
F
D
F
F
D
2/3F
5/6Fb
7/6F
F
1/2Fb
A
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C
A
B
7/6F
5/6Fb
2/3F
7/6F
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2/3F
B
C
7/6F
1/3Fb
1/3F
7/6F
1/3F


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-7/6
-7/6

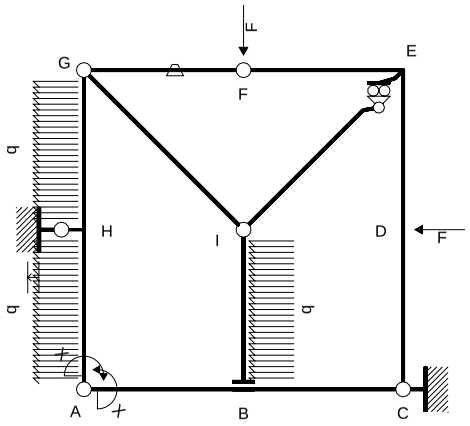

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13/6
1
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7/6
2/3
0
-1/3

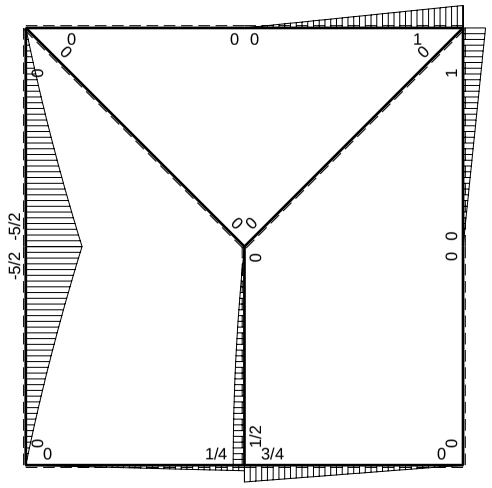
←□→ F

↑□↓ F

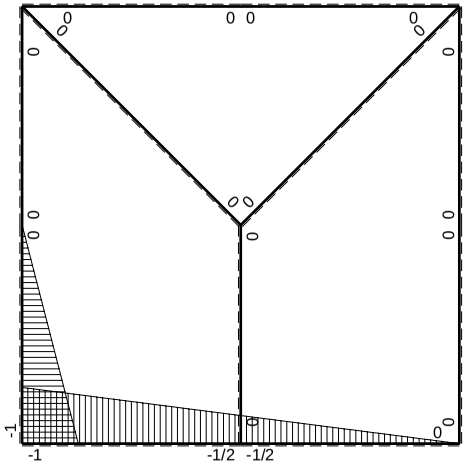

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-5/2
0 0
-5/6
1/2
1/3
0
0
-5/6
-1/6

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 265084 CI04.xxxx.070

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-3/4Fx$	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	-Fb/EJ	0	0	0	0+0	0
GF b	0	0	Fb/EJ	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b (-1/4\ x/b + 1/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/8\ x^2/b + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b (-1/8 + 1/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-1/8\ x + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b (-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-3/8\ b + 3/8\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-3/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b\ )\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

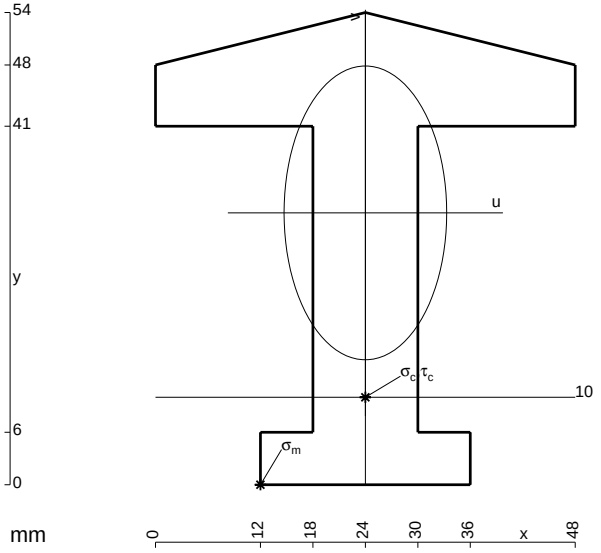
$L^{Xo}_{HA} = \int_o^b (5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (5/4\ b - b + 1/8\ b\ )\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b (2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

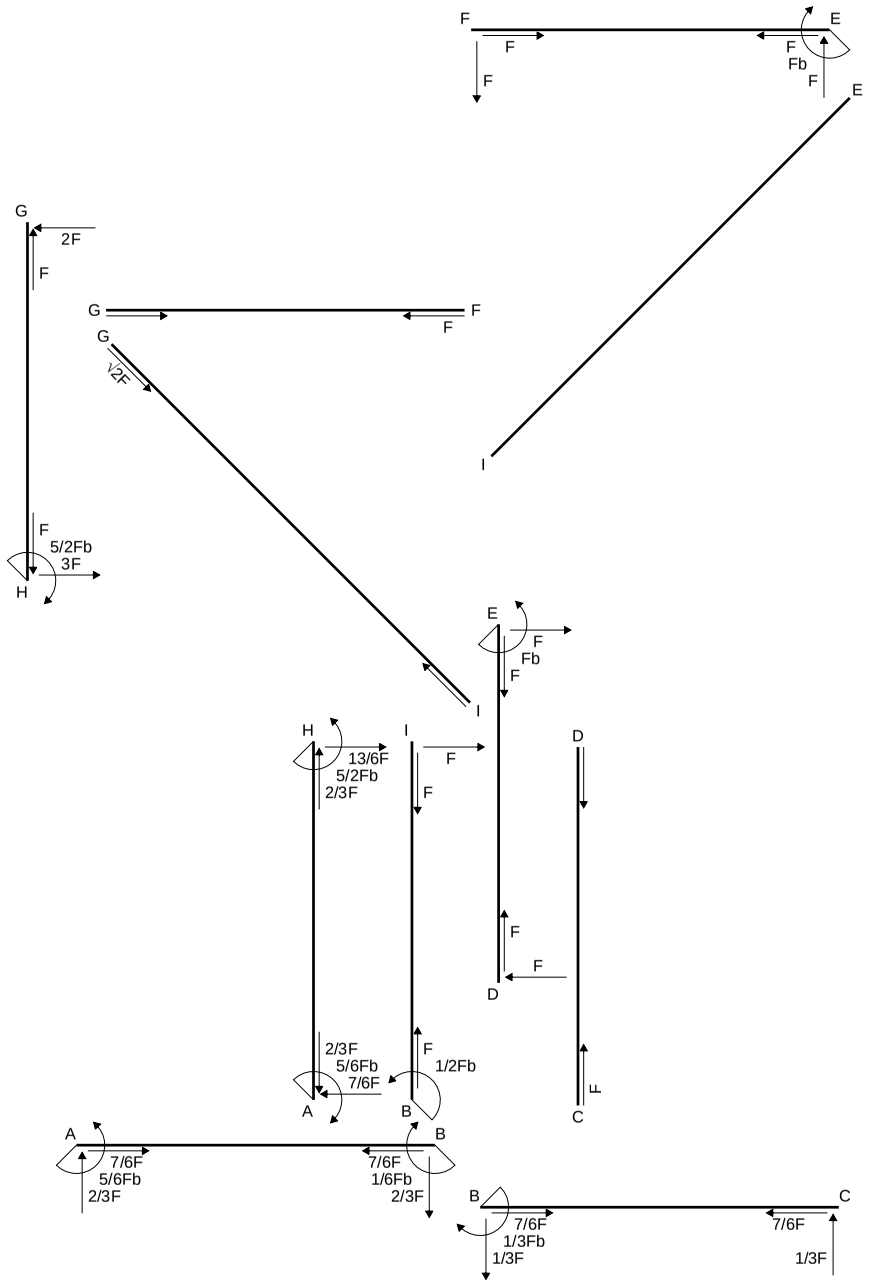
$= (\ b - 1/2\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

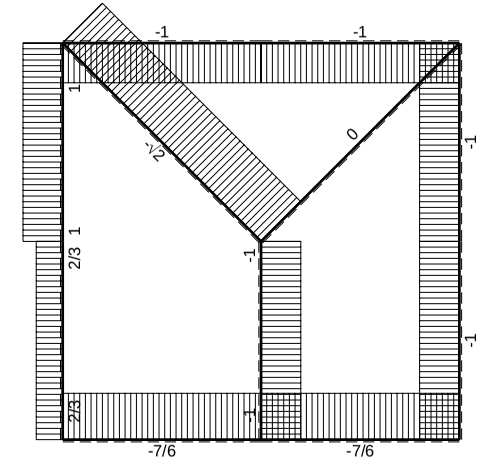
PROCEDIMENTO E RISULTATI 265084 CI04.xxxx.070

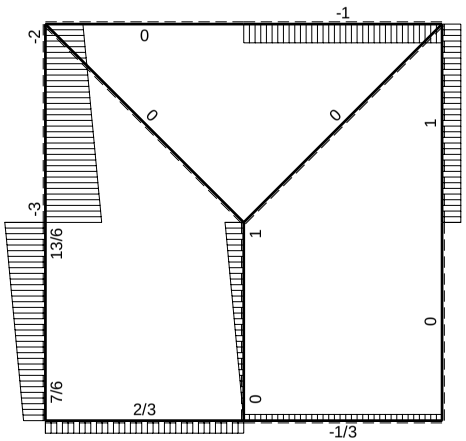


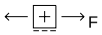
A = 1044. mm^2
J_u = 294700. mm^4
J_v = 90288. mm^4
y_g = 31.09 mm
N = 1520. N
T_y = -4560. N
M_x = -1900000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -31.09 mm
$\sigma_m = N/A - Mv/J_u$ = -199. N/mm^2
x_c = 24. mm
y_c = 10. mm
v_c = -21.09 mm
$\sigma_c = N/A - Mv/J_u$ = -134.5 N/mm^2
τ_c = 6.644 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 135. N/mm^2
S^* = 5153. mm^3

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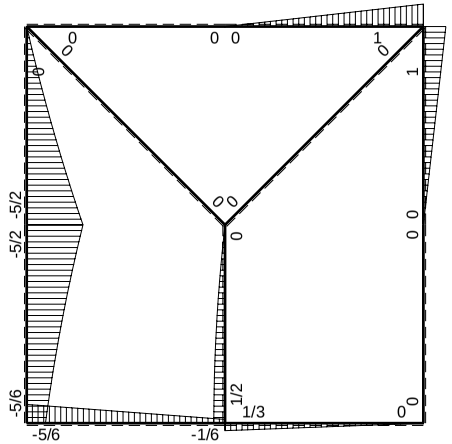

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2/3F
B
C
7/6F
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1/3F
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1/3F


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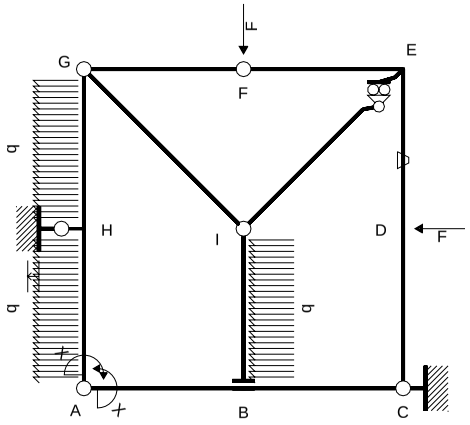

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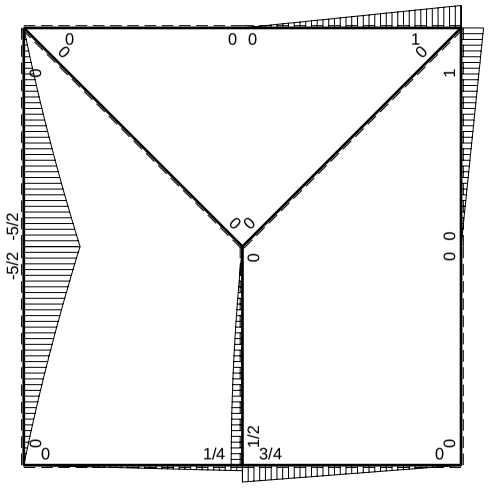

F


F

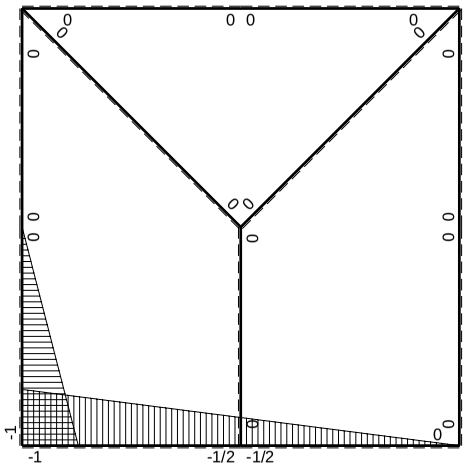

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-5/2
-5/2
0 0
-5/6
1/2
1/3
0
0
-5/6
-1/6


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 216391 CI04.xxxx.071

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PROCEDIMENTO E RISULTATI 216391 CI04.xxxx.071

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-Fb+Fx	Fb/EJ	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

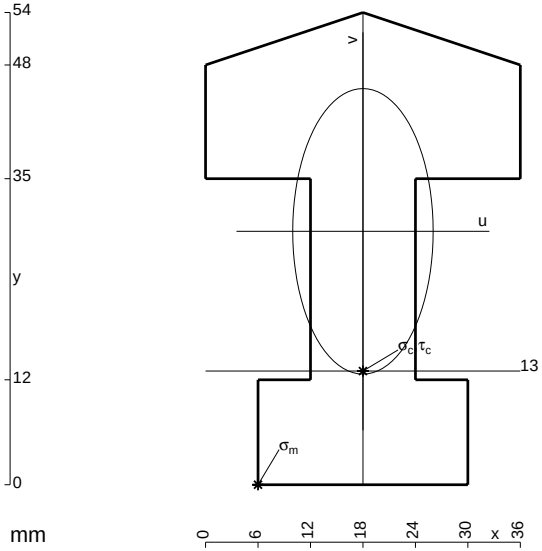
$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

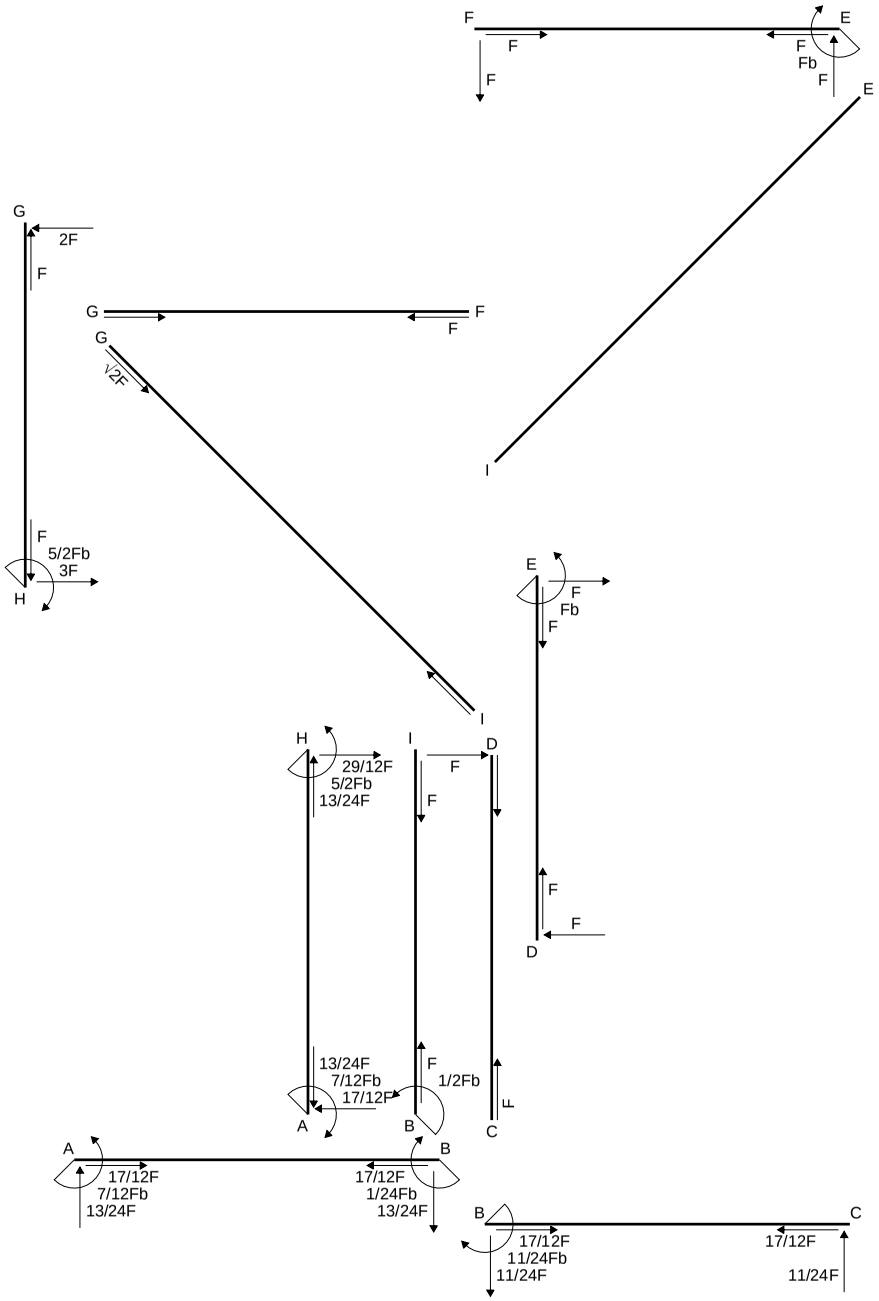
$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

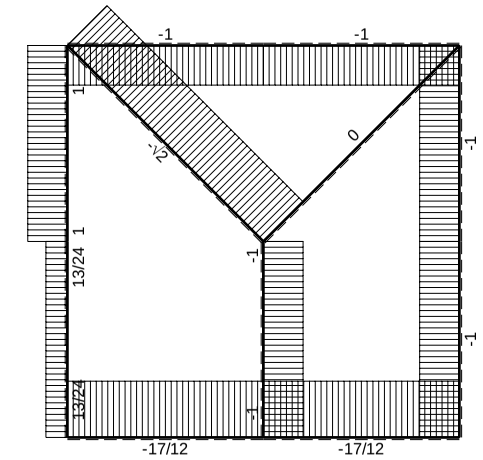
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

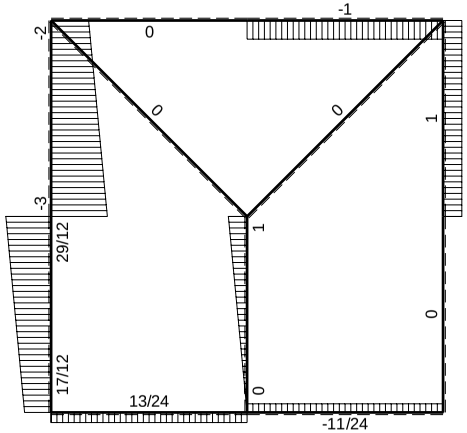
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$



A = 1140. mm^2
J_u = 303884. mm^4
J_v = 73512. mm^4
y_g = 28.98 mm
N = 1610. N
T_y = -4830. N
M_x = -2213750. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.98 mm
$\sigma_m = N/A - Mv/J_u$ = -209.7 N/mm^2
x_c = 18. mm
y_c = 13. mm
v_c = -15.98 mm
$\sigma_c = N/A - Mv/J_u$ = -115. N/mm^2
τ_c = 9.028 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 116.1 N/mm^2
S^* = 6816. mm^3

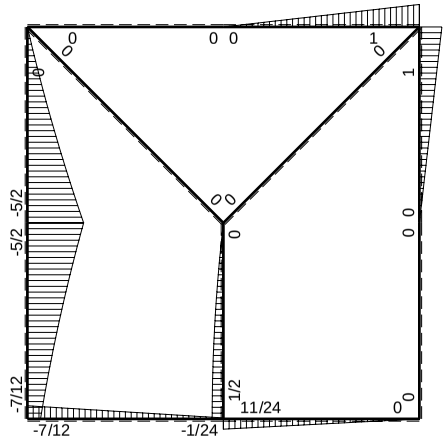

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5/2Fb
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1/24Fb
13/24F
B
17/12F
11/24Fb
11/24F
C
17/12F
11/24F


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-17/12
-17/12

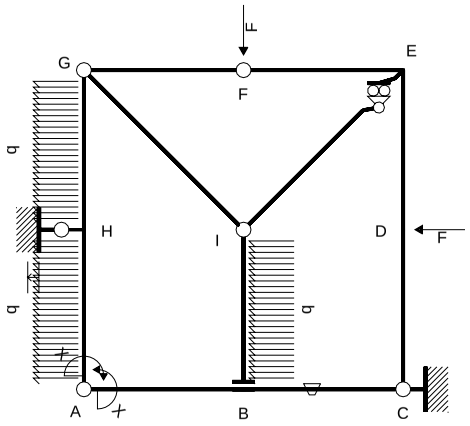

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1
0
17/12
13/24
0
-11/24

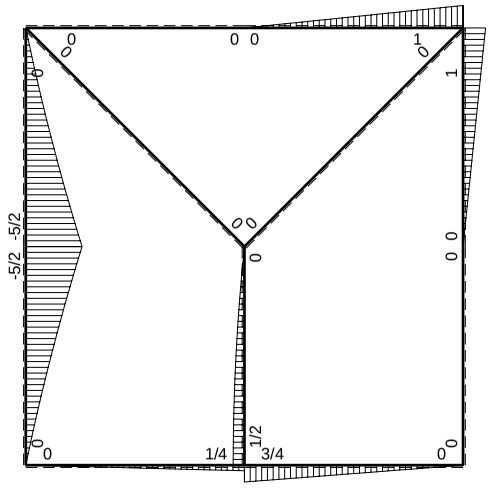
←□→ F

↑□↓ F

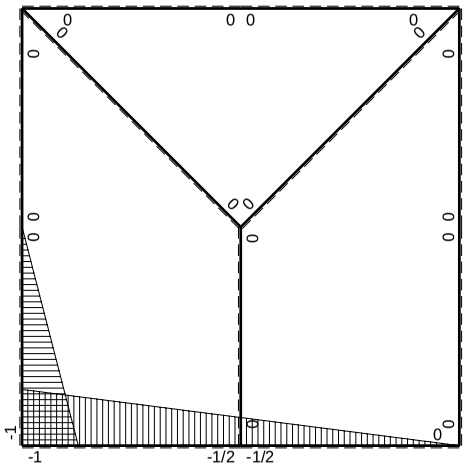

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-5/2
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-7/12
1/2
11/24
0
-7/12
-1/24

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 939077 CI04.xxxx.072

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	-Fb/EJ	$-3/8Fb+3/4Fx-3/8Fx^2/b$	$1/2Fb/EJ-1/2Fx/EJ$	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	Fb/EJ	$-3/8Fx^2/b$	1/2Fx/EJ	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/12Fb	

PROCEDIMENTO E RISULTATI 939077 CI04.xxxx.072

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1/2 - 1/2\ x/b\ \right)\ \theta\ \ dx$

$= \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x - 1/4\ x^2/b\right]_o^b\ \theta$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2\ x/b\ \right)\ \theta\ \ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/4\ x^2/b\ \right]_o^b\ \theta$

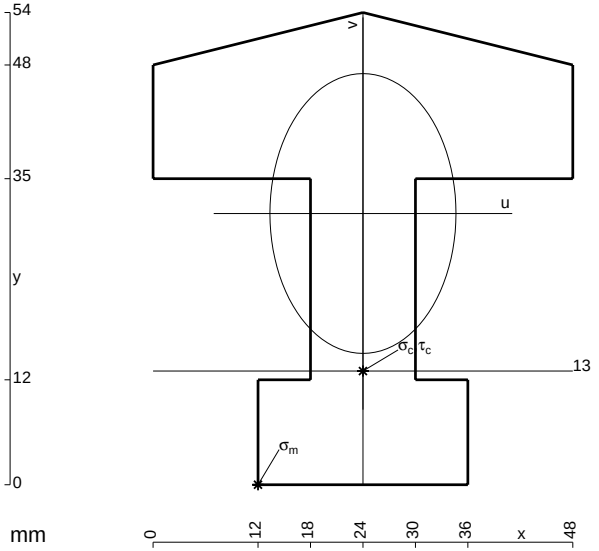
$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/4\ b\ \right)\ \theta\ \ = 1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

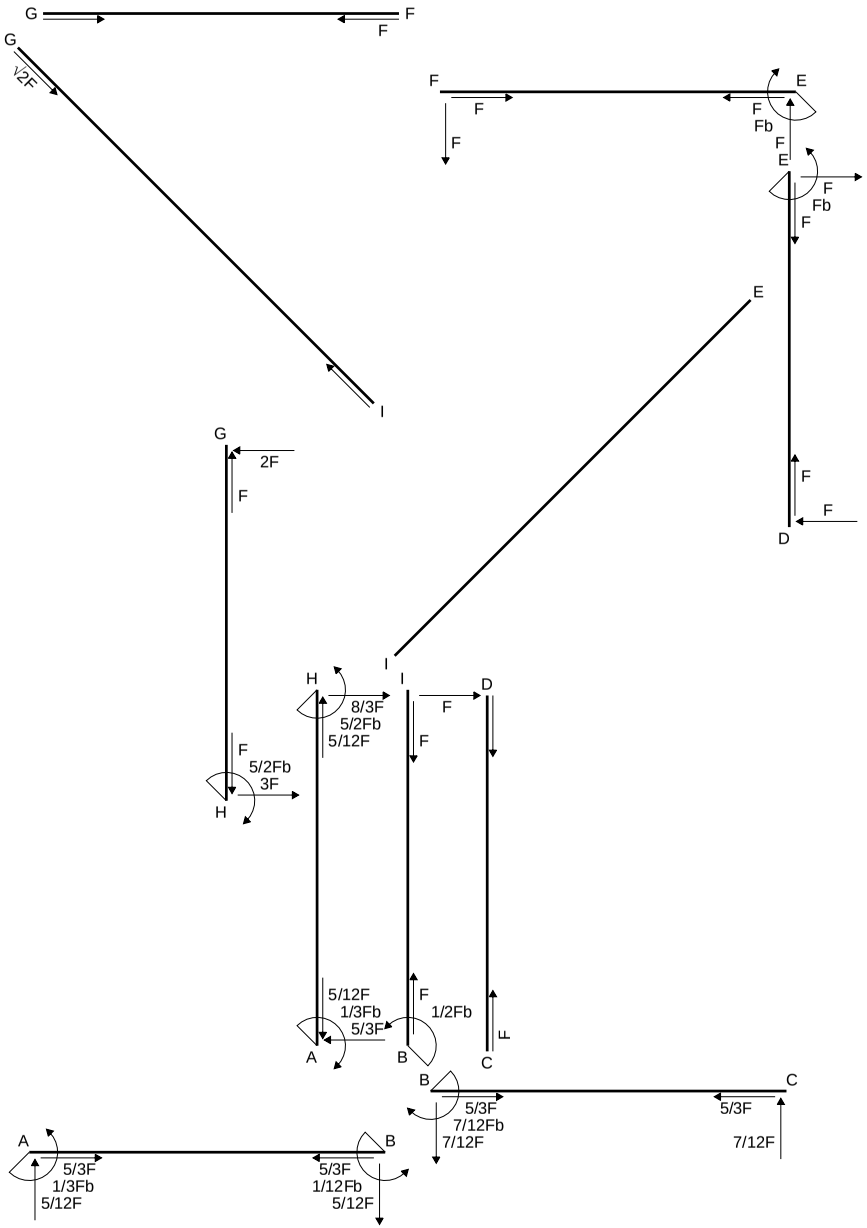
$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

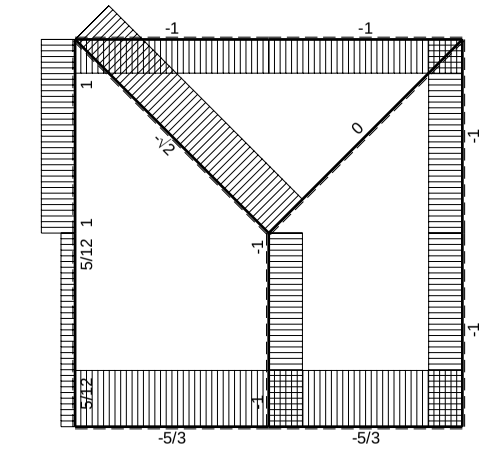
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

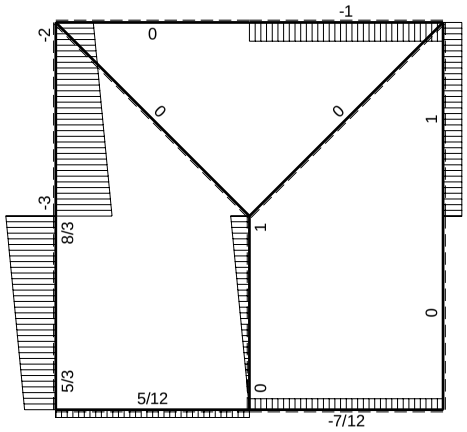
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

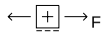


A = 1332. mm^2
J_u = 341004. mm^4
J_v = 150768. mm^4
y_g = 31.01 mm
N = 1620. N
T_y = -4860. N
M_x = -2430000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -31.01 mm
$\sigma_m = N/A - Mv/J_u$ = -219.8 N/mm^2
x_c = 24. mm
y_c = 13. mm
v_c = -18.01 mm
$\sigma_c = N/A - Mv/J_u$ = -127.1 N/mm^2
τ_c = 8.82 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 128.1 N/mm^2
S^* = 7426. mm^3

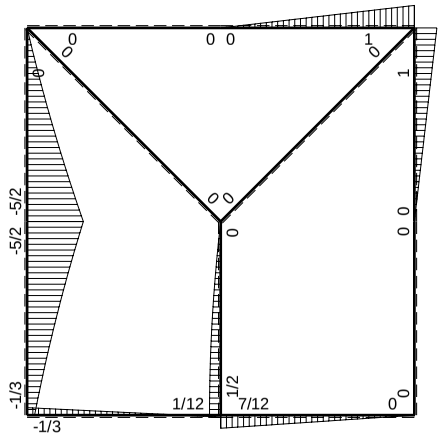

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8/3F
5/2Fb
5/12F
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F
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3F
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F
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B
C
B
C
5/3F
7/12Fb
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5/3F
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5/12F
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1/12Fb
5/12F


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-5/3
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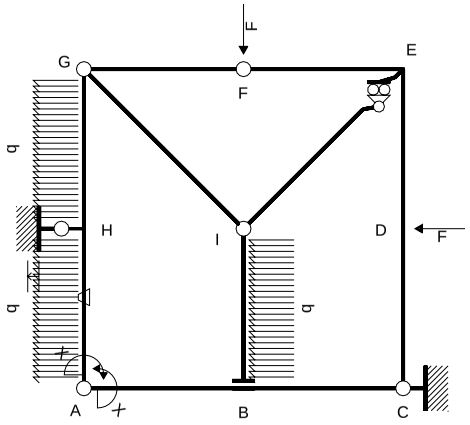

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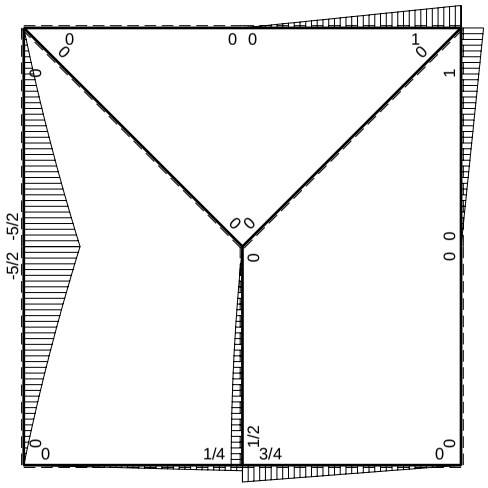

F


F

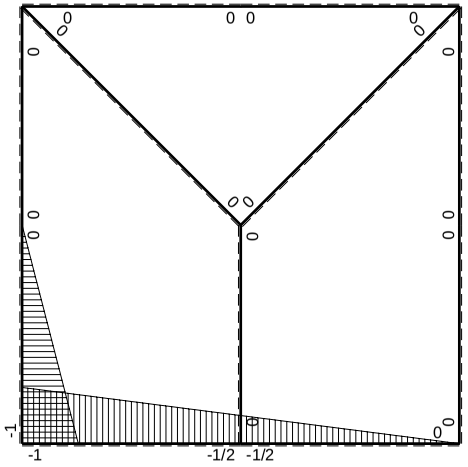

0
0 0
1
0
0
1
0 0
-5/2
-5/2
0
0 0
-1/3
1/12
1/2
7/12
0
0
-1/3


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264989 CI04.xxxx.073

@ Adolfo Zavelani Rossi, Politecnico di Milano, vers.27.03.13 16.04.26

PROCEDIMENTO E RISULTATI 264989 CI04.xxxx.073

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	-Fb/EJ	$5/2Fx-3Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(3/8+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	Fb/EJ	$2Fx-3/2Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/3Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/3Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\ \right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\ \theta\ \ dx$

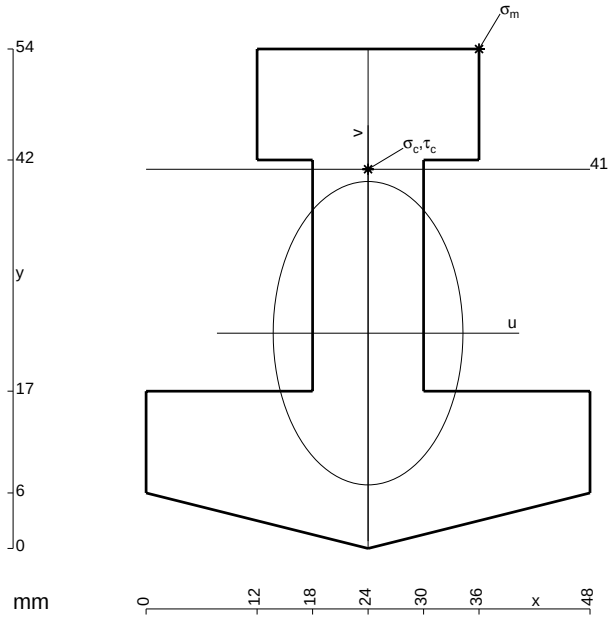
$= \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b\ \theta$

$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b\ \right)\ \theta\ \ = 7/8\ \ Fb^2/EJ$

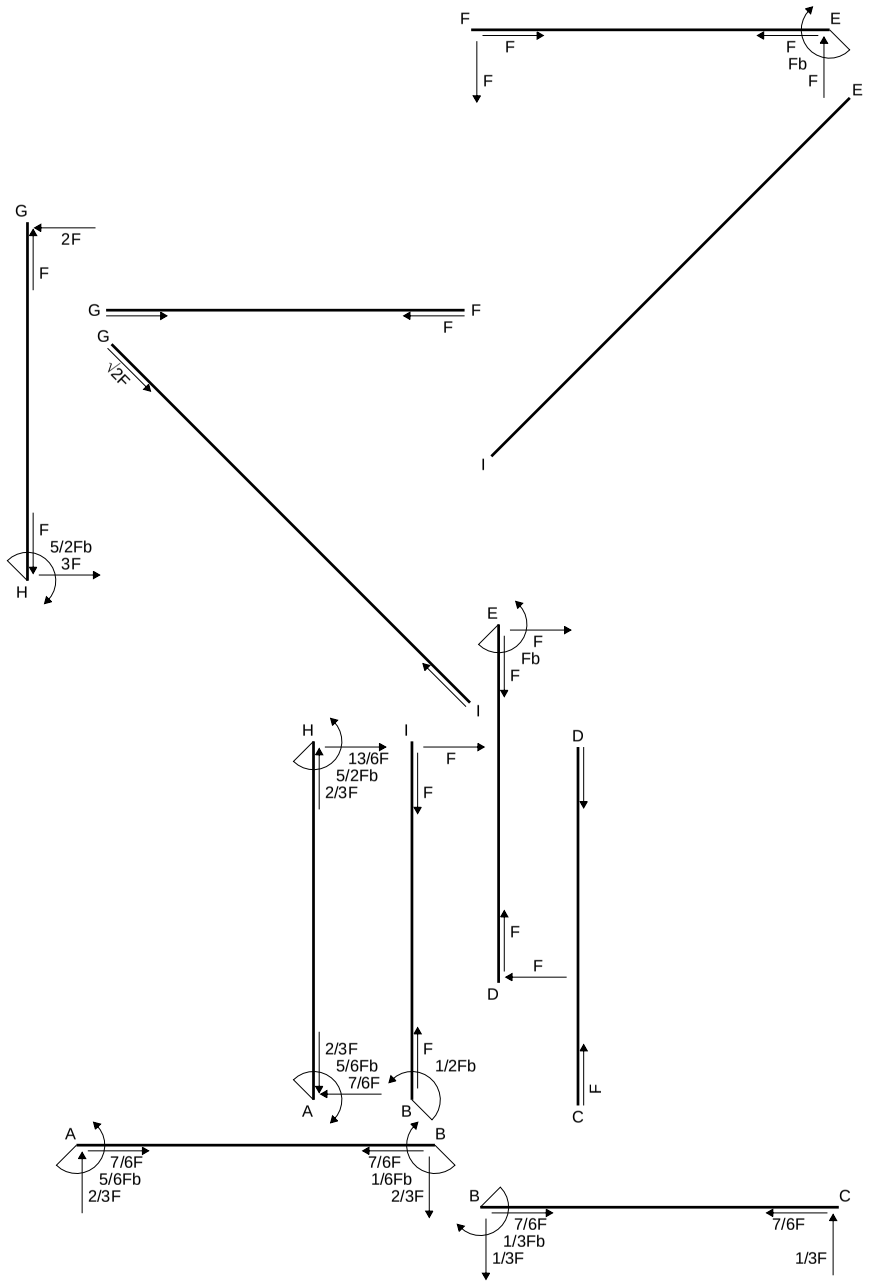
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\ \theta\ \ dx$

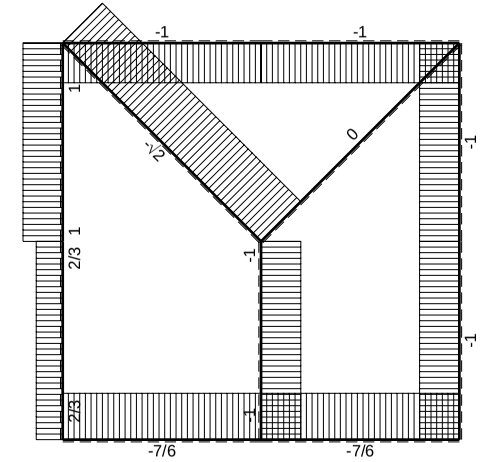
$= \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b\ \theta$

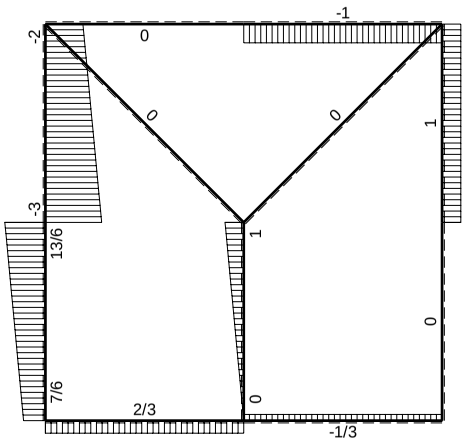
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\ \theta\ \ = 7/8\ \ Fb^2/EJ$



A = 1260. mm^2
J_u = 339087. mm^4
J_v = 132624. mm^4
y_g = 23.27 mm
N = 1550. N
T_y = -4650. N
M_x = -2518750. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 30.73 mm
$\sigma_m = N/A - Mv/J_u$ = 229.5 N/mm^2
x_c = 24. mm
y_c = 41. mm
v_c = 17.73 mm
$\sigma_c = N/A - Mv/J_u$ = 132.9 N/mm^2
τ_c = 8.389 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 133.7 N/mm^2
S^* = 7341. mm^3

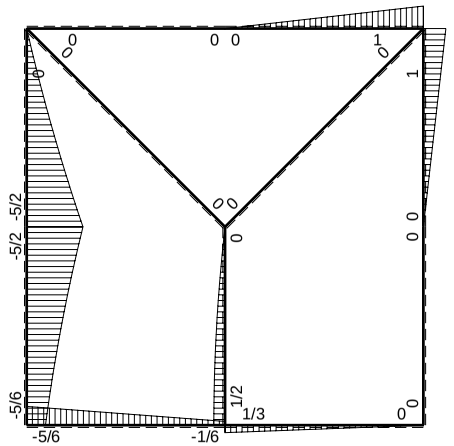

F
F
F
E
F
Fb
F
E
G
2F
F
G
F
F
G
½F
I
F
5/2Fb
3F
H
I
E
F
Fb
F
H
13/6F
5/2Fb
2/3F
I
F
F
D
F
F
D
2/3F
5/6Fb
7/6F
A
F
1/2Fb
B
F
C
A
7/6F
5/6Fb
2/3F
B
7/6F
1/6Fb
2/3F
B
7/6F
1/3Fb
1/3F
C
7/6F
1/3F


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1
-1
-7/6
-7/6

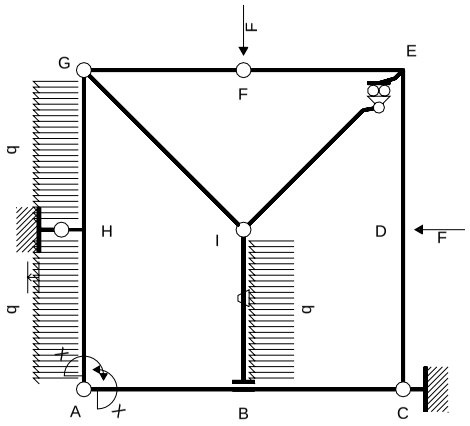

-2
0
-1
0
0
1
-3
13/6
1
0
7/6
2/3
0
-1/3

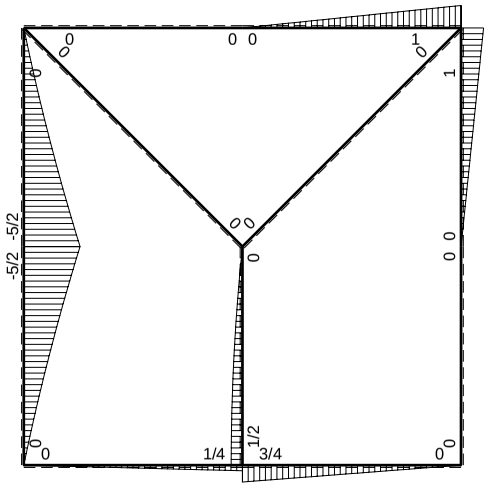
←□→ F

↑□↓ F

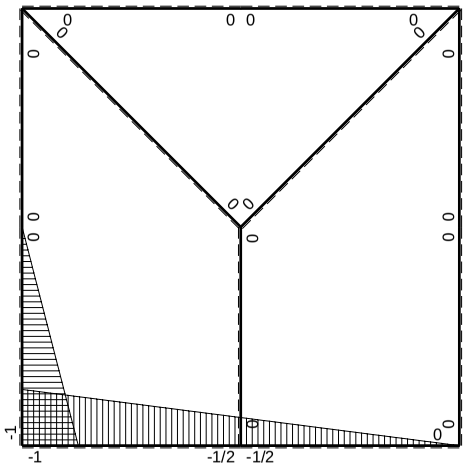

0
0 0
1
0
0
1
0
0
0
0
-5/2
-5/2
0 0
-5/6
1/2
1/3
0
0
-5/6
-1/6

□ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 274704 CI04.xxxx.074

@ Adolfo Zavelani Rossi, Politecnico di Milano, vers.27.03.13 16.04.26

PROCEDIMENTO E RISULTATI 274704 CI04.xxxx.074

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	-1/4Fx+1/8Fx^2/b	0	1-x/b+1/4x^2/b^2	(-1/12+0)Fb^2/EJ	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb+1/4Fx	0	-1/8Fb+1/8Fx^2/b	0	1/4+1/2x/b+1/4x^2/b^2		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	-3/8Fb+3/4Fx-3/8Fx^2/b	0	1/4-1/2x/b+1/4x^2/b^2	(-1/8+0)Fb^2/EJ	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	-3/8Fx^2/b	0	1/4x^2/b^2		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-2Fx-1/2qx^2	0	0	0	0	0+0	0
HG b	0	5/2Fb-3Fx+1/2qx^2	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	Fx-1/2qx^2	-Fb/EJ	0	0	0	0+0	0
BI b	0	-1/2Fb+1/2qx^2	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	-5/2Fb+3Fx-1/2qx^2	0	5/2Fx-3Fx^2/b+1/2qx^3/b	0	x^2/b^2	(3/8+0)Fb^2/EJ	1/3Xb/EJ
AH b	1-x/b	2Fx+1/2qx^2	0	2Fx-3/2Fx^2/b-1/2qx^3/b	0	1-2x/b+x^2/b^2		
H	cedimento nodo $-H_{1H}u_H$						-Fb^2/EJ	
	totali						-5/6Fb^2/EJ	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

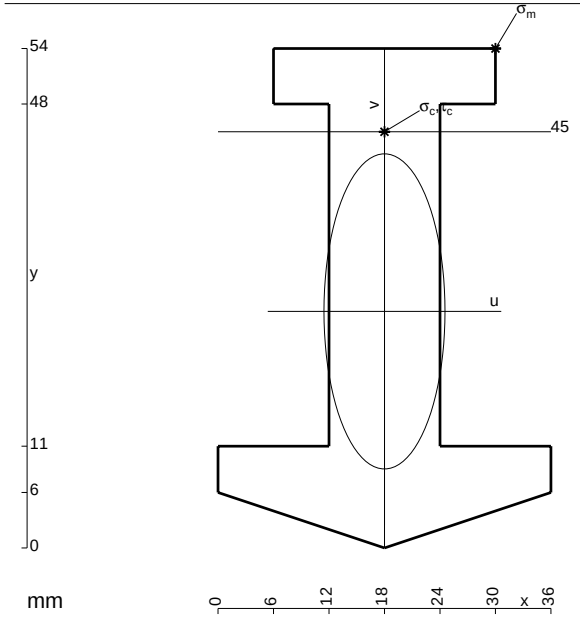
$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

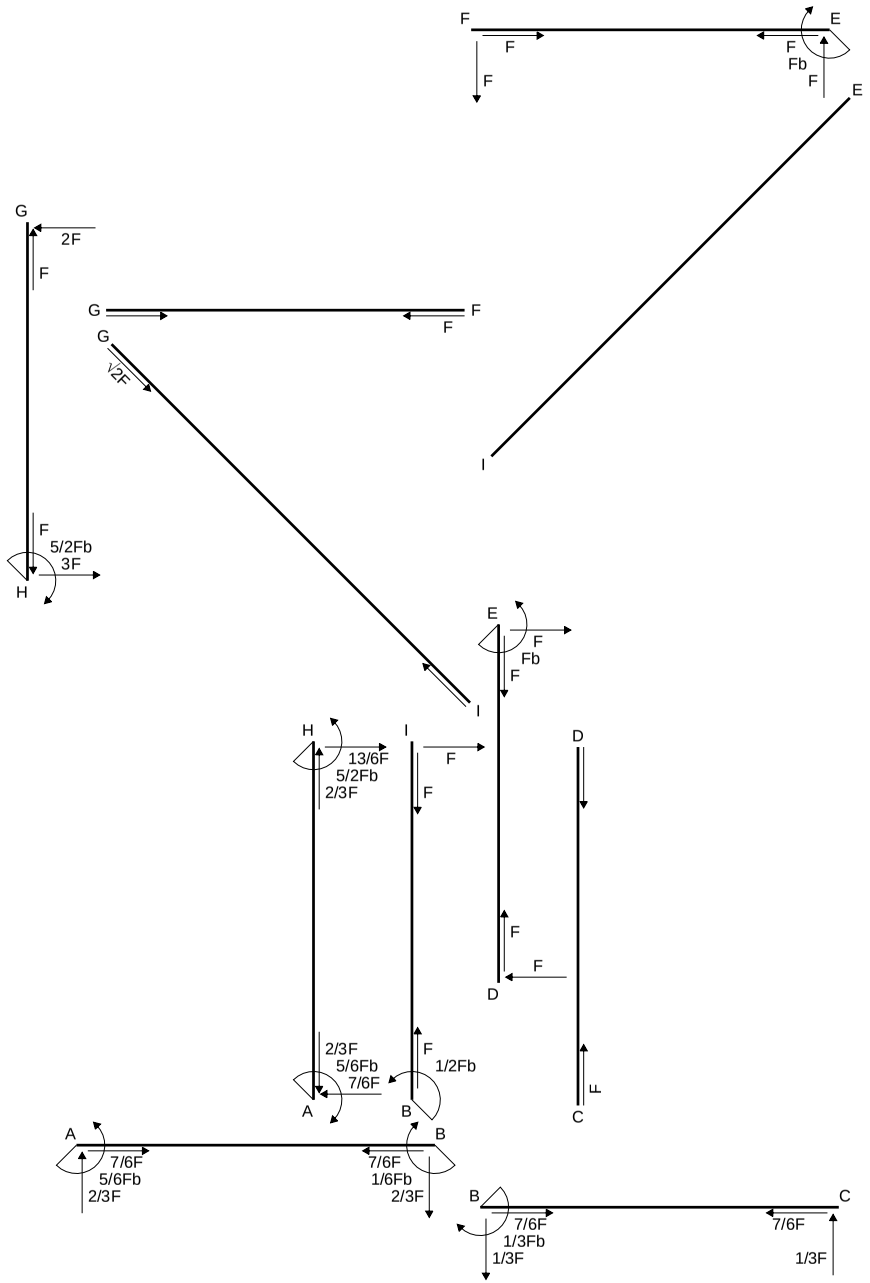
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

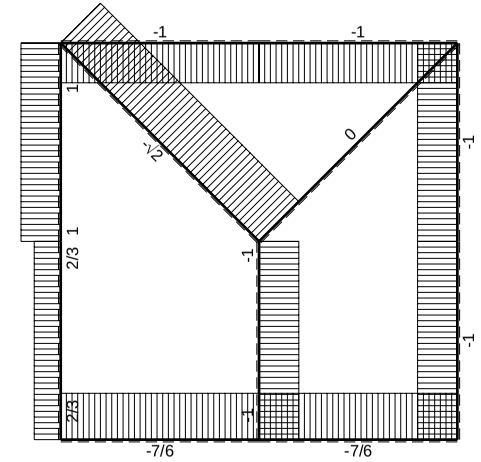
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

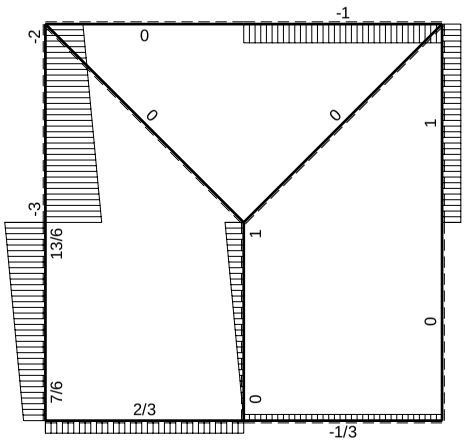
PROCEDIMENTO E RISULTATI 274704 CI04.xxxx.074



A = 876. mm^2
J_u = 254354. mm^4
J_v = 37512. mm^4
y_g = 25.58 mm
N = 1220. N
T_y = -3660. N
M_x = -2135000. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 28.42 mm
$\sigma_m = N/A - Mv/J_u$ = 240. N/mm^2
x_c = 18. mm
y_c = 45. mm
v_c = 19.42 mm
$\sigma_c = N/A - Mv/J_u$ = 164.4 N/mm^2
τ_c = 5.293 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 164.7 N/mm^2
S^* = 4414. mm^3

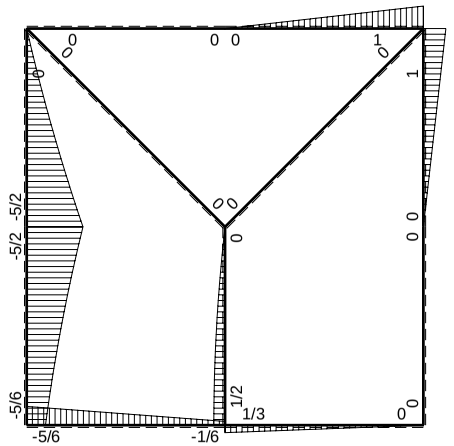

F
F
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F
Fb
F
E
F
F
G
2F
F
G
F
F
G
½F
I
F
5/2Fb
3F
H
I
E
F
Fb
F
H
13/6F
5/2Fb
2/3F
I
F
F
D
F
F
D
2/3F
5/6Fb
7/6F
F
1/2Fb
A
B
F
C
A
7/6F
5/6Fb
2/3F
B
7/6F
1/6Fb
2/3F
B
C
7/6F
1/3Fb
1/3F
7/6F
1/3F


-1
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1
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0
-1
-1
2/3 1
-1
2/3
1
-7/6
-7/6

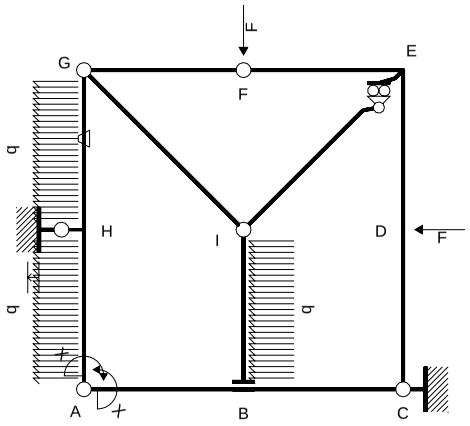

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-2
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0
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1
-3
13/6
1
0
7/6
2/3
0
-1/3

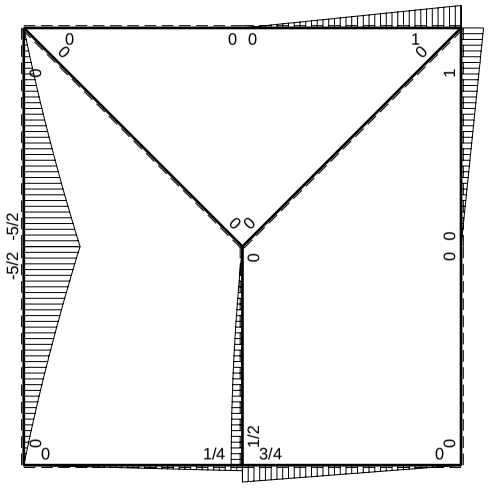
←□→ F

↑□↓ F

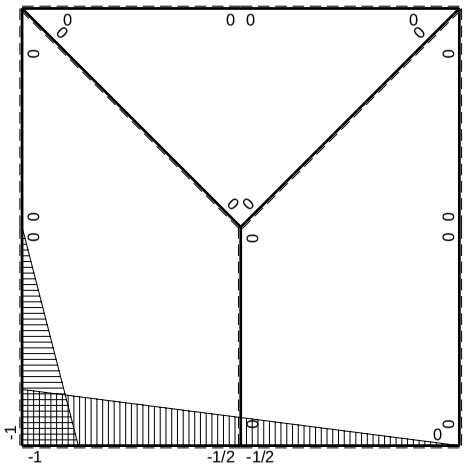

0
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0
0
-5/2
-5/2
0 0
-5/6
1/2
1/3
0
0
-5/6
-1/6

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 263877 CI04.xxxx.075

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

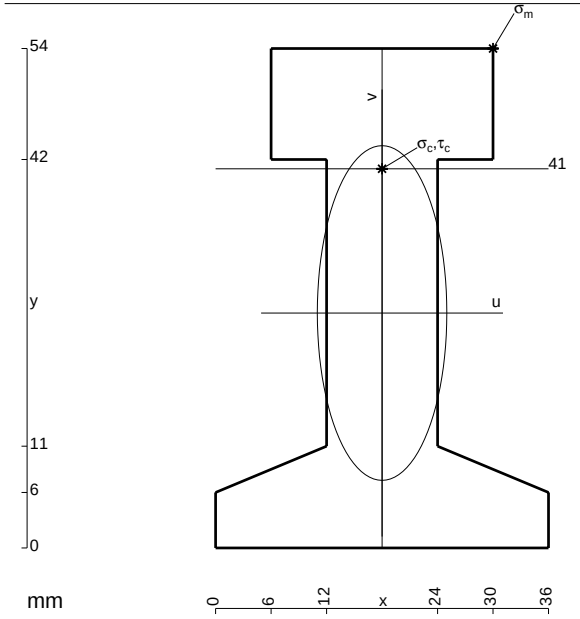
$$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$

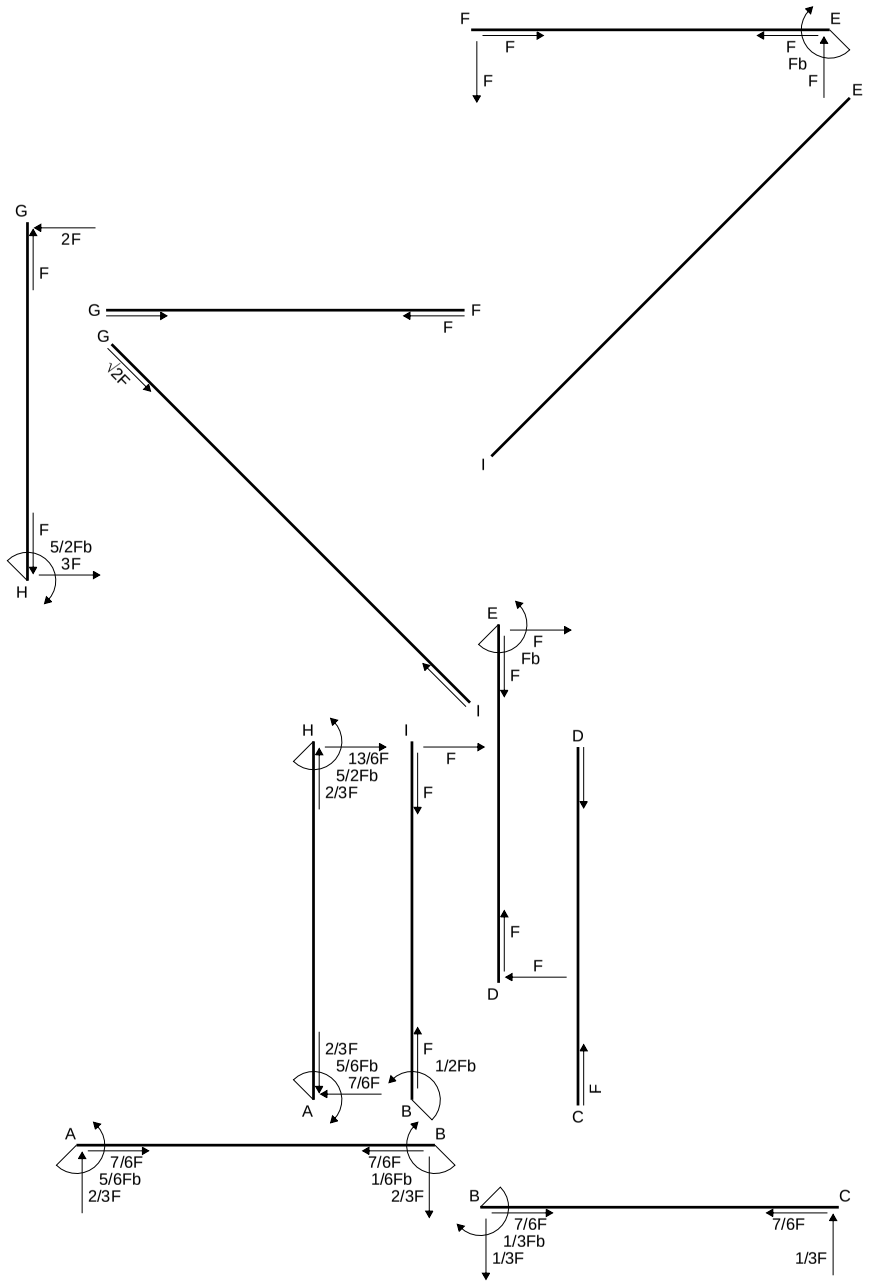
$$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

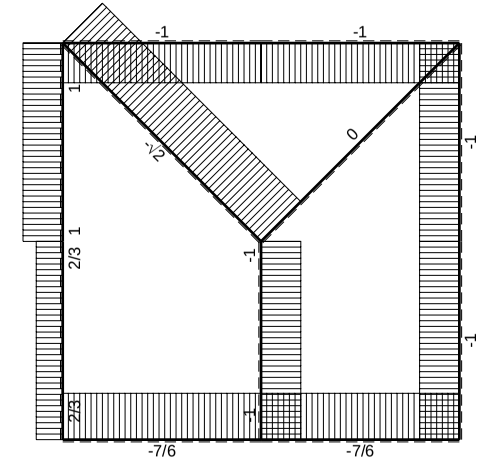
$$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$

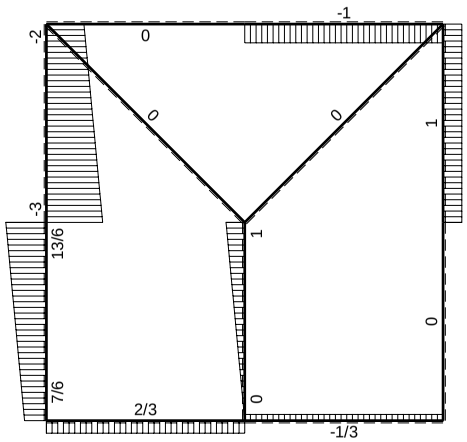
PROCEDIMENTO E RISULTATI 263877 CI04.xxxx.075



A = 996. mm^2
J_u = 326037. mm^4
J_v = 48816. mm^4
y_g = 25.4 mm
N = 1200. N
T_y = -3600. N
M_x = -2250000. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 28.6 mm
$\sigma_m = N/A - Mv/J_u$ = 198.6 N/mm^2
x_c = 18. mm
y_c = 41. mm
v_c = 15.6 mm
$\sigma_c = N/A - Mv/J_u$ = 108.8 N/mm^2
τ_c = 6.166 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 109.4 N/mm^2
S^* = 6702. mm^3

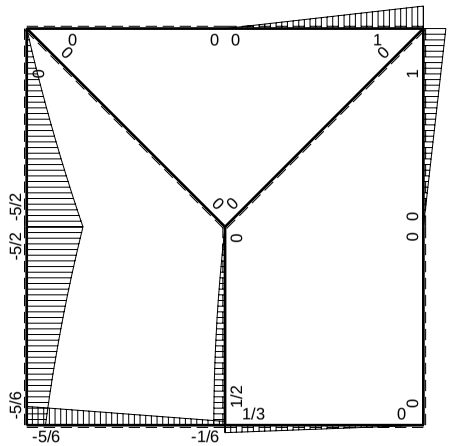

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F
Fb
F
I
H
13/6F
5/2Fb
2/3F
I
F
D
F
F
D
2/3F
5/6Fb
7/6F
F
1/2Fb
A
B
F
C
A
B
7/6F
5/6Fb
2/3F
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2/3F
B
C
7/6F
1/3Fb
1/3F
7/6F
1/3F


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-½
0
-1
2/3 1
-1
-1
2/3
1
-7/6
-7/6

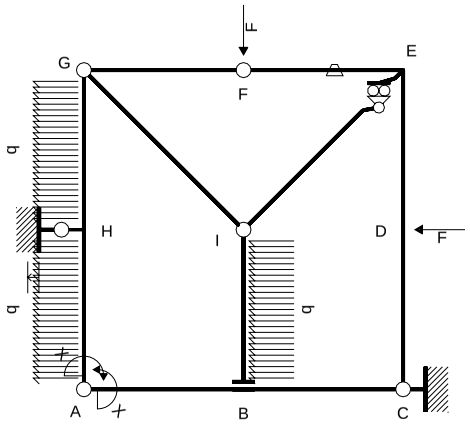

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0
7/6
2/3
0
-1/3

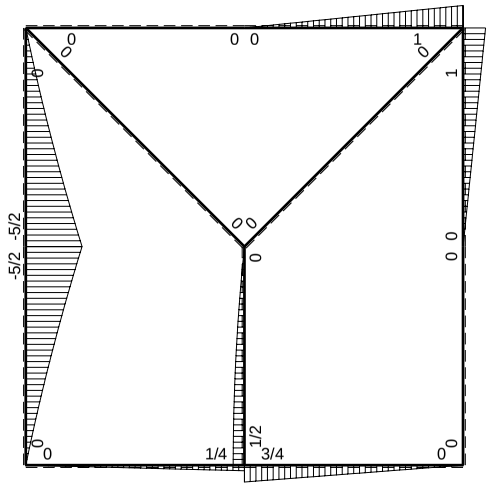
←□→ F

↑□↓ F

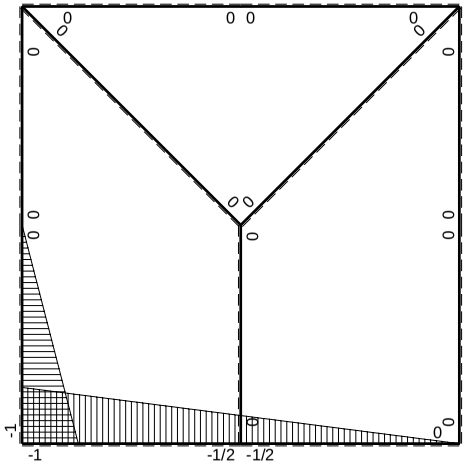

0
0 0
1
0
0
1
0
0
0
-5/2
-5/2
0 0
-5/6
1/2
1/3
0
0
-5/6
-1/6

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 265708 CI04.xxxx.076

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PROCEDIMENTO E RISULTATI 265708 CI04.xxxx.076

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	-Fb/EJ	0	0	0	0+0	0
FE b	0	-Fx	Fb/EJ	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$
$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

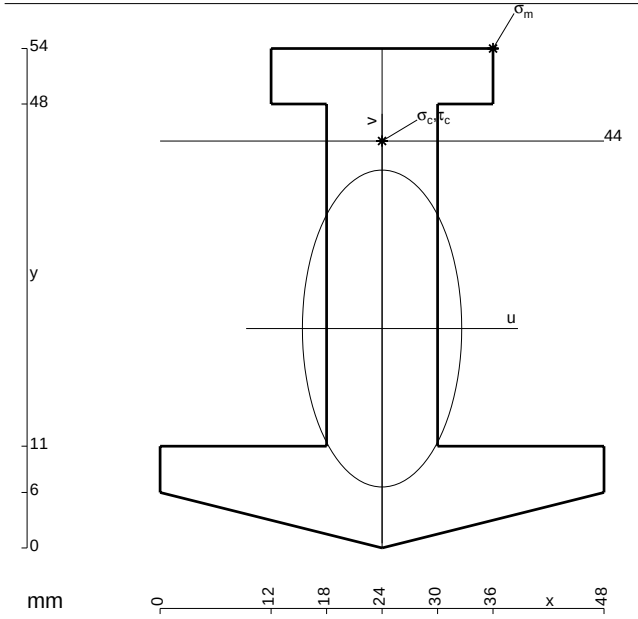
$$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

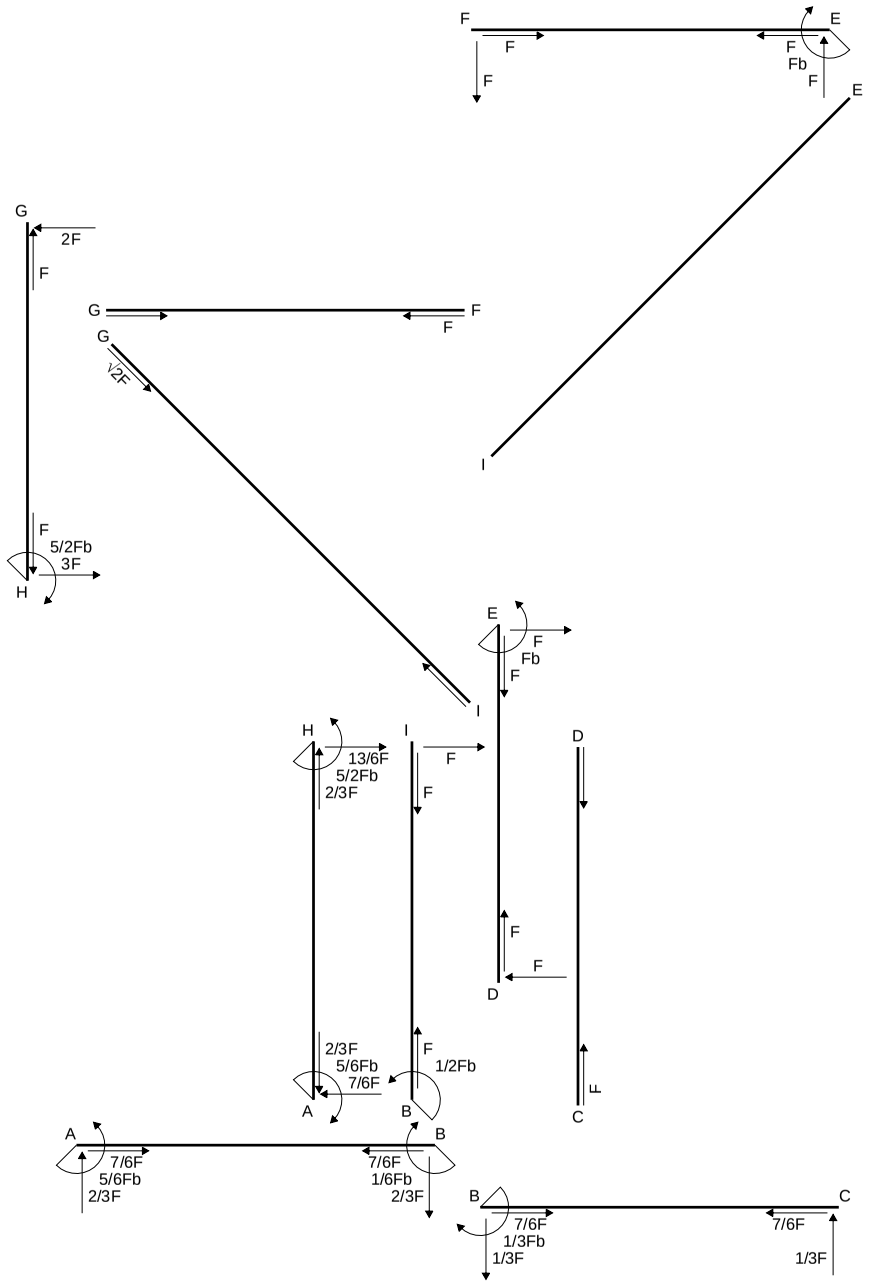
$$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$

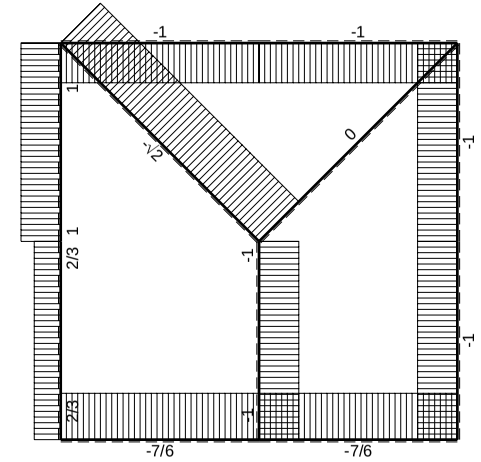
$$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$
$$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$

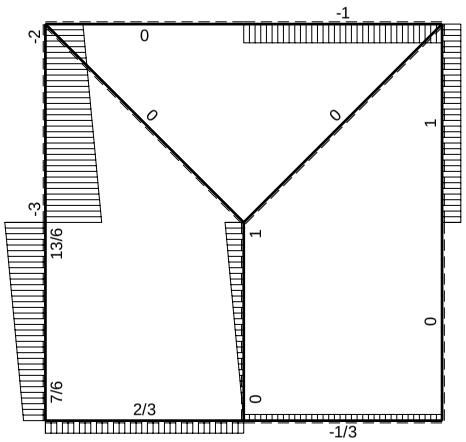
PROCEDIMENTO E RISULTATI 265708 CI04.xxxx.076



A = 972. mm^2
J_u = 285465. mm^4
J_v = 72144. mm^4
y_g = 23.72 mm
N = 980. N
T_y = -2940. N
M_x = -1960000. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 30.28 mm
$\sigma_m = N/A - Mv/J_u$ = 208.9 N/mm^2
x_c = 24. mm
y_c = 44. mm
v_c = 20.28 mm
$\sigma_c = N/A - Mv/J_u$ = 140.2 N/mm^2
τ_c = 4.289 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 140.4 N/mm^2
S^* = 4997. mm^3

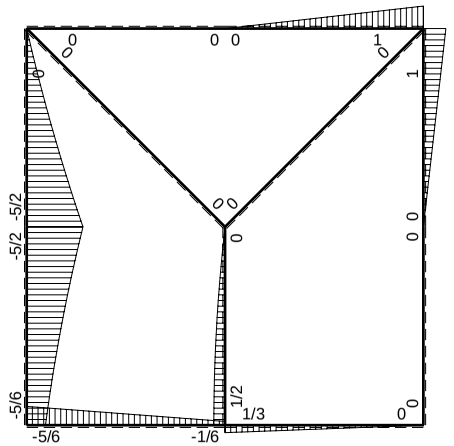

F
E
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F
Fb
F
E
G
2F
F
G
F
F
G
½F
I
F
5/2Fb
3F
H
E
F
Fb
F
I
H
13/6F
5/2Fb
2/3F
I
F
F
D
F
F
D
2/3F
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F
1/2Fb
A
B
F
C
A
B
7/6F
5/6Fb
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1/6Fb
2/3F
B
C
7/6F
1/3Fb
1/3F
7/6F
1/3F


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-1
1
½
0
-1
2/3 1
-1
-1
2/3
1
-7/6
-7/6

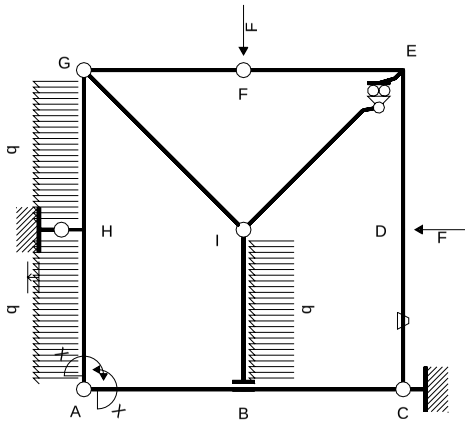

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0
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13/6
1
0
7/6
2/3
0
-1/3

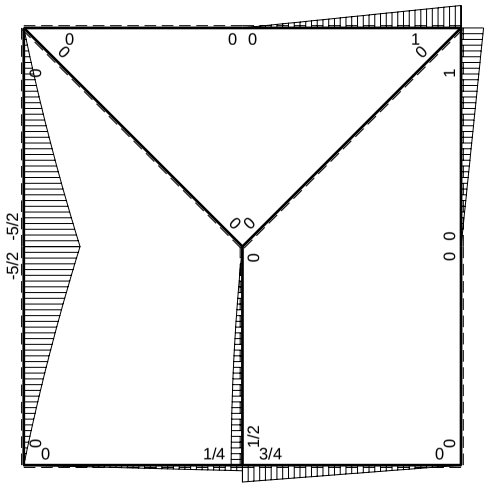
←□→ F

↑□↓ F

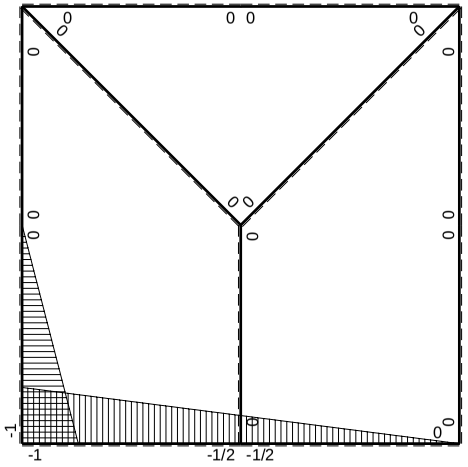

0
0 0
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0
0
-5/2 -5/2
0 0
-5/6
1/2
1/3
0
0
-5/6
-1/6

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 265715 CI04.xxxx.077

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	-Fb/EJ	0	0	0	0+0	0
DC b	0	0	Fb/EJ	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/6Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\ \right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

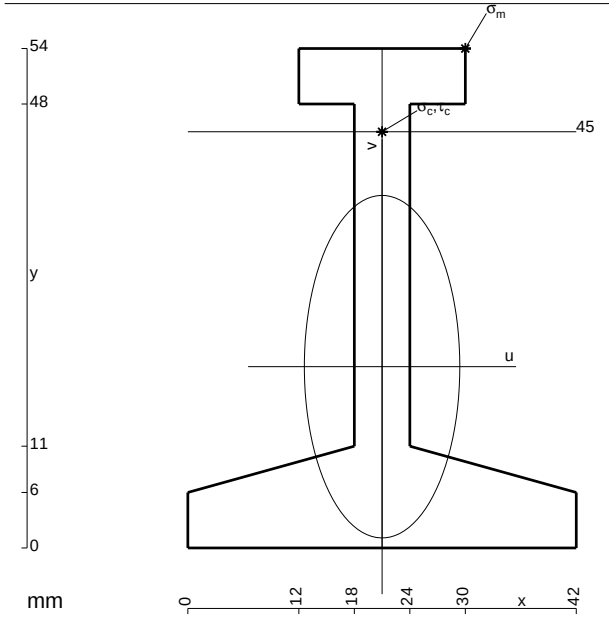
$$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$

$$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

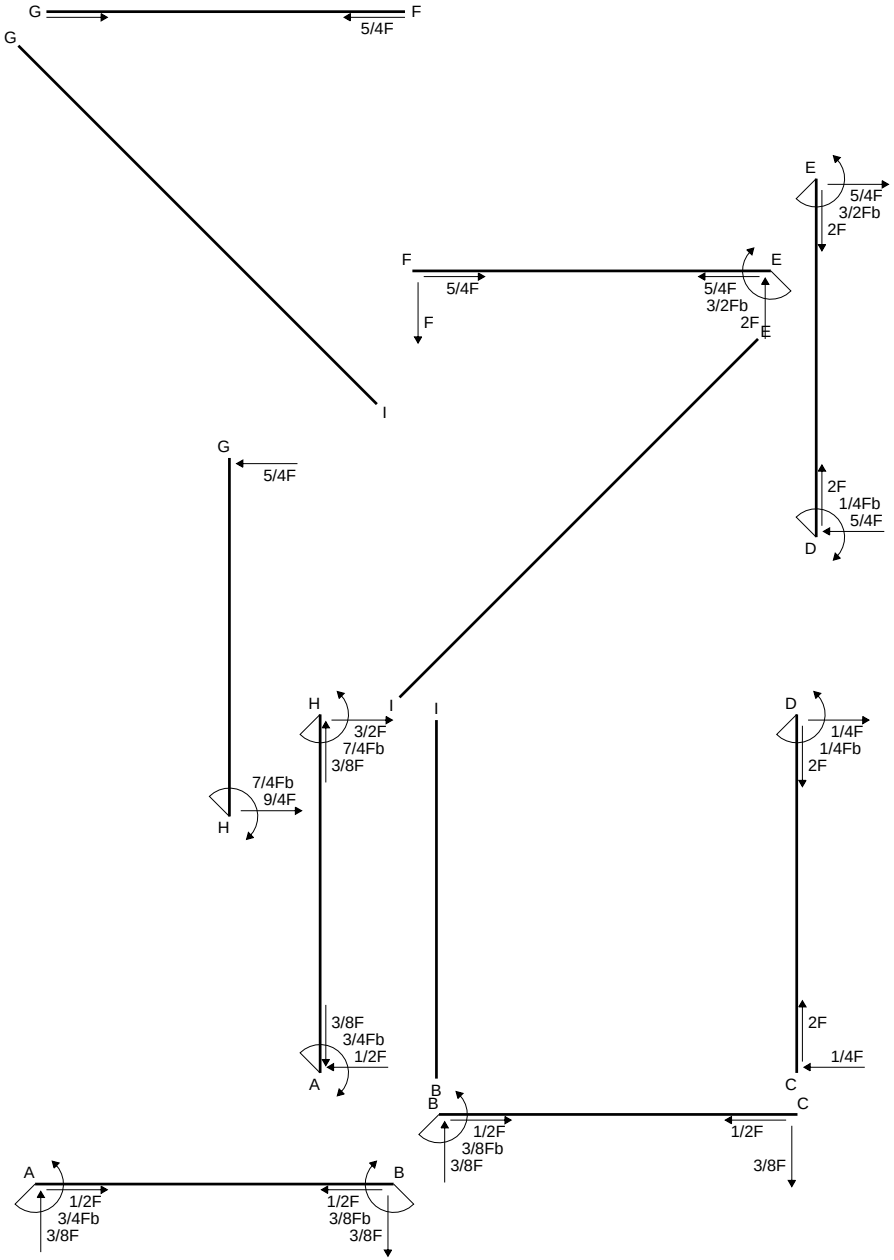
$$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$

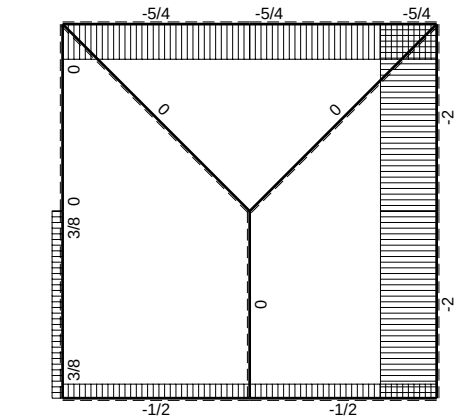
PROCEDIMENTO E RISULTATI 265715 CI04.xxxx.077

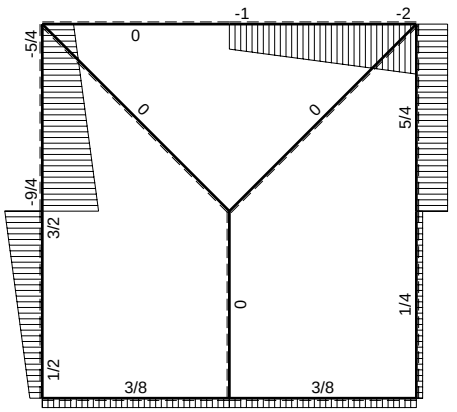


A = 702. mm^2
J_u = 240790. mm^4
J_v = 49626. mm^4
y_g = 19.6 mm
N = 720. N
T_y = -2160. N
M_x = -1530000. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 9. mm
v_m = 34.4 mm
$\sigma_m = N/A - Mv/J_u$ = 219.6 N/mm^2
x_c = 21. mm
y_c = 45. mm
v_c = 25.4 mm
$\sigma_c = N/A - Mv/J_u$ = 162.4 N/mm^2
τ_c = 5.794 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 162.7 N/mm^2
S^* = 3876. mm^3

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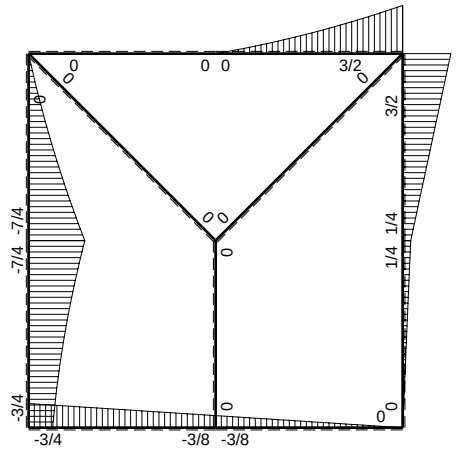

G
F
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G
I
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5/4F
3/2Fb
2F
F
5/4F
F
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5/4F
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2F
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2F
1/4Fb
5/4F
D
G
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H
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3/2F
7/4Fb
3/8F
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3/4Fb
3/8F
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3/8F


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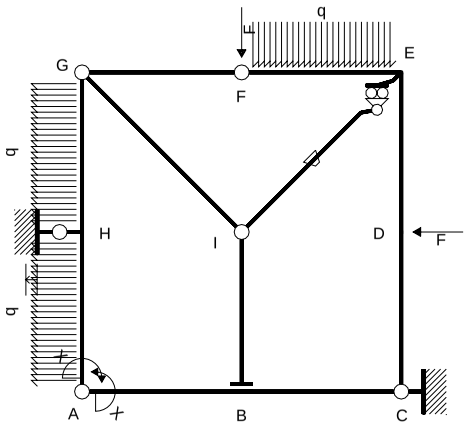

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3/8
3/8

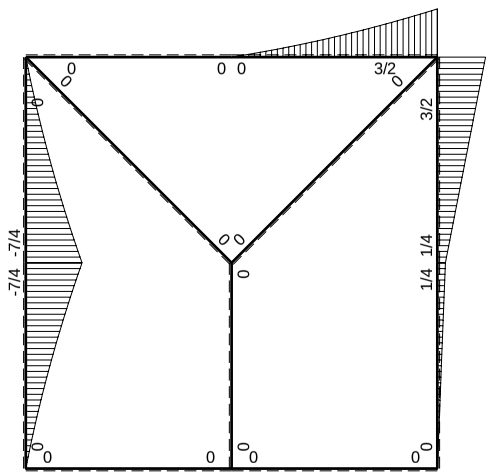
F

F

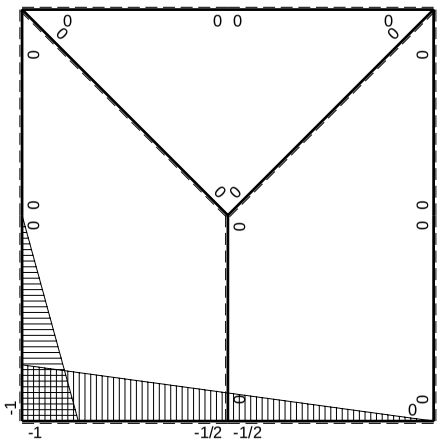

0
0 0
3/2
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3/2
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-7/4
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1/4
1/4
-7/4
0
0
0
0
-3/4
-3/8
-3/8
-3/4

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 216487 CI04.xxxx.078

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PROCEDIMENTO E RISULTATI 216487 CI04.xxxx.078

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

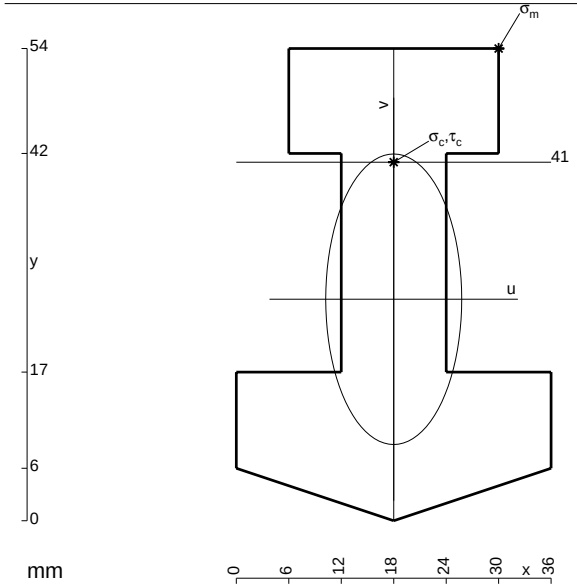
$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

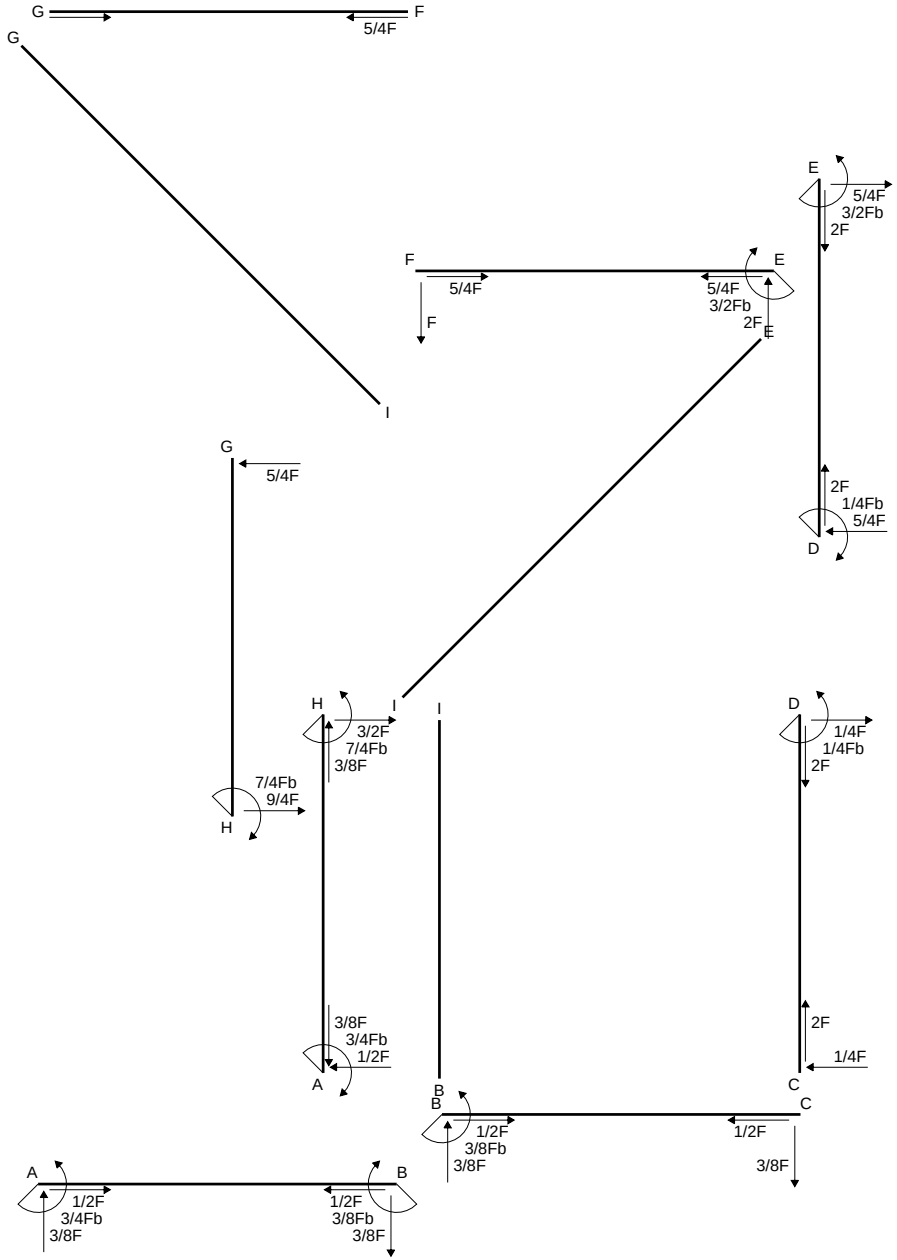
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

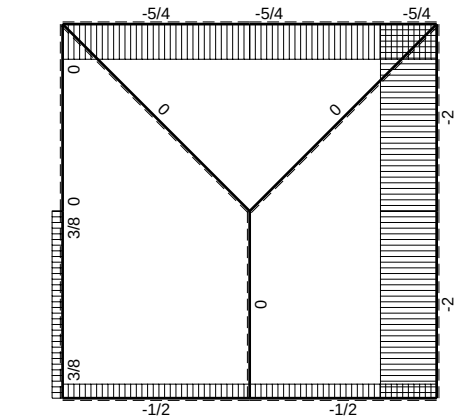
PROCEDIMENTO E RISULTATI 216487 CI04.xxxx.078

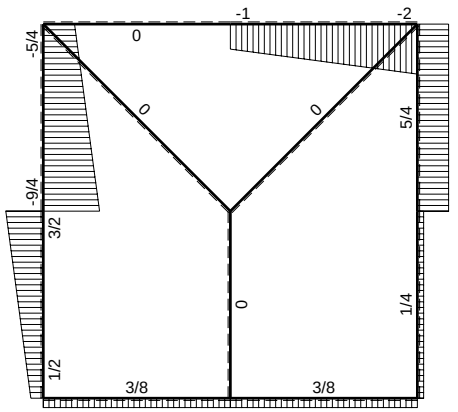


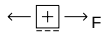
A = 1092. mm^2
J_u = 301397. mm^4
J_v = 66024. mm^4
y_g = 25.33 mm
T_y = -3443. N
M_x = -2409750. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 28.67 mm
$\sigma_m = -Mv/J_u$ = 229.2 N/mm^2
x_c = 18. mm
y_c = 41. mm
v_c = 15.67 mm
$\sigma_c = -Mv/J_u$ = 125.3 N/mm^2
τ_c = 6.399 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 125.8 N/mm^2
S^* = 6723. mm^3

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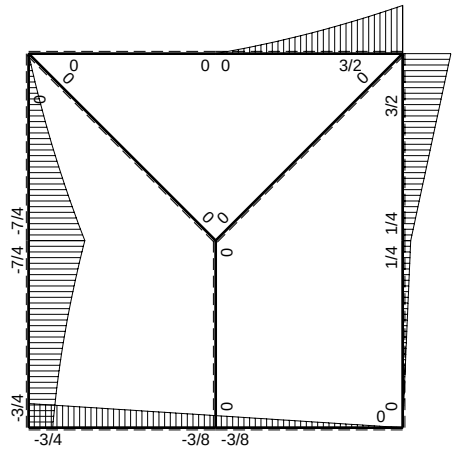






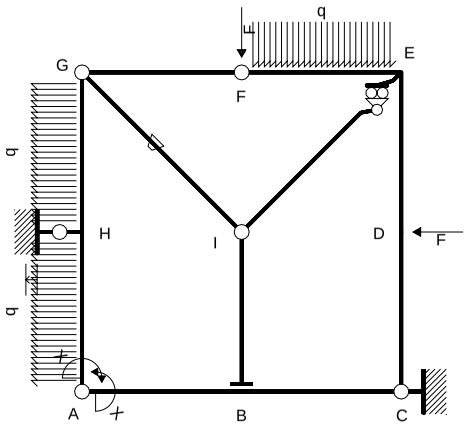


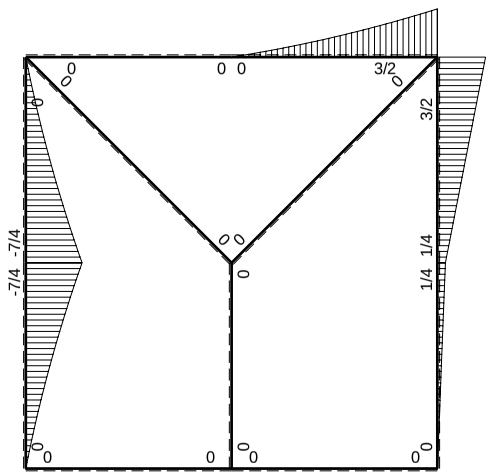




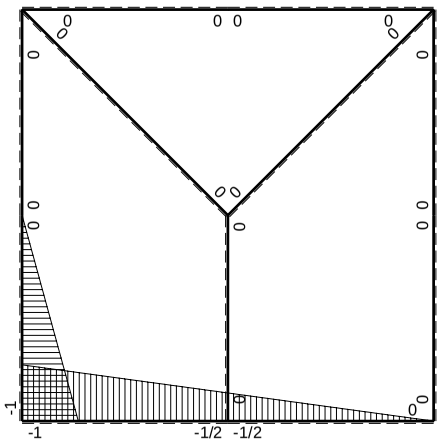


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264526 CI04.xxxx.079

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PROCEDIMENTO E RISULTATI 264526 CI04.xxxx.079

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

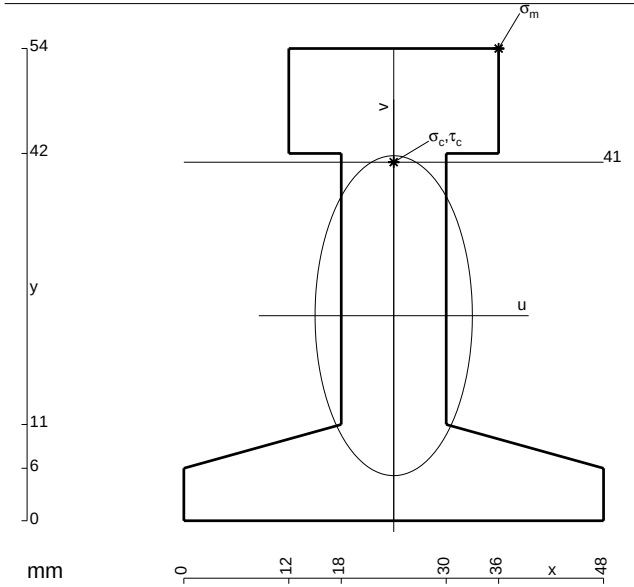
$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

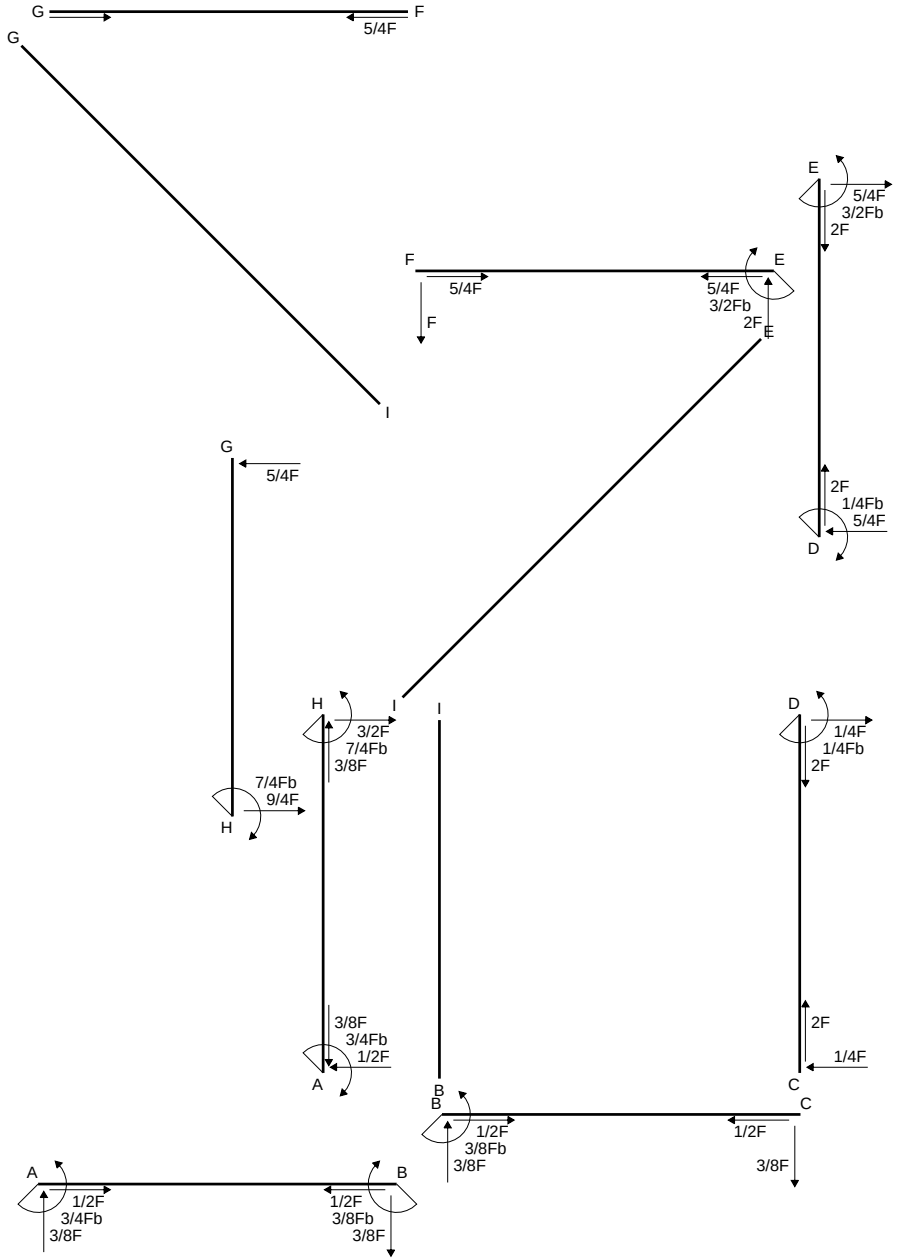
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

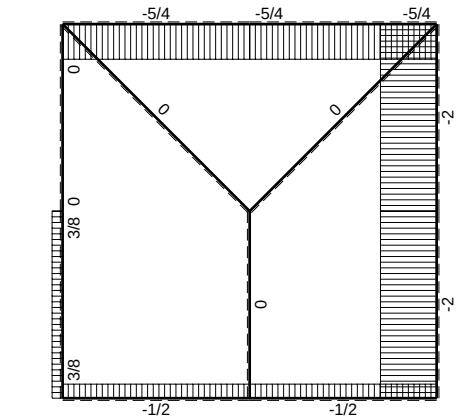
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

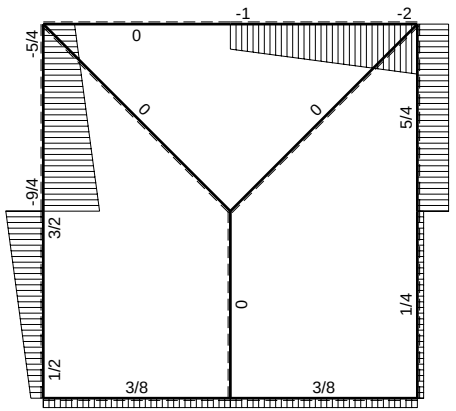
PROCEDIMENTO E RISULTATI 264526 CI04.xxxx.079



A = 1098. mm^2
J_u = 367673. mm^4
J_v = 88884. mm^4
y_g = 23.45 mm
T_y = -3893. N
M_x = -2876130. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 30.55 mm
$\sigma_m = -Mv/J_u$ = 239. N/mm^2
x_c = 24. mm
y_c = 41. mm
v_c = 17.55 mm
$\sigma_c = -Mv/J_u$ = 137.3 N/mm^2
τ_c = 6.429 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 137.8 N/mm^2
S^* = 7288. mm^3

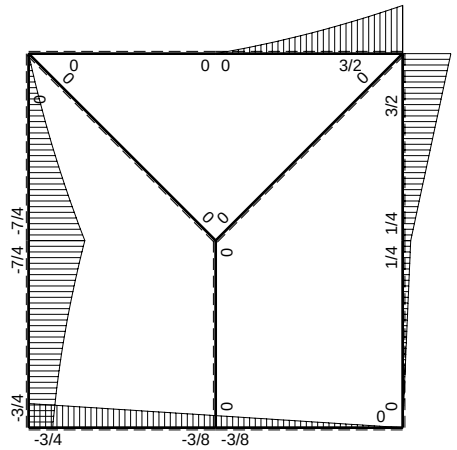






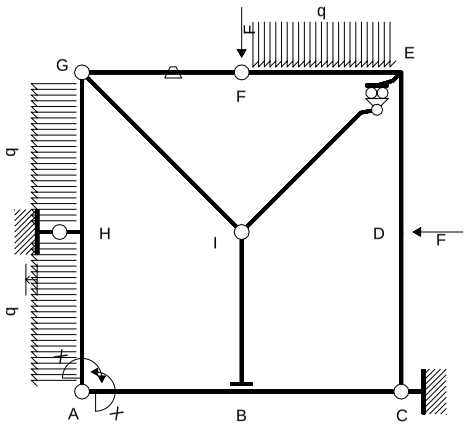
F

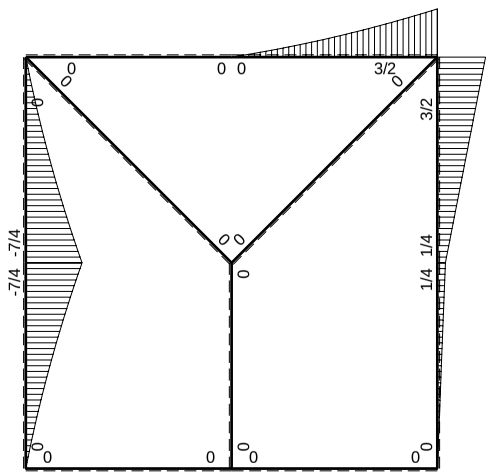
F



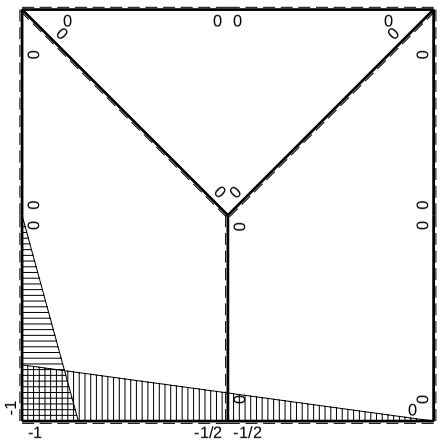
Fb

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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 267010 CI04.xxxx.080

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PROCEDIMENTO E RISULTATI 267010 CI04.xxxx.080

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	-Fb/EJ	0	0	0	0+0	0
GF b	0	0	Fb/EJ	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

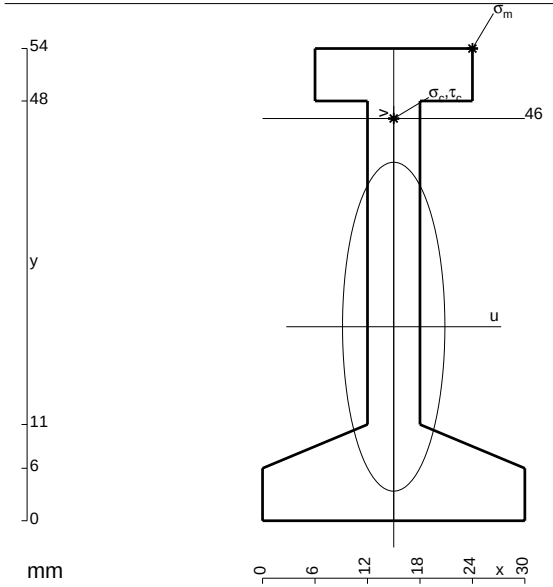
$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

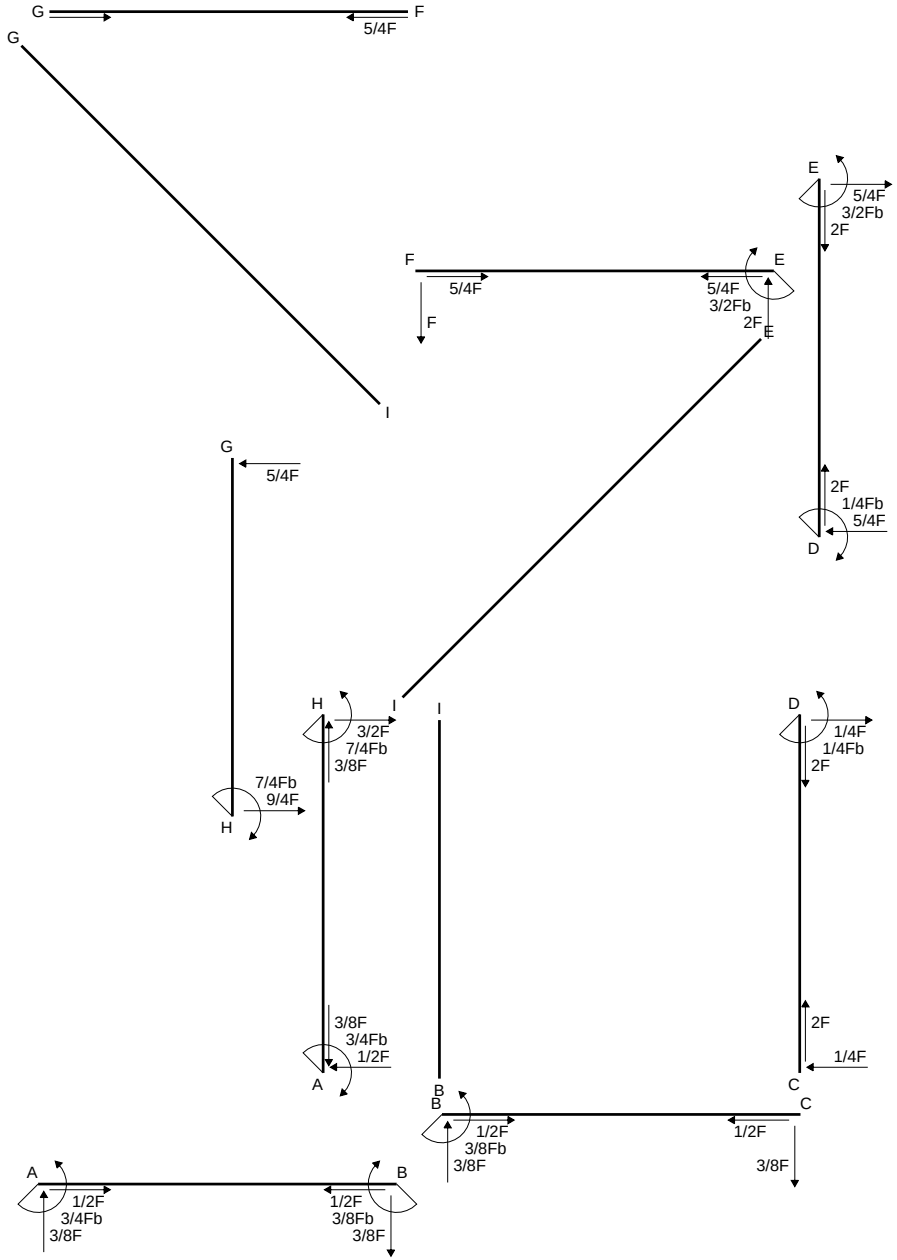
$= \left(7/8\ b - 3/4\ b + 1/8\ b\right) Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

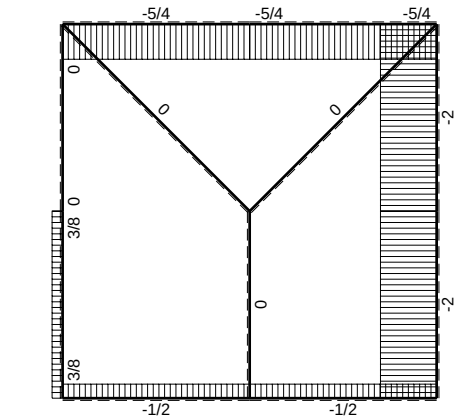
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

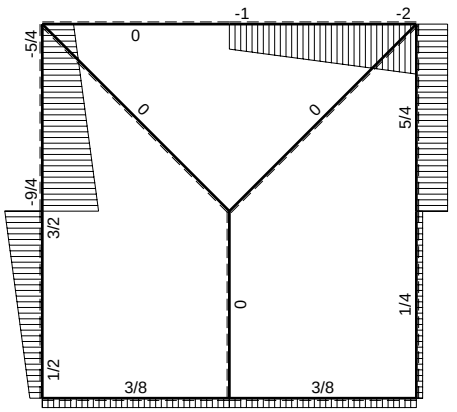
$= \left(5/8\ b - 1/4\ b - 1/8\ b\right) Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$



A = 600. mm^2
J_u = 212405. mm^4
J_v = 20592. mm^4
y_g = 22.19 mm
T_y = -3420. N
M_x = -1330000. Nmm
x_m = 24. mm
y_m = 54. mm
u_m = 9. mm
v_m = 31.81 mm
$\sigma_m = -Mv/J_u$ = 199.2 N/mm^2
x_c = 15. mm
y_c = 46. mm
v_c = 23.81 mm
$\sigma_c = -Mv/J_u$ = 149.1 N/mm^2
τ_c = 9.15 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 149.9 N/mm^2
S^* = 3410. mm^3

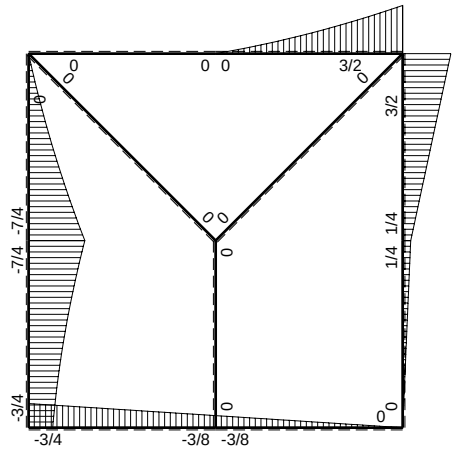

G
F
5/4F
G
I
E
5/4F
3/2Fb
2F
F
5/4F
F
E
5/4F
3/2Fb
2F
E
2F
1/4Fb
5/4F
D
G
5/4F
H
I
3/2F
7/4Fb
3/8F
7/4Fb
9/4F
H
I
D
1/4F
1/4Fb
2F
3/8F
3/4Fb
1/2F
A
2F
1/4F
B
C
B
C
1/2F
3/8Fb
3/8F
1/2F
3/8F
A
B
1/2F
3/4Fb
3/8F
1/2F
3/8Fb
3/8F


-5/4
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3/8
-1/2
-1/2

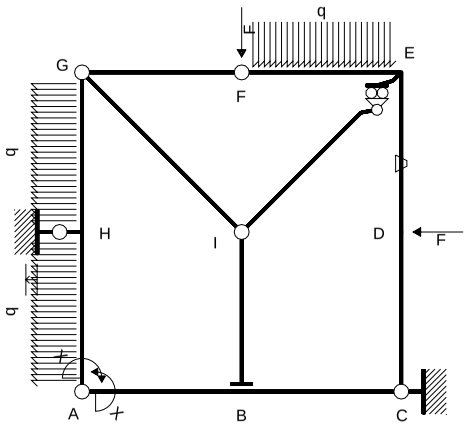

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-2
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0
0
5/4
-9/4
3/2
0
1/4
1/2
3/8
3/8

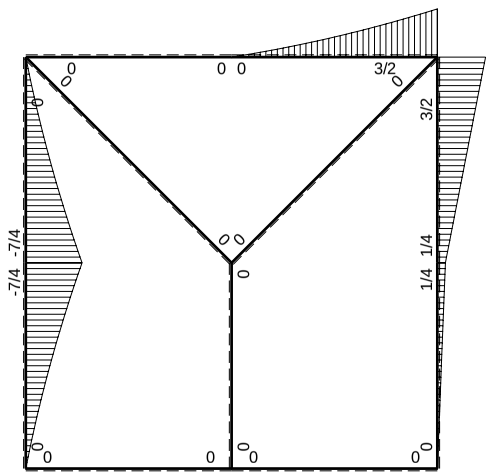
F

F

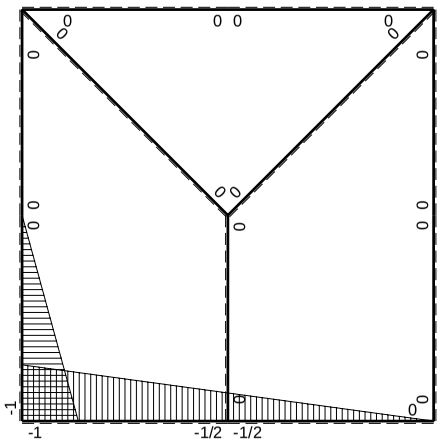

0
0 0
3/2
0
0
3/2
0
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-7/4
-7/4
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1/4
1/4
-7/4
0
0
0
0
-3/4
-3/8
-3/8
-3/4

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 962891 CI04.xxxx.081

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	Fb/EJ	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

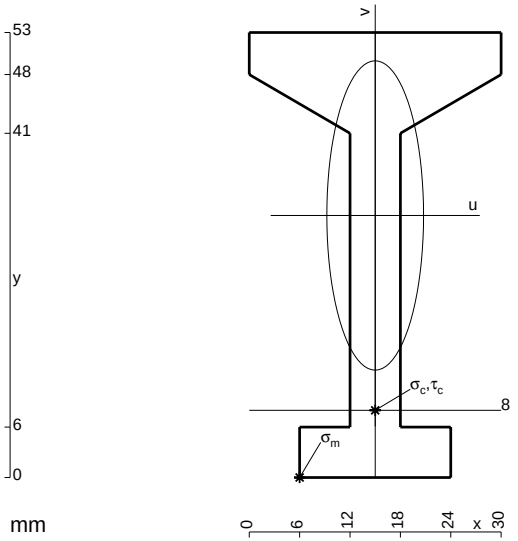
$L^{Xo}_{HA} = \int_o^b (7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (7/8\ b - 3/4\ b + 1/8\ b)\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b (5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

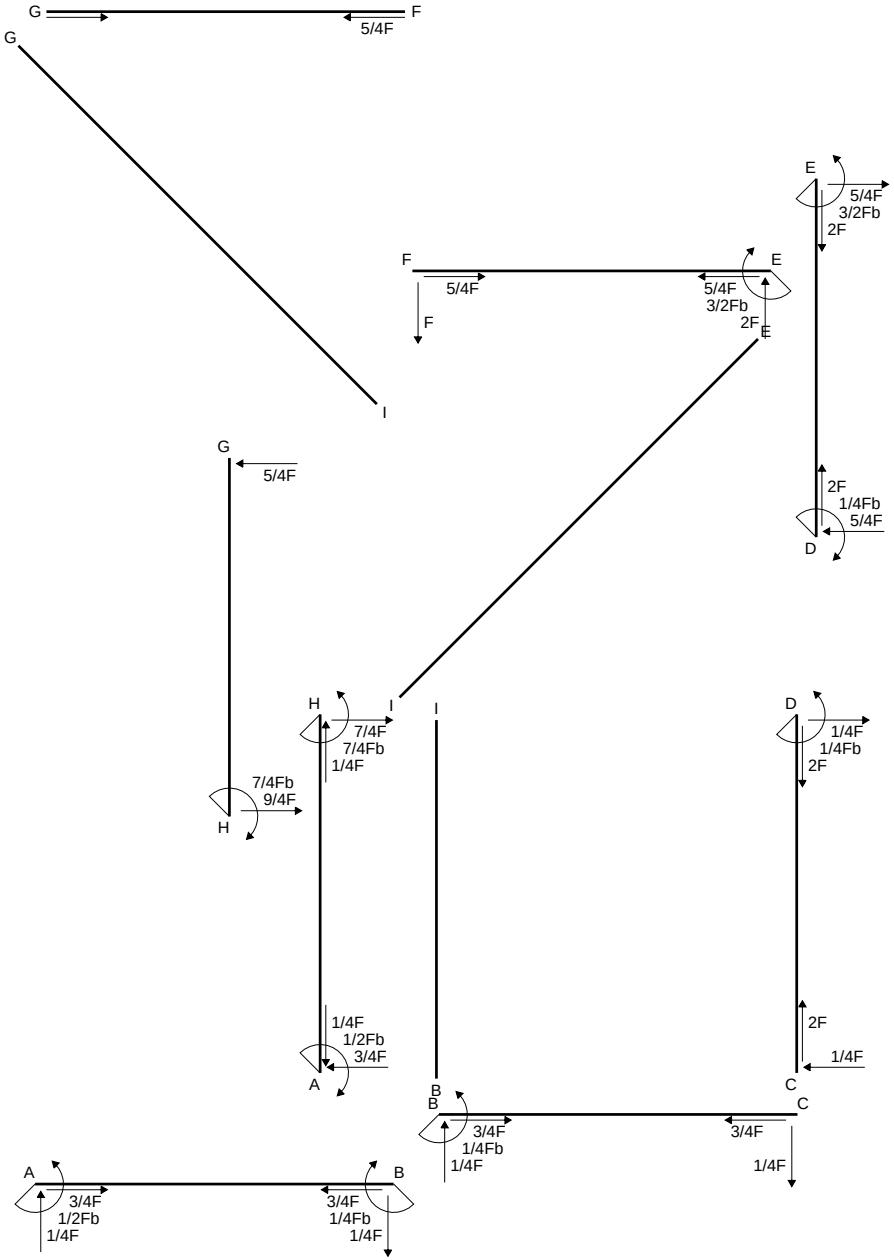
$= (5/8\ b - 1/4\ b - 1/8\ b)\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

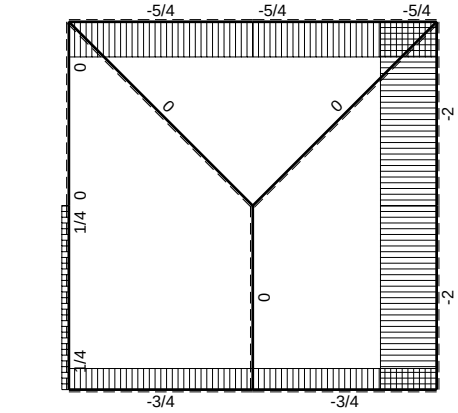
PROCEDIMENTO E RISULTATI 962891 CI04.xxxx.081

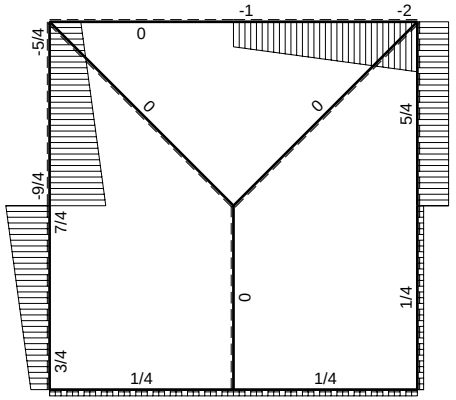


A = 594. mm^2
J_u = 201694. mm^4
J_v = 19710. mm^4
y_g = 31.21 mm
T_y = -3285. N
M_x = -1354150. Nmm
x_m = 6. mm
u_m = -9. mm
v_m = -31.21 mm
$\sigma_m = -Mv/J_u$ = -209.5 N/mm^2
x_c = 15. mm
y_c = 8. mm
v_c = -23.21 mm
$\sigma_c = -Mv/J_u$ = -155.8 N/mm^2
τ_c = 9.059 N/mm^2
$\sigma_0 = \sqrt{\sigma^2 + 3\tau^2}$ = 156.6 N/mm^2
S^* = 3337. mm^3

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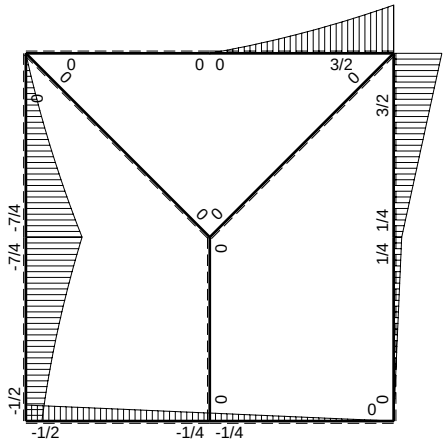

G
F
5/4F
G
I
E
5/4F
3/2Fb
2F
F
5/4F
F
5/4F
3/2Fb
2F
E
E
2F
1/4Fb
5/4F
D
G
5/4F
H
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7/4F
7/4Fb
1/4F
7/4Fb
9/4F
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C
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C
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1/4F
3/4F
1/4F
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B
3/4F
1/2Fb
1/4F
3/4F
1/4Fb
1/4F


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1/4 0
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-2
1/4
-3/4
-3/4

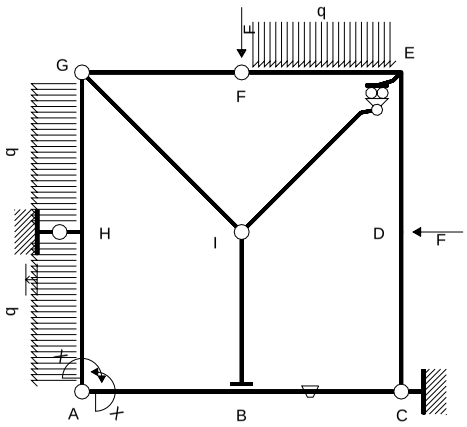

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-2
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5/4
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7/4
0
1/4
3/4
1/4
1/4

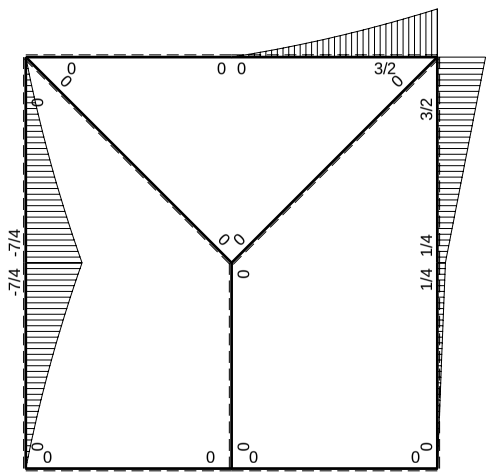
F

F

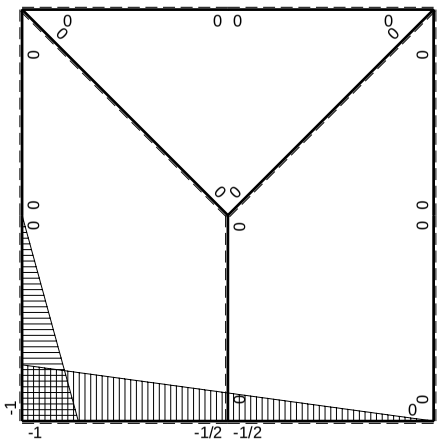

0
0 0
3/2
0
0
3/2
-7/4 -7/4
0 0
0
1/4 1/4
-7/4
0
-1/2
0
0 0
-1/2
-1/4 -1/4

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 266362 CI04.xxxx.082

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PROCEDIMENTO E RISULTATI 266362 CI04.xxxx.082

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	-Fb/EJ	0	1/2Fb/EJ-1/2Fx/EJ	$1/4-1/2x/b+1/4x^2/b^2$	$(0+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	0	Fb/EJ	0	1/2Fx/EJ	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/2Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/2Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{BC} = \int_o^b (1/2 - 1/2\ x/b)\ \theta\ dx = [1/2\ x - 1/4\ x^2/b\ ]_o^b\ \theta$

$= (1/2\ b - 1/4\ b)\ \theta\ = 1/4\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-1/2\ x/b)\ \theta\ dx = [-1/4\ x^2/b\ ]_o^b\ \theta$

$= (-1/4\ b)\ \theta\ = 1/4\ Fb^2/EJ$

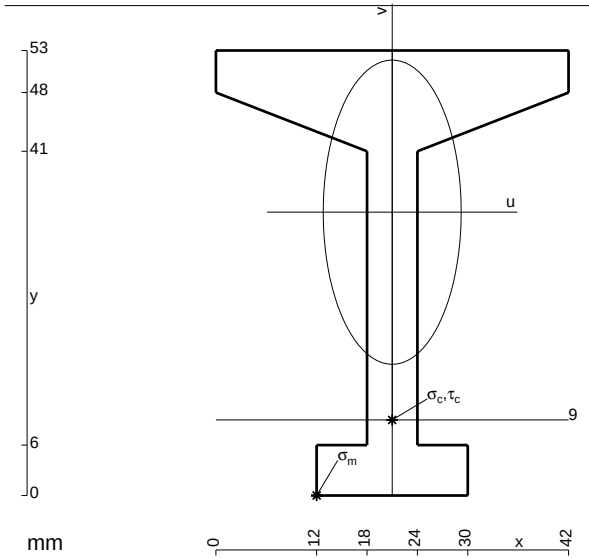
$L^{Xo}_{HA} = \int_o^b (7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (7/8\ b - 3/4\ b + 1/8\ b)\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b (5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (5/8\ b - 1/4\ b - 1/8\ b)\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

PROCEDIMENTO E RISULTATI 266362 CI04.xxxx.082



$A = 696.\ mm^2$

$J_u = 228562.\ mm^4$

$J_v = 47016.\ mm^4$

$y_g = 33.75\ mm$

$T_y = -3285.\ N$

$M_x = -1481900.\ Nmm$

$x_m = 12.\ mm$

$u_m = -9.\ mm$

$v_m = -33.75\ mm$

$\sigma_m = -Mv/J_u = -218.8\ N/mm^2$

$x_c = 21.\ mm$

$y_c = 9.\ mm$

$v_c = -24.75\ mm$

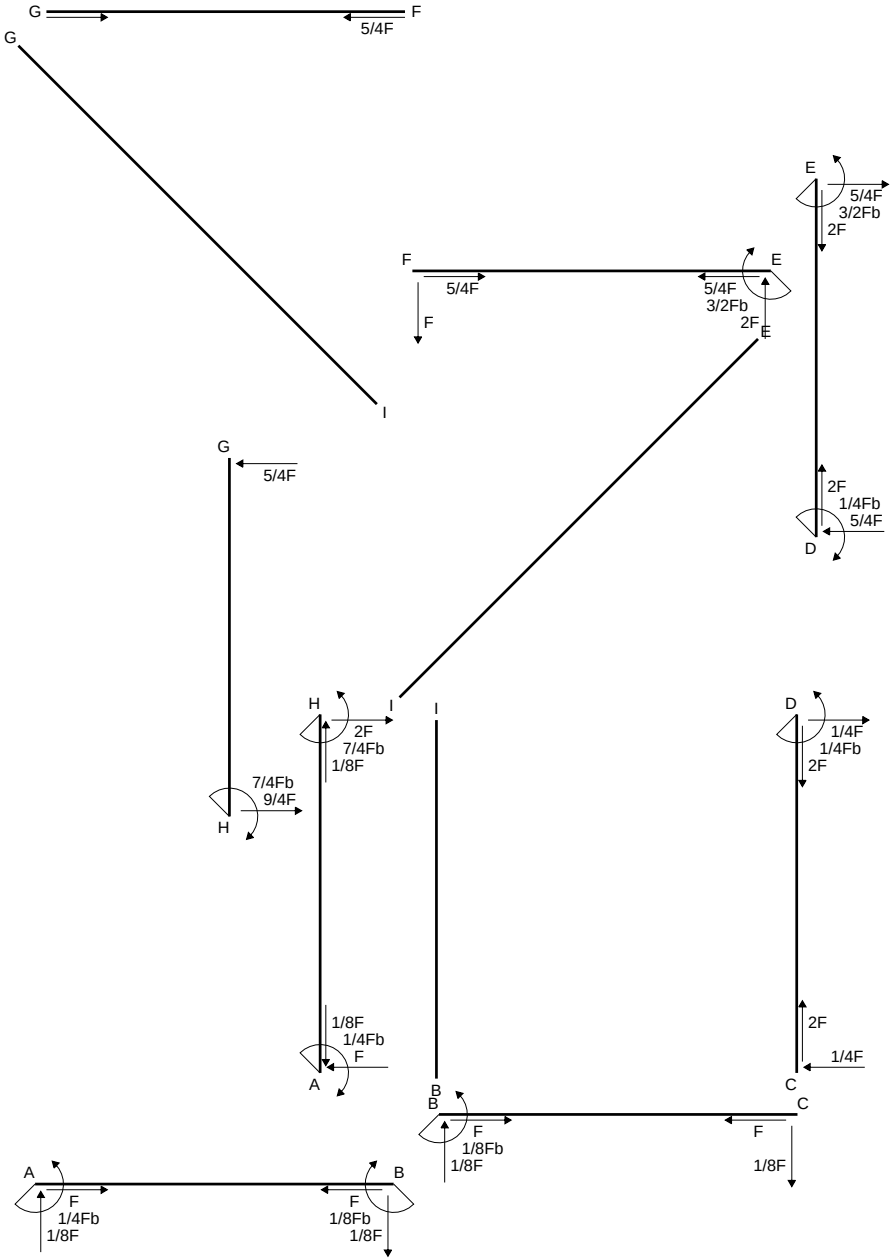
$\sigma_c = -Mv/J_u = -160.4\ N/mm^2$

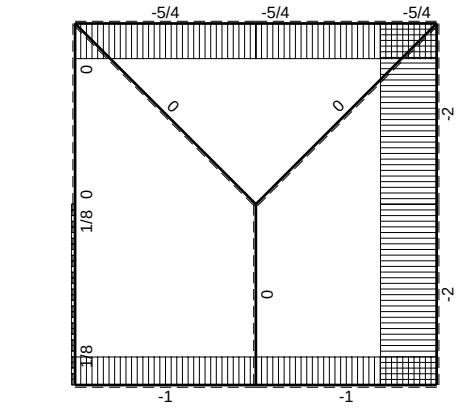
$\tau_c = 9.086\ N/mm^2$

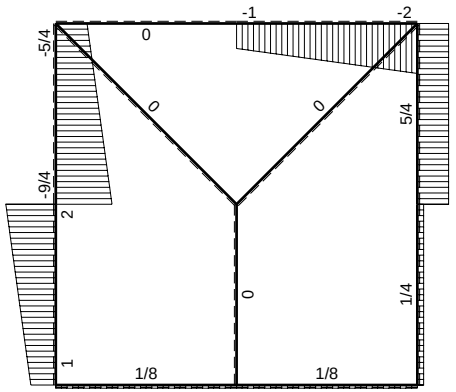
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2} = 161.2\ N/mm^2$

$S^* = 3793.\ mm^3$

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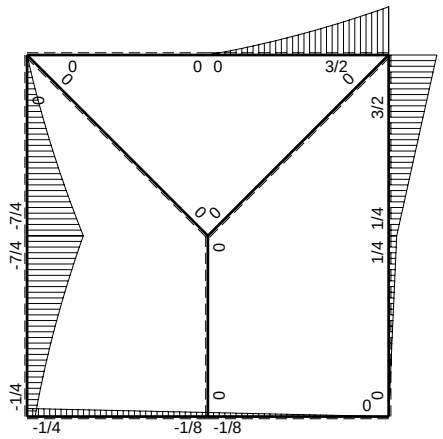

G
F
5/4F
G
I
E
5/4F
3/2Fb
2F
F
5/4F
F
5/4F
3/2Fb
2F
E
E
2F
1/4Fb
5/4F
D
G
5/4F
H
I
2F
7/4Fb
1/8F
7/4Fb
9/4F
H
I
D
1/4F
1/4Fb
2F
1/8F
1/4Fb
F
A
B
C
2F
1/4F
B
C
F
1/8Fb
1/8F
F
1/8F
A
B
F
1/4Fb
1/8F
F
1/8Fb
1/8F


-5/4
-5/4
-5/4
0
0
0
-2
1/8 0
0
-2
1/8
-1
-1

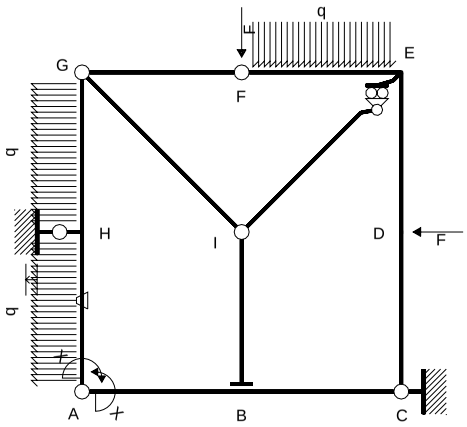

-1
-2
-5/4
0
0
0
5/4
-9/4
2
0
1/4
1
1/8
1/8

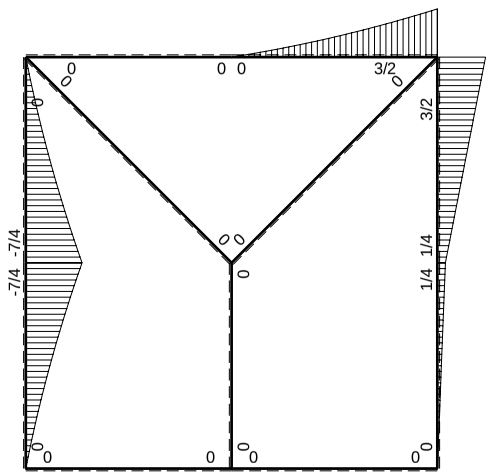
F

F

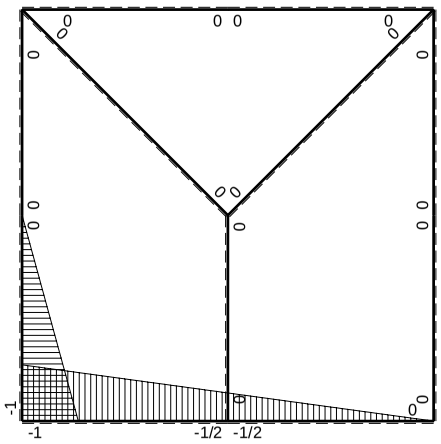

0
0 0
3/2
0
0
3/2
0 0
-7/4 -7/4
0
1/4 1/4
-1/4
0
0
0
0
-1/4
-1/8 -1/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264390 CI04.xxxx.083

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	-Fb/EJ	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(1/4+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	Fb/EJ	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{HA} = \int_o^b (7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx + \int_o^b (\ x/b\ )\ \theta\ dx$

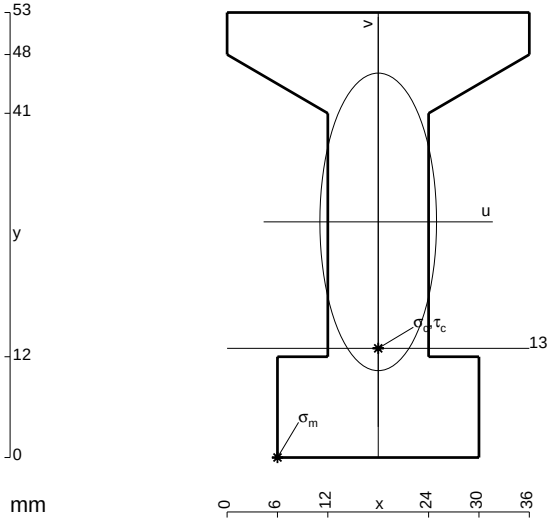
$= [7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ\ + [1/2\ x^2/b\ ]_o^b\ \theta$

$= (7/8\ b - 3/4\ b + 1/8\ b\ )\ Fb\ 1/EJ\ + (1/2\ b\ )\ \theta\ = 3/4\ Fb^2/EJ$

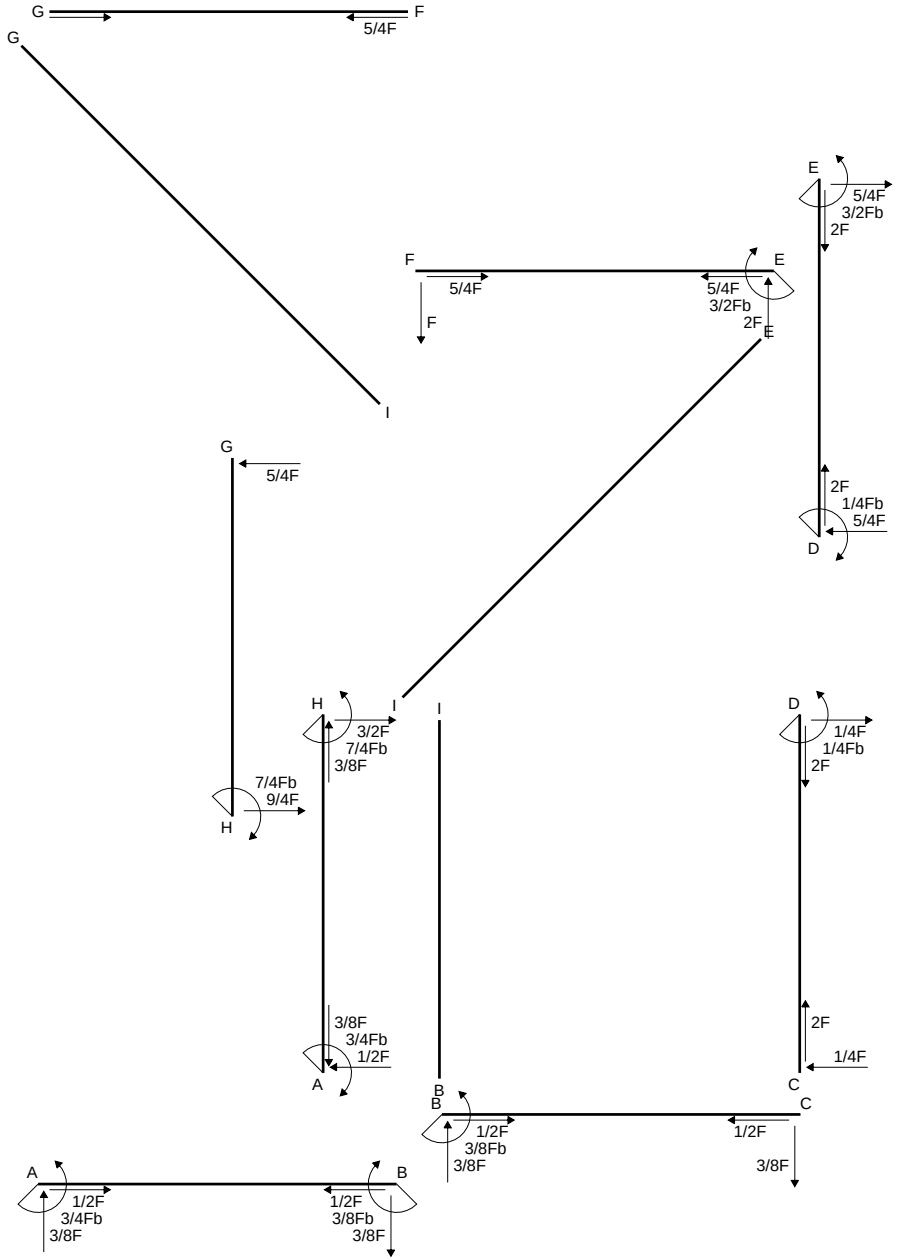
$L^{Xo}_{AH} = \int_o^b (5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx + \int_o^b (-1 + x/b\ )\ \theta\ dx$

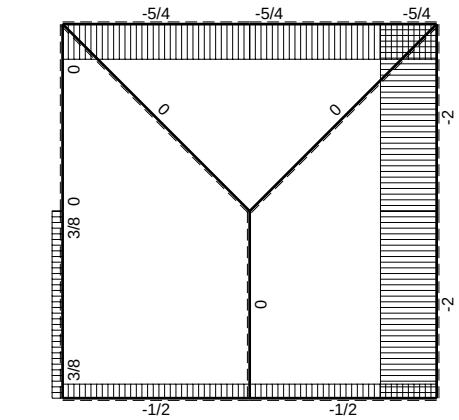
$= [5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ\ + [-\ x + 1/2\ x^2/b\ ]_o^b\ \theta$

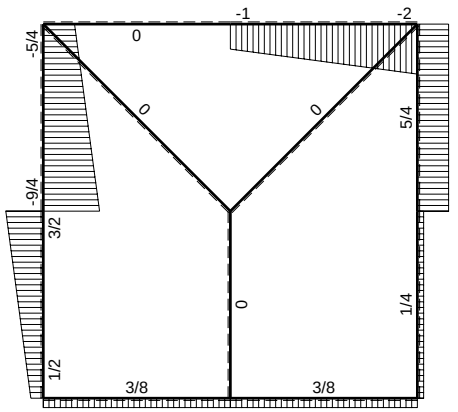
$= (5/8\ b - 1/4\ b - 1/8\ b\ )\ Fb\ 1/EJ\ + (-\ b + 1/2\ b\ )\ \theta\ = 3/4\ Fb^2/EJ$

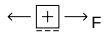


A = 984. mm^2
J_u = 309174. mm^4
J_v = 47520. mm^4
y_g = 28.06 mm
T_y = -5153. N
M_x = -2524730. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.06 mm
$\sigma_m = -Mv/J_u$ = -229.2 N/mm^2
x_c = 18. mm
y_c = 13. mm
v_c = -15.06 mm
$\sigma_c = -Mv/J_u$ = -123. N/mm^2
τ_c = 9.084 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 124. N/mm^2
S^* = 6541. mm^3

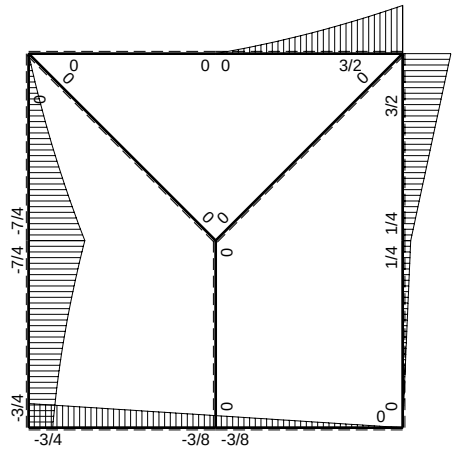






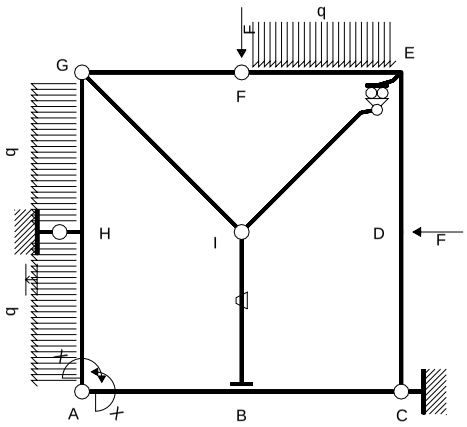


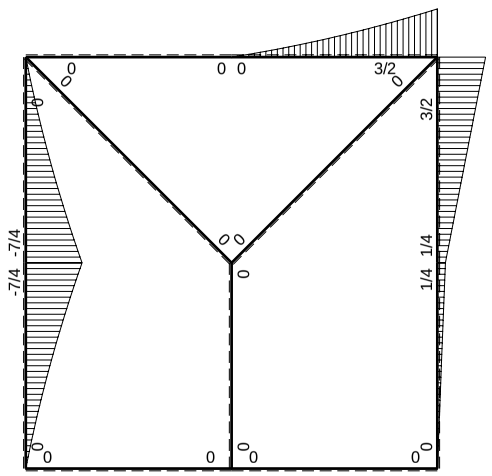




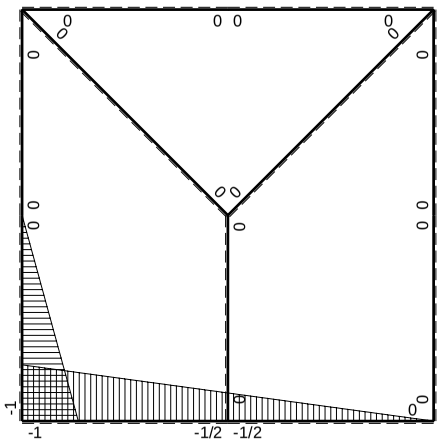


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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PROCEDIMENTO E RISULTATI 302320 CI04.xxxx.084

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	-Fb/EJ	0	0	0	0+0	0
BI b	0	0	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

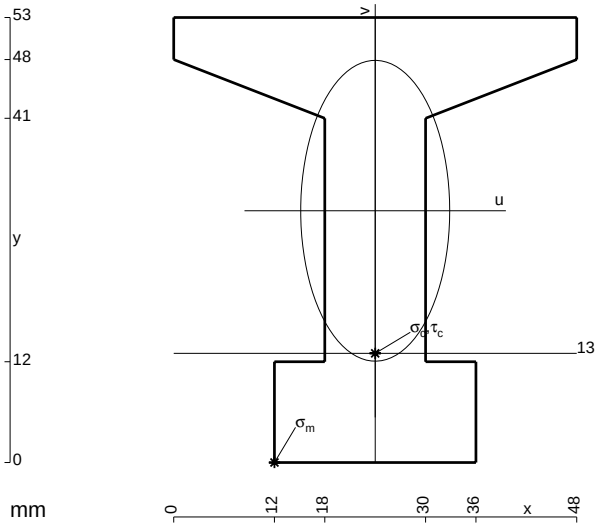
$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{HA} = \int_o^b (7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

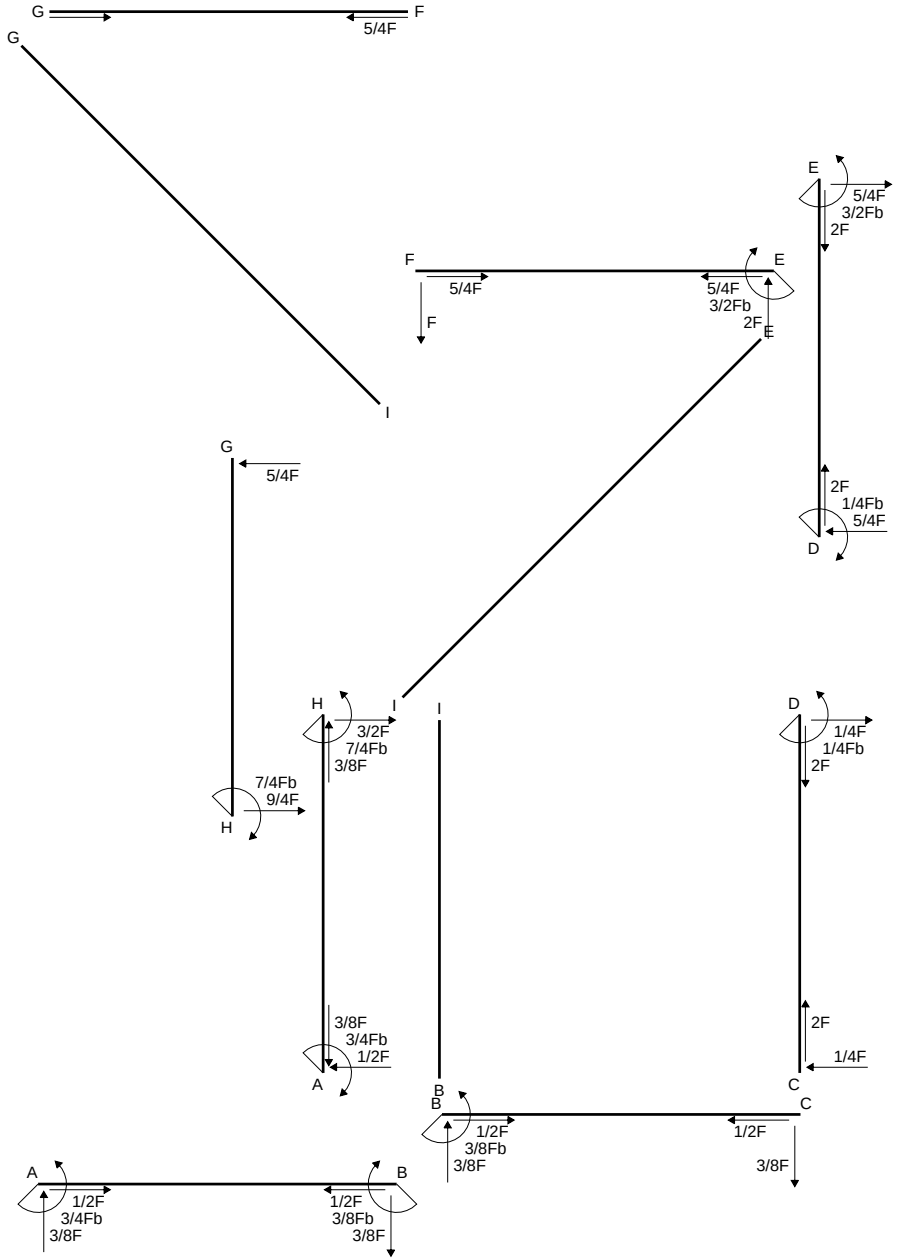
$= (7/8\ b - 3/4\ b + 1/8\ b)\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

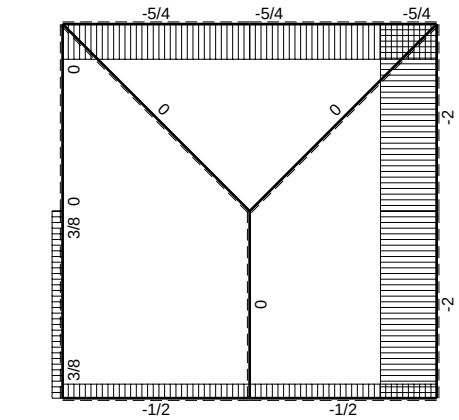
$L^{Xo}_{AH} = \int_o^b (5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

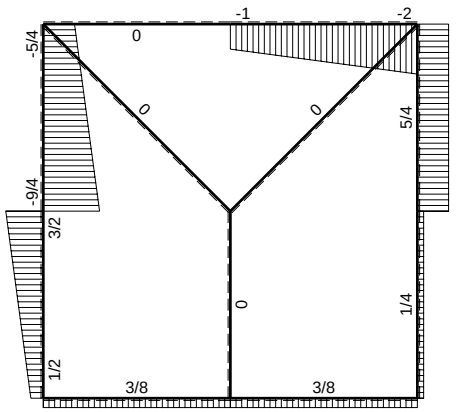
$= (5/8\ b - 1/4\ b - 1/8\ b)\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

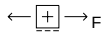


A = 1086. mm^2
J_u = 348629. mm^4
J_v = 85500. mm^4
y_g = 29.98 mm
T_y = -5265. N
M_x = -2784600. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -29.98 mm
$\sigma_m = -Mv/J_u$ = -239.5 N/mm^2
x_c = 24. mm
y_c = 13. mm
v_c = -16.98 mm
$\sigma_c = -Mv/J_u$ = -135.7 N/mm^2
τ_c = 8.957 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 136.5 N/mm^2
S^* = 7117. mm^3

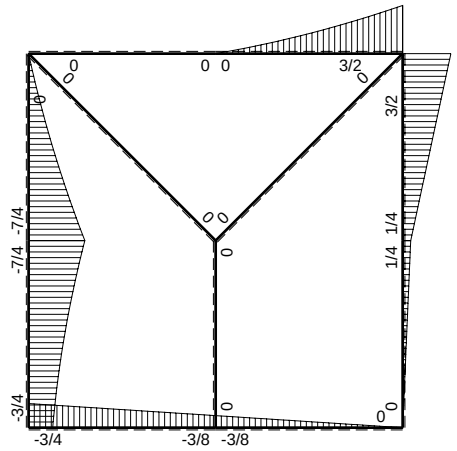






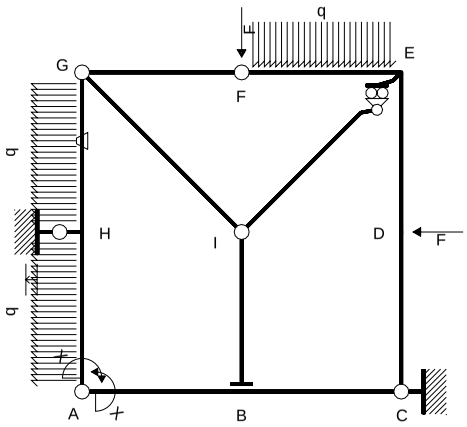


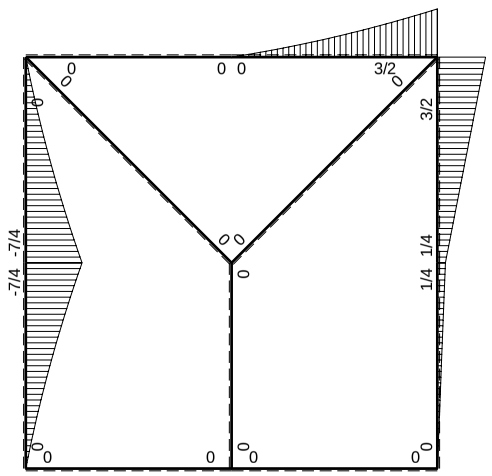




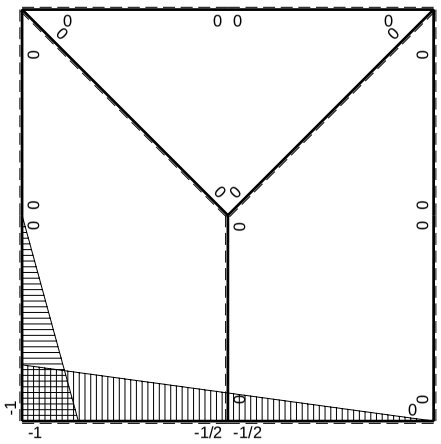


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 218577 CI04.xxxx.085

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PROCEDIMENTO E RISULTATI 218577 CI04.xxxx.085

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

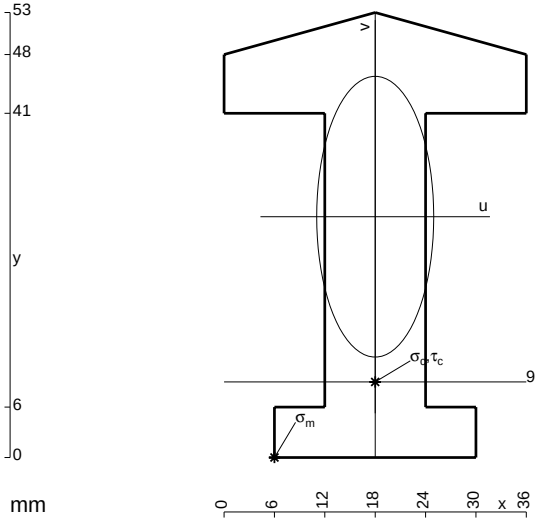
$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

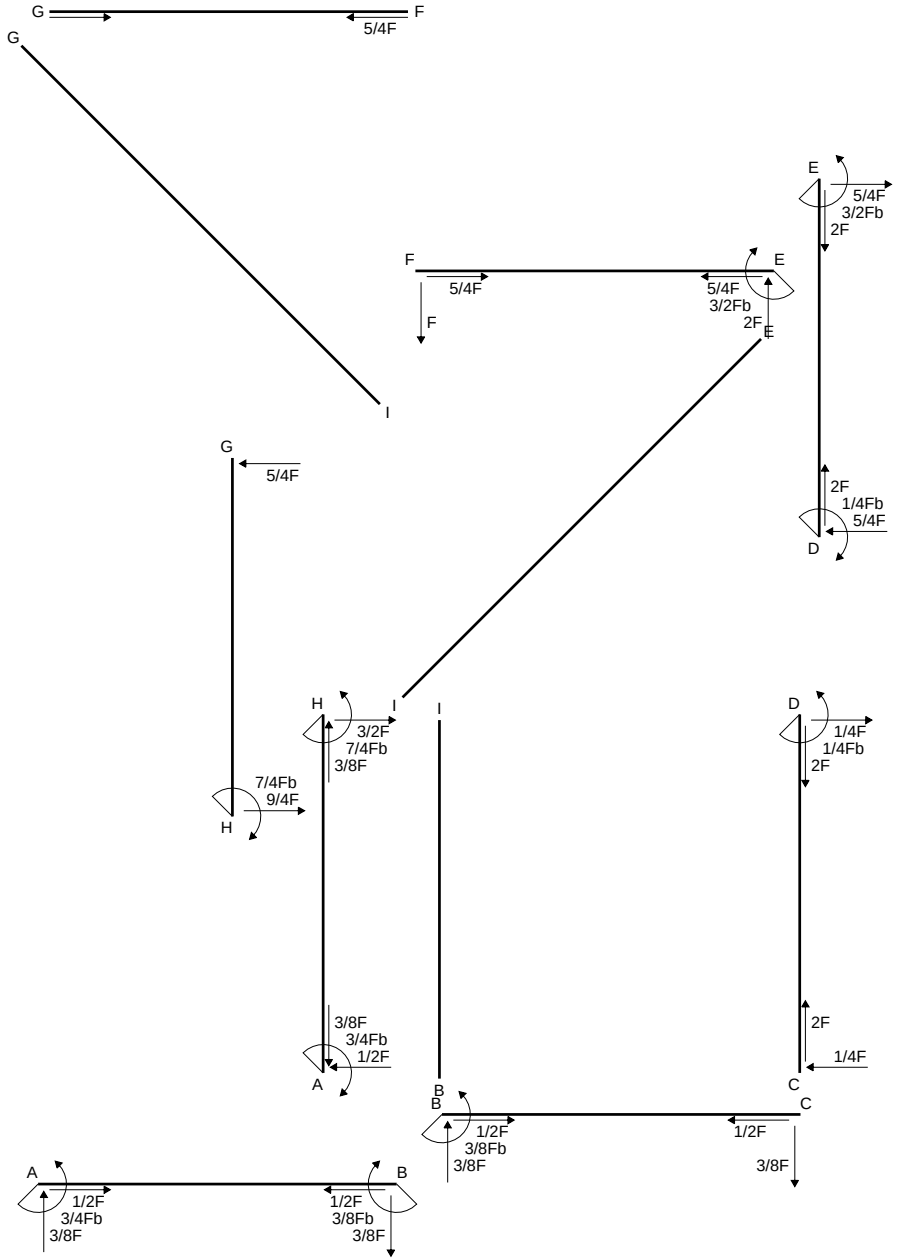
$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

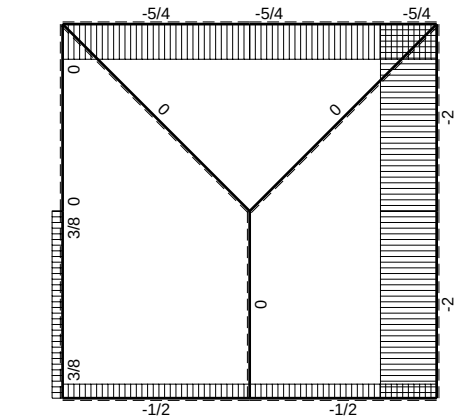
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

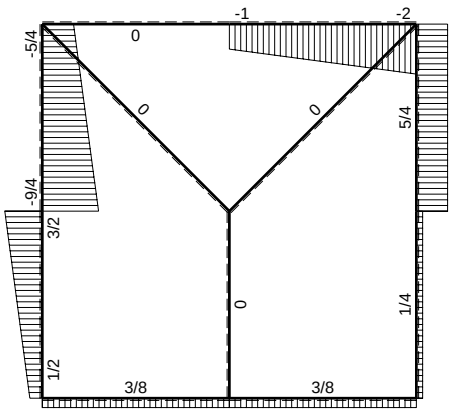
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$



A = 906. mm^2
J_u = 253401. mm^4
J_v = 44028. mm^4
y_g = 28.68 mm
T_y = -3105. N
M_x = -1762950. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.68 mm
$\sigma_m = -Mv/J_u$ = -199.5 N/mm^2
x_c = 18. mm
y_c = 9. mm
v_c = -19.68 mm
$\sigma_c = -Mv/J_u$ = -136.9 N/mm^2
τ_c = 4.555 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 137.2 N/mm^2
S^* = 4461. mm^3

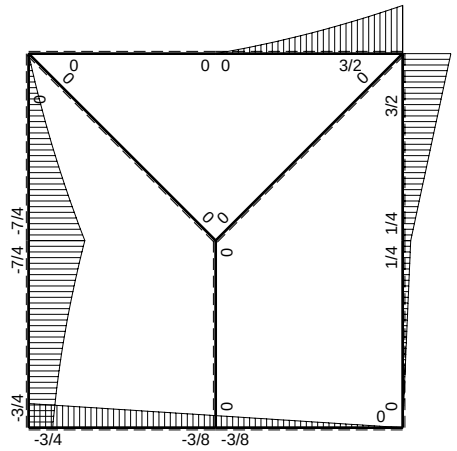

G
F
5/4F
G
I
E
5/4F
3/2Fb
2F
F
5/4F
F
E
5/4F
3/2Fb
2F
E
2F
1/4Fb
5/4F
D
G
5/4F
H
I
3/2F
7/4Fb
3/8F
7/4Fb
9/4F
H
I
D
1/4F
1/4Fb
2F
3/8F
3/4Fb
1/2F
A
2F
1/4F
B
C
B
C
1/2F
3/8Fb
3/8F
1/2F
3/8F
A
B
1/2F
3/4Fb
3/8F
1/2F
3/8Fb
3/8F


-5/4
-5/4
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0
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-2
3/8
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0
-2
3/8
-1/2
-1/2

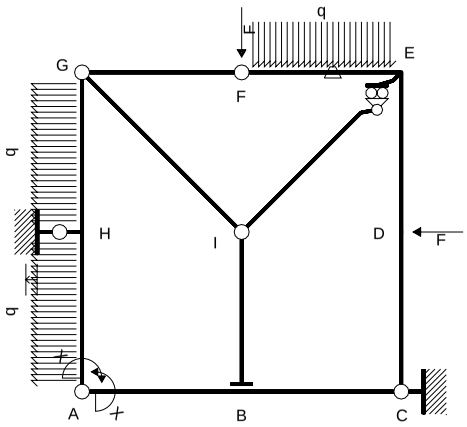

-1
-2
-5/4
0
0
0
5/4
-9/4
3/2
0
1/4
1/2
3/8
3/8

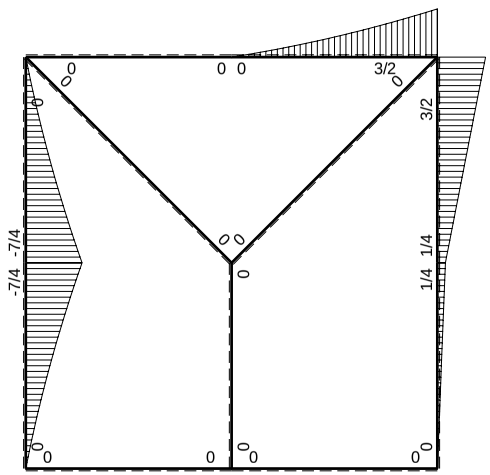
F

F

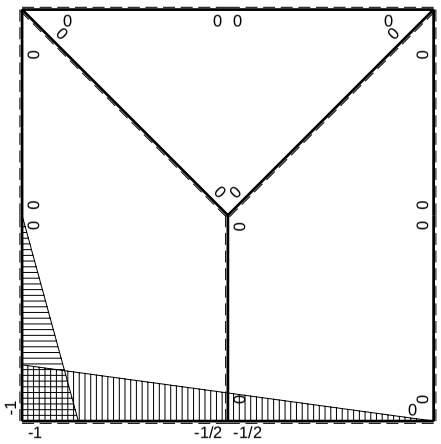

0
0 0
3/2
0
0
3/2
0
0
-7/4
-7/4
0
1/4
1/4
0
0
0
0
-3/4
-3/4
-3/8
-3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 265477 CI04.xxxx.086

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PROCEDIMENTO E RISULTATI 265477 CI04.xxxx.086

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	Fb/EJ	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

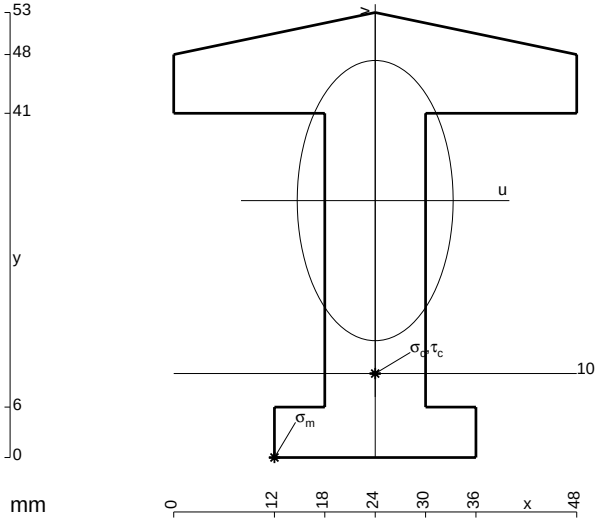
$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

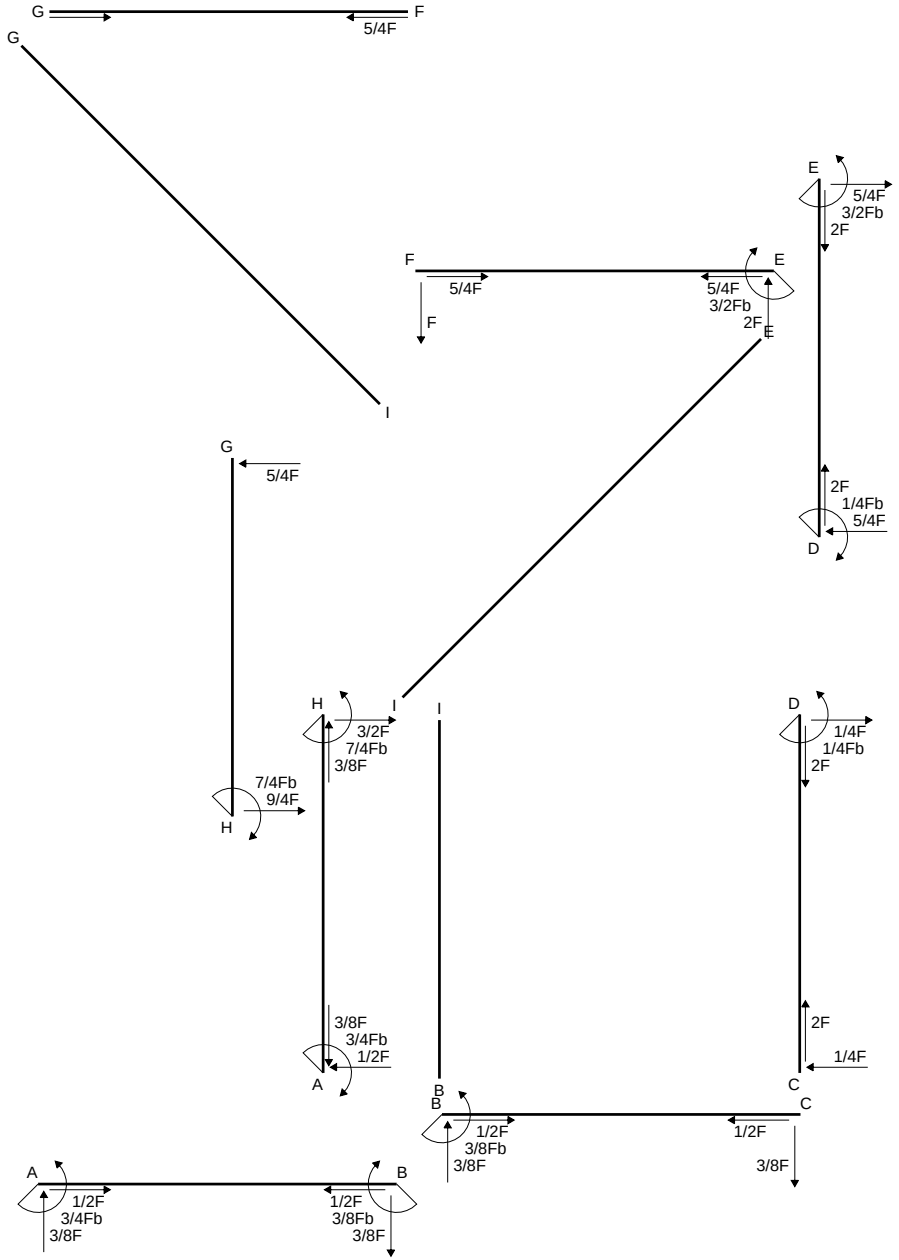
$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

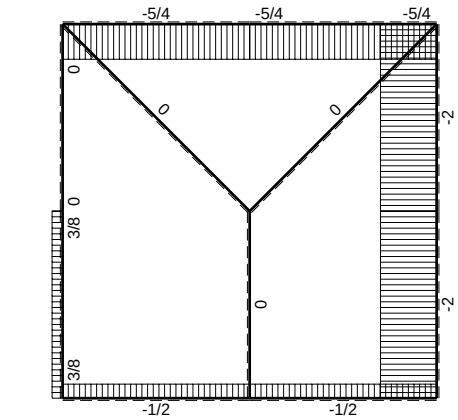
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

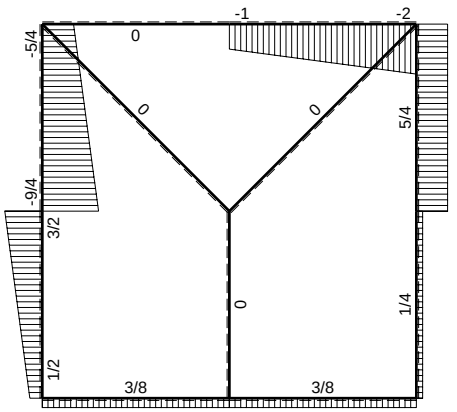
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

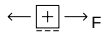


A = 1020. mm^2
J_u = 284254. mm^4
J_v = 87984. mm^4
y_g = 30.6 mm
T_y = -3195. N
M_x = -1938300. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.6 mm
$\sigma_m = -Mv/J_u$ = -208.7 N/mm^2
x_c = 24. mm
y_c = 10. mm
v_c = -20.6 mm
$\sigma_c = -Mv/J_u$ = -140.5 N/mm^2
τ_c = 4.739 N/mm^2
$\sigma_0 = \sqrt{\sigma^2 + 3\tau^2}$ = 140.7 N/mm^2
S^* = 5060. mm^3

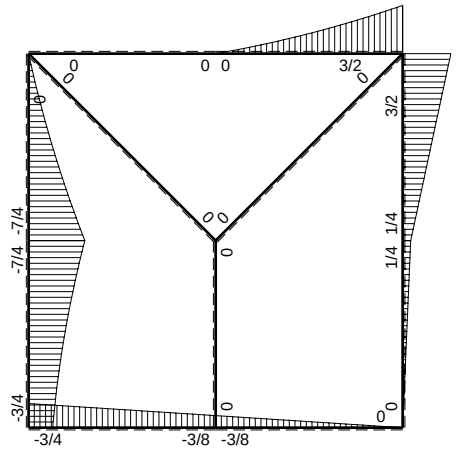






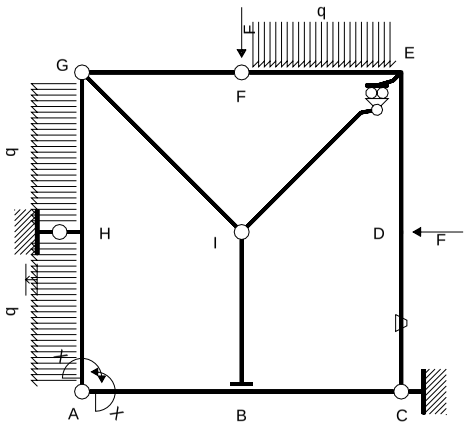


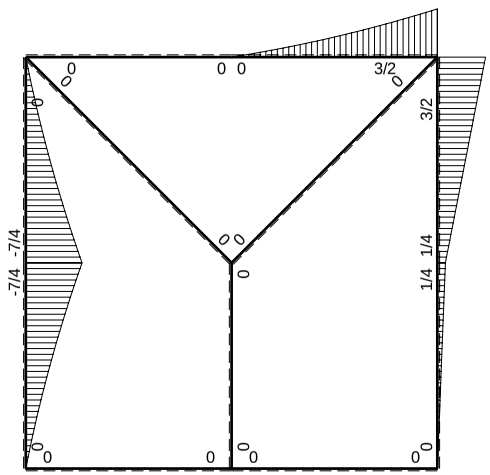




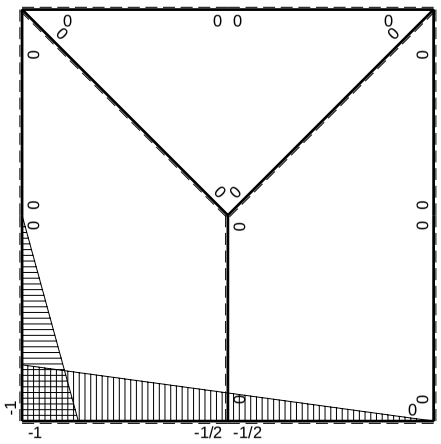


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 986307 CI04.xxxx.087

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PROCEDIMENTO E RISULTATI 986307 CI04.xxxx.087

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	-Fb/EJ	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	Fb/EJ	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

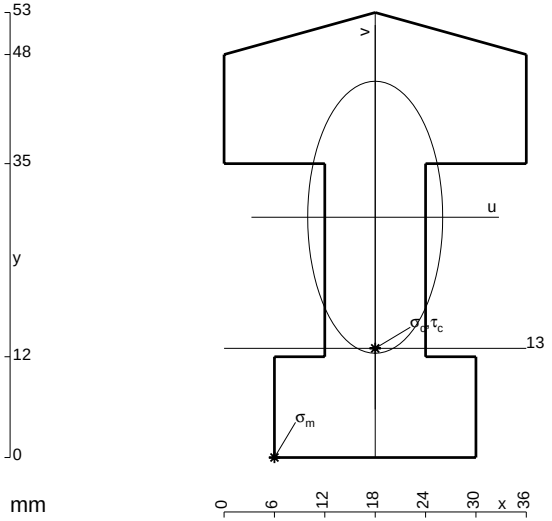
$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{HA} = \int_o^b (7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

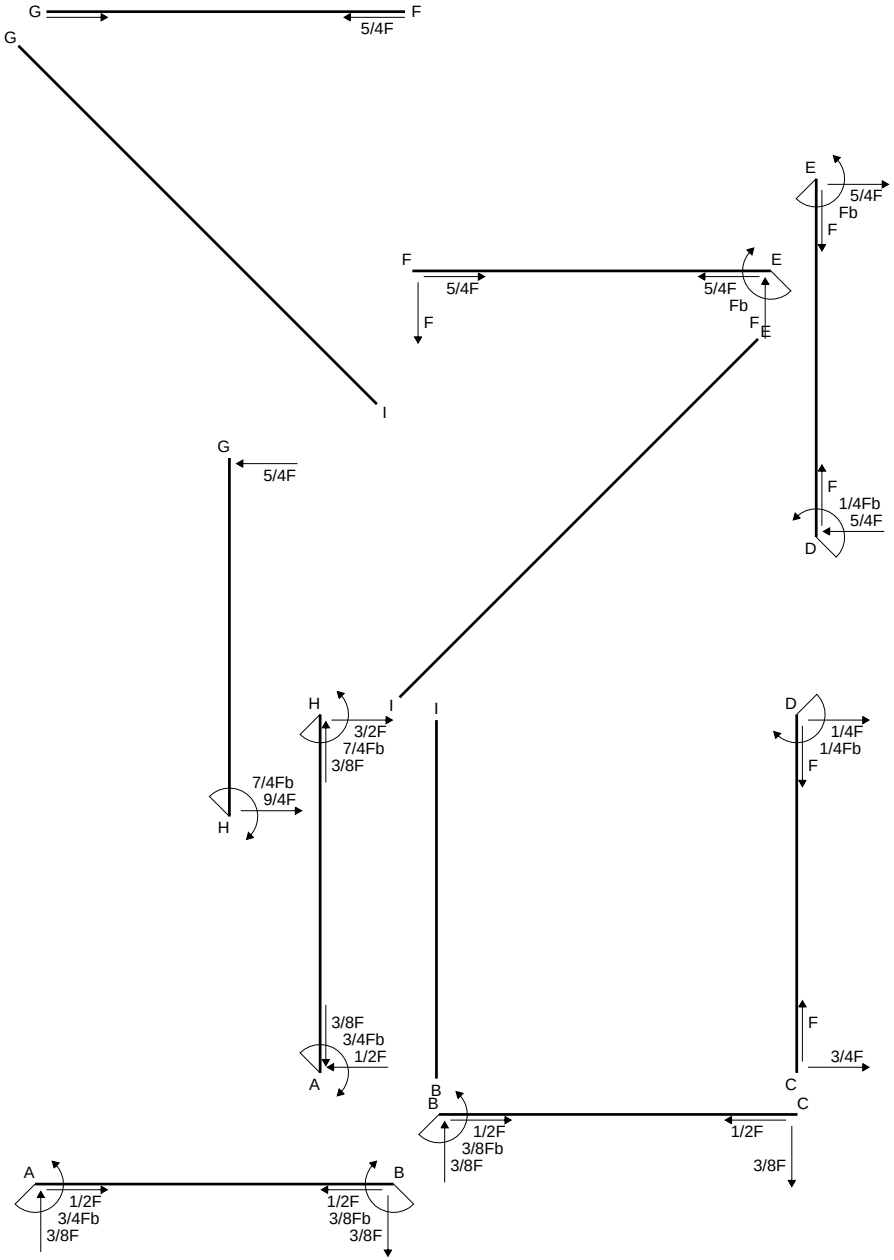
$= (7/8\ b - 3/4\ b + 1/8\ b\ )\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

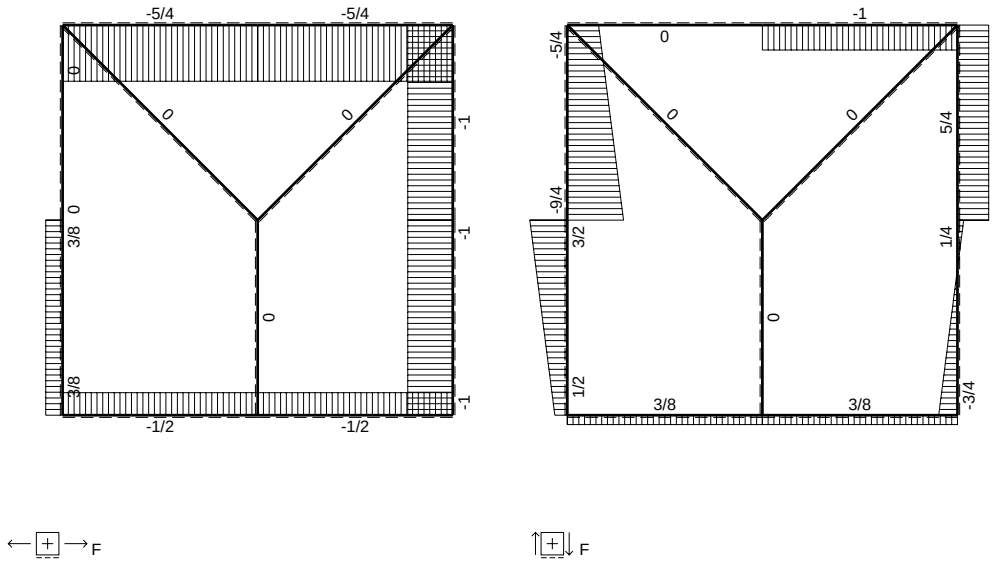
$L^{Xo}_{AH} = \int_o^b (5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (5/8\ b - 1/4\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

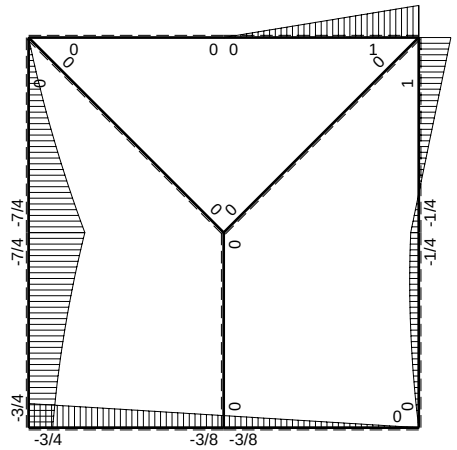


A = 1122. mm^2
J_u = 294439. mm^4
J_v = 72540. mm^4
y_g = 28.61 mm
T_y = -3488. N
M_x = -2251380. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.61 mm
$\sigma_m = -Mv/J_u$ = -218.8 N/mm^2
x_c = 18. mm
y_c = 13. mm
v_c = -15.61 mm
$\sigma_c = -Mv/J_u$ = -119.4 N/mm^2
τ_c = 6.62 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 119.9 N/mm^2
S^* = 6706. mm^3

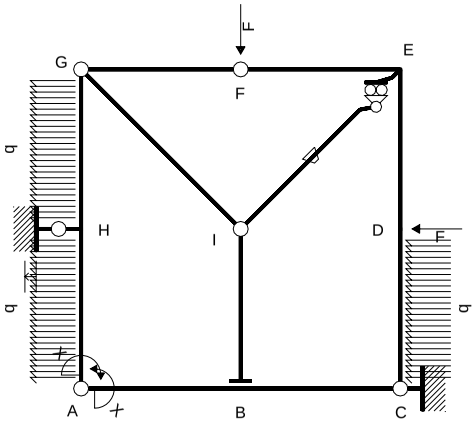

G
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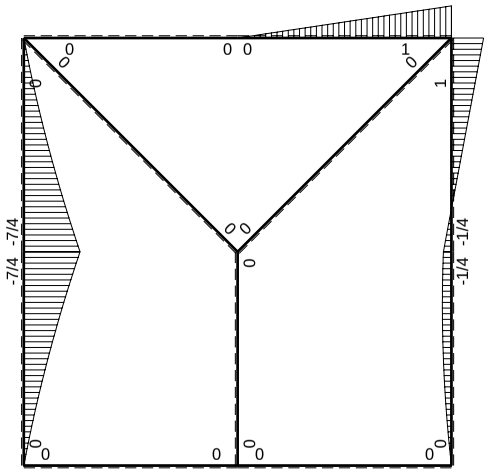

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-3/4

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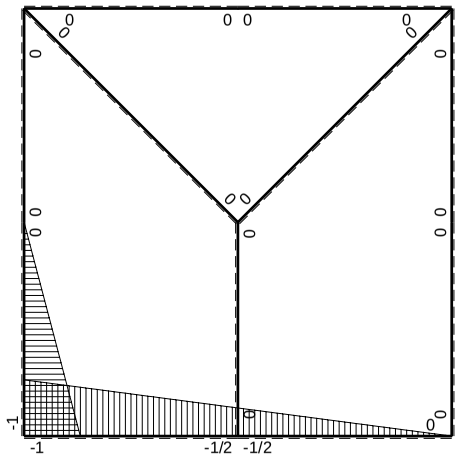

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-3/4
-3/4
-3/8
-3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 263194 CI04.xxxx.088

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PROCEDIMENTO E RISULTATI 263194 CI04.xxxx.088

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

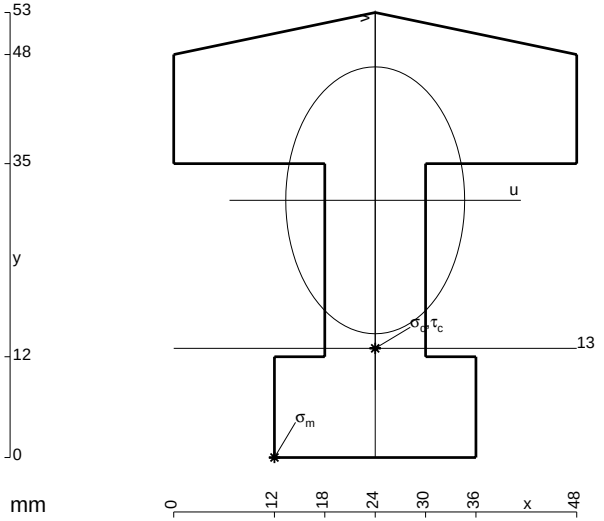
$L^{Xo}_{HA} = \int_o^b (7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (7/8\ b - 3/4\ b + 1/8\ b\ )\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b (5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

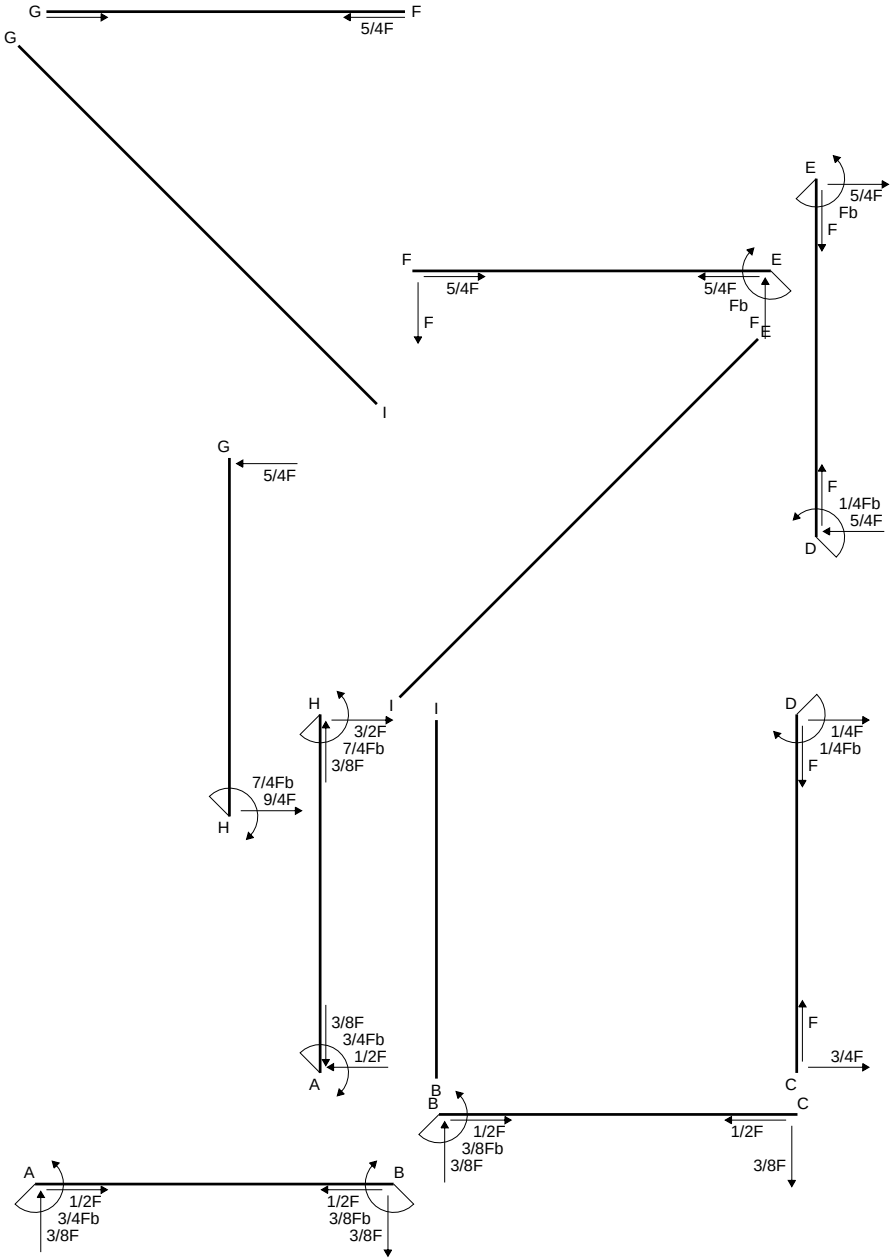
$= (5/8\ b - 1/4\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

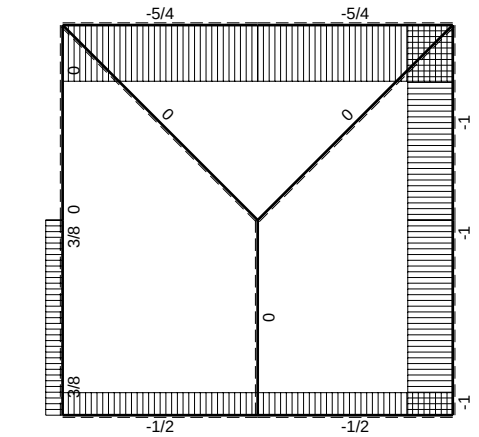
PROCEDIMENTO E RISULTATI 263194 CI04.xxxx.088

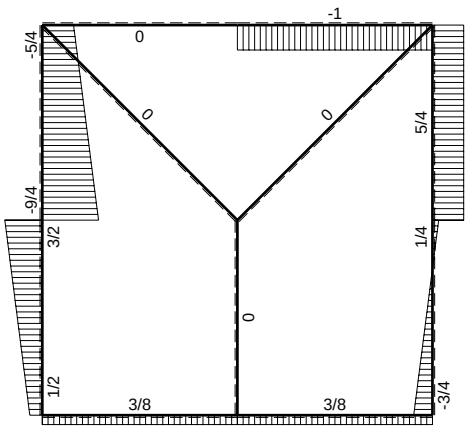


A = 1308. mm^2
J_u = 330537. mm^4
J_v = 148464. mm^4
y_g = 30.63 mm
T_y = -3623. N
M_x = -2479400. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.63 mm
$\sigma_m = -Mv/J_u$ = -229.8 N/mm^2
x_c = 24. mm
y_c = 13. mm
v_c = -17.63 mm
$\sigma_c = -Mv/J_u$ = -132.3 N/mm^2
τ_c = 6.678 N/mm^2
$\sigma_0 = \sqrt{\sigma^2 + 3\tau^2}$ = 132.8 N/mm^2
S^* = 7312. mm^3

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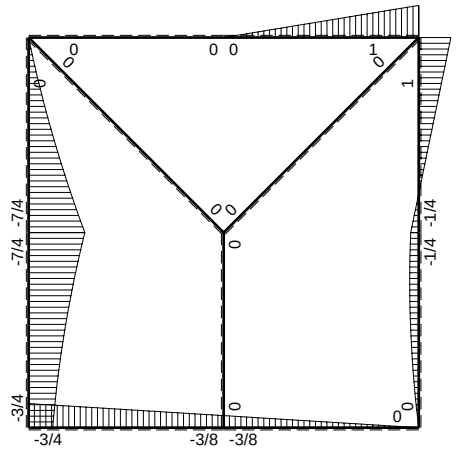

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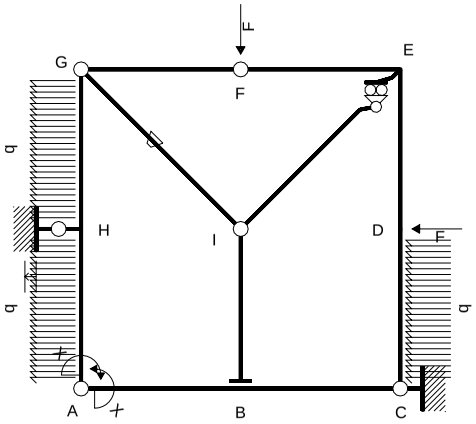

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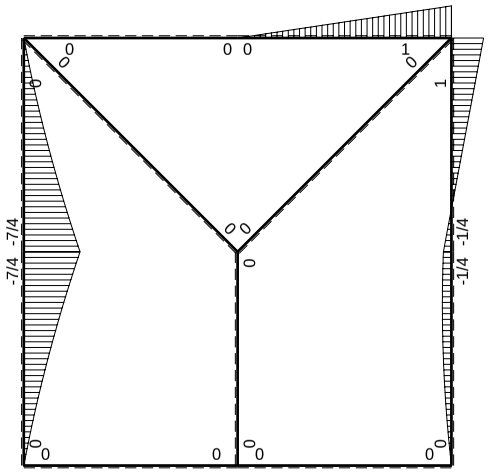
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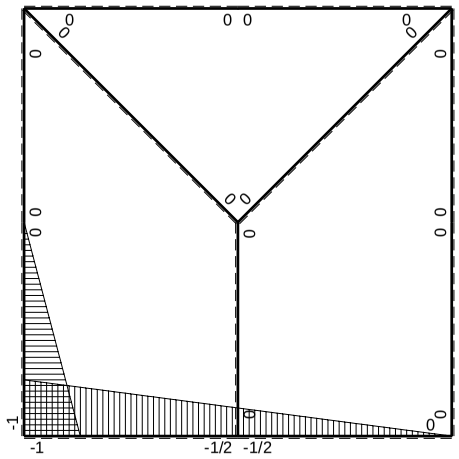

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-3/4
-3/4
-3/8
-3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 218770 CI04.xxxx.089

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PROCEDIMENTO E RISULTATI 218770 CI04.xxxx.089

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

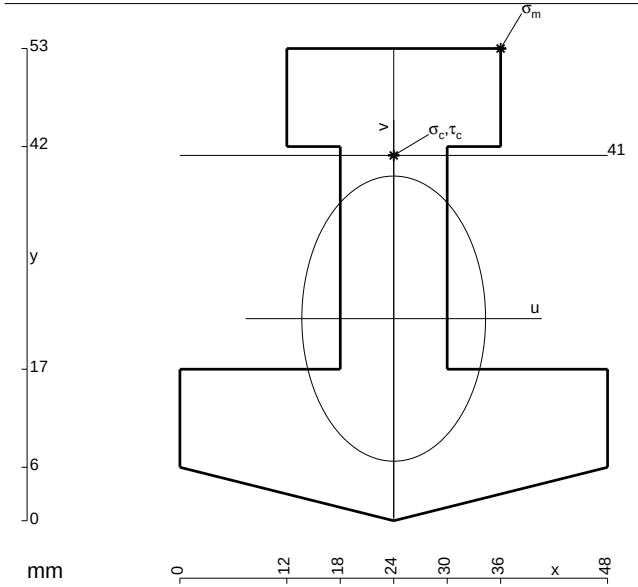
$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

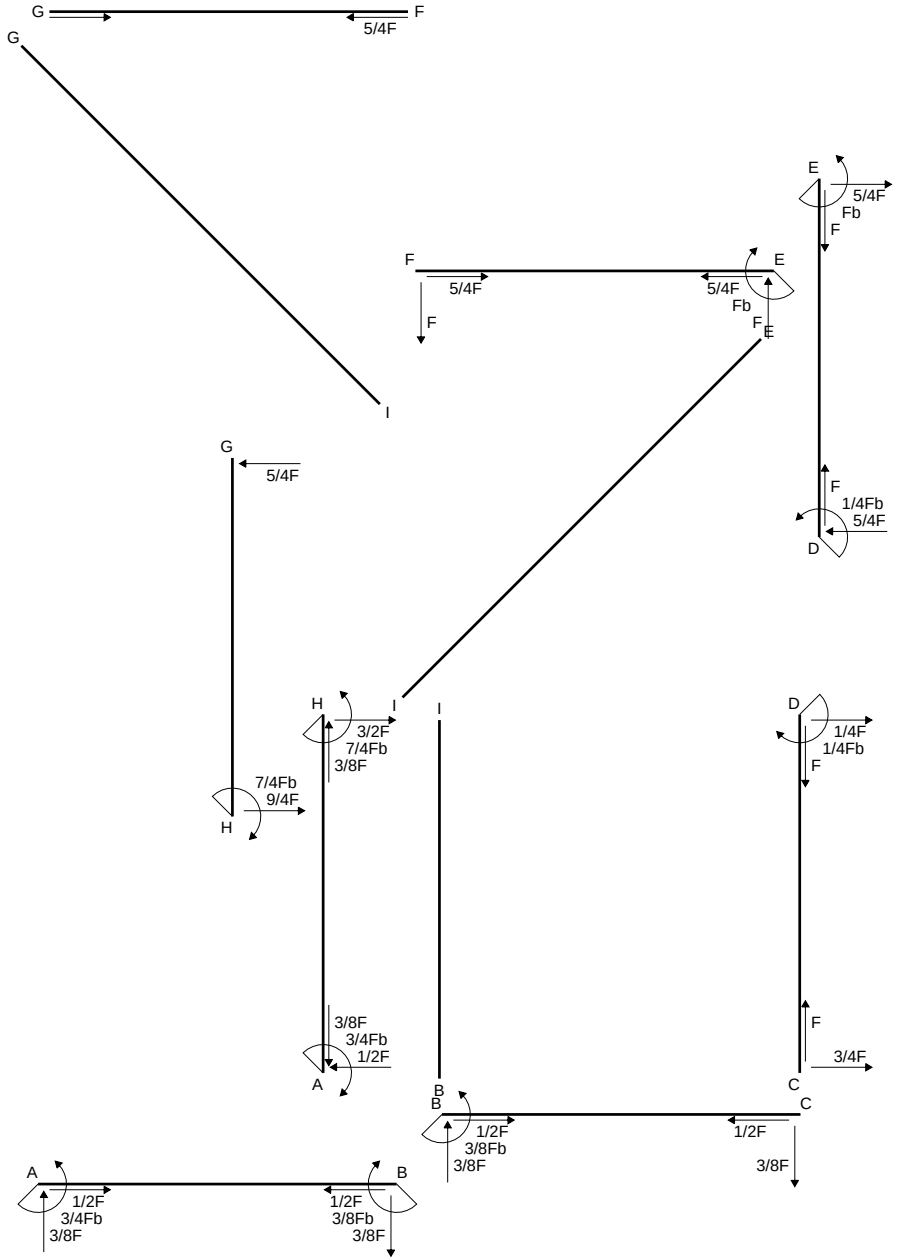
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

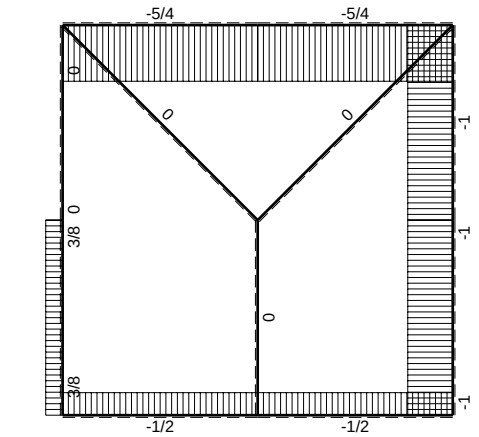
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

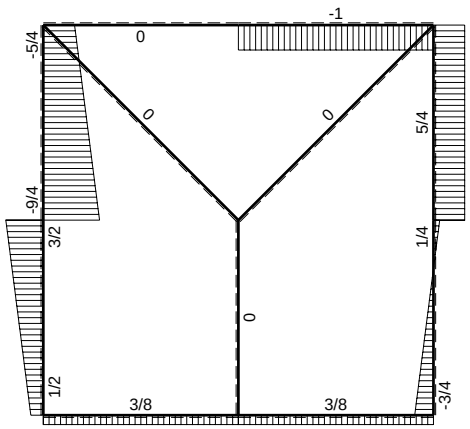
PROCEDIMENTO E RISULTATI 218770 CI04.xxxx.089



A = 1236. mm^2
J_u = 316729. mm^4
J_v = 131472. mm^4
y_g = 22.68 mm
T_y = -3465. N
M_x = -2506350. Nmm
x_m = 36. mm
y_m = 53. mm
u_m = 12. mm
v_m = 30.32 mm
$\sigma_m = -Mv/J_u$ = 239.9 N/mm^2
x_c = 24. mm
y_c = 41. mm
v_c = 18.32 mm
$\sigma_c = -Mv/J_u$ = 144.9 N/mm^2
τ_c = 6.178 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 145.3 N/mm^2
S^* = 6777. mm^3

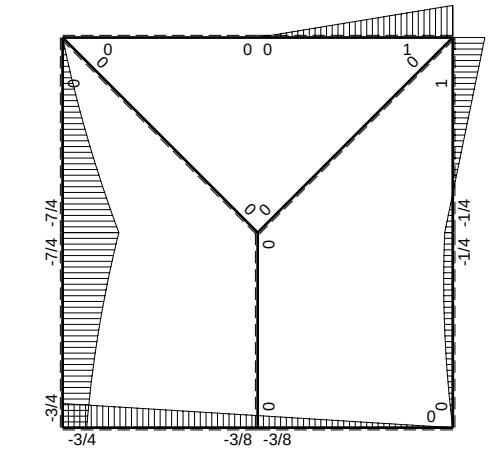

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5/4F
G
I
E
5/4F
Fb
F
F
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5/4F
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7/4Fb
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B
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3/4Fb
3/8F
1/2F
3/8Fb
3/8F


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-1/2

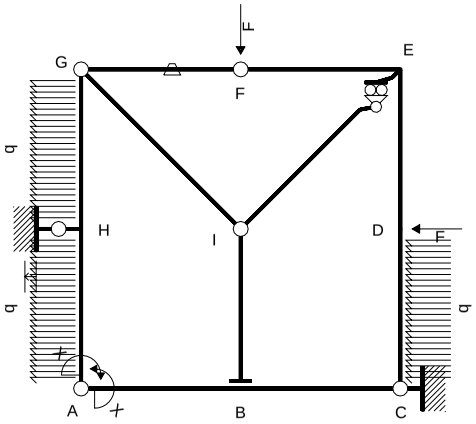

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1/4
0
1/2
3/8
3/8
-3/4

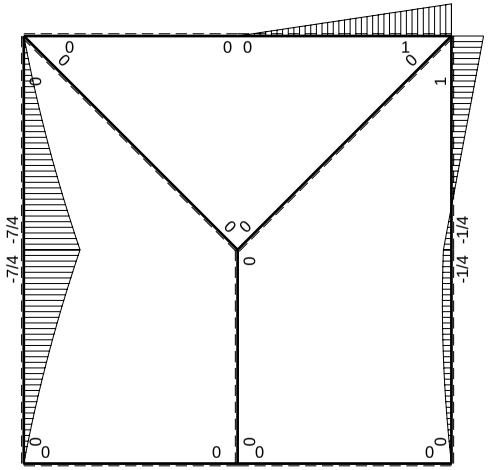
F

F

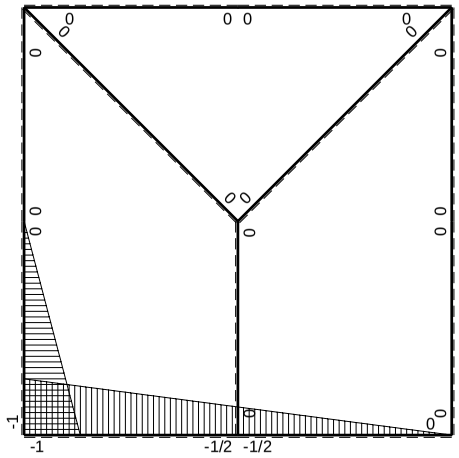

0
0 0
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1
0 0
-7/4
-7/4
-1/4
-1/4
0
0
0
0
0
-3/4
-3/4
-3/8
-3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 214608 CI04.xxxx.090

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	-Fb/EJ	0	0	0	0+0	0
GF b	0	0	Fb/EJ	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

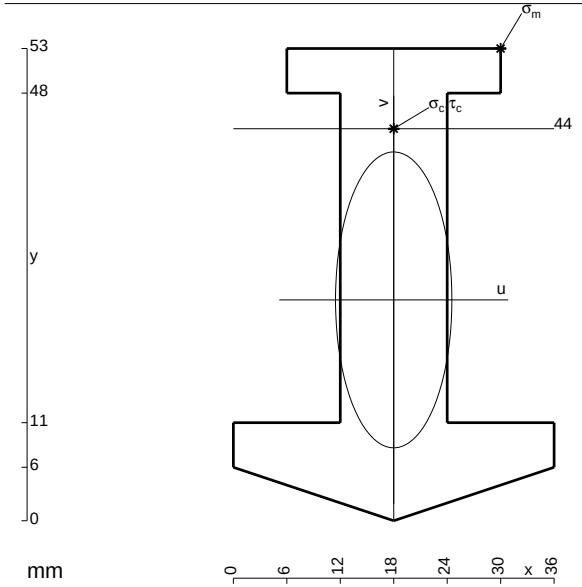
$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

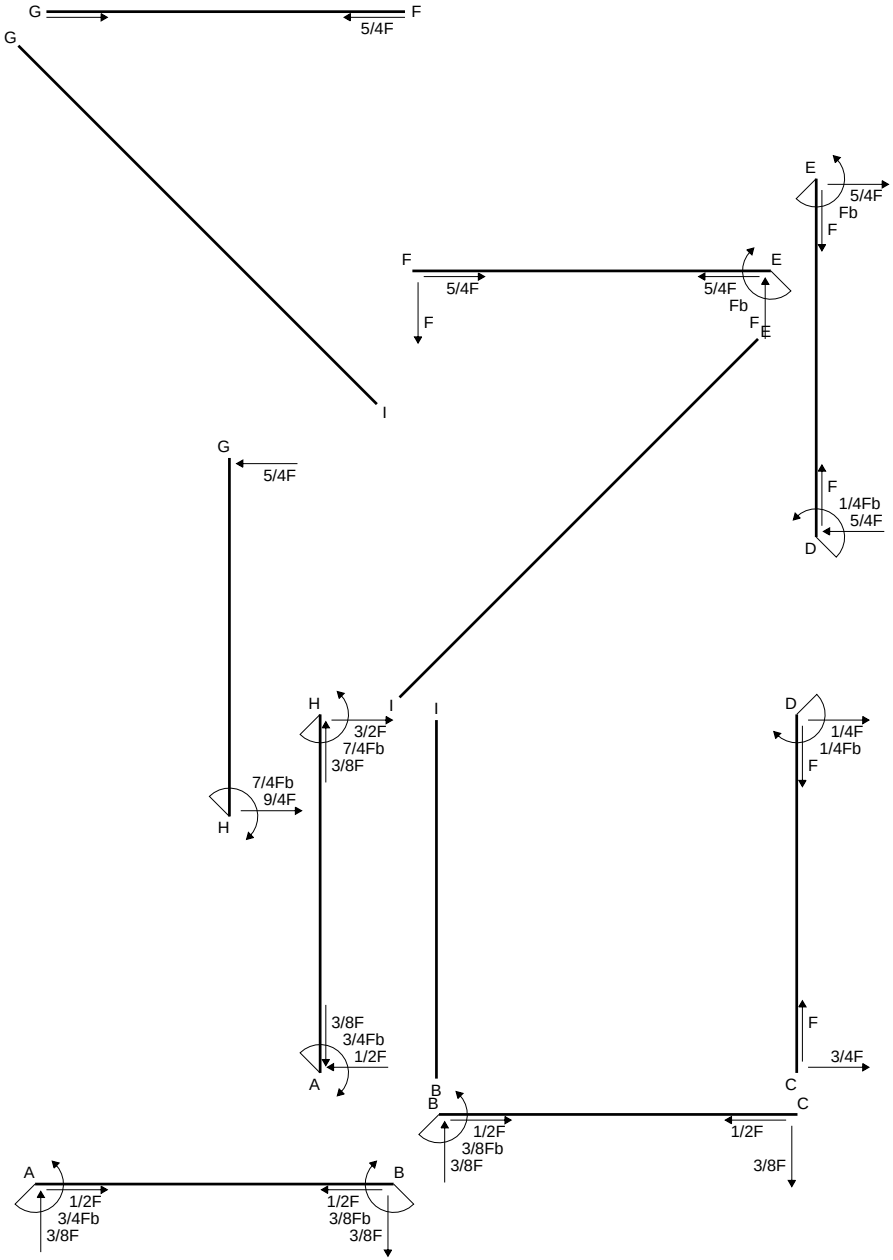
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

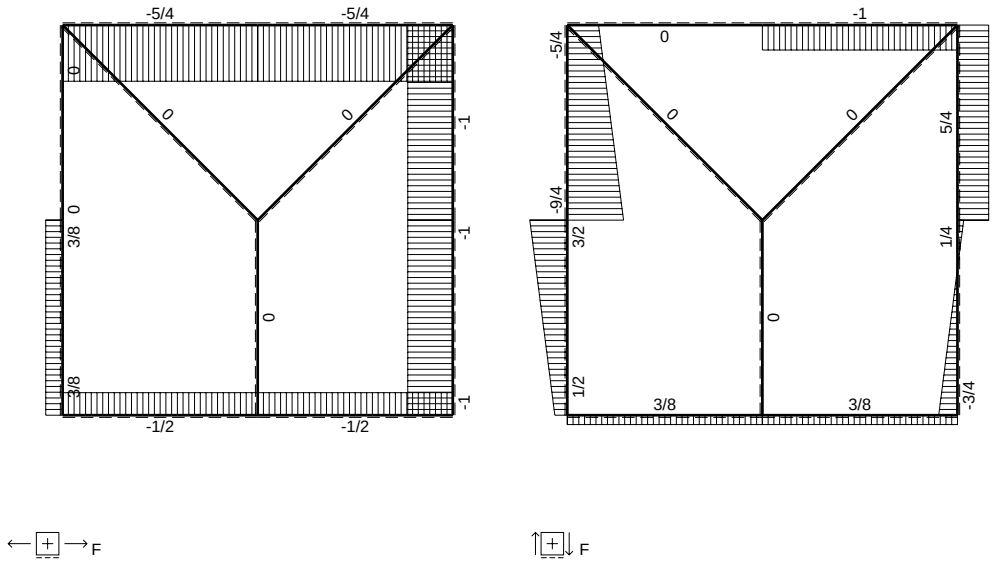
PROCEDIMENTO E RISULTATI 214608 CI04.xxxx.090



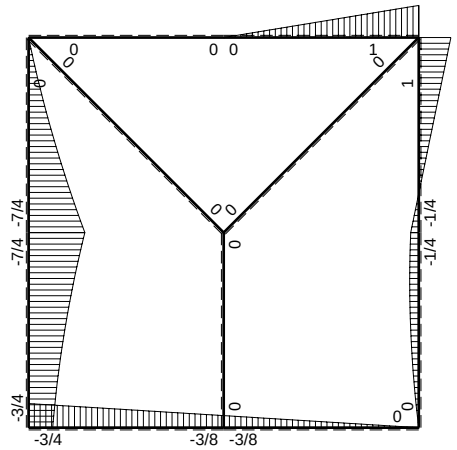
A = 852. mm^2
J_u = 235110. mm^4
J_v = 36360. mm^4
y_g = 24.79 mm
T_y = -4365. N
M_x = -1663550. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 12. mm
v_m = 28.21 mm
$\sigma_m = -Mv/J_u$ = 199.6 N/mm^2
x_c = 18. mm
y_c = 44. mm
v_c = 19.21 mm
$\sigma_c = -Mv/J_u$ = 135.9 N/mm^2
τ_c = 6.349 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 136.4 N/mm^2
S^* = 4103. mm^3

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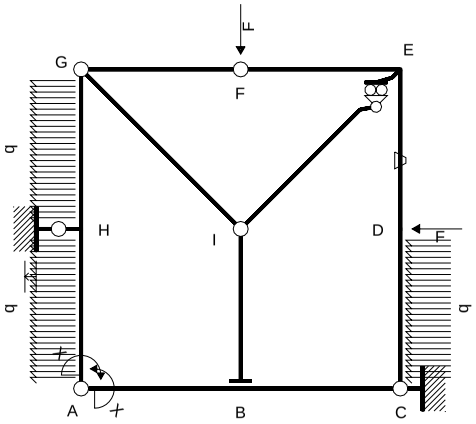

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1/4Fb
5/4F
D
H
I
3/2F
7/4Fb
3/8F
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D
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F
3/8F
3/4Fb
1/2F
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F
3/4F
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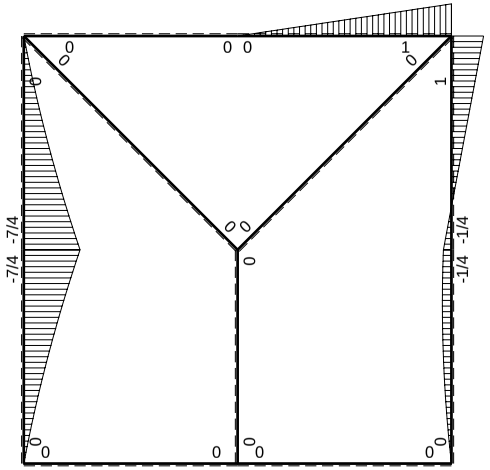

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3/8
3/8
-3/4

F F

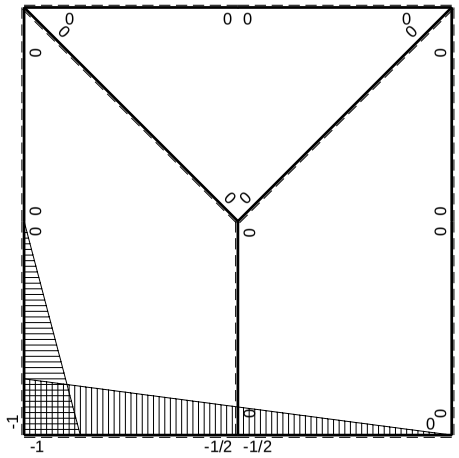

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-7/4
-1/4
-1/4
0
0
0
0
-3/4
-3/4
-3/8
-3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 248683 CI04.xxxx.091

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PROCEDIMENTO E RISULTATI 248683 CI04.xxxx.091

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	Fb/EJ	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

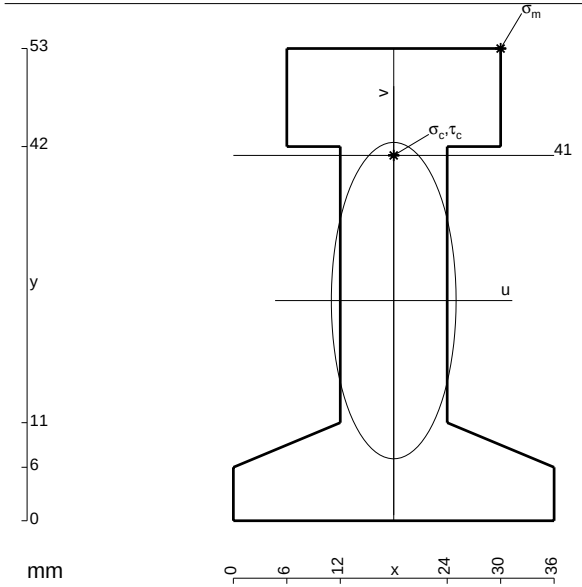
$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

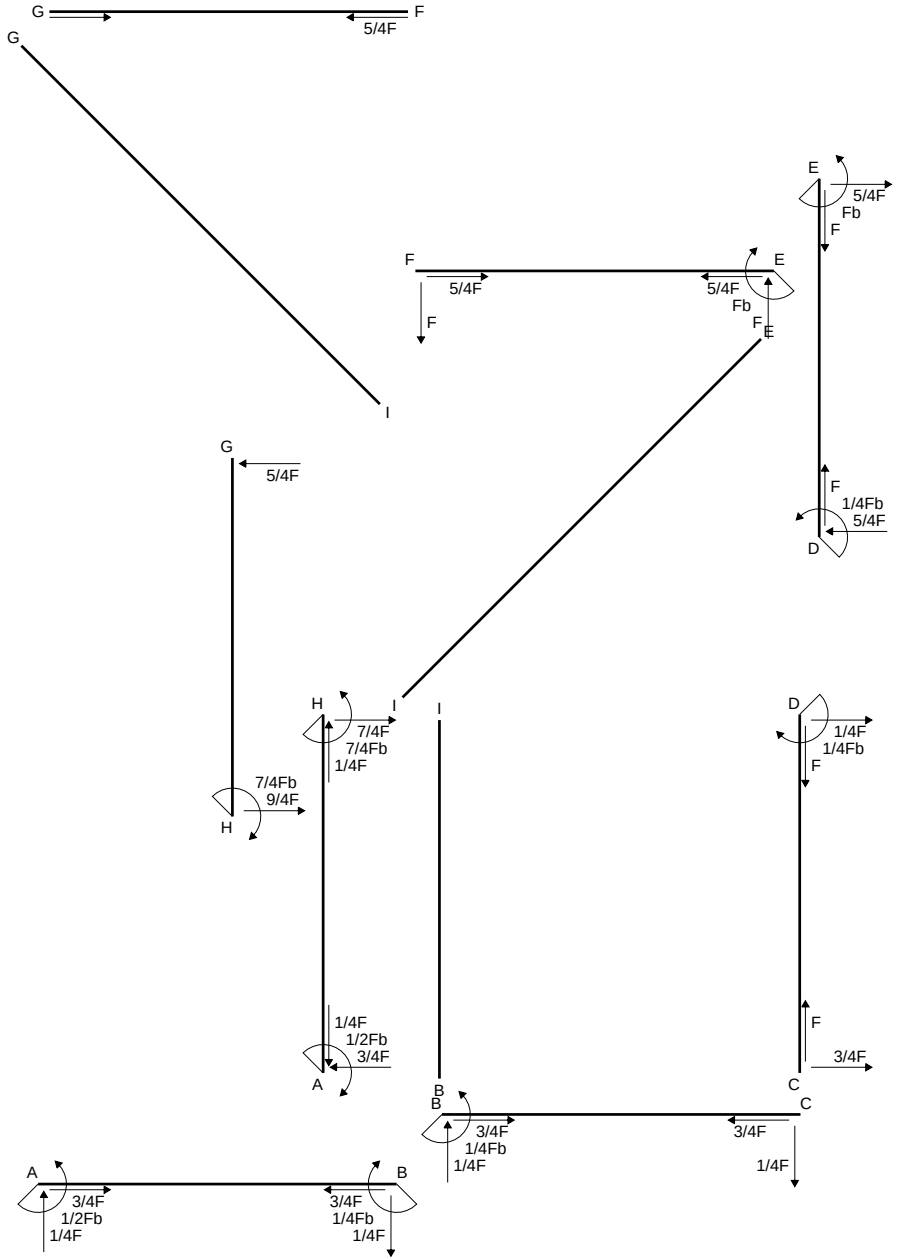
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

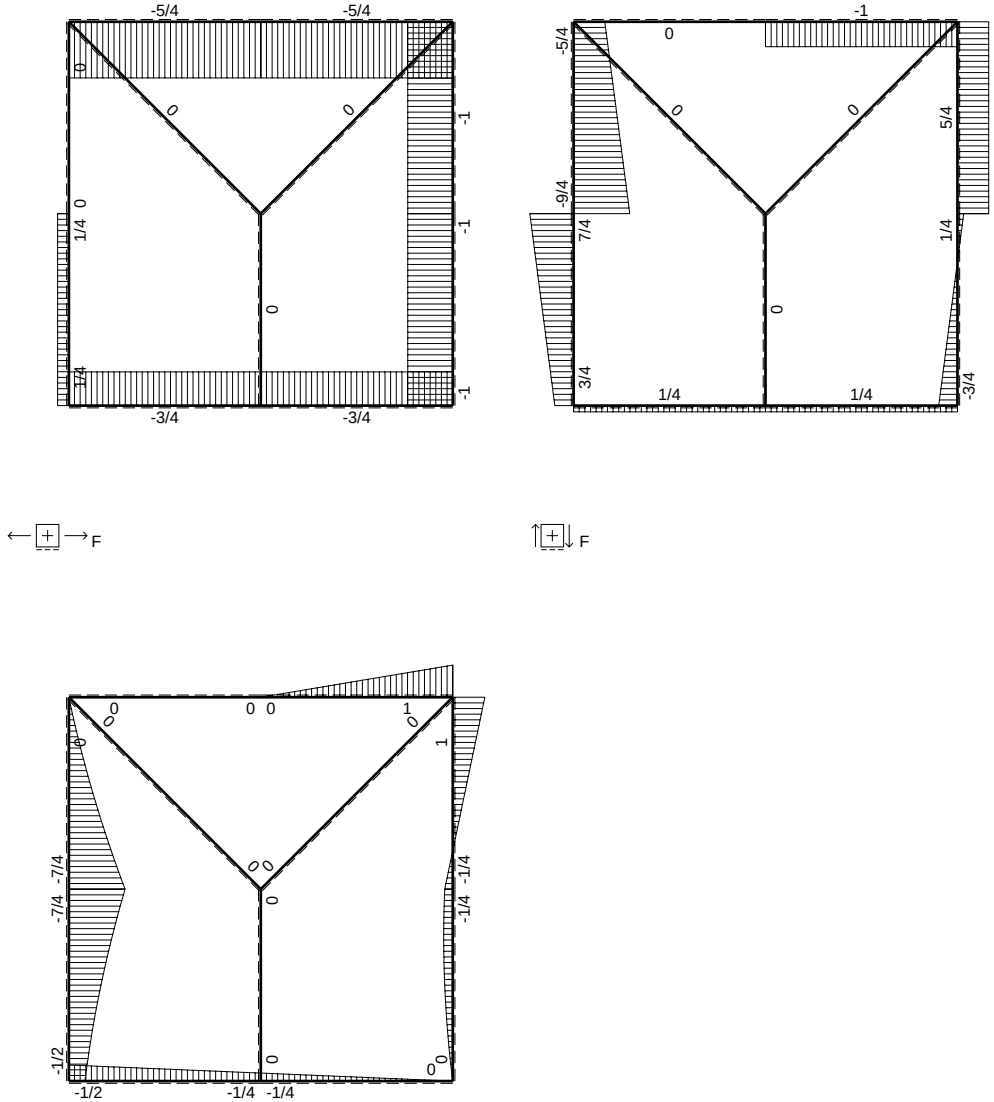
PROCEDIMENTO E RISULTATI 248683 CI04.xxxx.091

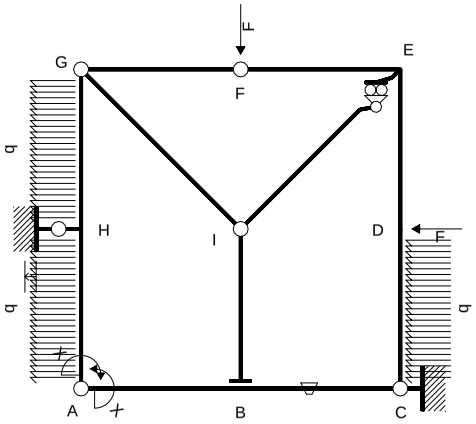


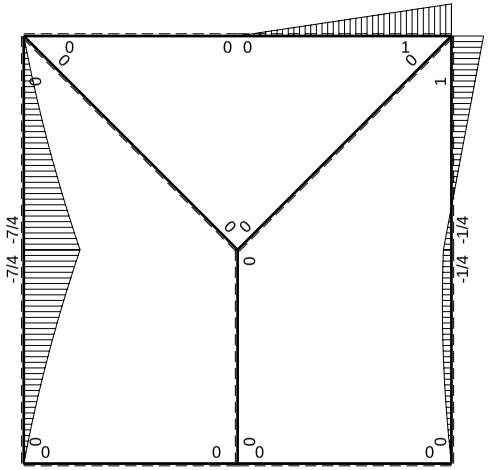
A = 972. mm^2
J_u = 306619. mm^4
J_v = 47664. mm^4
y_g = 24.71 mm
T_y = -5513. N
M_x = -2272380. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 12. mm
v_m = 28.29 mm
$\sigma_m = -Mv/J_u$ = 209.7 N/mm^2
x_c = 18. mm
y_c = 41. mm
v_c = 16.29 mm
$\sigma_c = -Mv/J_u$ = 120.7 N/mm^2
τ_c = 9.317 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 121.8 N/mm^2
S^* = 6219. mm^3

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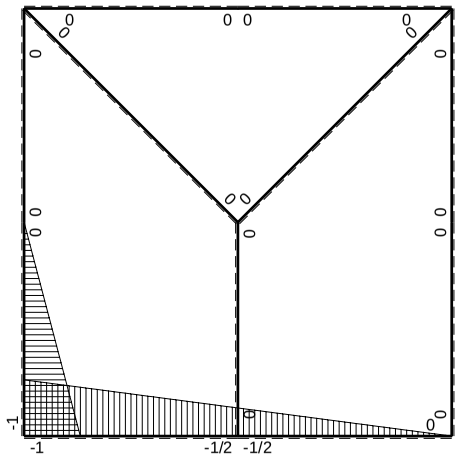

G
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1/4
-3/4
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F
-7/4
-7/4
-1/4
-1/4
-1/2
-1/4
-1/4
-1/2
Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	-Fb/EJ	0	1/2Fb/EJ-1/2Fx/EJ	$1/4-1/2x/b+1/4x^2/b^2$	$(0+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	0	Fb/EJ	0	1/2Fx/EJ	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/2Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/2Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{BC} = \int_o^b \left(1/2 - 1/2\ x/b\ \right)\theta\ dx = \left[1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(1/2\ b - 1/4\ b\ \right)\theta\ = 1/4\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/2\ x/b\ \right)\theta\ dx = \left[-1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/4\ b\ \right)\theta\ = 1/4\ Fb^2/EJ$

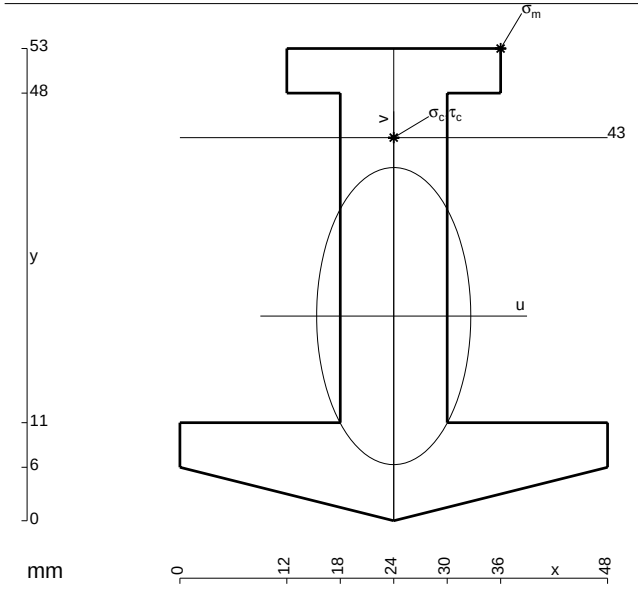
$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

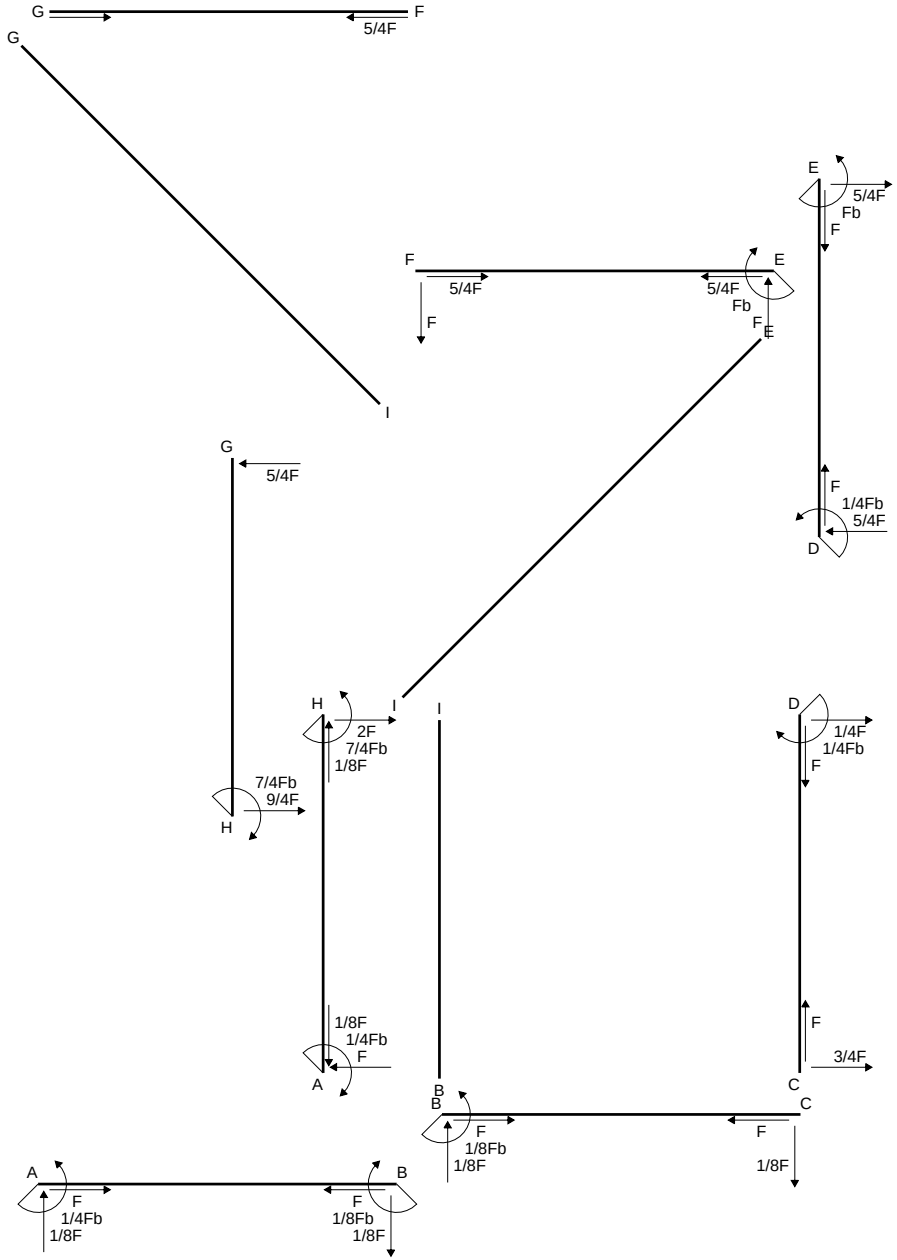
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

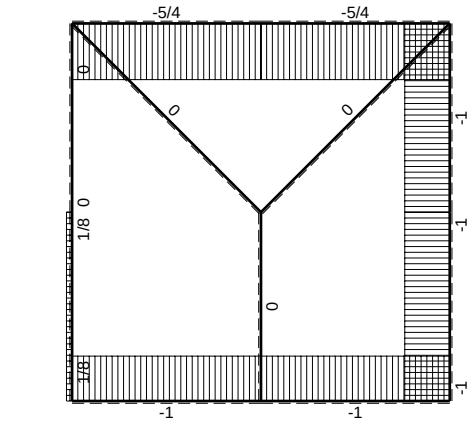
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

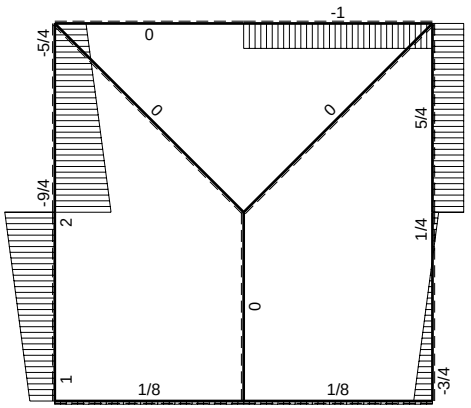
PROCEDIMENTO E RISULTATI 266563 CI04.xxxx.092



A = 948. mm^2
J_u = 263643. mm^4
J_v = 70992. mm^4
y_g = 22.97 mm
T_y = -4275. N
M_x = -1928500. Nmm
x_m = 36. mm
y_m = 53. mm
u_m = 12. mm
v_m = 30.03 mm
$\sigma_m = -Mv/J_u$ = 219.7 N/mm^2
x_c = 24. mm
y_c = 43. mm
v_c = 20.03 mm
$\sigma_c = -Mv/J_u$ = 146.5 N/mm^2
τ_c = 6.291 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 146.9 N/mm^2
S^* = 4656. mm^3

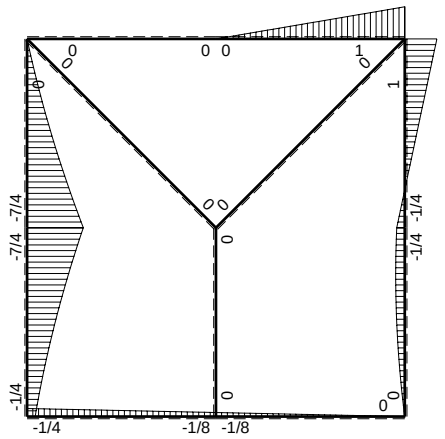

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D
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2F
7/4Fb
1/8F
7/4Fb
9/4F
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1/4Fb
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-1

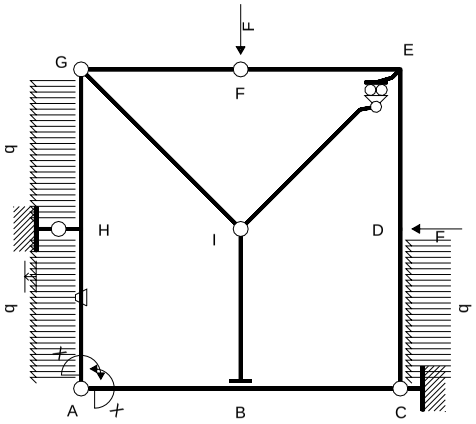

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0
1
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1/8
-3/4

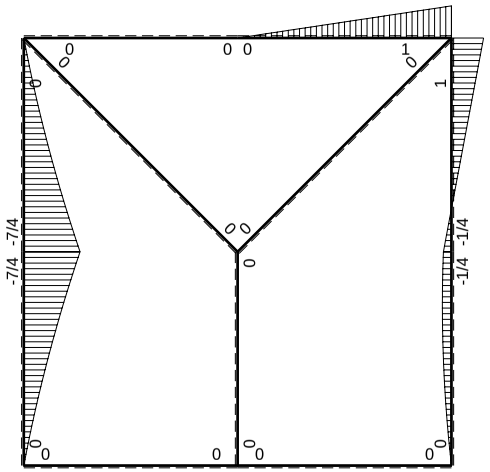
F

F

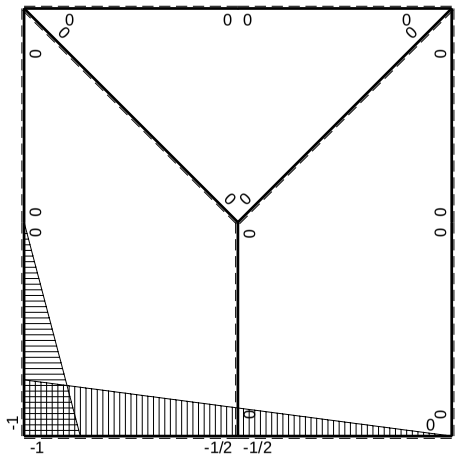

0
0 0
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-7/4 -7/4
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-1/4
-1/8 -1/8
0
0
0
0

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 248282 CI04.xxxx.093

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	-Fb/EJ	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(1/4+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	Fb/EJ	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\theta\ dx$

$= \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b \theta$

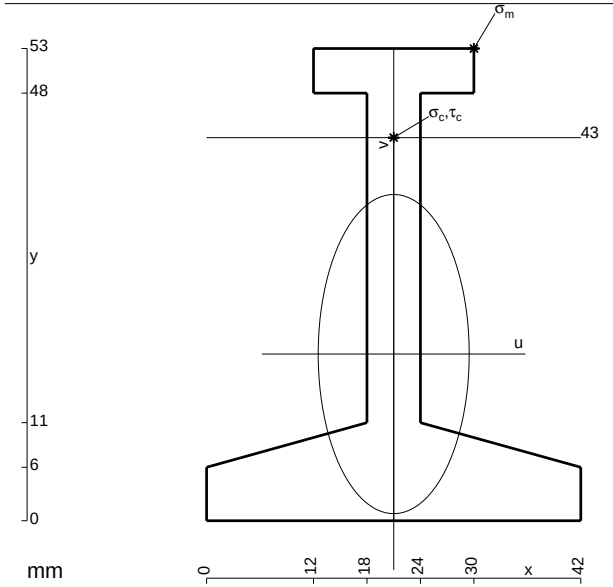
$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ + \left(1/2\ b\ \right)\theta\ = 3/4\ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\theta\ dx$

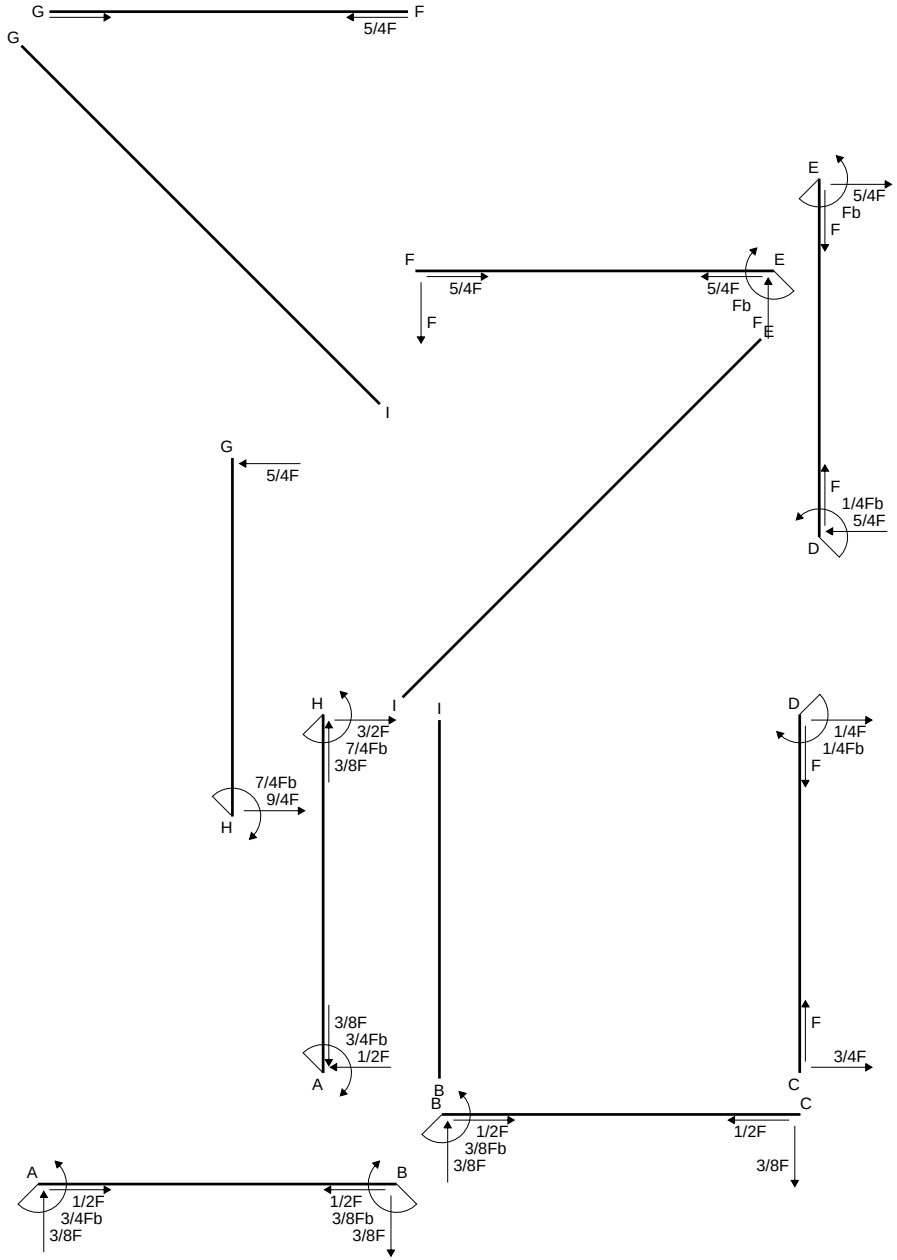
$= \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b \theta$

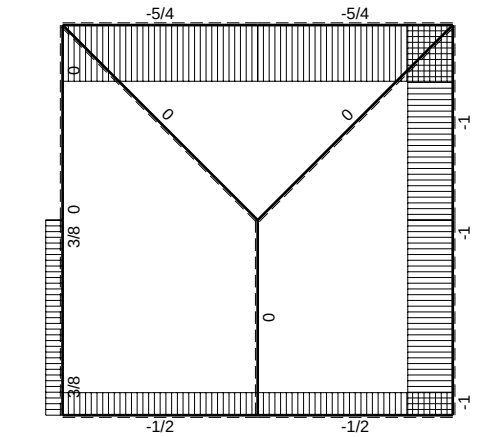
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\theta\ = 3/4\ Fb^2/EJ$

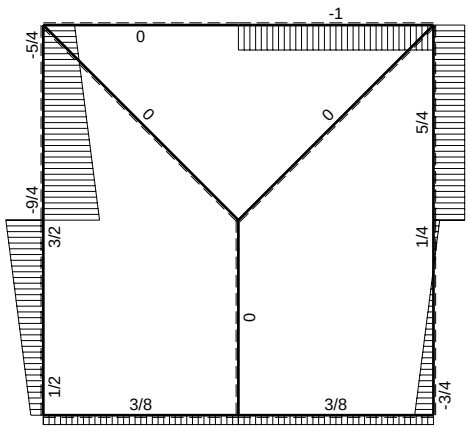
PROCEDIMENTO E RISULTATI 248282 CI04.xxxx.093



A = 684. mm^2
J_u = 219556. mm^4
J_v = 49140. mm^4
y_g = 18.71 mm
T_y = -2993. N
M_x = -1466330. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 9. mm
v_m = 34.29 mm
$\sigma_m = -Mv/J_u$ = 229. N/mm^2
x_c = 21. mm
y_c = 43. mm
v_c = 24.29 mm
$\sigma_c = -Mv/J_u$ = 162.2 N/mm^2
τ_c = 8.326 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 162.9 N/mm^2
S^* = 3665. mm^3

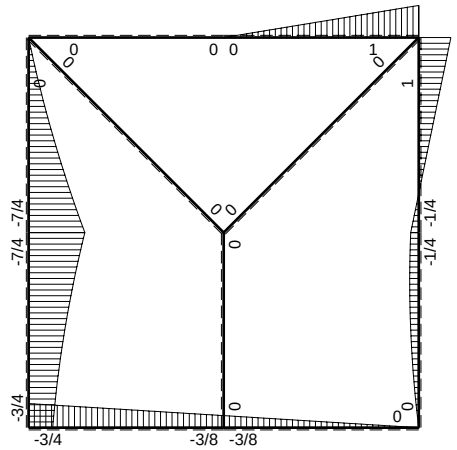

G
F
5/4F
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5/4F
Fb
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F
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5/4F
Fb
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H
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7/4Fb
3/8F
7/4Fb
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B
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3/8Fb
3/8F


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-1/2

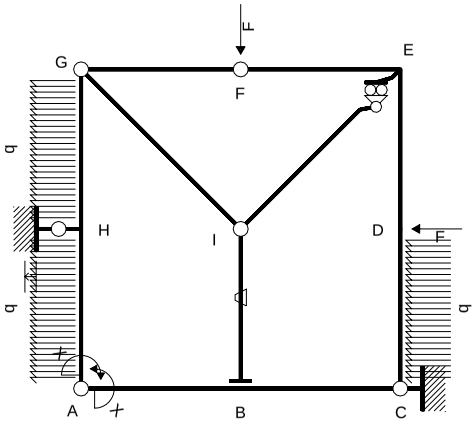

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3/8
-3/4

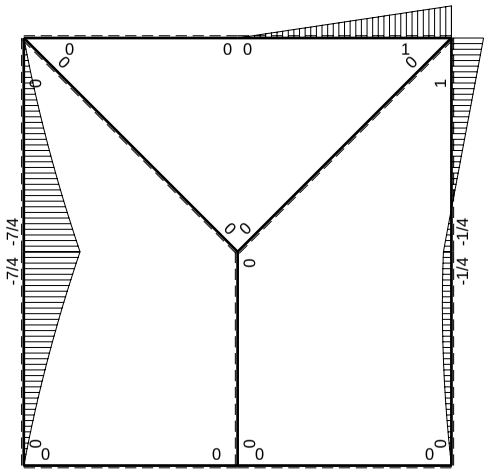
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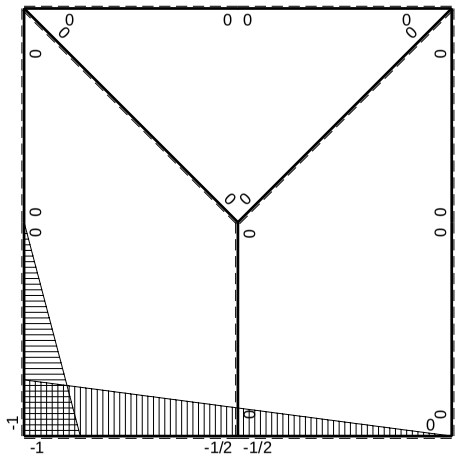

0
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-7/4
-1/4
-1/4
0
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0
0
0
-3/4
-3/4
-3/8
-3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 269001 CI04.xxxx.094

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	-Fb/EJ	0	0	0	0+0	0
BI b	0	0	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

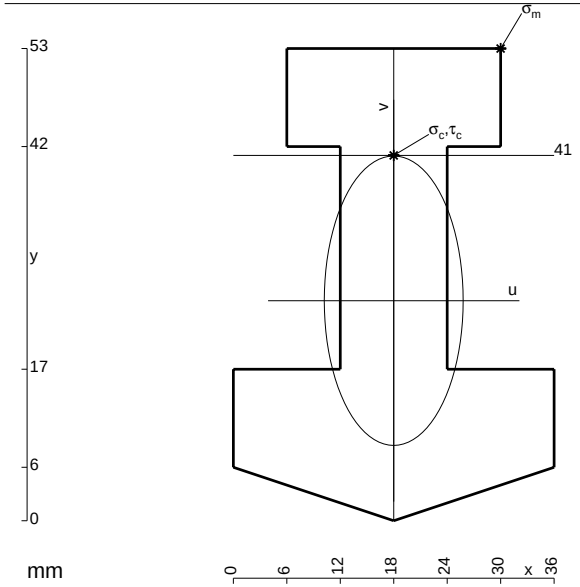
$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

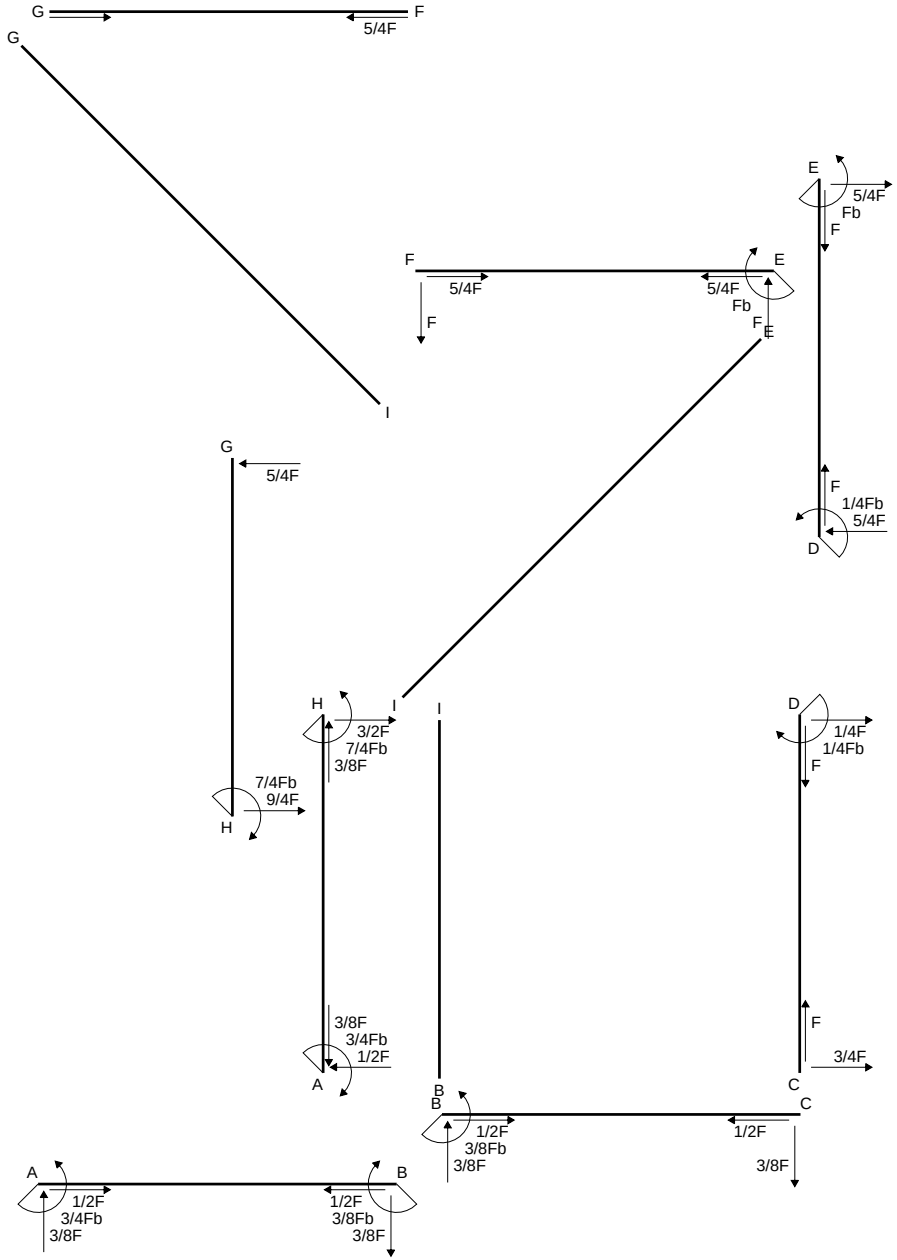
$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

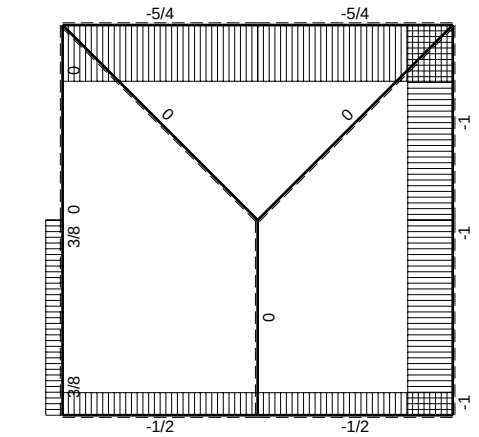
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

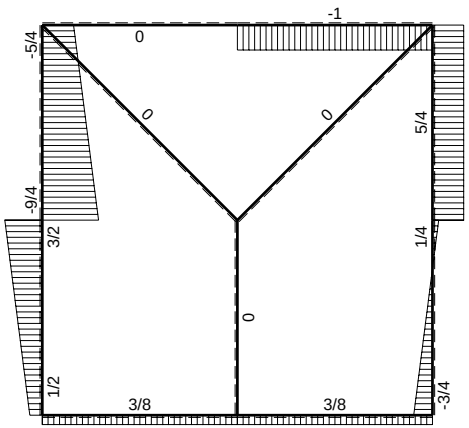
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$



A = 1068. mm^2
J_u = 281922. mm^4
J_v = 64872. mm^4
y_g = 24.7 mm
T_y = -4500. N
M_x = -2380000. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 12. mm
v_m = 28.3 mm
$\sigma_m = -Mv/J_u$ = 238.9 N/mm^2
x_c = 18. mm
y_c = 41. mm
v_c = 16.3 mm
$\sigma_c = -Mv/J_u$ = 137.6 N/mm^2
τ_c = 8.276 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 138.4 N/mm^2
S^* = 6222. mm^3

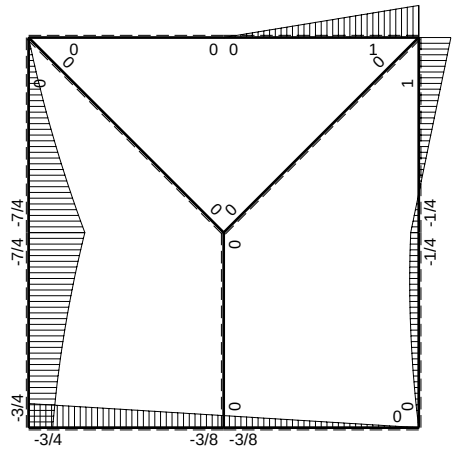

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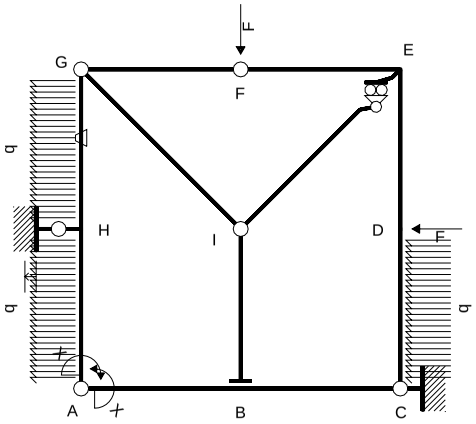

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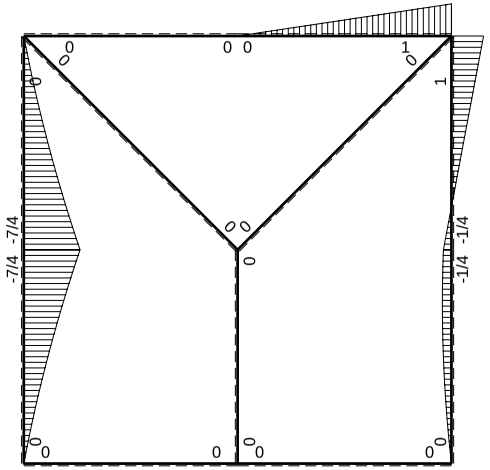
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F

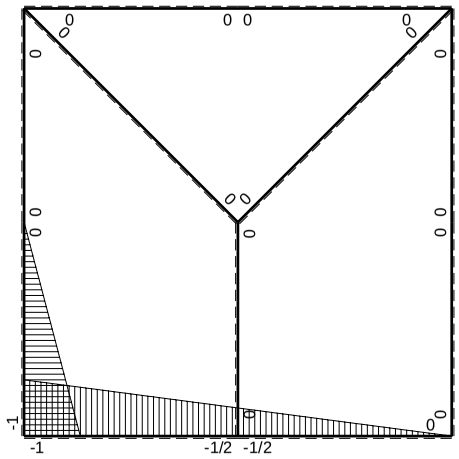

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0
0
0
-3/4
-3/4
-3/8
-3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264038 CI04.xxxx.095

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PROCEDIMENTO E RISULTATI 264038 CI04.xxxx.095

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

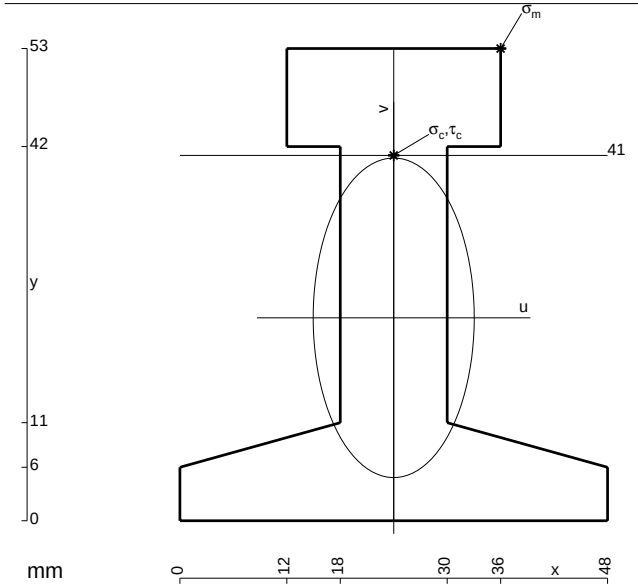
$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

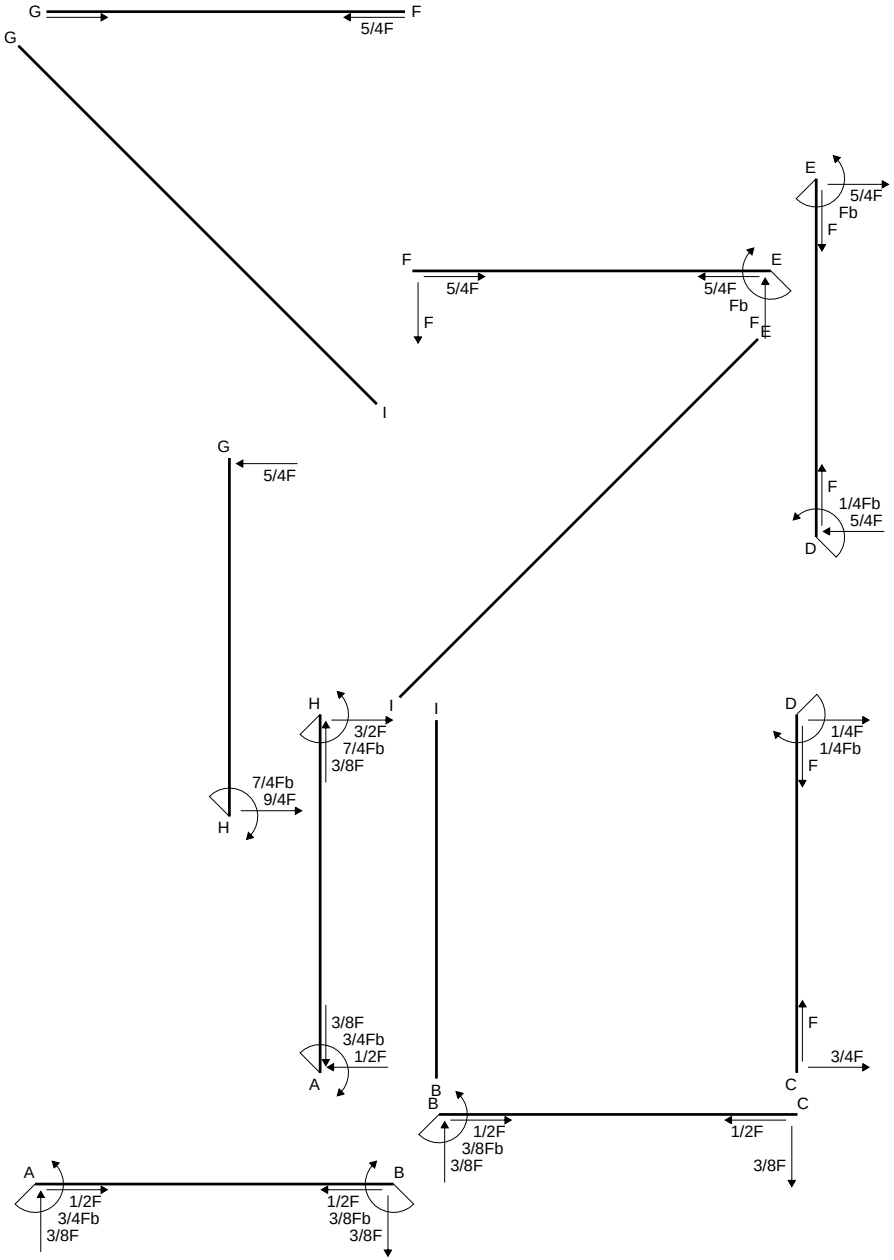
$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

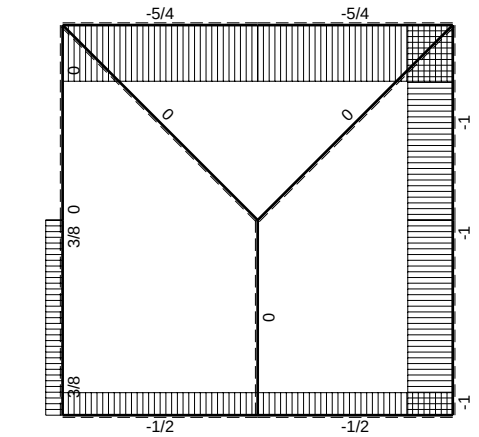
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

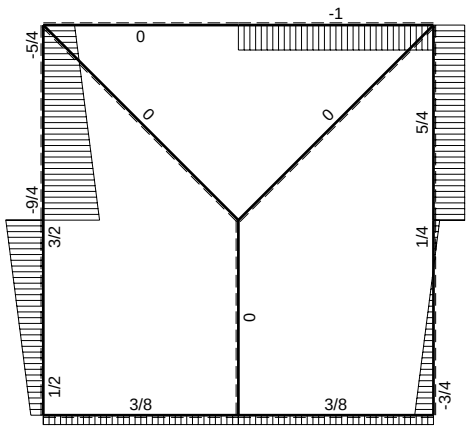
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$



A = 1074. mm^2
J_u = 345511. mm^4
J_v = 87732. mm^4
y_g = 22.78 mm
T_y = -4005. N
M_x = -2273950. Nmm
x_m = 36. mm
y_m = 53. mm
u_m = 12. mm
v_m = 30.22 mm
$\sigma_m = -Mv/J_u$ = 198.9 N/mm^2
x_c = 24. mm
y_c = 41. mm
v_c = 18.22 mm
$\sigma_c = -Mv/J_u$ = 119.9 N/mm^2
τ_c = 6.522 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 120.5 N/mm^2
S^* = 6752. mm^3

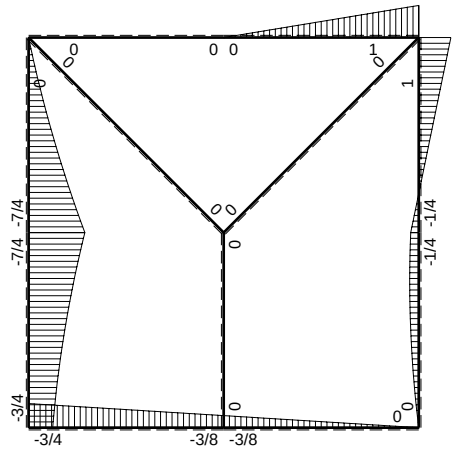

G
F
5/4F
G
I
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5/4F
Fb
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F
5/4F
E
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Fb
F
E
G
5/4F
F
1/4Fb
5/4F
D
H
I
3/2F
7/4Fb
3/8F
7/4Fb
9/4F
H
I
D
1/4F
1/4Fb
F
3/8F
3/4Fb
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A
F
3/4F
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A
B
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1/2F
3/8Fb
3/8F


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-1/2

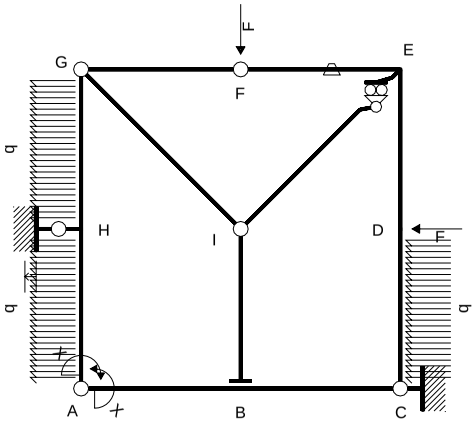

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1/2
3/8
3/8
-3/4

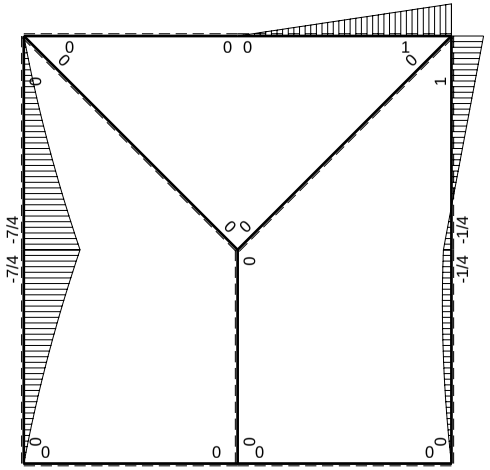
F

F

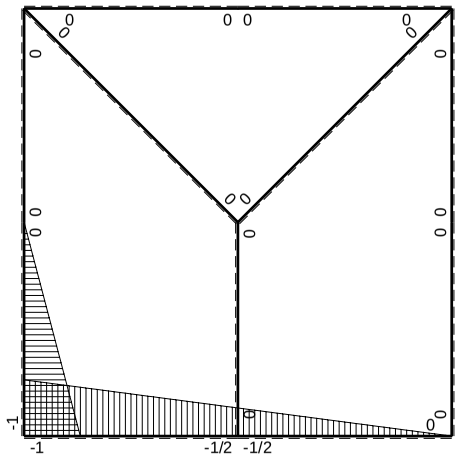

0
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1
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-7/4
-7/4
-1/4
-1/4
0
0
0
0
0
-3/4
-3/4
-3/8
-3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 266348 CI04.xxxx.096

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	0	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	-Fb/EJ	0	0	0	0+0	0
FE b	0	-Fx	Fb/EJ	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

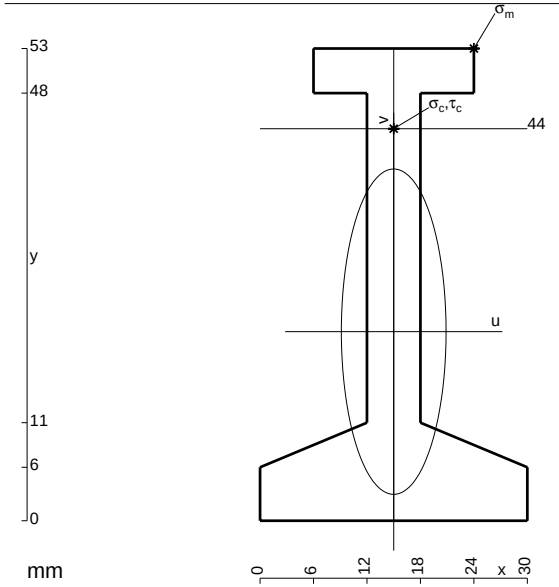
$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

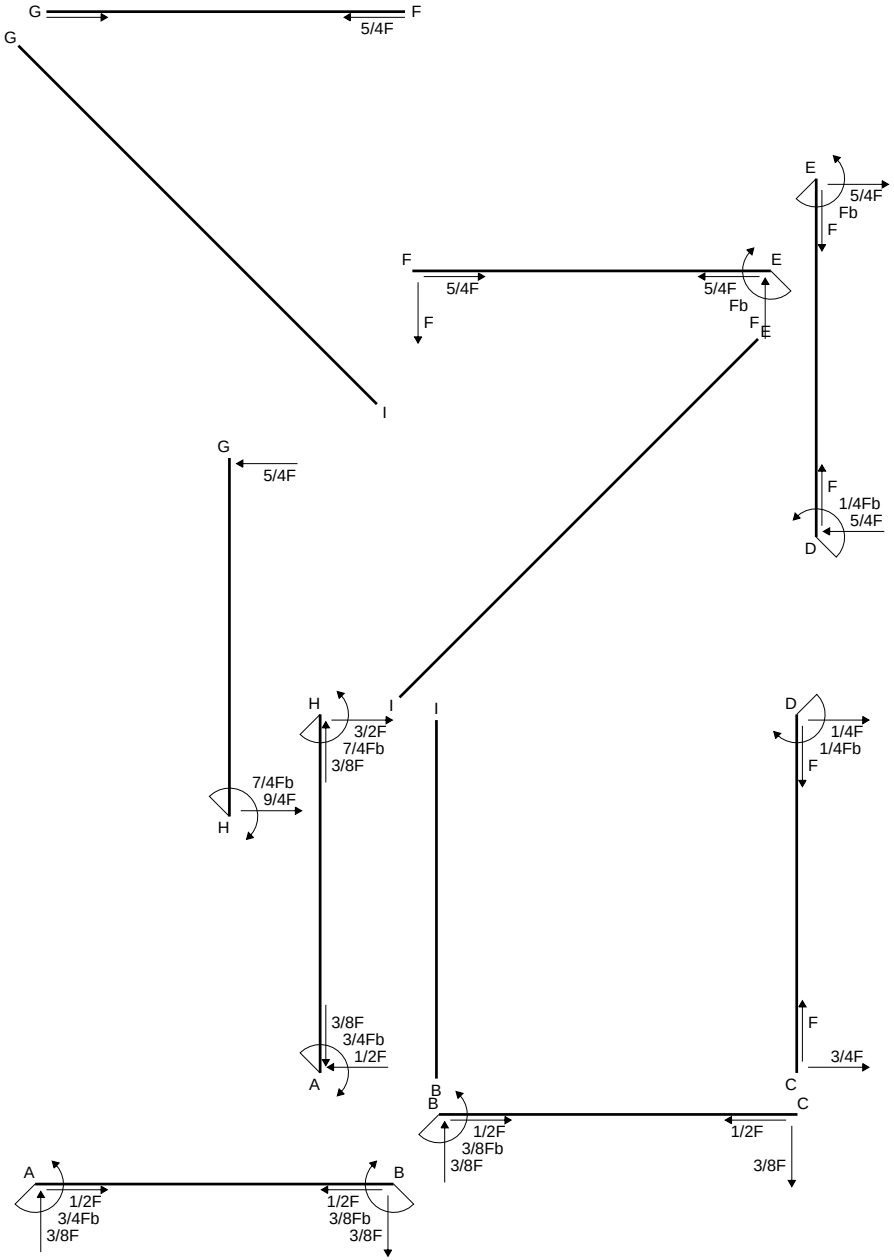
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

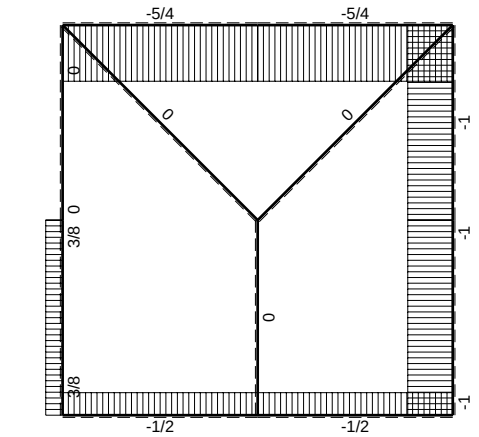
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

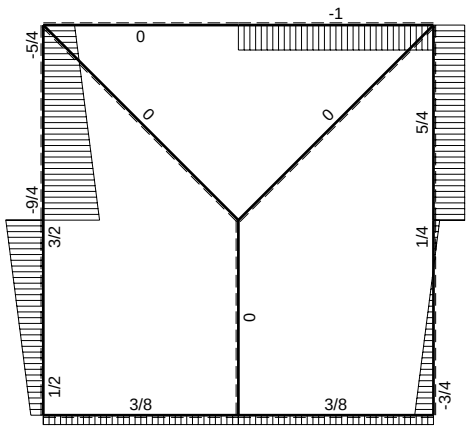
PROCEDIMENTO E RISULTATI 266348 CI04.xxxx.096



A = 582. mm^2
J_u = 194208. mm^4
J_v = 20106. mm^4
y_g = 21.22 mm
T_y = -2115. N
M_x = -1283100. Nmm
x_m = 24. mm
y_m = 53. mm
u_m = 9. mm
v_m = 31.78 mm
$\sigma_m = -Mv/J_u$ = 210. N/mm^2
x_c = 15. mm
y_c = 44. mm
v_c = 22.78 mm
$\sigma_c = -Mv/J_u$ = 150.5 N/mm^2
τ_c = 5.863 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 150.9 N/mm^2
S^* = 3230. mm^3

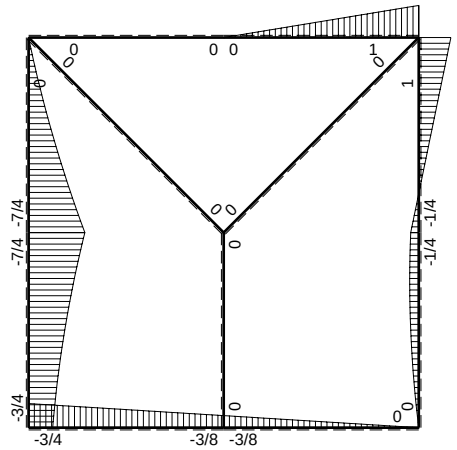

G
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5/4F
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Fb
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Fb
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E
G
5/4F
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D
H
I
3/2F
7/4Fb
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7/4Fb
9/4F
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C
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3/8Fb
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1/2F
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A
B
1/2F
3/4Fb
3/8F
1/2F
3/8Fb
3/8F


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-1/2

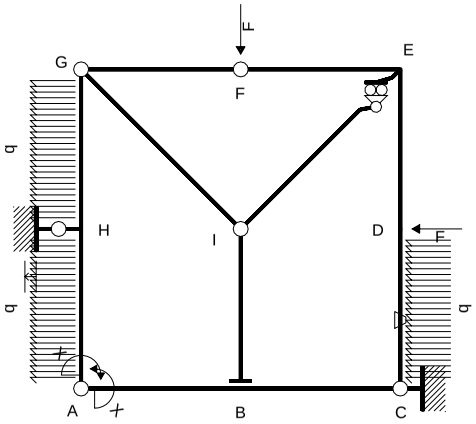

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3/8
3/8
-3/4

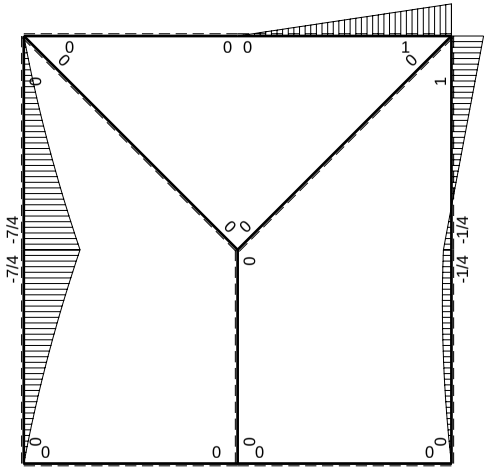
F

F

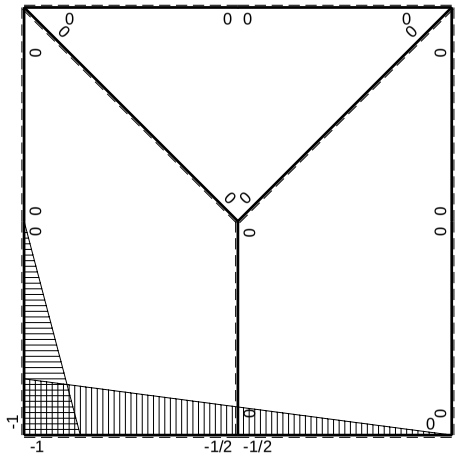

0
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-1/4
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0
0
0
0
0
-3/4
-3/4
-3/8
-3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 267428 CI04.xxxx.097

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PROCEDIMENTO E RISULTATI 267428 CI04.xxxx.097

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-3/4Fx+1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
DC b	0	$1/4Fb+1/4Fx-1/2qx^2$	Fb/EJ	0	0	0		
DE b	0	-1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-Fb+5/4Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

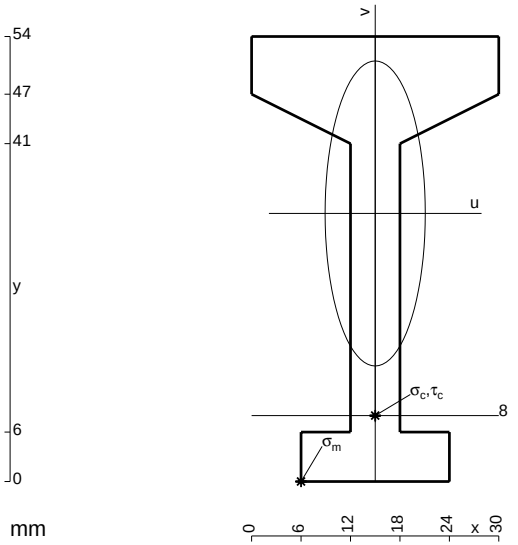
$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{HA} = \int_o^b (7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

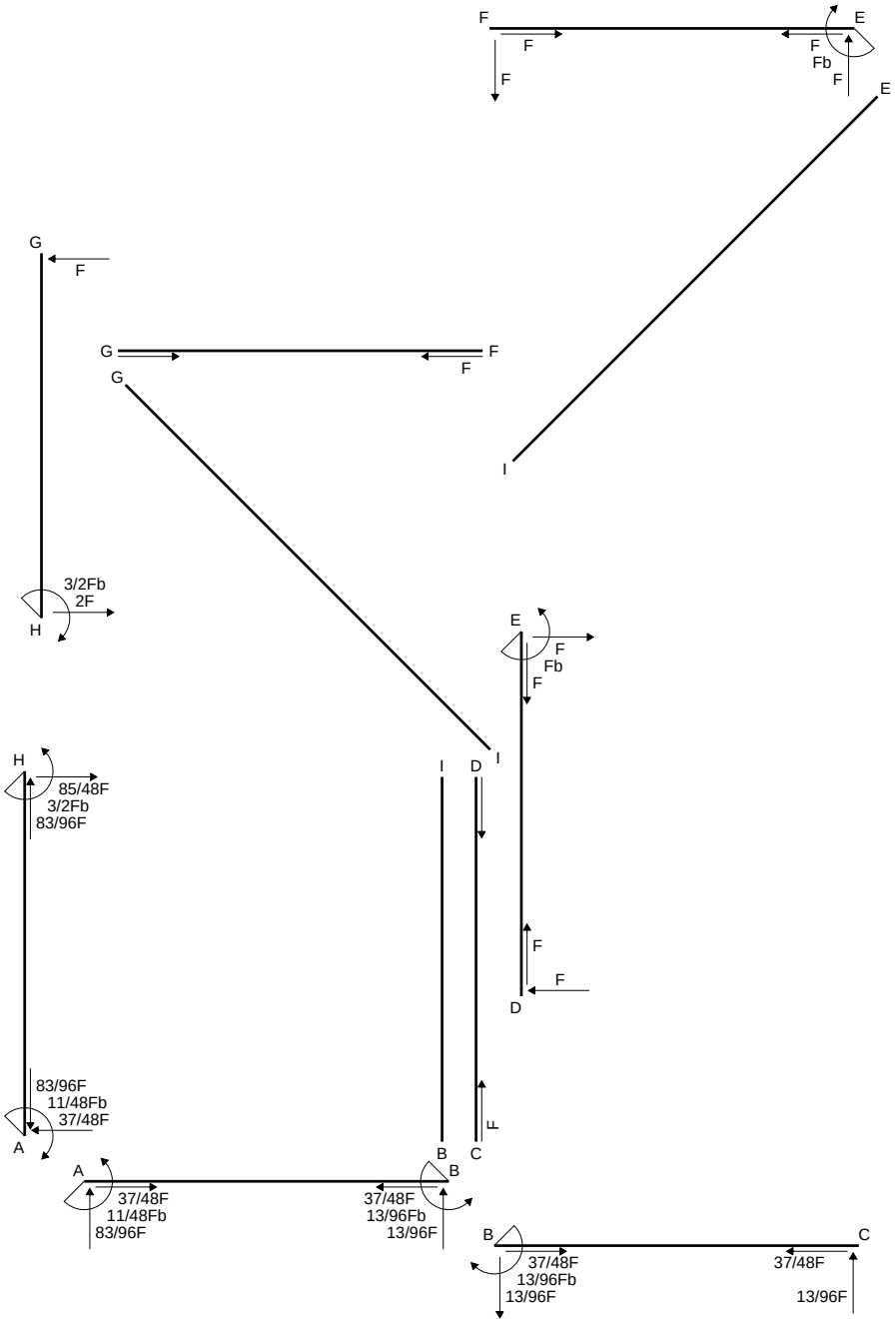
$= (7/8\ b - 3/4\ b + 1/8\ b)\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

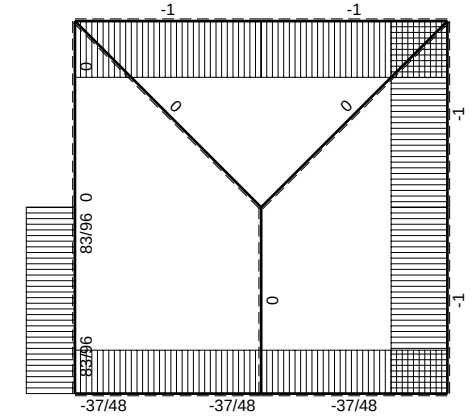
$L^{Xo}_{AH} = \int_o^b (5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

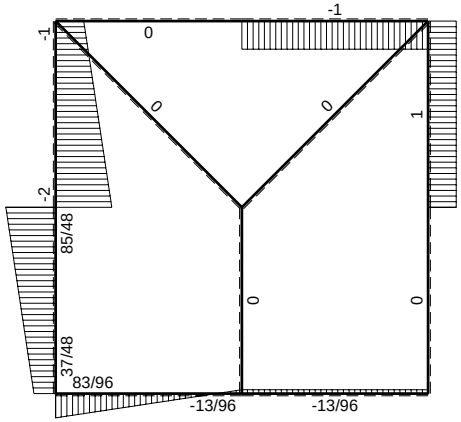
$= (5/8\ b - 1/4\ b - 1/8\ b)\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$



A = 636. mm^2
J_u = 217919. mm^4
J_v = 23508. mm^4
y_g = 32.53 mm
T_y = -2228. N
M_x = -1472630. Nmm
x_m = 6. mm
u_m = -9. mm
v_m = -32.53 mm
$\sigma_m = -Mv/J_u$ = -219.8 N/mm^2
x_c = 15. mm
y_c = 8. mm
v_c = -24.53 mm
$\sigma_c = -Mv/J_u$ = -165.8 N/mm^2
τ_c = 5.955 N/mm^2
$\sigma_0 = \sqrt{\sigma^2 + 3\tau^2}$ = 166.1 N/mm^2
S^* = 3495. mm^3

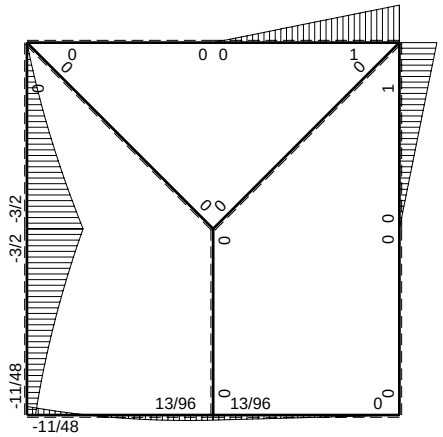

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-37/48
-37/48
-37/48

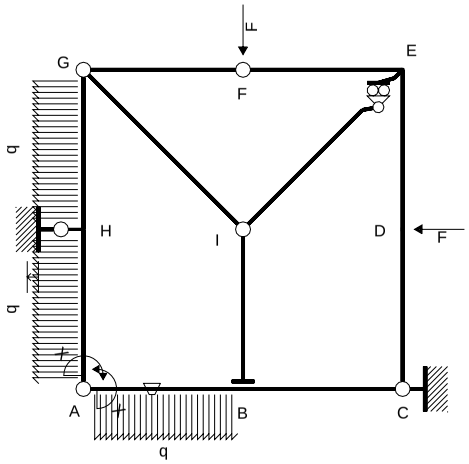

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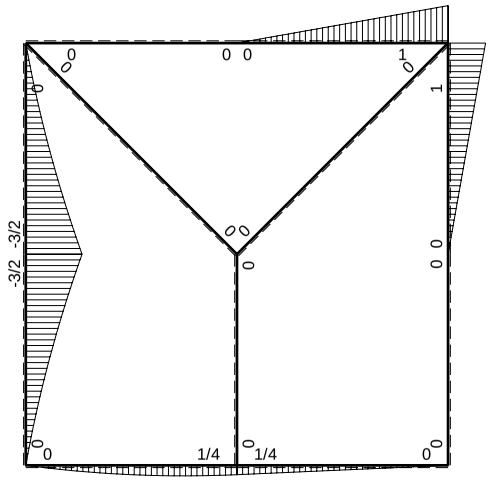
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F

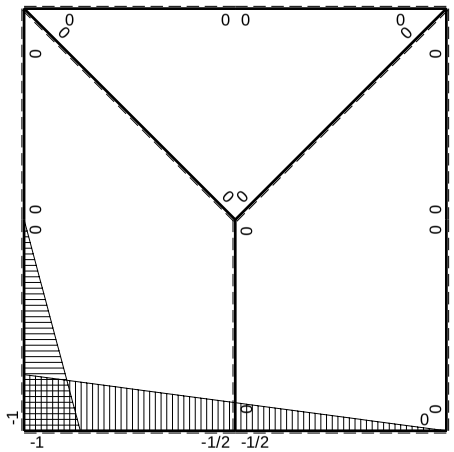

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0
-11/48

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264872 CI04.xxxx.098

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	$-1+1/2x/b$	$3/4Fx-1/2qx^2$	$-Fb/EJ$	$-3/4Fx+7/8Fx^2/b-1/4qx^3/b$	$Fb/EJ-1/2Fx/EJ$	$1-x/b+1/4x^2/b^2$	$(-7/48+3/4)Fb^2/EJ$	$7/12Xb/EJ$
BA b	$1/2+1/2x/b$	$-1/4Fb-1/4Fx+1/2qx^2$	Fb/EJ	$-1/8Fb-1/4Fx+1/8Fx^2/b+1/4qx^3/b$	$1/2Fb/EJ+1/2Fx/EJ$	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	$-1/2+1/2x/b$	$1/4Fb-1/4Fx$	0	$-1/8Fb+1/4Fx-1/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/24+0)Fb^2/EJ$	$1/12Xb/EJ$
CB b	$1/2x/b$	$-1/4Fx$	0	$-1/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	$-x/b$	$-3/2Fb+2Fx-1/2qx^2$	0	$3/2Fx-2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(5/24+0)Fb^2/EJ$	$1/3Xb/EJ$
AH b	$1-x/b$	$Fx+1/2qx^2$	0	$Fx-1/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-11/48Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						$11/48Fb$	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 7/8\ x^2/b^2 - 1/4\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1 - 1/2\ x/b\right)\ \theta\ \ dx$

$= \left[-3/8\ x^2/b + 7/24\ x^3/b^2 - 1/16\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-3/8\ b + 7/24\ b - 1/16\ b\ \right)\ Fb\ 1/EJ\ + \left(\ b - 1/4\ b\ \right)\ \theta\ \ = 29/48\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 - 1/4\ x/b + 1/8\ x^2/b^2 + 1/4\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2 - 1/2\ x/b\right)\ \theta\ \ dx$

$= \left[-1/8\ x - 1/8\ x^2/b + 1/24\ x^3/b^2 + 1/16\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b - 1/8\ b + 1/24\ b + 1/16\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 29/48\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/8 + 1/4\ x/b - 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/8\ x^2/b - 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/8\ b - 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/8\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

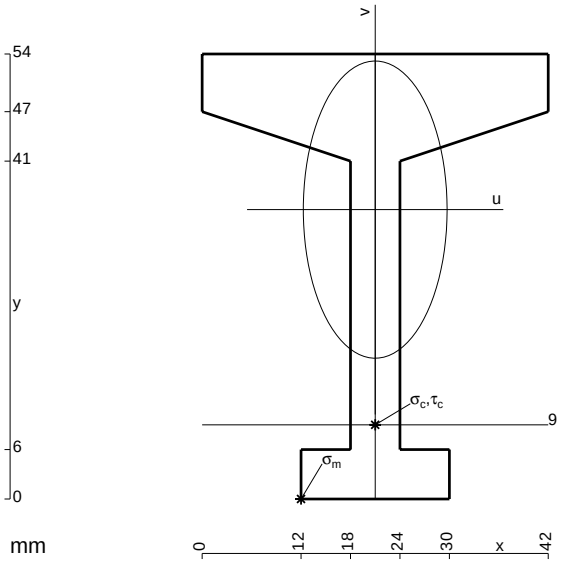
$= \left(-1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/24\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(3/2\ x/b - 2\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[3/4\ x^2/b - 2/3\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

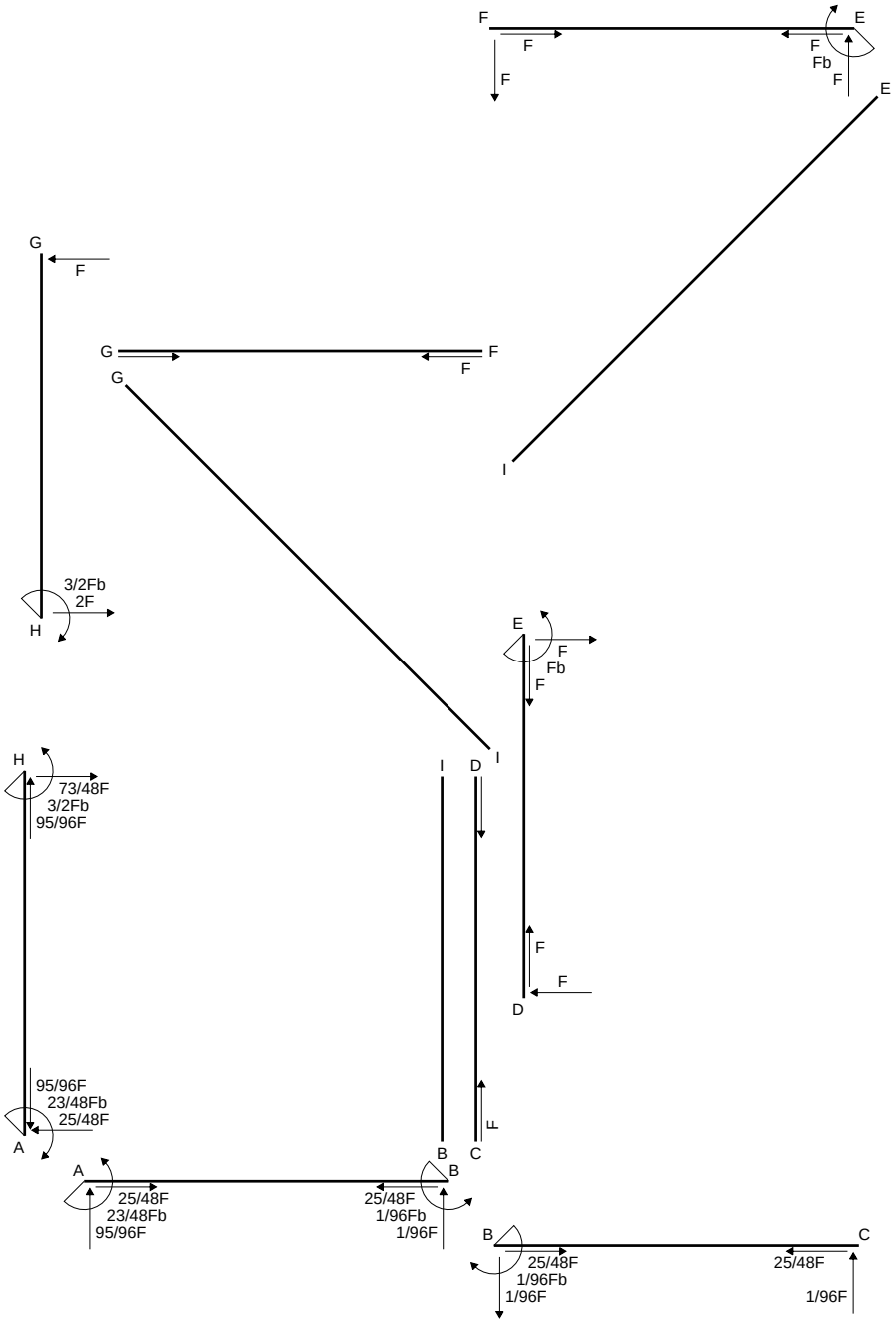
$= \left(3/4\ b - 2/3\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 5/24\ \ Fb^2/EJ$

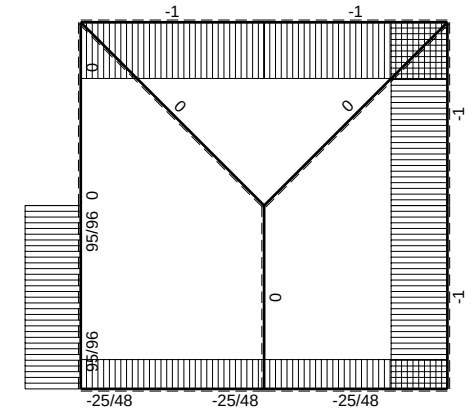
$L^{Xo}_{AH} = \int_o^b \left(\ x/b - 1/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[1/2\ x^2/b - 1/6\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

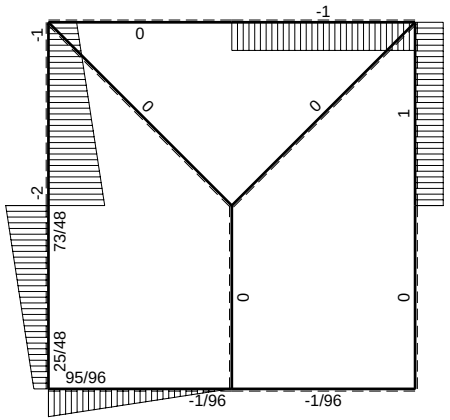
$= \left(1/2\ b - 1/6\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 5/24\ \ Fb^2/EJ$



A = 756. mm^2
J_u = 245989. mm^4
J_v = 57564. mm^4
y_g = 35.12 mm
T_y = -2380. N
M_x = -1606500. Nmm
x_m = 12. mm
u_m = -9. mm
v_m = -35.12 mm
$\sigma_m = -Mv/J_u$ = -229.4 N/mm^2
x_c = 21. mm
y_c = 9. mm
v_c = -26.12 mm
$\sigma_c = -Mv/J_u$ = -170.6 N/mm^2
τ_c = 6.395 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 170.9 N/mm^2
S^* = 3966. mm^3

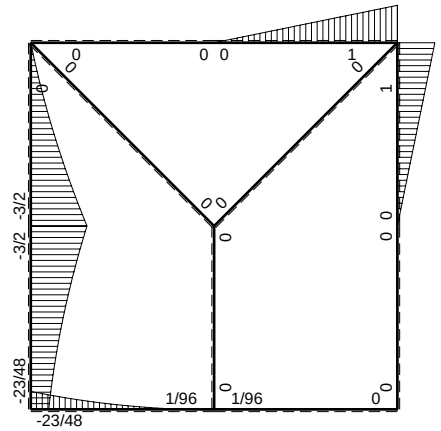

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25/48F
1/96F


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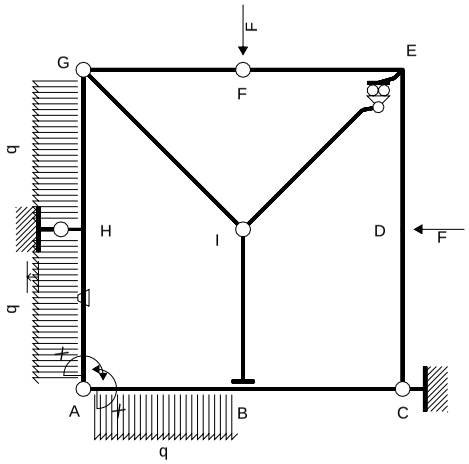

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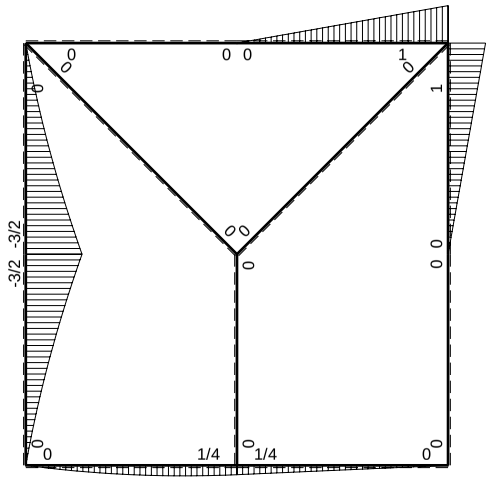
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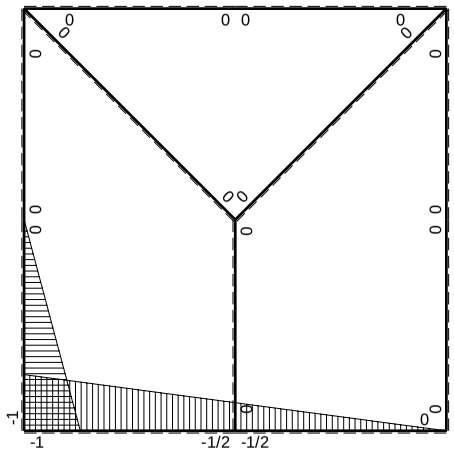

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Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264047 CI04.xxxx.099

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PROCEDIMENTO E RISULTATI 264047 CI04.xxxx.099

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx-1/2qx^2	0	-3/4Fx+7/8Fx^2/b-1/4qx^3/b	0	1-x/b+1/4x^2/b^2	(-7/48+0)Fb^2/EJ	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb-1/4Fx+1/2qx^2	0	-1/8Fb-1/4Fx+1/8Fx^2/b+1/4qx^3/b	0	1/4+1/2x/b+1/4x^2/b^2		
BC b	-1/2+1/2x/b	1/4Fb-1/4Fx	0	-1/8Fb+1/4Fx-1/8Fx^2/b	0	1/4-1/2x/b+1/4x^2/b^2	(-1/24+0)Fb^2/EJ	1/12Xb/EJ
CB b	1/2x/b	-1/4Fx	0	-1/8Fx^2/b	0	1/4x^2/b^2		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-Fx-1/2qx^2	0	0	0	0	0+0	0
HG b	0	3/2Fb-2Fx+1/2qx^2	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	-3/2Fb+2Fx-1/2qx^2	-Fb/EJ	3/2Fx-2Fx^2/b+1/2qx^3/b	Fx/EJ	x^2/b^2	(5/24+1/2)Fb^2/EJ	1/3Xb/EJ
AH b	1-x/b	Fx+1/2qx^2	Fb/EJ	Fx-1/2Fx^2/b-1/2qx^3/b	Fb/EJ-Fx/EJ	1-2x/b+x^2/b^2		
H	cedimento nodo $-H_{1H}u_H$						-Fb^2/EJ	
	totali						-23/48Fb^2/EJ	Xb/EJ
	iperstatica $X=W_{AB}$						23/48Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 7/8\ x^2/b^2 - 1/4\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 7/24\ x^3/b^2 - 1/16\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 7/24\ b - 1/16\ b\ \right) Fb\ 1/EJ\ = -7/48\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 - 1/4\ x/b + 1/8\ x^2/b^2 + 1/4\ x^3/b^3\ \right) Fb\ 1/EJ\ dx$

$= \left[-1/8\ x - 1/8\ x^2/b + 1/24\ x^3/b^2 + 1/16\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b - 1/8\ b + 1/24\ b + 1/16\ b\ \right) Fb\ 1/EJ\ = -7/48\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/8 + 1/4\ x/b - 1/8\ x^2/b^2\right) Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/8\ x^2/b - 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/8\ b - 1/24\ b\ \right) Fb\ 1/EJ\ = -1/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/8\ x^2/b^2\right) Fb\ 1/EJ\ dx = \left[-1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/24\ b\ \right) Fb\ 1/EJ\ = -1/24\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(3/2\ x/b - 2\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\theta\ dx$

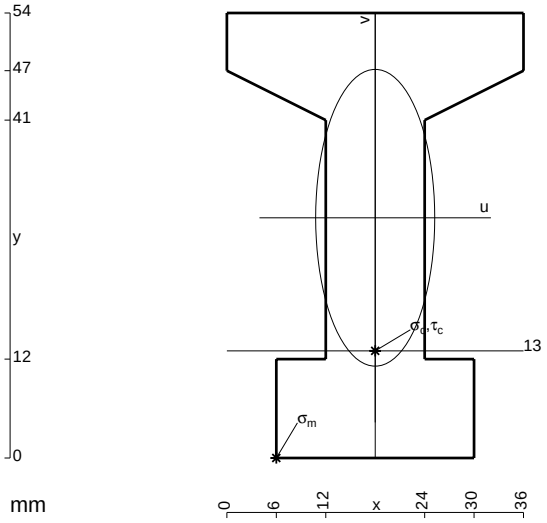
$= \left[3/4\ x^2/b - 2/3\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b\ \theta$

$= \left(3/4\ b - 2/3\ b + 1/8\ b\ \right) Fb\ 1/EJ\ + \left(1/2\ b\ \right)\theta\ \ = 17/24\ \ Fb^2/EJ$

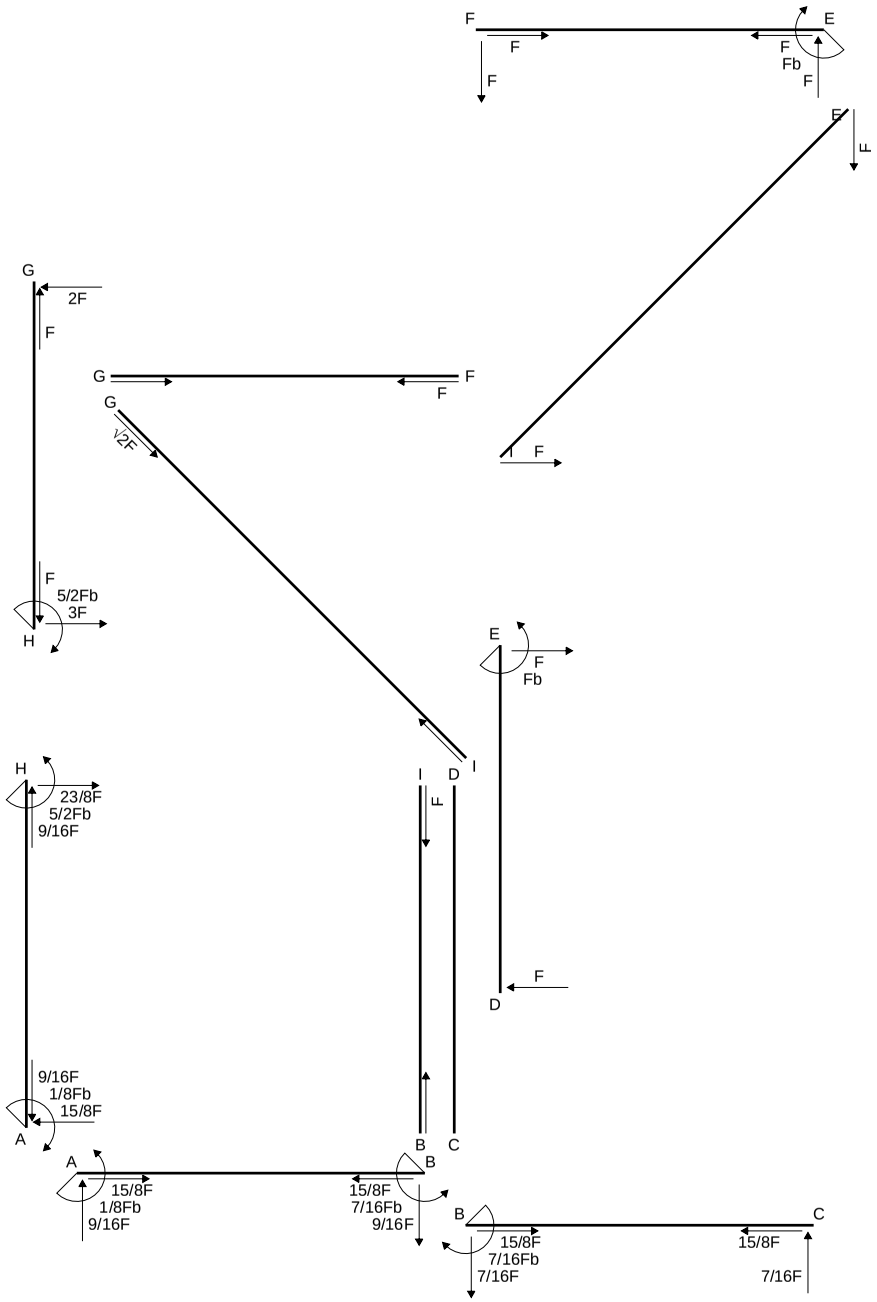
$L^{Xo}_{AH} = \int_o^b \left(\ x/b - 1/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\theta\ dx$

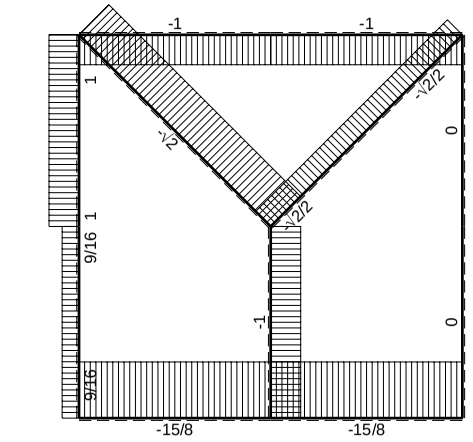
$= \left[1/2\ x^2/b - 1/6\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b\ \theta$

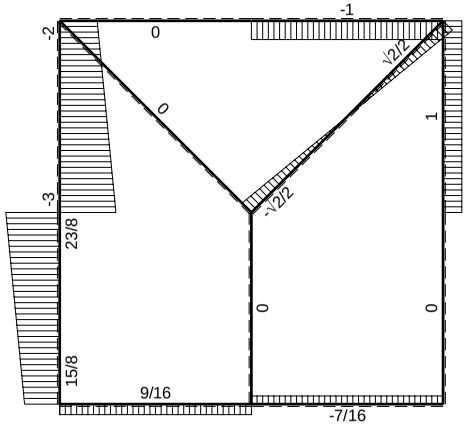
$= \left(1/2\ b - 1/6\ b - 1/8\ b\ \right) Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\theta\ \ = 17/24\ \ Fb^2/EJ$

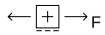


A = 1032. mm^2
J_u = 334856. mm^4
J_v = 53856. mm^4
y_g = 29.15 mm
T_y = -3860. N
M_x = -2750250. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -29.15 mm
$\sigma_m = -Mv/J_u$ = -239.4 N/mm^2
x_c = 18. mm
y_c = 13. mm
v_c = -16.15 mm
$\sigma_c = -Mv/J_u$ = -132.7 N/mm^2
τ_c = 6.597 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 133.1 N/mm^2
S^* = 6867. mm^3

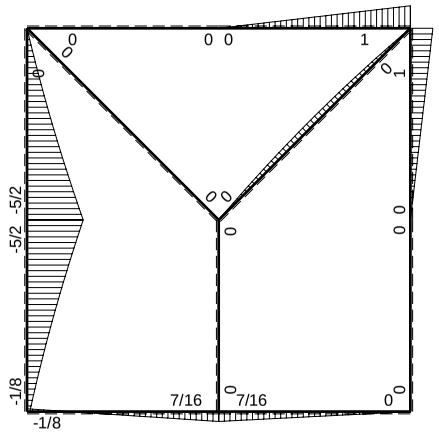

F
F
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E
F
Fb
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E
F
G
2F
F
G
F
F
G
√2F
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5/2Fb
3F
H
E
F
Fb
H
23/8F
5/2Fb
9/16F
I
D
I
F
F
D
9/16F
1/8Fb
15/8F
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A
B
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B
B
15/8F
7/16Fb
7/16F
C
15/8F
7/16F


-1
-1
1
-√2
-√2/2
0
-√2/2
9/16 1
-1
0
9/16
-15/8
-15/8

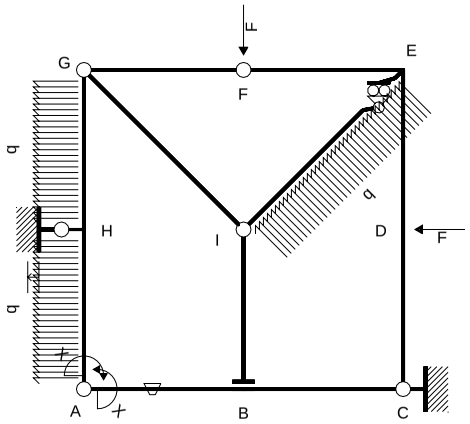

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0
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√2/2
0
1
-√2/2
-3
23/8
0
0
15/8
9/16
-7/16

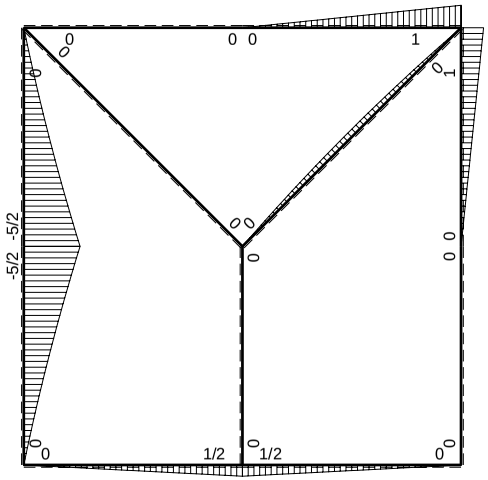

F


F

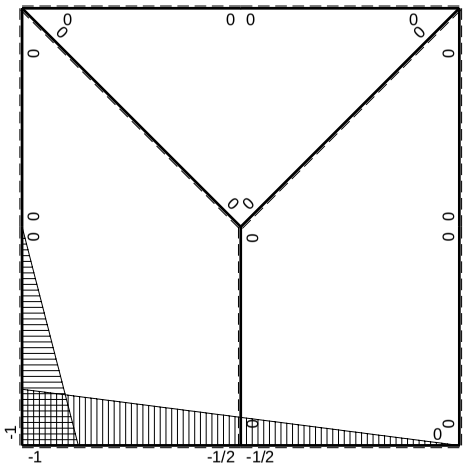

0
0 0
1
0
0
1
0 0
-5/2
-5/2
0
0 0
-1/8
7/16
0
7/16
0
0
-1/8


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 248062 CI04.xxxx.100

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	-Fb/EJ	$-1/2Fx+1/4Fx^2/b$	Fb/EJ-1/2Fx/EJ	$1-x/b+1/4x^2/b^2$	$(-1/6+3/4)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/2Fb+1/2Fx	Fb/EJ	$-1/4Fb+1/4Fx^2/b$	1/2Fb/EJ+1/2Fx/EJ	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx + \int_o^b \left(1 - 1/2\ x/b\right)\theta\ dx$

$= \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ\ + \left[\ x - 1/4\ x^2/b\ \right]_o^b \theta$

$= \left(-1/4\ b + 1/12\ b\ \right) Fb\ 1/EJ\ + \left(\ b - 1/4\ b\ \right)\theta\ = 7/12\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx + \int_o^b \left(-1/2 - 1/2\ x/b\right)\theta\ dx$

$= \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ\ + \left[-1/2\ x - 1/4\ x^2/b\ \right]_o^b \theta$

$= \left(-1/4\ b + 1/12\ b\ \right) Fb\ 1/EJ\ + \left(-1/2\ b - 1/4\ b\ \right)\theta\ = 7/12\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right) Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ$

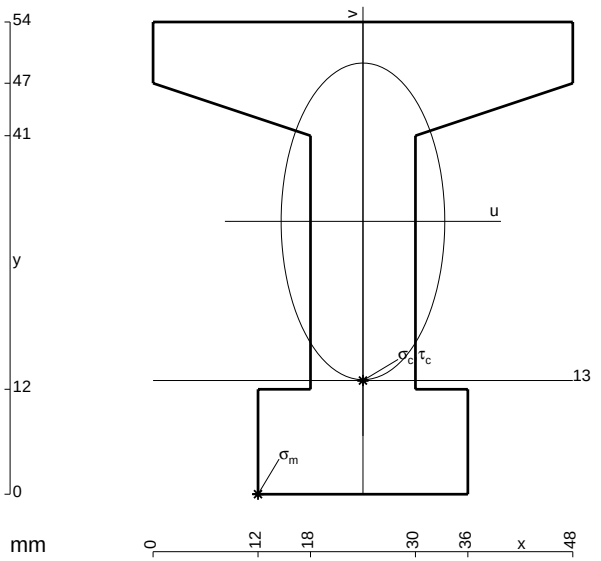
$= \left(-1/12\ b\ \right) Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

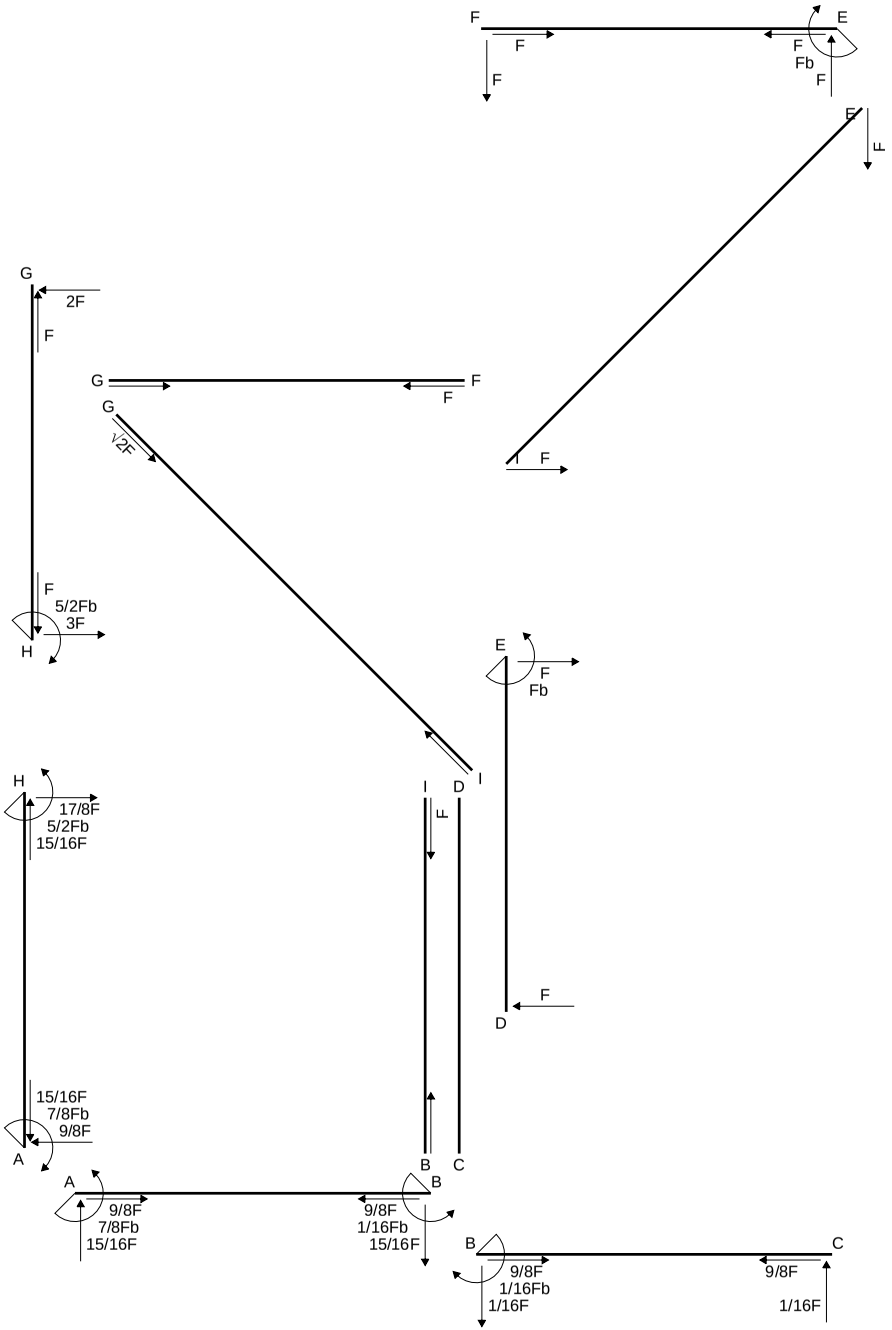
$= \left(5/4\ b - b + 1/8\ b\ \right) Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

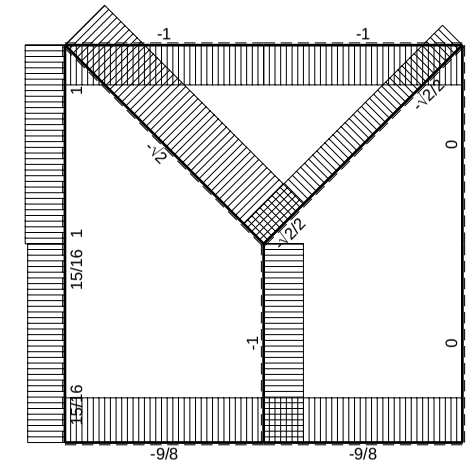
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

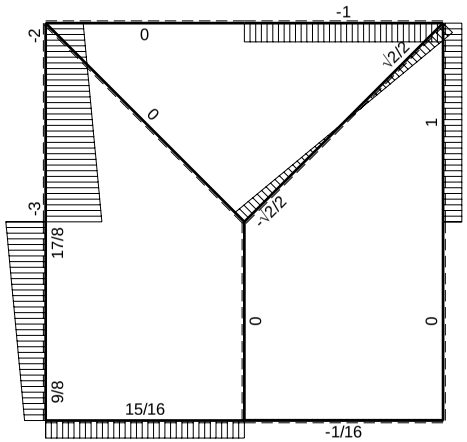
$= \left(\ b - 1/2\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

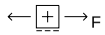


A = 1152. mm^2
J_u = 377748. mm^4
J_v = 100872. mm^4
y_g = 31.2 mm
N = 1950. N
T_y = -5850. N
M_x = -2437500. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -31.2 mm
$\sigma_m = N/A - Mv/J_u$ = -199.7 N/mm^2
x_c = 24. mm
y_c = 13. mm
v_c = -18.2 mm
$\sigma_c = N/A - Mv/J_u$ = -115.8 N/mm^2
τ_c = 9.657 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 117. N/mm^2
S^* = 7483. mm^3

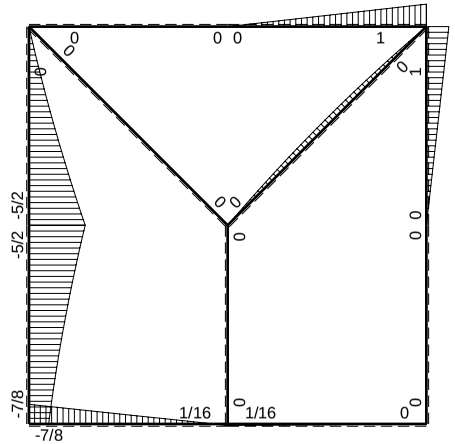

F
F
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E
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Fb
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2F
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G
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√2F
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3F
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Fb
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17/8F
5/2Fb
15/16F
I
D
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F
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D
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7/8Fb
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B
B
C
9/8F
7/8Fb
15/16F
9/8F
1/16Fb
15/16F
B
C
9/8F
1/16Fb
1/16F
9/8F
1/16F


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-1
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-√2/2
-√2/2
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15/16
1
-1
0
15/16
-9/8
-9/8

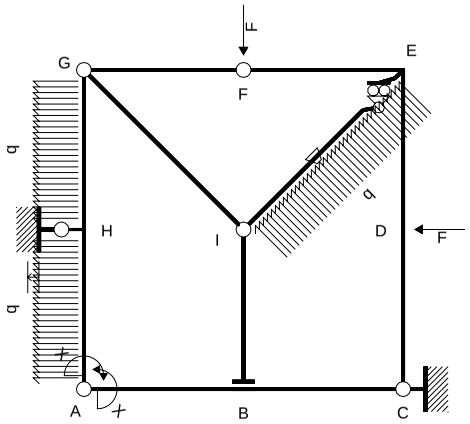

-1
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√2/2
0
1
-3
-√2/2
17/8
0
0
9/8
15/16
-1/16

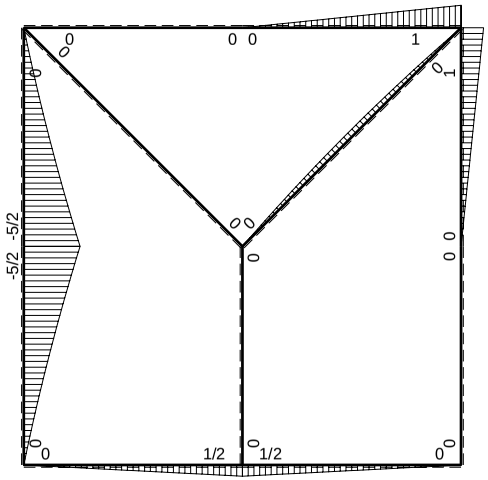

F


F

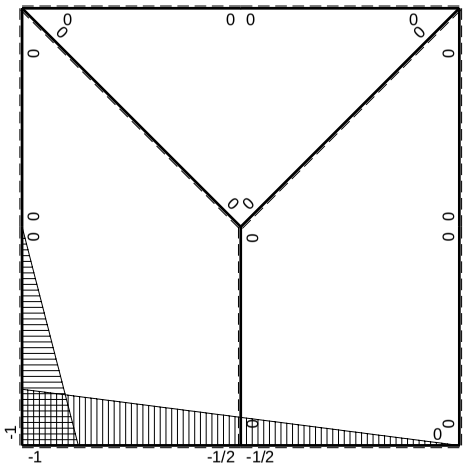

0
0 0
1
0
0
1
0 0
-5/2
-5/2
0
0 0
-7/8
1/16
0
1/16
0 0
-7/8


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264522 CI04.xxxx.101

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-1/2Fx$	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

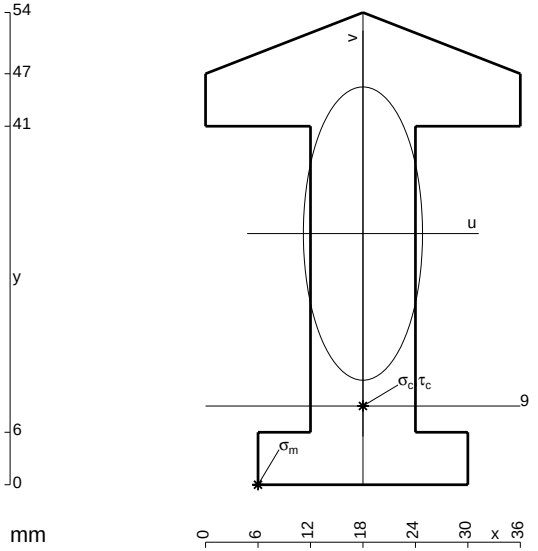
$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

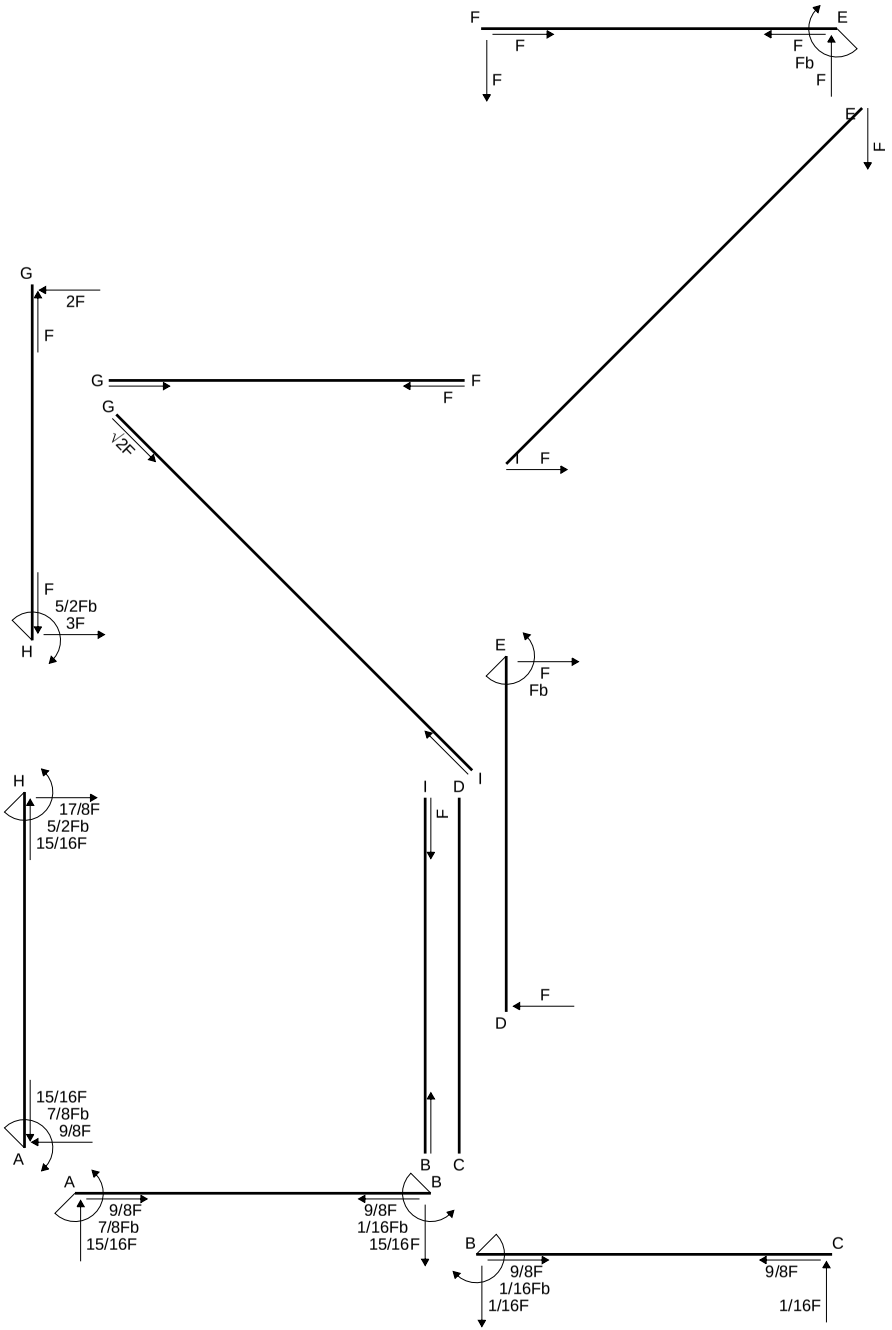
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

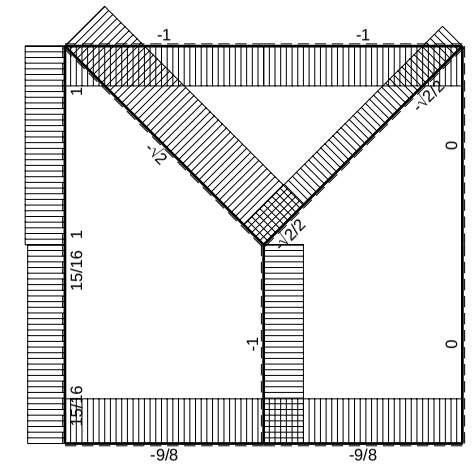
PROCEDIMENTO E RISULTATI 264522 CI04.xxxx.101

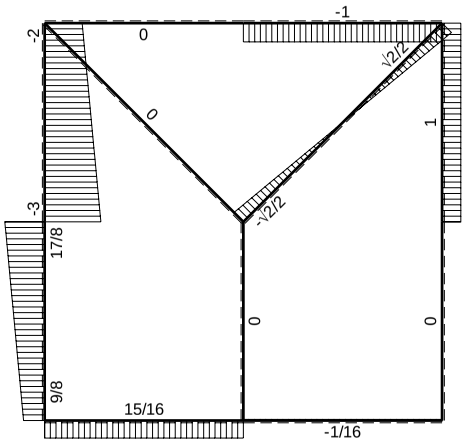


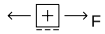
A = 906. mm^2
J_u = 254971. mm^4
J_v = 42084. mm^4
y_g = 28.72 mm
N = 1360. N
T_y = -4080. N
M_x = -1870000. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.72 mm
$\sigma_m = N/A - Mv/J_u$ = -209.1 N/mm^2
x_c = 18. mm
y_c = 9. mm
v_c = -19.72 mm
$\sigma_c = N/A - Mv/J_u$ = -143.1 N/mm^2
τ_c = 5.958 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 143.5 N/mm^2
S^* = 4468. mm^3

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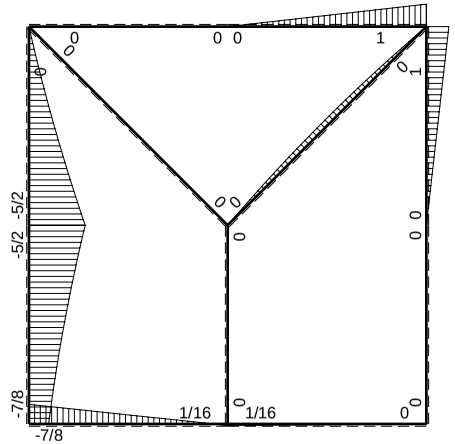

F
F
F
E
F
Fb
F
F
F
G
2F
F
G
F
F
G
√2F
F
F
5/2Fb
3F
H
E
F
Fb
H
17/8F
5/2Fb
15/16F
I
D
I
F
F
D
15/16F
7/8Fb
9/8F
A
A
B
C
B
9/8F
7/8Fb
15/16F
9/8F
1/16Fb
15/16F
B
C
9/8F
1/16Fb
1/16F
9/8F
1/16F


-1
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1
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0
15/16
-9/8
-9/8

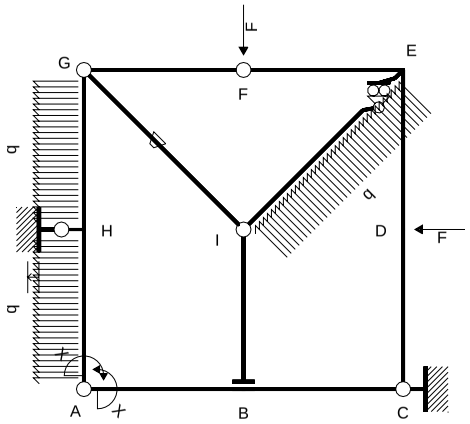

-1
-2
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√2/2
0
1
-3
-√2/2
17/8
0
0
9/8
15/16
-1/16

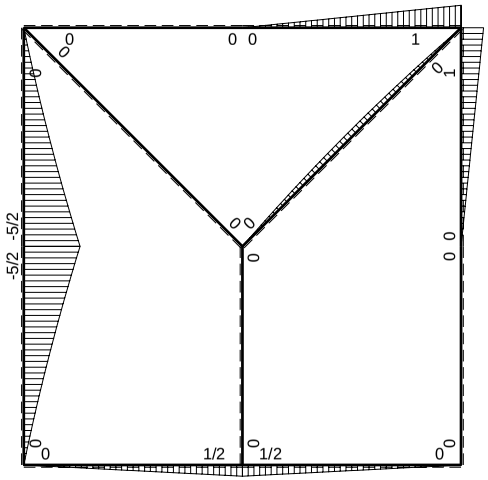

F


F

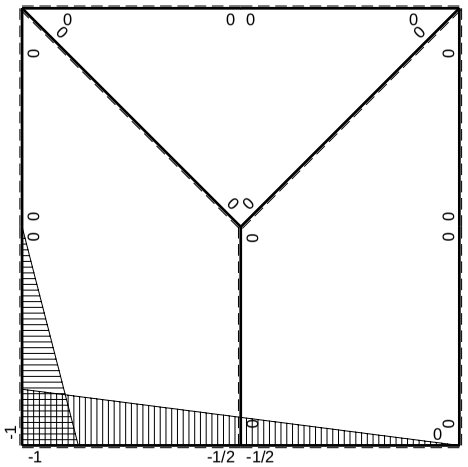

0
0 0
1
0
0
1
0
0
0
-5/2
-5/2
0
0 0
-7/8
1/16
0
1/16
0 0
-7/8


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 268257 CI04.xxxx.102

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

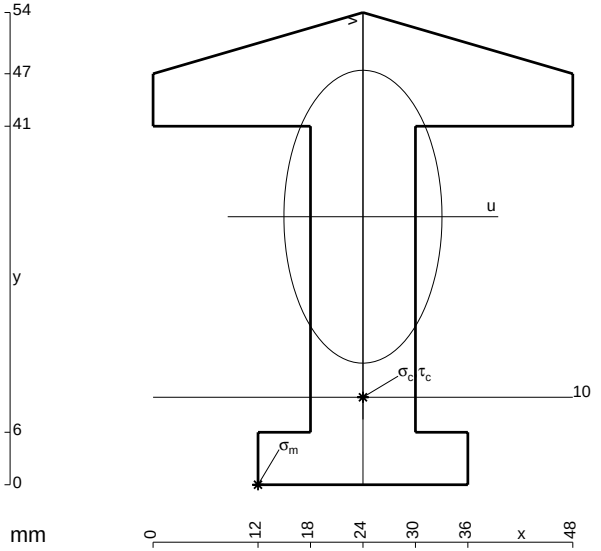
$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

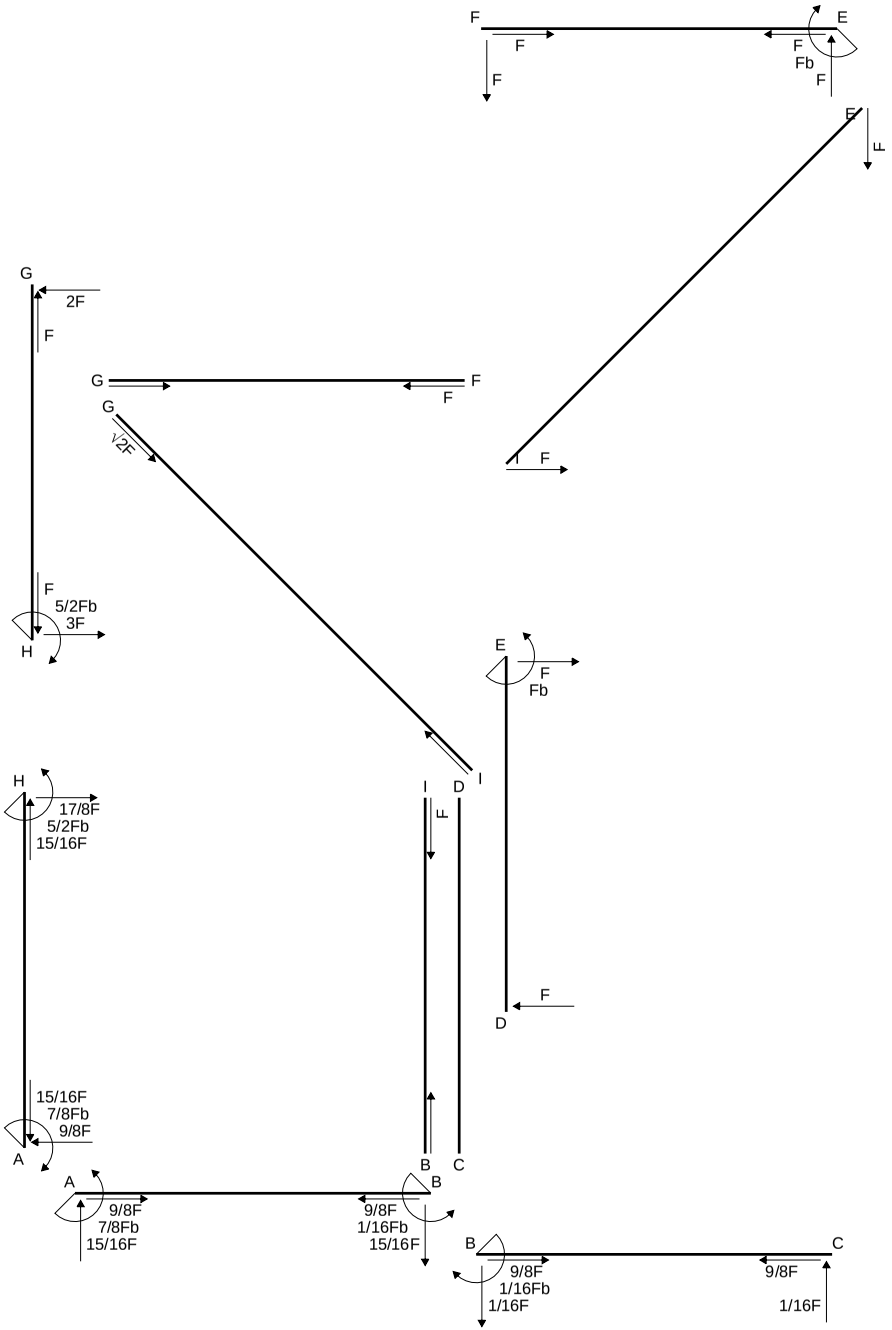
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

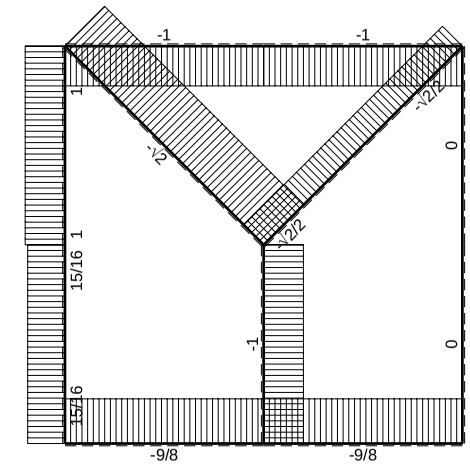
PROCEDIMENTO E RISULTATI 268257 CI04.xxxx.102

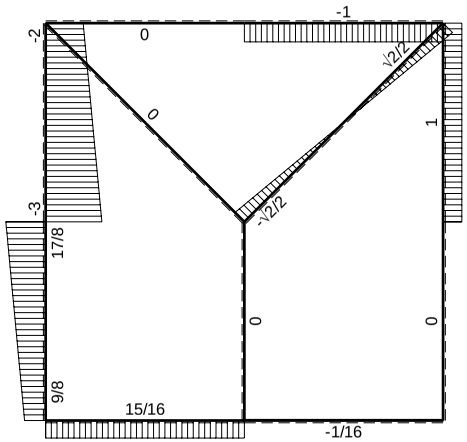


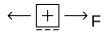
A = 1020. mm^2
J_u = 286162. mm^4
J_v = 83376. mm^4
y_g = 30.65 mm
N = 1370. N
T_y = -4110. N
M_x = -2055000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.65 mm
$\sigma_m = N/A - Mv/J_u$ = -218.8 N/mm^2
x_c = 24. mm
y_c = 10. mm
v_c = -20.65 mm
$\sigma_c = N/A - Mv/J_u$ = -146.9 N/mm^2
τ_c = 6.066 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 147.3 N/mm^2
S^* = 5069. mm^3

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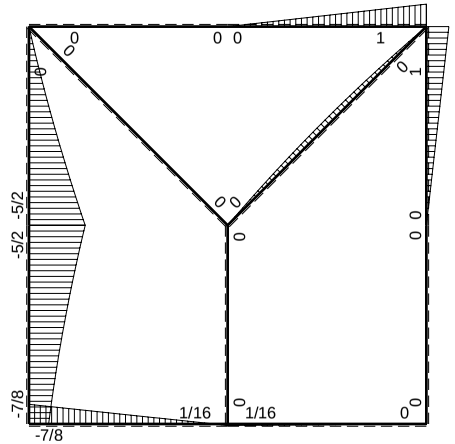

F
E
Fb
G
2F
√2F
H
5/2Fb
3F
D
17/8F
5/2Fb
15/16F
15/16F
7/8Fb
9/8F
A
B
C
9/8F
1/16Fb
1/16F


-1
-1
1
-√2/2
-√2/2
-√2/2
0
0
0
15/16
1
-1
15/16
-9/8
-9/8

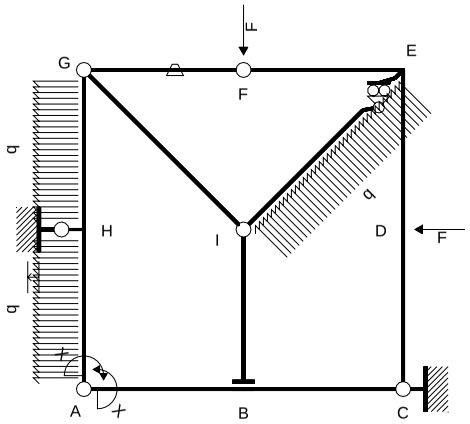

-1
-2
0
√2/2
0
1
-3
-√2/2
17/8
0
0
9/8
15/16
-1/16

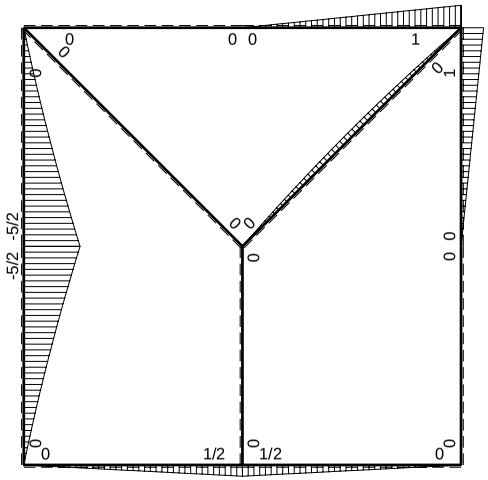

F


F

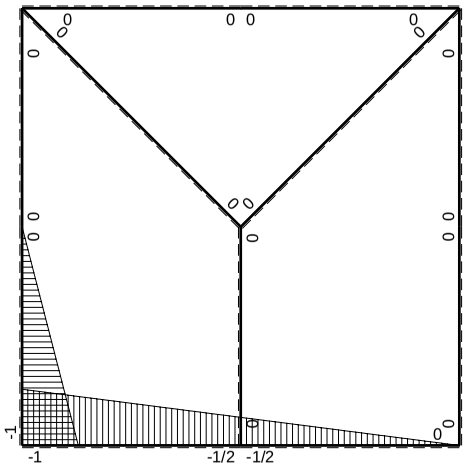

0
0 0
1
0
0
1
0 0
0
0 0
-5/2
-5/2
0
0 0
-7/8
1/16
1/16
0
0
-7/8


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 956343 CI04.xxxx.103

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-1/2Fx$	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	-Fb/EJ	0	0	0	0+0	0
GF b	0	0	Fb/EJ	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b (-1/2\ x/b + 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/12\ b)\ Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b (-1/4 + 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x + 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/12\ b)\ Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b (-1/4 + 1/2\ x/b - 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/4\ b - 1/12\ b)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/12\ b)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

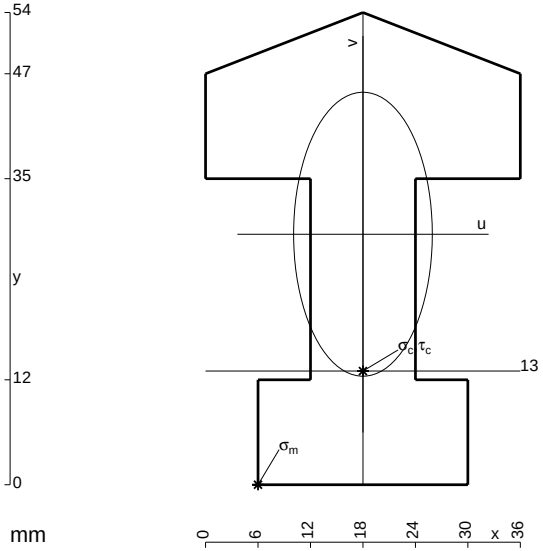
$L^{Xo}_{HA} = \int_o^b (5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (5/4\ b - b + 1/8\ b)\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

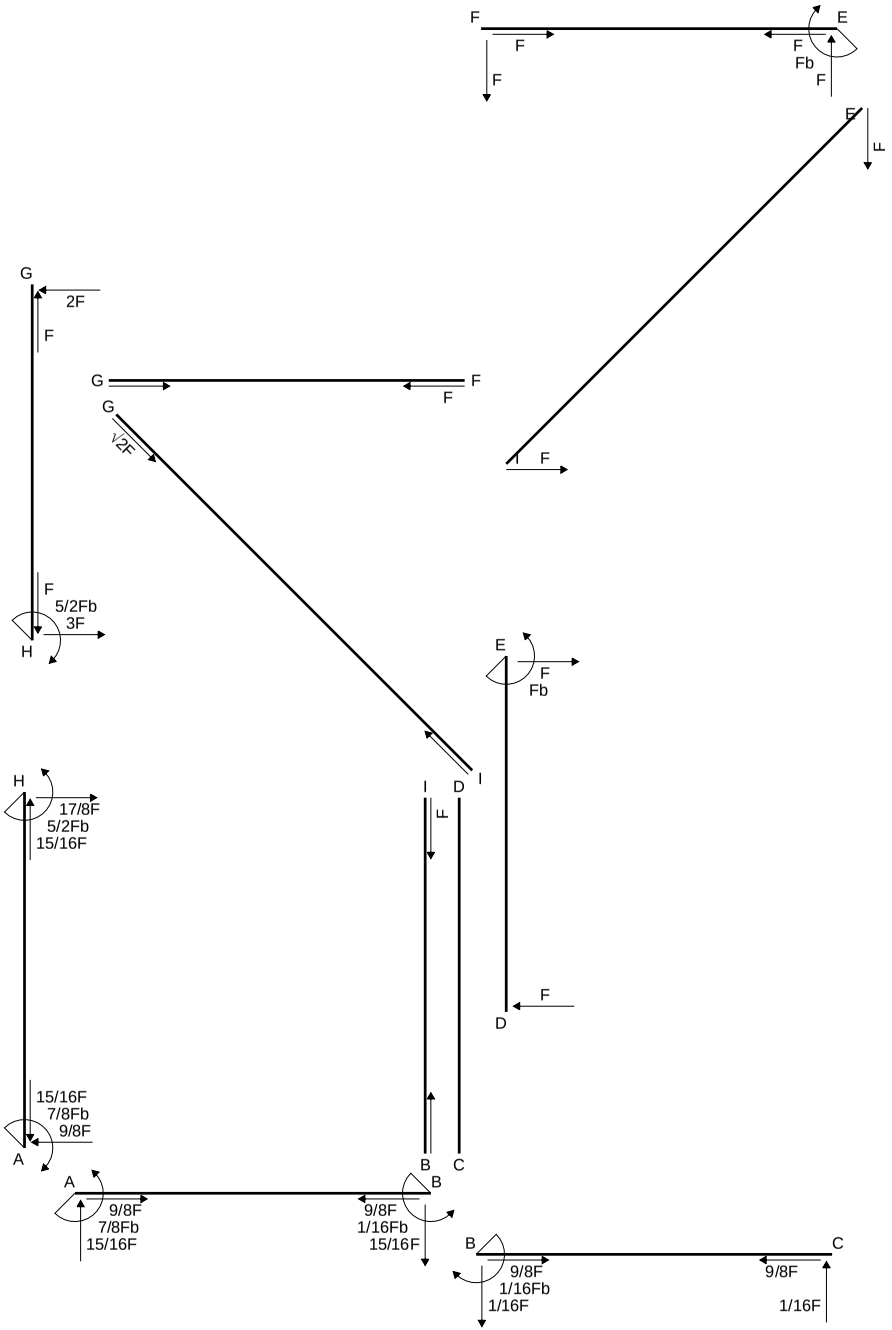
$L^{Xo}_{AH} = \int_o^b (2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

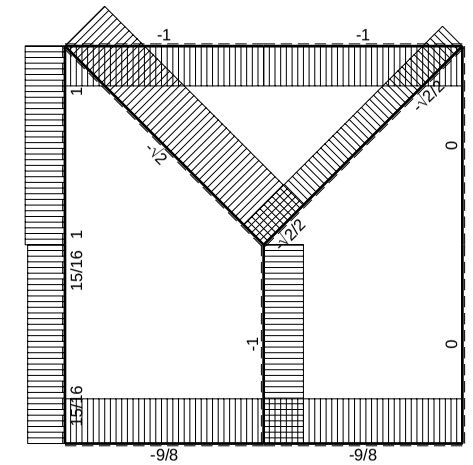
$= (\ b - 1/2\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

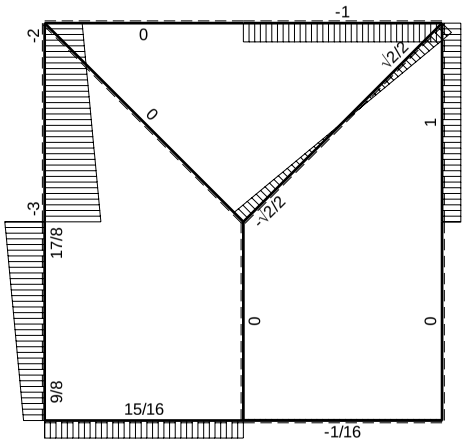
PROCEDIMENTO E RISULTATI 956343 CI04.xxxx.103

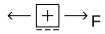


A = 1122. mm^2
J_u = 296013. mm^4
J_v = 70596. mm^4
y_g = 28.65 mm
N = 1470. N
T_y = -4410. N
M_x = -2388750. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.65 mm
$\sigma_m = N/A - Mv/J_u$ = -229.9 N/mm^2
x_c = 18. mm
y_c = 13. mm
v_c = -15.65 mm
$\sigma_c = N/A - Mv/J_u$ = -125. N/mm^2
τ_c = 8.338 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 125.8 N/mm^2
S^* = 6716. mm^3

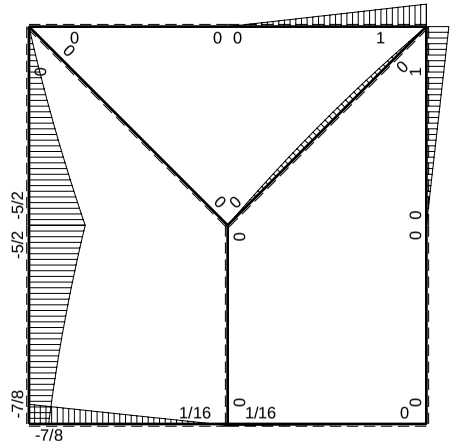

F
E
Fb
G
2F
√2F
5/2Fb
3F
H
17/8F
5/2Fb
15/16F
I
D
15/16F
7/8Fb
9/8F
A
B
C
1/16Fb
1/16F


-1
-1
-√2/2
-√2/2
-√2/2
15/16
-9/8
-9/8

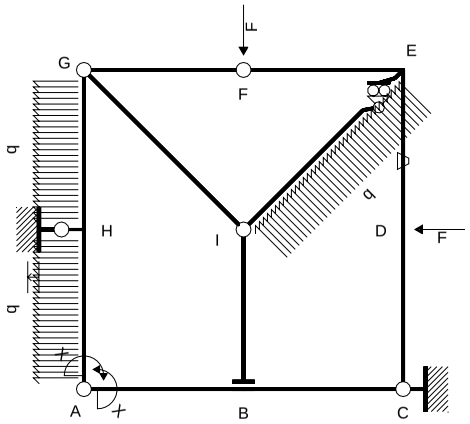

-2
-1
√2/2
-√2/2
-3
17/8
9/8
15/16
-1/16

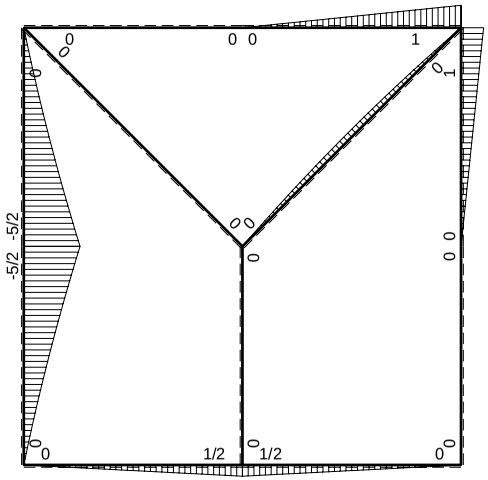

F


F

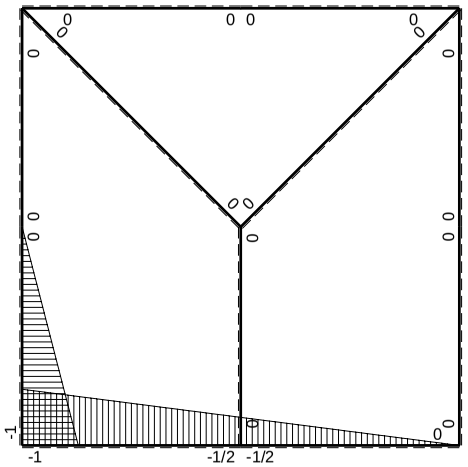

-5/2
-5/2
-7/8
1/16
1/16
-7/8


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 212572 CI04.xxxx.104

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PROCEDIMENTO E RISULTATI 212572 CI04.xxxx.104

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-Fb+Fx	Fb/EJ	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

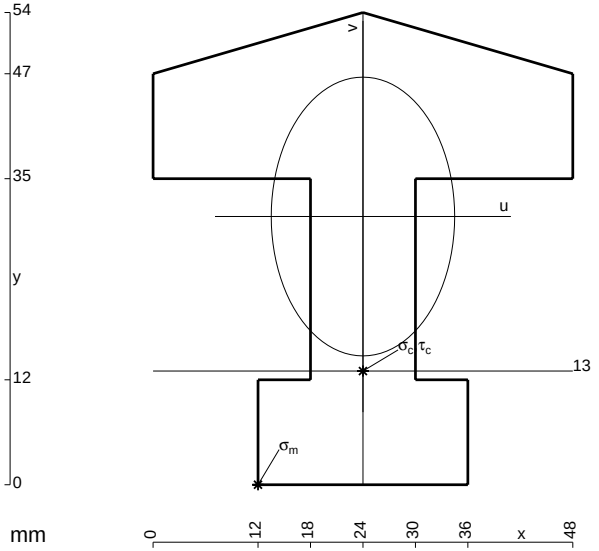
$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

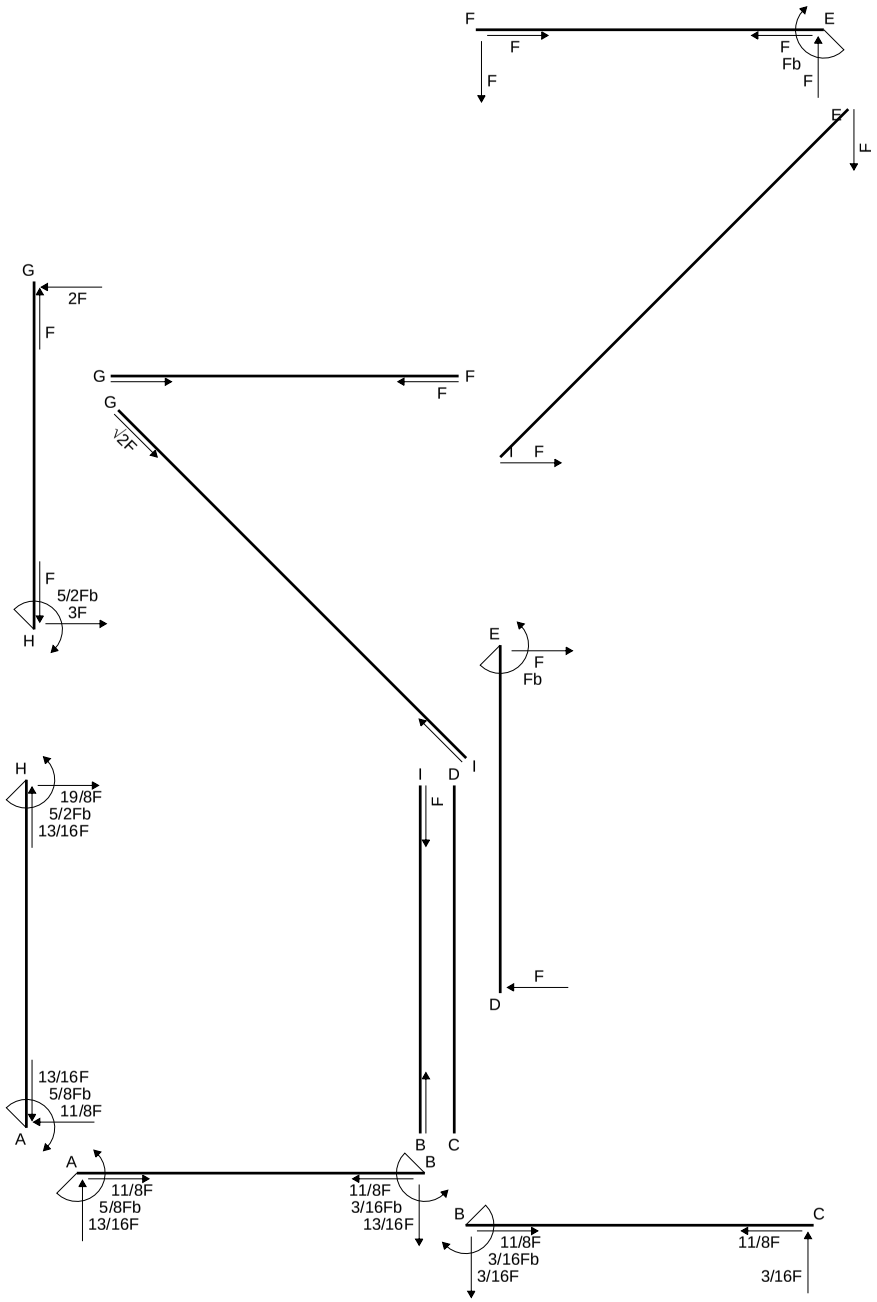
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

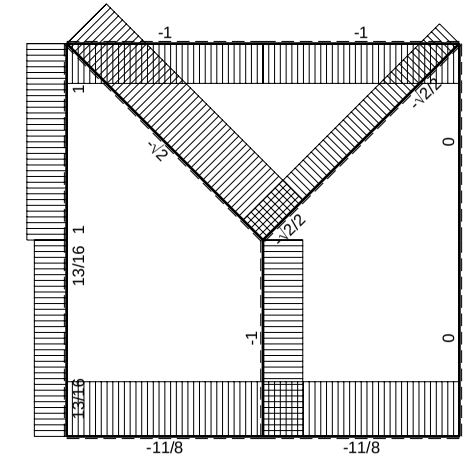
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

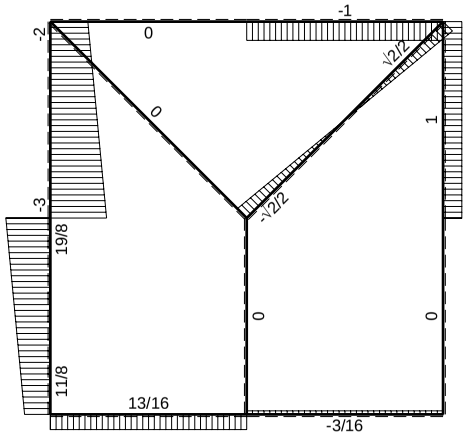
PROCEDIMENTO E RISULTATI 212572 CI04.xxxx.104



A = 1308. mm^2
J_u = 332443. mm^4
J_v = 143856. mm^4
y_g = 30.67 mm
N = 1490. N
T_y = -4470. N
M_x = -2607500. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.67 mm
$\sigma_m = N/A - Mv/J_u$ = -239.4 N/mm^2
x_c = 24. mm
y_c = 13. mm
v_c = -17.67 mm
$\sigma_c = N/A - Mv/J_u$ = -137.5 N/mm^2
τ_c = 8.206 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 138.2 N/mm^2
S^* = 7323. mm^3

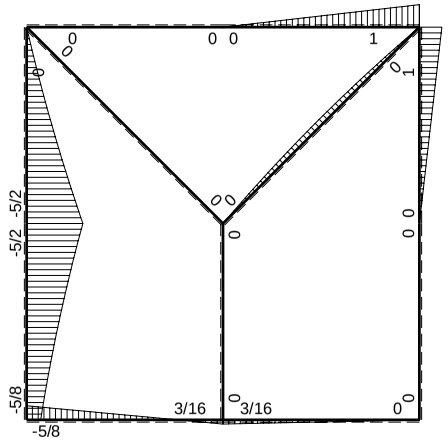

F
F
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Fb
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F
G
2F
F
G
F
F
G
√2F
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F
5/2Fb
3F
H
E
F
Fb
H
19/8F
5/2Fb
13/16F
I
D
I
F
F
D
13/16F
5/8Fb
11/8F
A
A
B
C
B
11/8F
5/8Fb
13/16F
11/8F
3/16Fb
13/16F
B
C
11/8F
3/16Fb
3/16F
11/8F
3/16F


-1
-1
1
-√2/2
0
-√2/2
13/16 1
-1
0
13/16
-11/8
-11/8

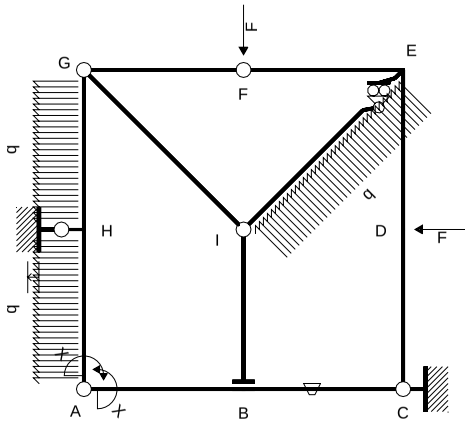

-2
0
-1
√2/2
0
1
-3
-√2/2
19/8
0
0
11/8
13/16
-3/16

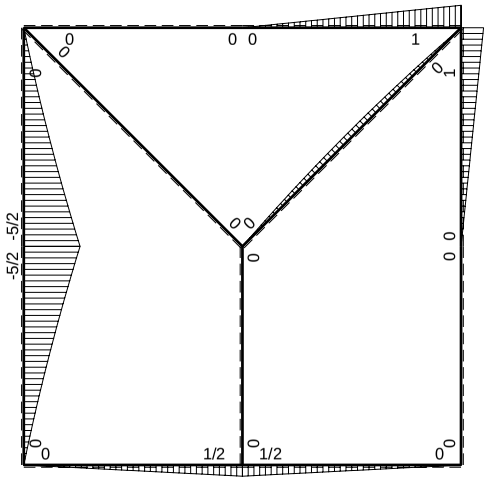
←□→ F

↑□↓ F

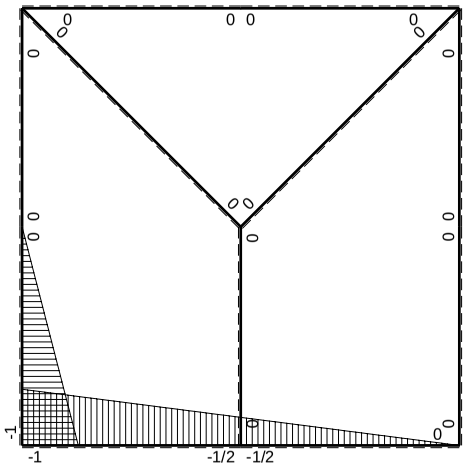

0
0 0
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0
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1
0 0
-5/2
-5/2
0
0 0
-5/8
3/16
3/16
0
0
-5/8

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 268011 CI04.xxxx.105

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	-Fb/EJ	$-1/4Fb+1/2Fx-1/4Fx^2/b$	1/2Fb/EJ-1/2Fx/EJ	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	Fb/EJ	$-1/4Fx^2/b$	1/2Fx/EJ	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1/2 - 1/2\ x/b\right)\ \theta\ \ dx$

$= \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 1/6\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2\ x/b\right)\ \theta\ \ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/4\ b\ \right)\ \theta\ \ = 1/6\ \ Fb^2/EJ$

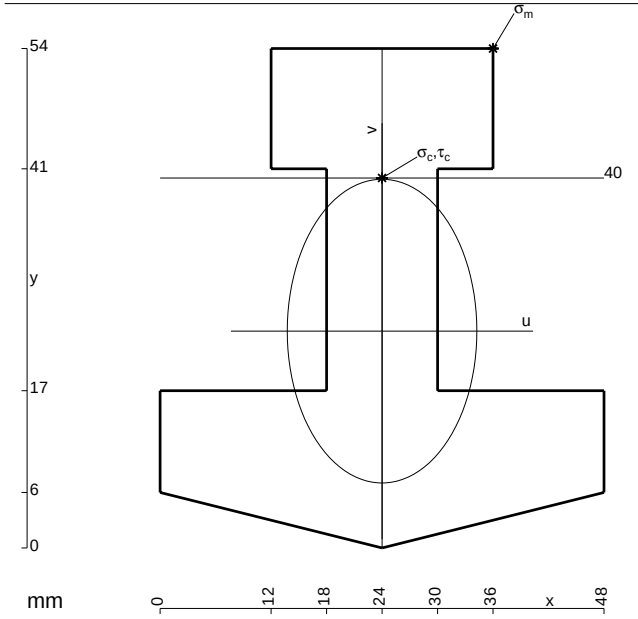
$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

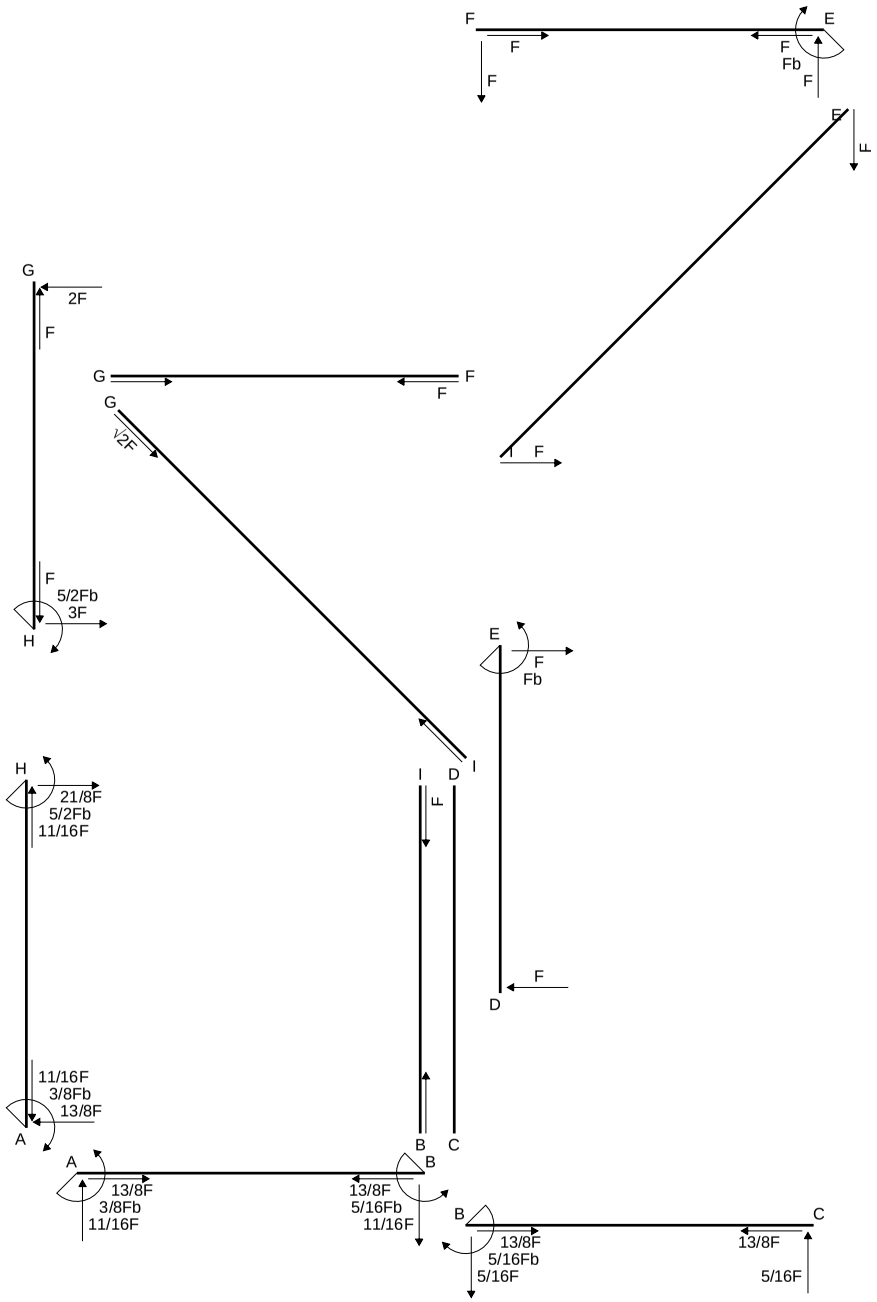
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

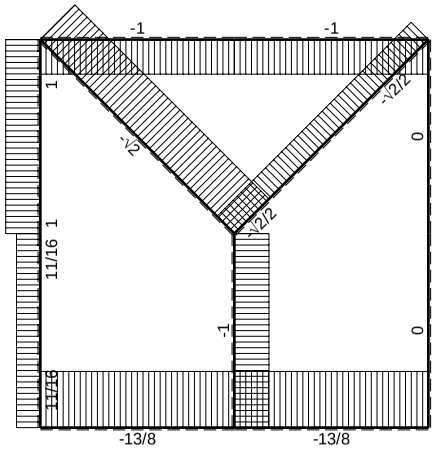
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

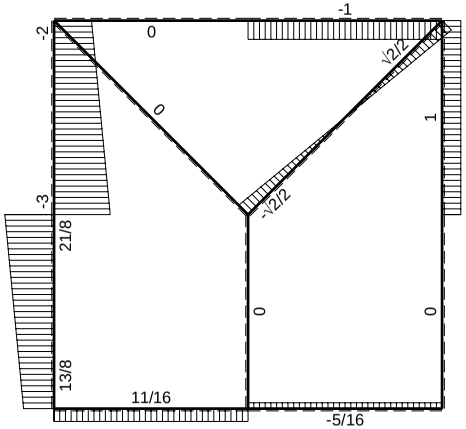
PROCEDIMENTO E RISULTATI 268011 CI04.xxxx.105



A = 1272. mm^2
J_u = 343038. mm^4
J_v = 133632. mm^4
y_g = 23.44 mm
N = 1190. N
T_y = -3570. N
M_x = -2231250. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 30.56 mm
$\sigma_m = N/A - Mv/J_u$ = 199.7 N/mm^2
x_c = 24. mm
y_c = 40. mm
v_c = 16.56 mm
$\sigma_c = N/A - Mv/J_u$ = 108.6 N/mm^2
τ_c = 6.687 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 109.2 N/mm^2
S^* = 7710. mm^3

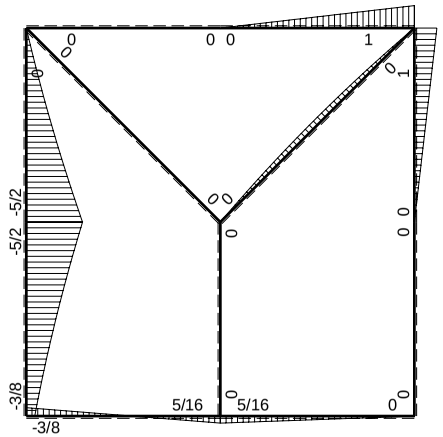

F
F
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Fb
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2F
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√2F
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5/2Fb
11/16F
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D
I
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13/8F
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5/16F
C
13/8F
5/16F


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-√2/2
-√2/2
0
11/16 1
-1
0
11/16
-13/8
-13/8

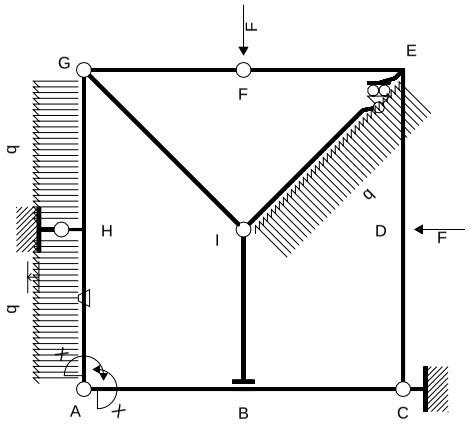

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1
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-√2/2
21/8
0
0
13/8
11/16
-5/16

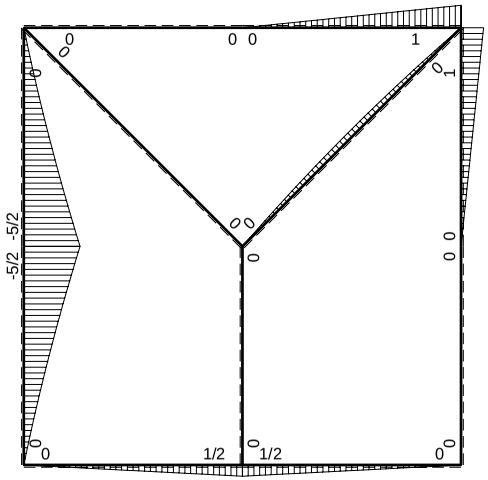
←□→ F

↑□↓ F

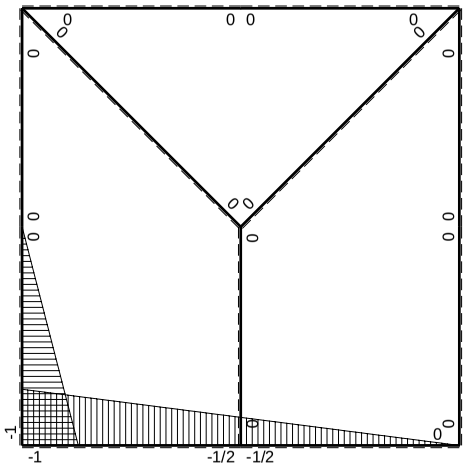

0
0 0
1
0
0
1
0 0
-5/2
-5/2
0
0 0
0
5/16
0
5/16
0
0
-3/8
-3/8

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 266252 CI04.xxxx.106

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PROCEDIMENTO E RISULTATI 266252 CI04.xxxx.106

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	-Fb/EJ	$5/2Fx-3Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(3/8+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	Fb/EJ	$2Fx-3/2Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/8Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\ \theta\ \ dx$$

$$= \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b\ \theta$$

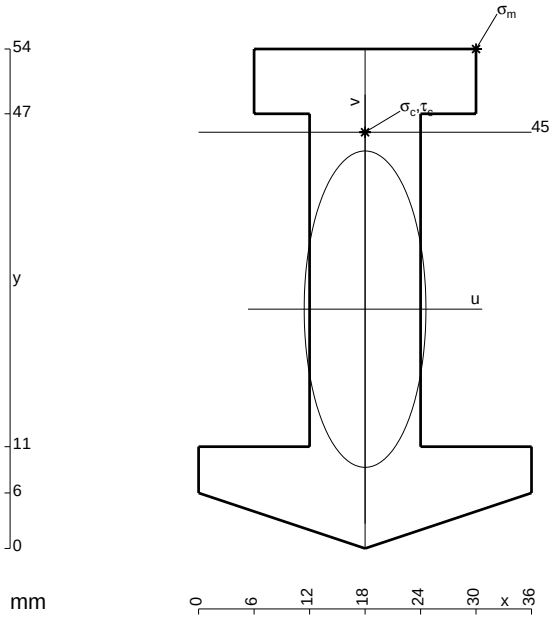
$$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b\ \right)\ \theta\ \ = 7/8\ \ Fb^2/EJ$$

$$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\ \theta\ \ dx$$

$$= \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b\ \theta$$

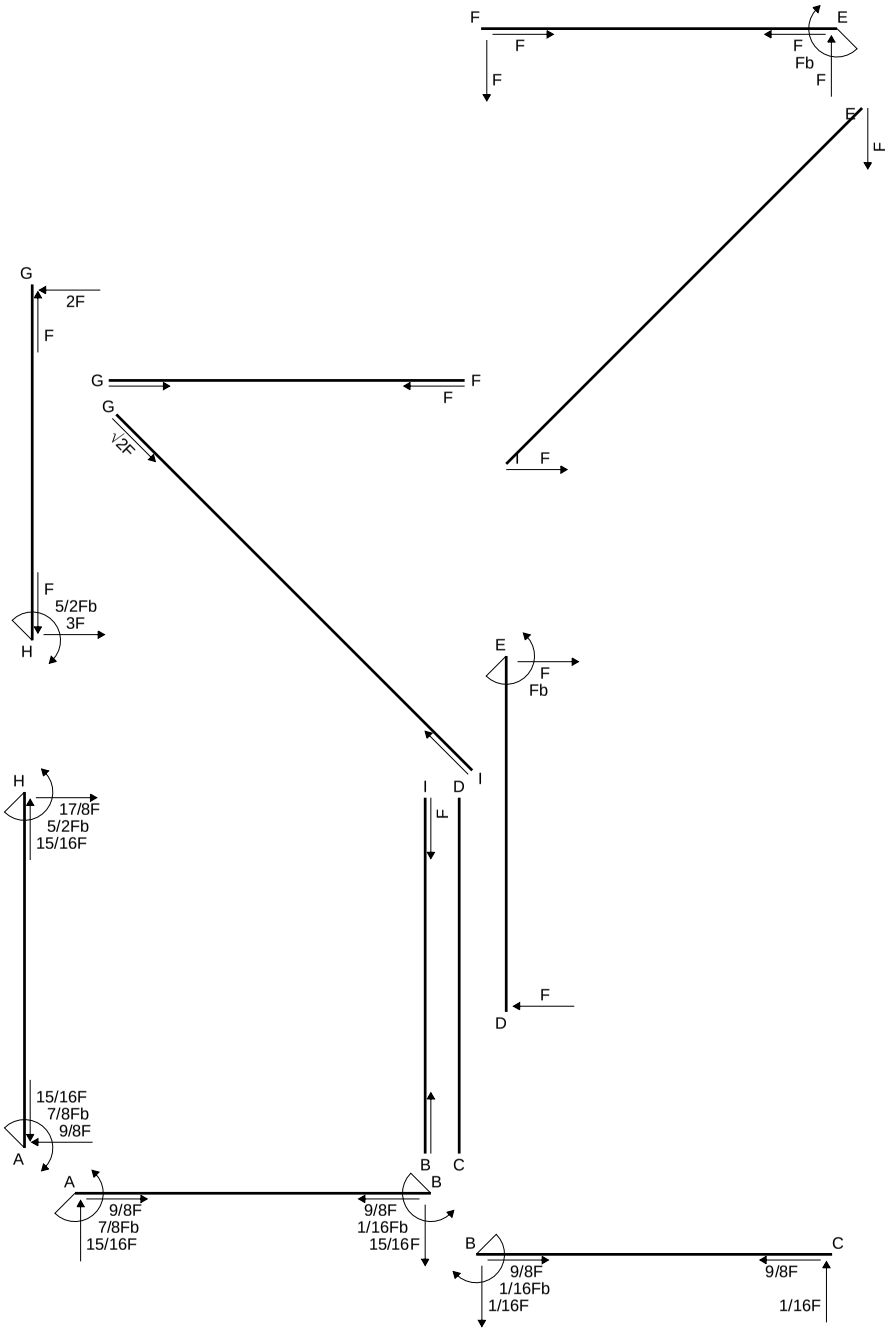
$$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\ \theta\ \ = 7/8\ \ Fb^2/EJ$$

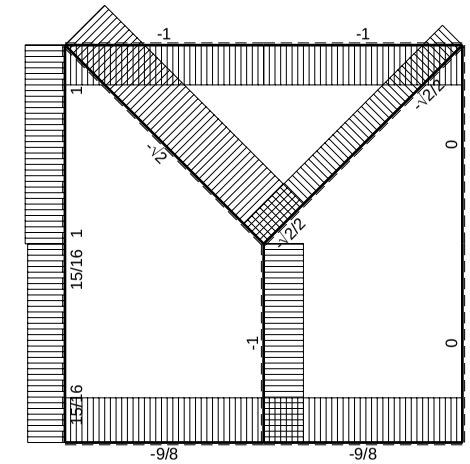
PROCEDIMENTO E RISULTATI 266252 CI04.xxxx.106

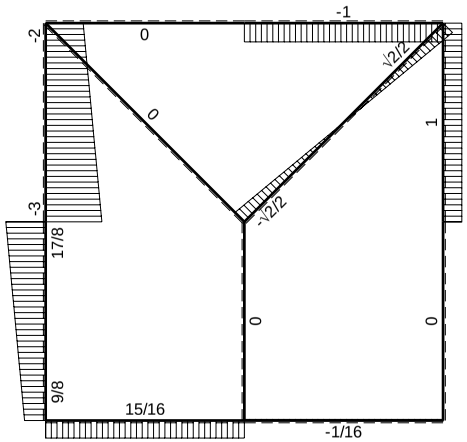


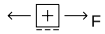
A = 888. mm^2
J_u = 260045. mm^4
J_v = 38520. mm^4
y_g = 25.87 mm
N = 960. N
T_y = -2880. N
M_x = -1920000. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 28.13 mm
$\sigma_m = N/A - Mv/J_u$ = 208.8 N/mm^2
x_c = 18. mm
y_c = 45. mm
v_c = 19.13 mm
$\sigma_c = N/A - Mv/J_u$ = 142.3 N/mm^2
τ_c = 4.264 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 142.5 N/mm^2
S^* = 4621. mm^3

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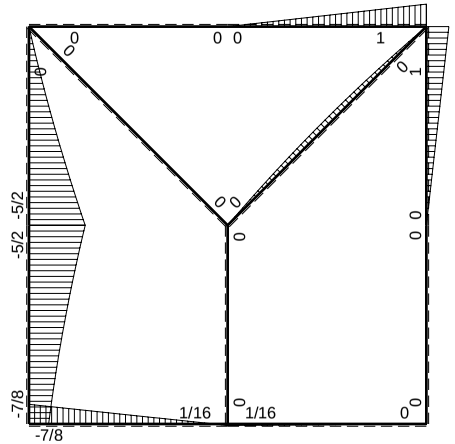

F
E
Fb
G
2F
5/2Fb
3F
H
√2F
I
D
17/8F
5/2Fb
15/16F
15/16F
7/8Fb
9/8F
A
B
C
9/8F
7/8Fb
15/16F
9/8F
1/16Fb
15/16F
9/8F
1/16Fb
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1/16F


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15/16
-9/8
-9/8

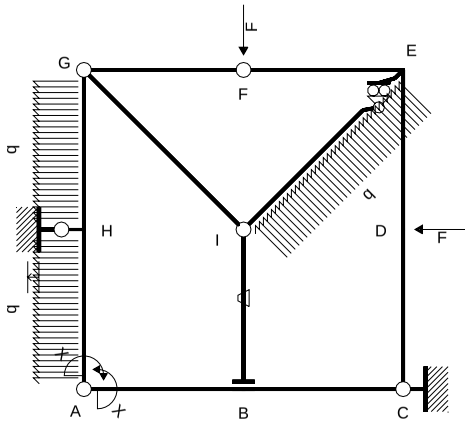

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15/16
-1/16

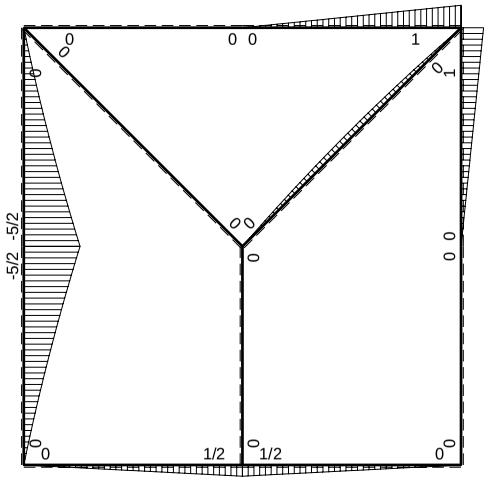

F


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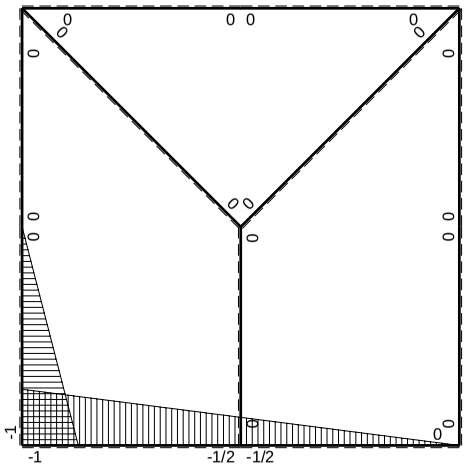

0
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1
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1
0 0
0
0 0
-5/2
-5/2
0
0 0
-7/8
1/16
1/16
0
0
-7/8


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 226461 CI04.xxxx.107

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-1/2Fx$	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	-Fb/EJ	0	0	0	0+0	0
BI b	0	0	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

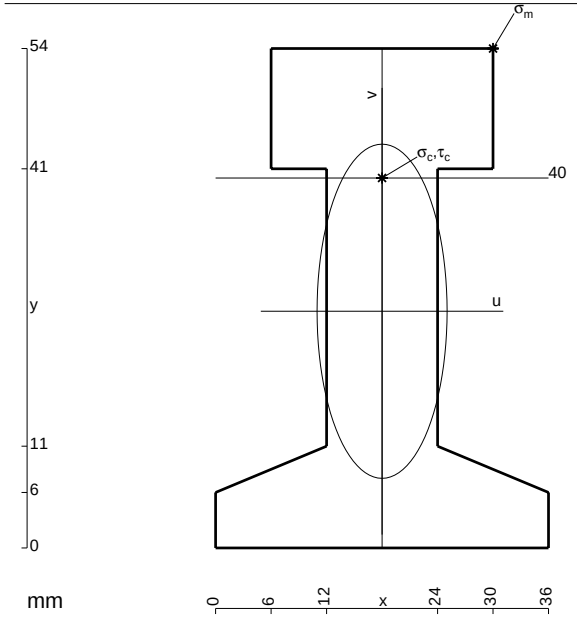
$$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$

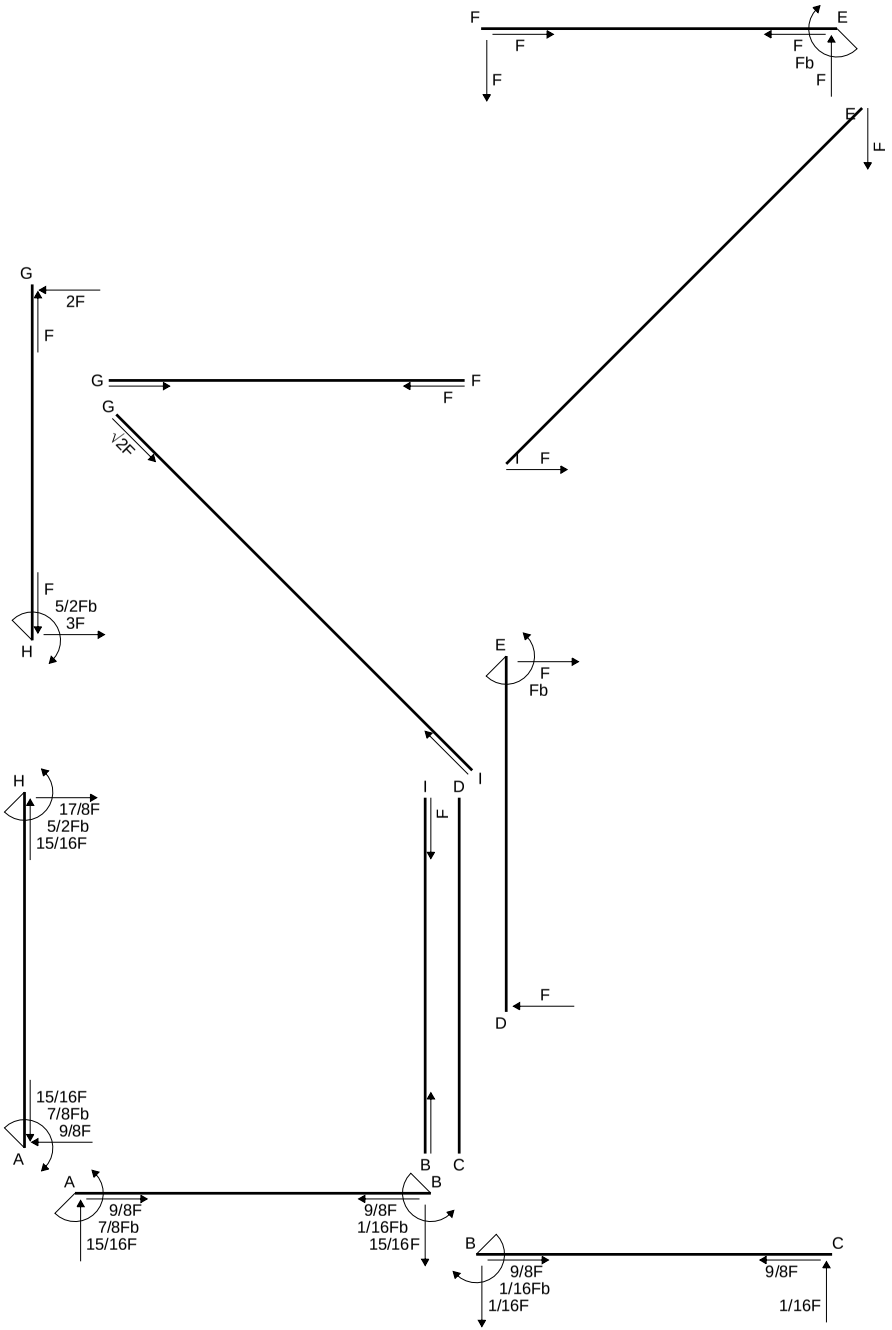
$$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

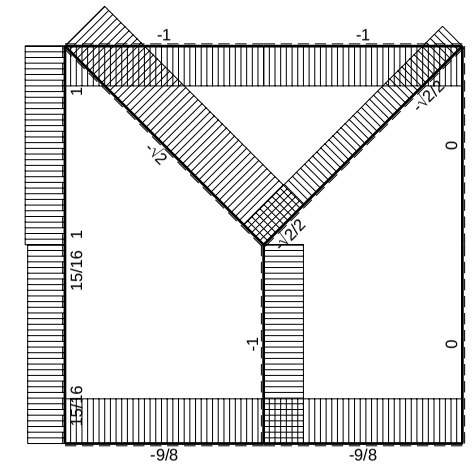
$$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$

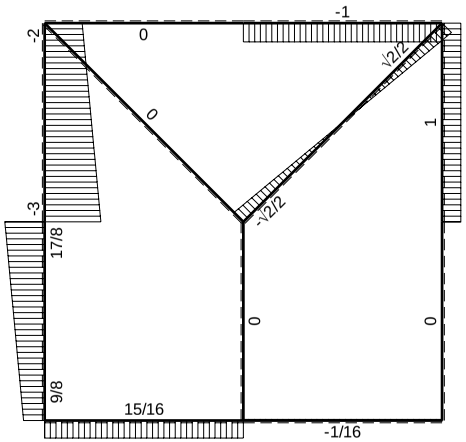
PROCEDIMENTO E RISULTATI 226461 CI04.xxxx.107

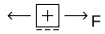


A = 1008. mm^2
J_u = 329111. mm^4
J_v = 49824. mm^4
y_g = 25.59 mm
N = 1190. N
T_y = -3570. N
M_x = -2528750. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 28.41 mm
$\sigma_m = N/A - Mv/J_u$ = 219.4 N/mm^2
x_c = 18. mm
y_c = 40. mm
v_c = 14.41 mm
$\sigma_c = N/A - Mv/J_u$ = 111.9 N/mm^2
τ_c = 6.34 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 112.4 N/mm^2
S^* = 7014. mm^3

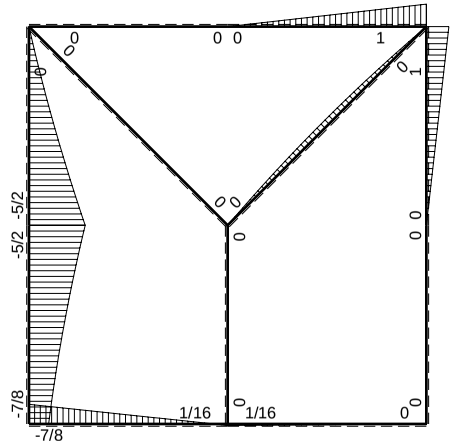

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Fb
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√2F
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-9/8
-9/8

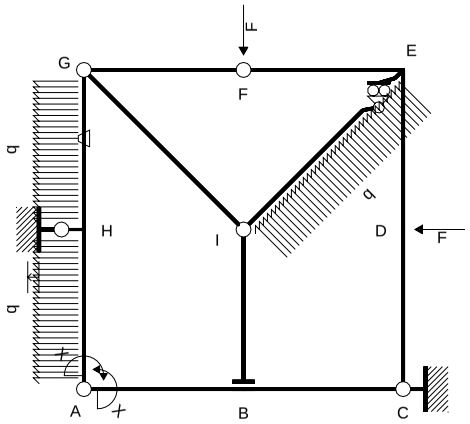

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17/8
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9/8
15/16
-1/16

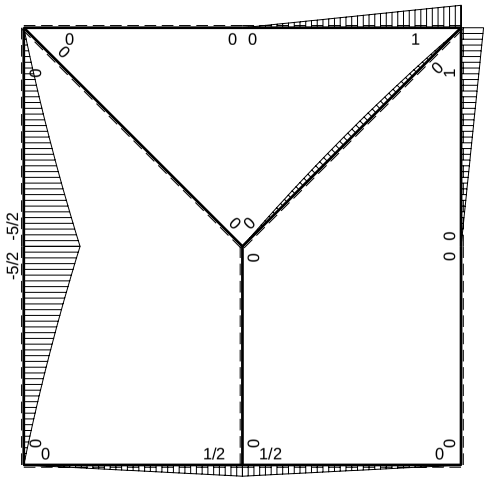

F


F

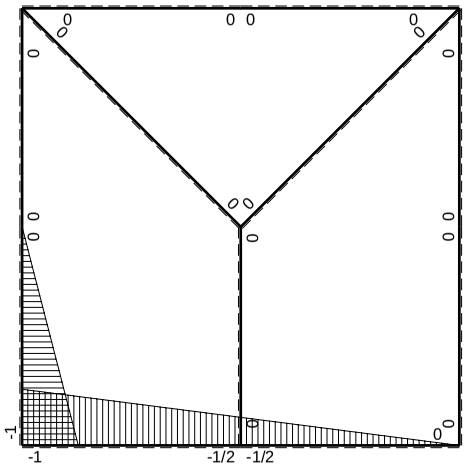

0
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0 0
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-5/2
0
0 0
-7/8
1/16
0
1/16
0 0
-7/8


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 213451 CI04.xxxx.108

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

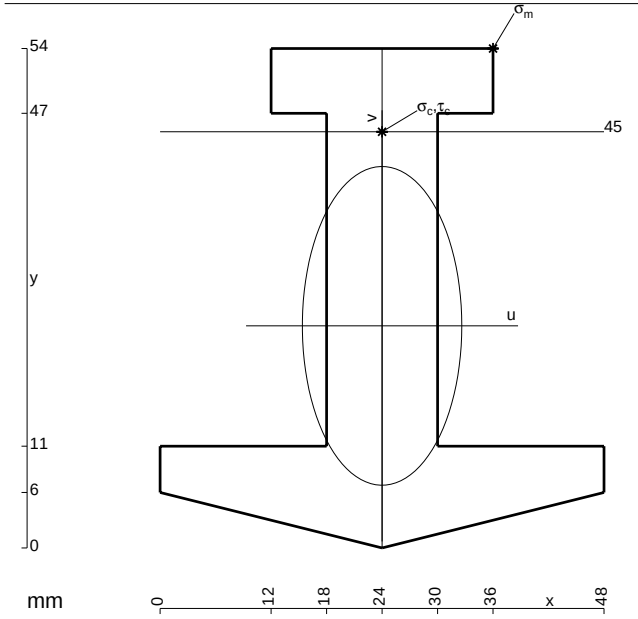
$$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

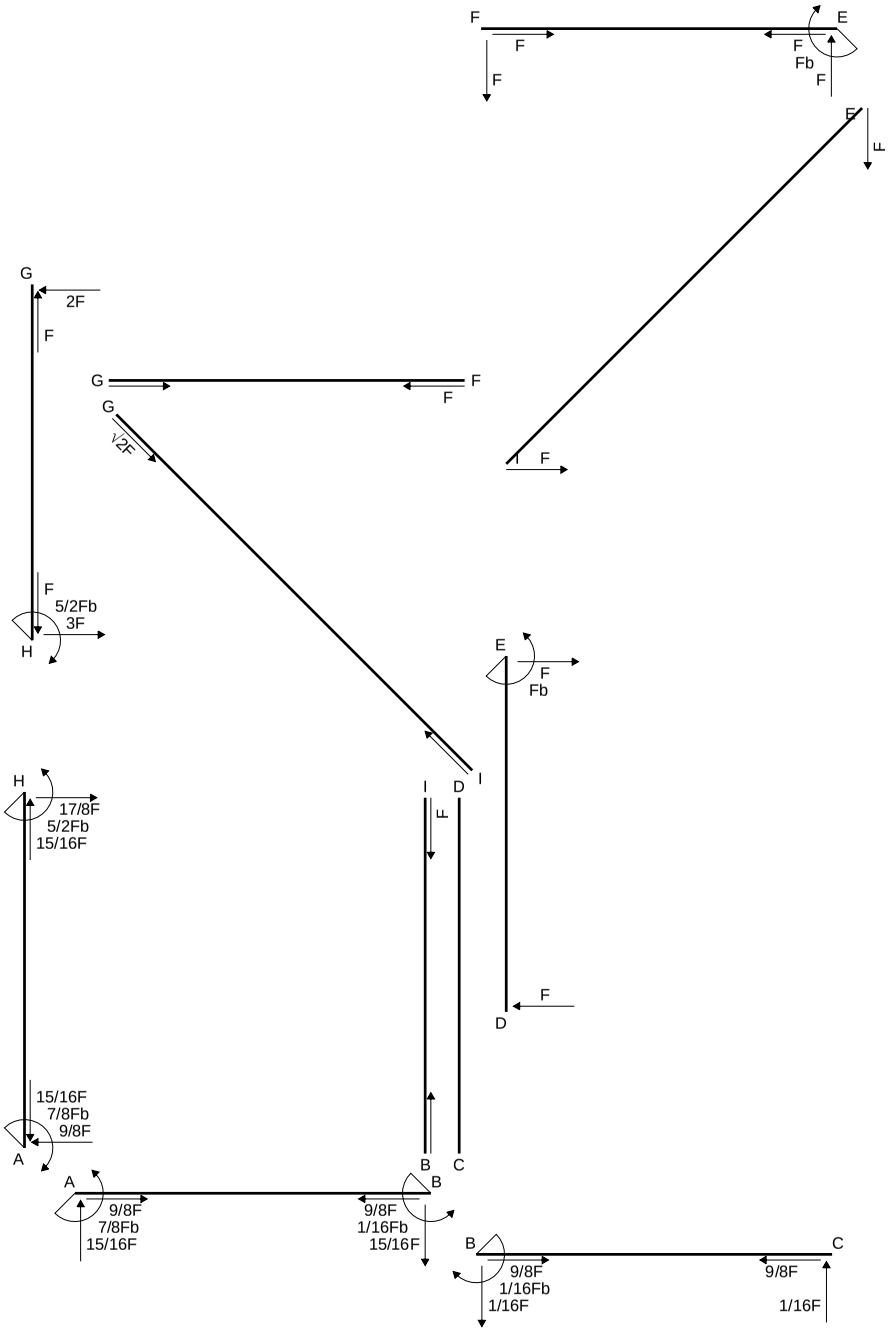
$$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$

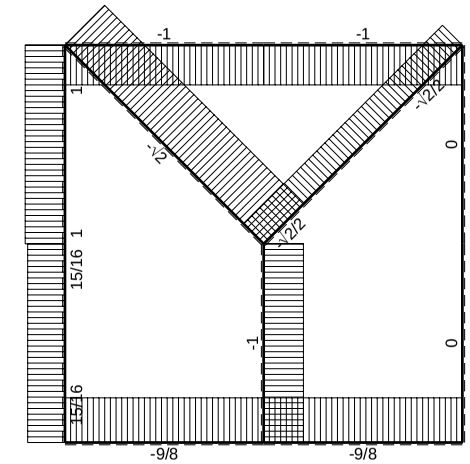
$$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

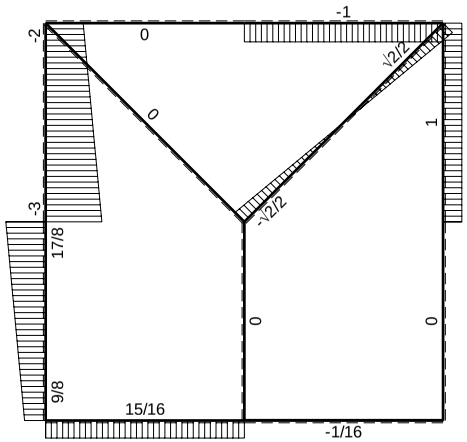
$$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$

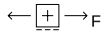


A = 984. mm^2
J_u = 292168. mm^4
J_v = 73152. mm^4
y_g = 24.01 mm
N = 990. N
T_y = -2970. N
M_x = -2227500. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 29.99 mm
$\sigma_m = N/A - Mv/J_u$ = 229.6 N/mm^2
x_c = 24. mm
y_c = 45. mm
v_c = 20.99 mm
$\sigma_c = N/A - Mv/J_u$ = 161. N/mm^2
τ_c = 4.217 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 161.2 N/mm^2
S^* = 4978. mm^3

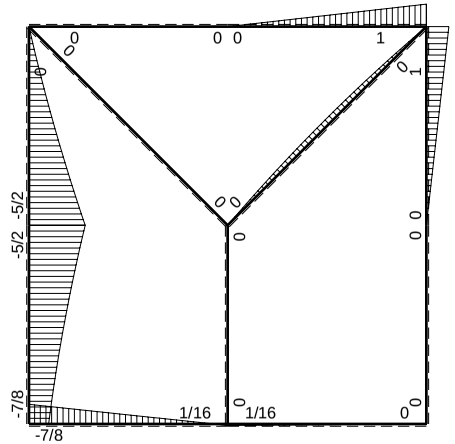

F
E
Fb
G
2F
5/2Fb
3F
H
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I
D
17/8F
5/2Fb
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7/8Fb
9/8F
A
B
C
9/8F
7/8Fb
15/16F
1/16Fb
1/16F


-1
-1
1
-√2/2
-√2/2
-√2/2
0
0
15/16
1
-1
15/16
-9/8
-9/8

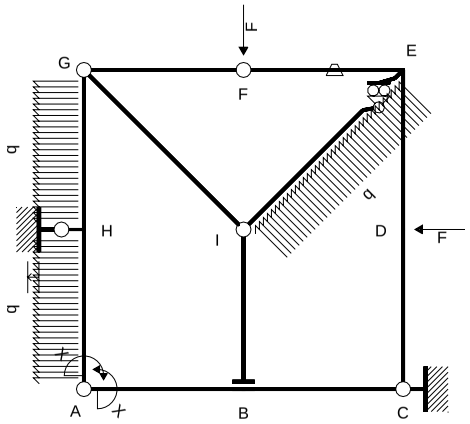

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-2
0
√2/2
0
1
-3
-√2/2
17/8
0
0
9/8
15/16
-1/16

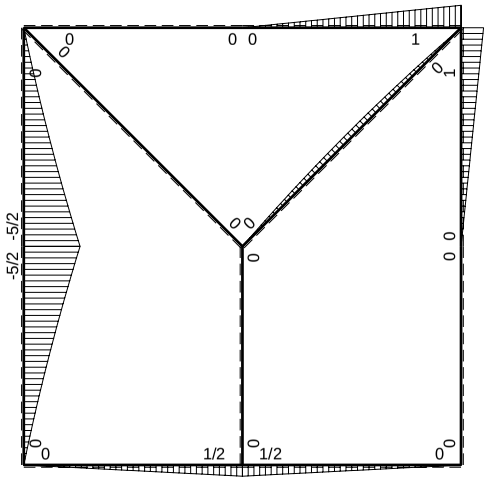

F


F

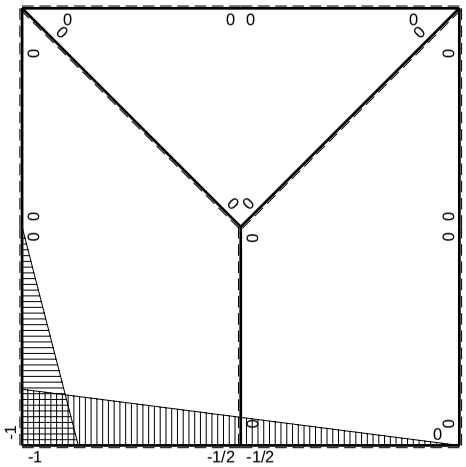

0
0 0
1
0
0
1
0 0
0
0 0
-5/2
-5/2
0
0 0
-7/8
1/16
1/16
0
0
-7/8


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	-Fb/EJ	0	0	0	0+0	0
FE b	0	-Fx	Fb/EJ	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

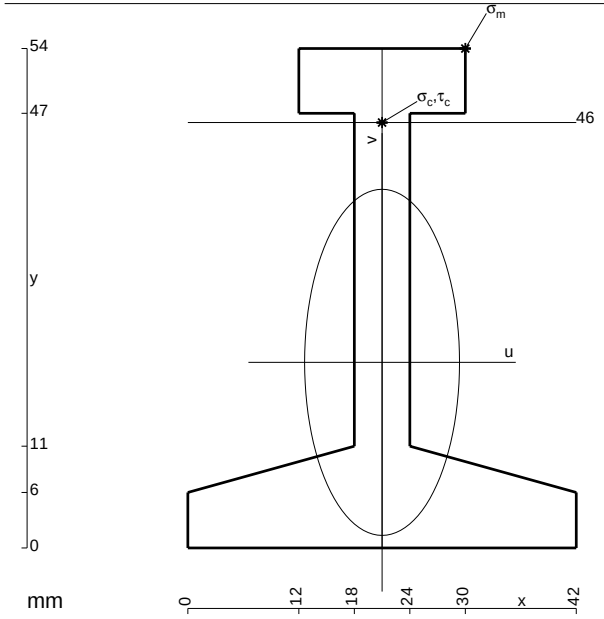
$$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$

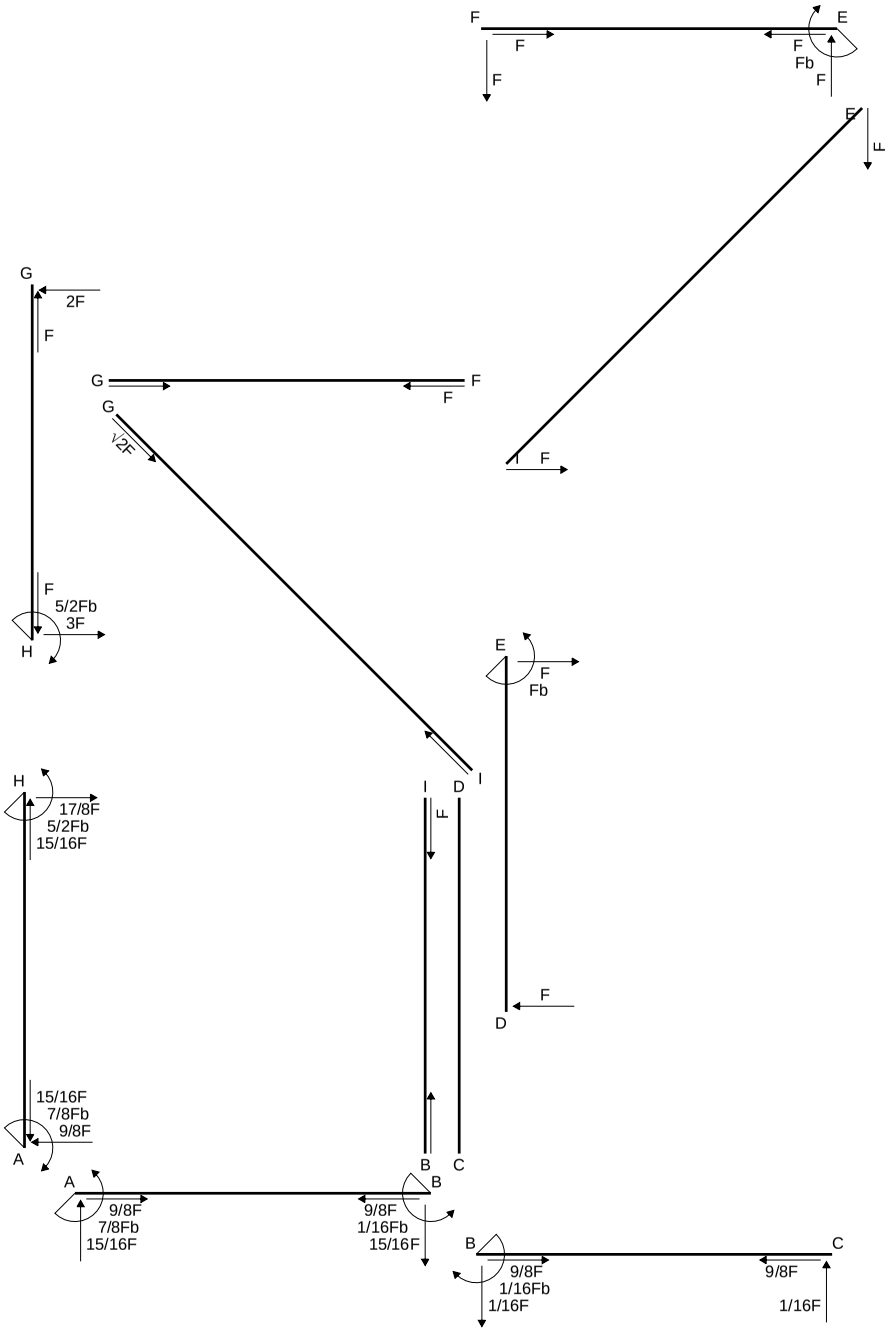
$$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

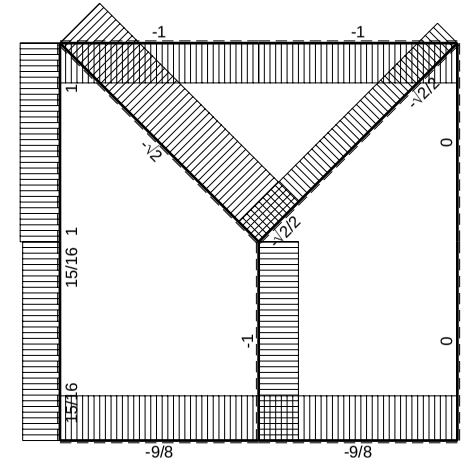
$$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$$

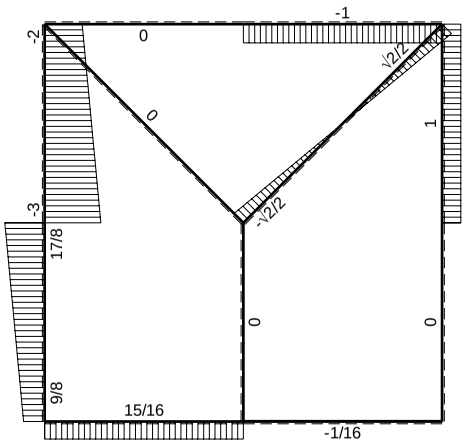
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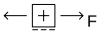


A = 714. mm^2
J_u = 249976. mm^4
J_v = 50094. mm^4
y_g = 20.07 mm
N = 740. N
T_y = -2220. N
M_x = -1757500. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 9. mm
v_m = 33.93 mm
$\sigma_m = N/A - Mv/J_u$ = 239.6 N/mm^2
x_c = 21. mm
y_c = 46. mm
v_c = 25.93 mm
$\sigma_c = N/A - Mv/J_u$ = 183.4 N/mm^2
τ_c = 5.91 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 183.6 N/mm^2
S^* = 3993. mm^3

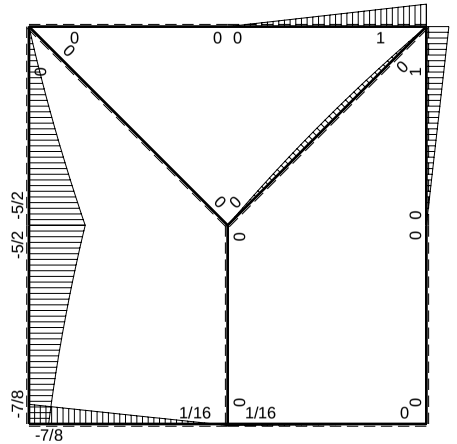

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I
D
17/8F
5/2Fb
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7/8Fb
9/8F
A
B
C
9/8F
7/8Fb
15/16F
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1/16F


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1
-√2/2
-√2/2
-√2/2
0
0
15/16
1
-1
15/16
-9/8
-9/8

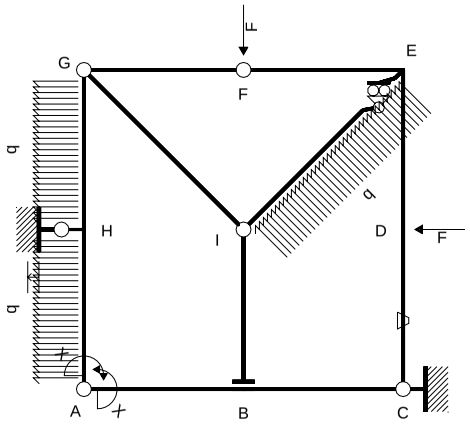

-1
-2
0
√2/2
0
-√2/2
-3
17/8
1
0
0
9/8
15/16
-1/16

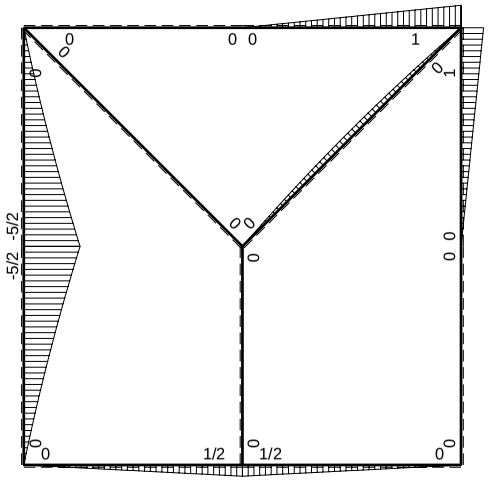

F


F

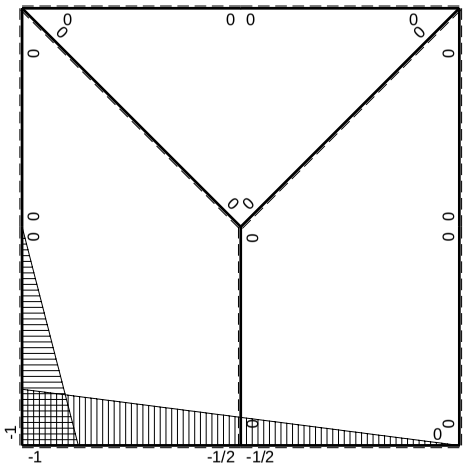

0
0 0
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0
0
1
0 0
0
0
-5/2
-5/2
0
0 0
-7/8
1/16
1/16
0
0
-7/8


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 215080 CI04.xxxx.110

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PROCEDIMENTO E RISULTATI 215080 CI04.xxxx.110

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-1/2Fx$	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	-Fb/EJ	0	0	0	0+0	0
DC b	0	0	Fb/EJ	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

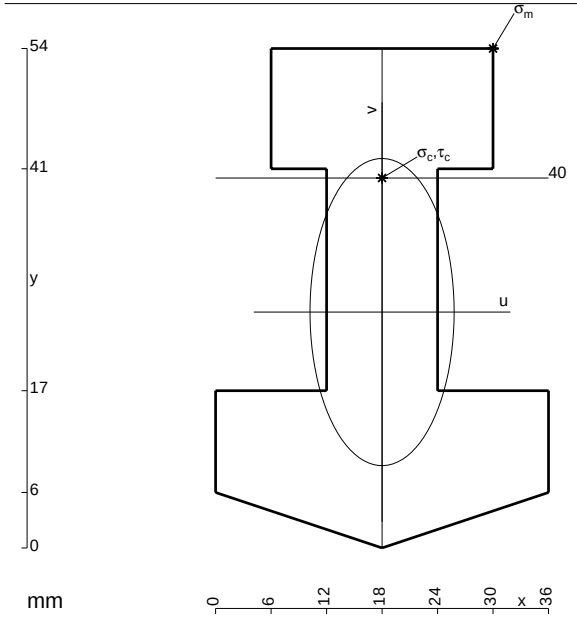
$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

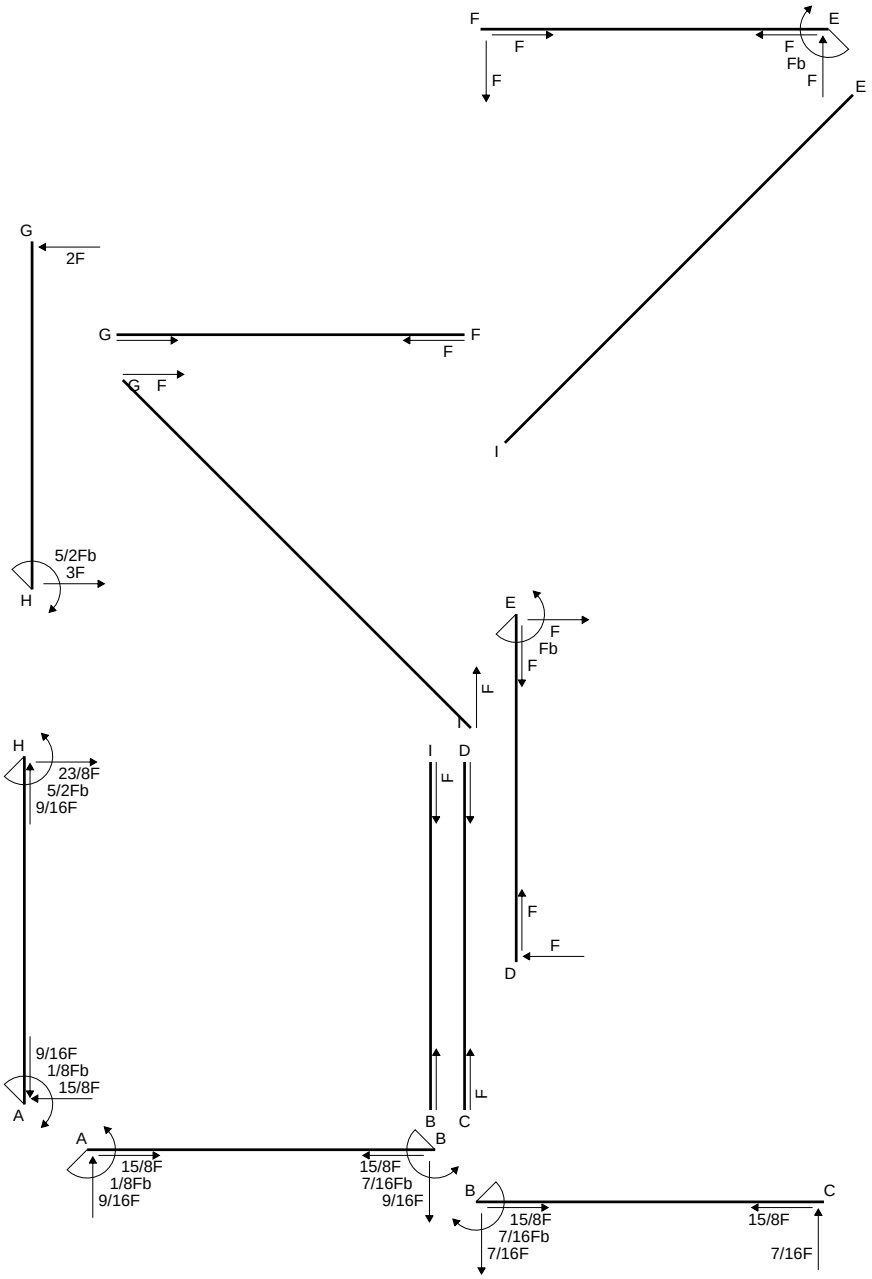
$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

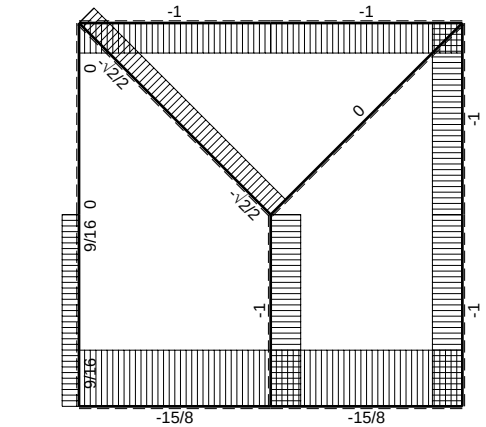
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

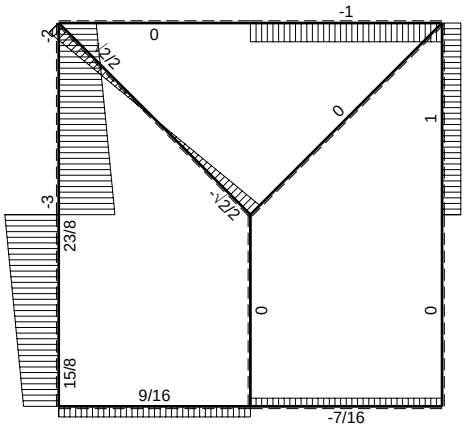
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$



A = 1104. mm^2
J_u = 304502. mm^4
J_v = 67032. mm^4
y_g = 25.51 mm
N = 1690. N
T_y = -5070. N
M_x = -2112500. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 28.49 mm
$\sigma_m = N/A - Mv/J_u$ = 199.2 N/mm^2
x_c = 18. mm
y_c = 40. mm
v_c = 14.49 mm
$\sigma_c = N/A - Mv/J_u$ = 102.1 N/mm^2
τ_c = 9.771 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 103.5 N/mm^2
S^* = 7042. mm^3

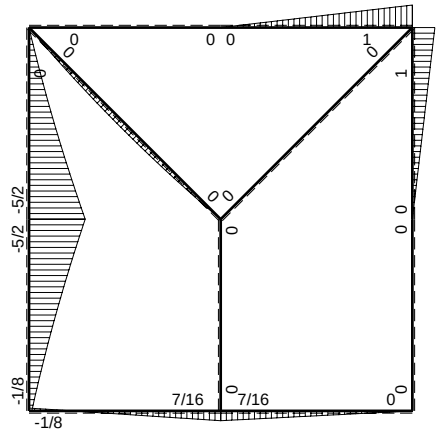

F
E
F
F
Fb
F
E
G
2F
G
F
F
G
F
I
5/2Fb
3F
H
E
F
Fb
F
F
H
I
D
23/8F
5/2Fb
9/16F
F
F
D
F
9/16F
1/8Fb
15/8F
A
B
C
A
B
15/8F
1/8Fb
9/16F
15/8F
7/16Fb
9/16F
B
C
15/8F
7/16Fb
7/16F
15/8F
7/16F


-1
-1
0
√2/2
0
-1
-√2/2
9/16
0
-1
-1
9/16
-15/8
-15/8

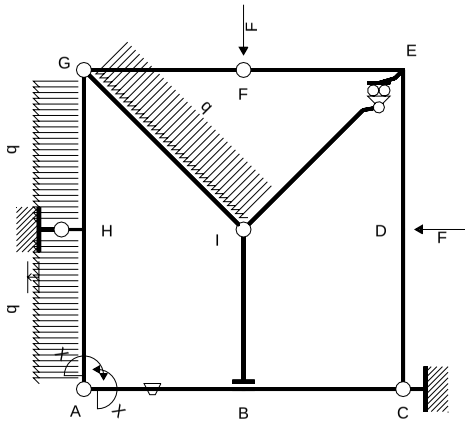

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0
1
-√2/2
-3
23/8
0
0
15/8
9/16
-7/16

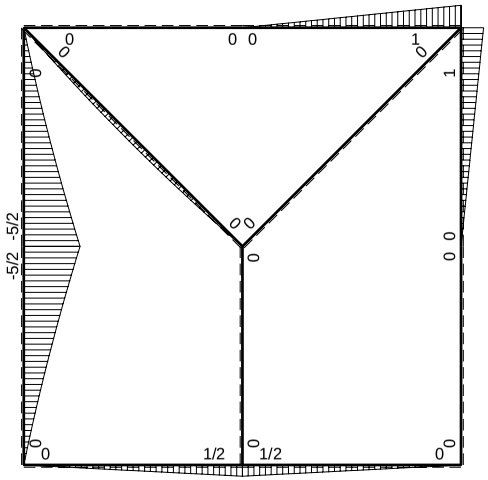
F

F

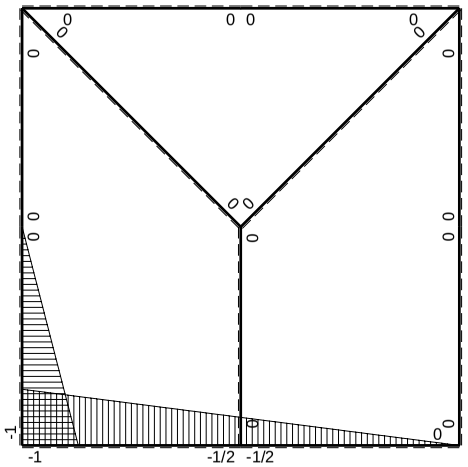

0
0 0
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0
0
1
0 0
0
-5/2
-5/2
0
0 0
-1/8
7/16
0
7/16
0
0
-1/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 266284 CI04.xxxx.111

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PROCEDIMENTO E RISULTATI 266284 CI04.xxxx.111

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	-Fb/EJ	$-1/2Fx+1/4Fx^2/b$	Fb/EJ-1/2Fx/EJ	$1-x/b+1/4x^2/b^2$	$(-1/6+3/4)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/2Fb+1/2Fx	Fb/EJ	$-1/4Fb+1/4Fx^2/b$	1/2Fb/EJ+1/2Fx/EJ	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx + \int_o^b \left(1 - 1/2\ x/b\right)\theta\ dx$

$= \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ\ + \left[\ x - 1/4\ x^2/b\ \right]_o^b \theta$

$= \left(-1/4\ b + 1/12\ b\ \right) Fb\ 1/EJ\ + \left(\ b - 1/4\ b\ \right)\theta\ = 7/12\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx + \int_o^b \left(-1/2 - 1/2\ x/b\right)\theta\ dx$

$= \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ\ + \left[-1/2\ x - 1/4\ x^2/b\ \right]_o^b \theta$

$= \left(-1/4\ b + 1/12\ b\ \right) Fb\ 1/EJ\ + \left(-1/2\ b - 1/4\ b\ \right)\theta\ = 7/12\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right) Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ$

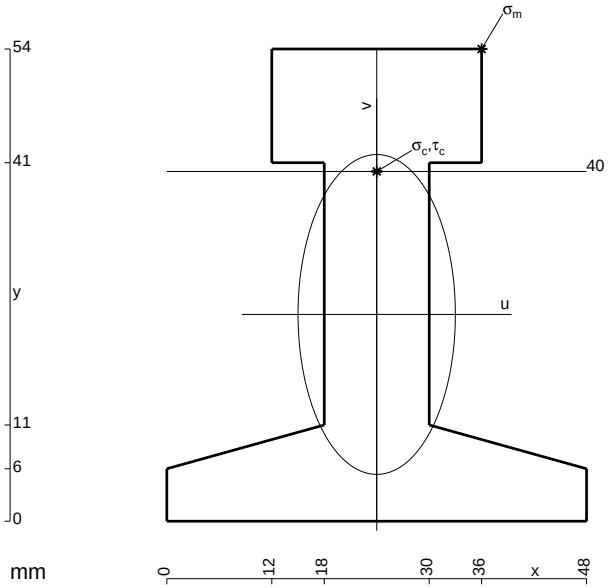
$= \left(-1/12\ b\ \right) Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

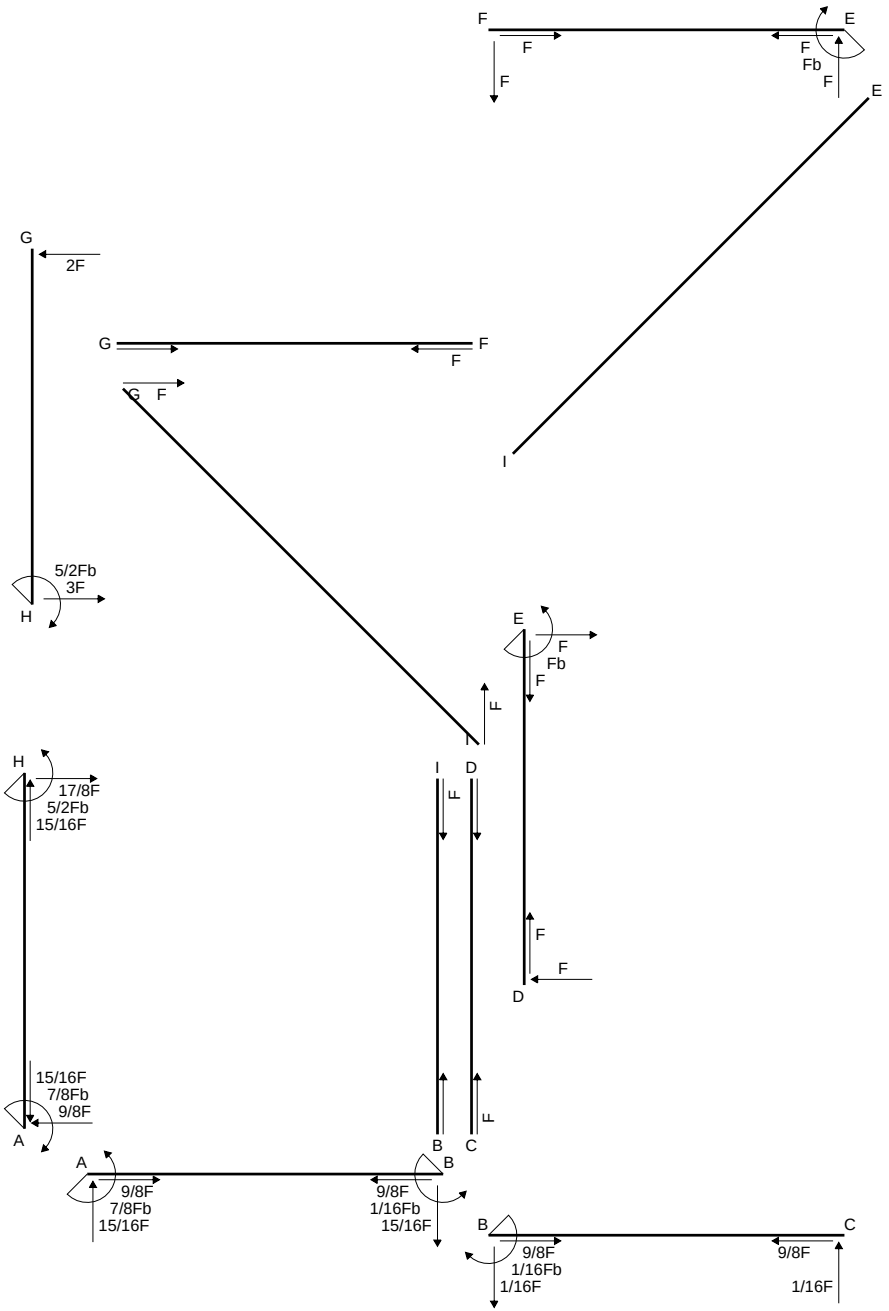
$= \left(5/4\ b - b + 1/8\ b\ \right) Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

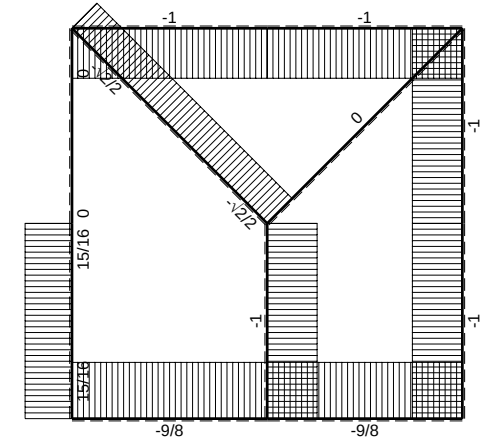
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

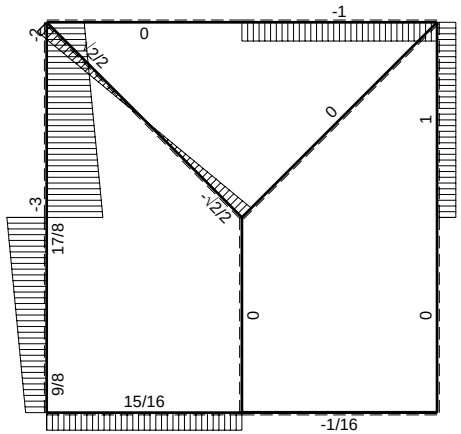
$= \left(\ b - 1/2\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

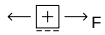


A = 1110. mm^2
J_u = 371542. mm^4
J_v = 89892. mm^4
y_g = 23.64 mm
T_y = -5580. N
M_x = -2557500. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 30.36 mm
$\sigma_m = -Mv/J_u$ = 209. N/mm^2
x_c = 24. mm
y_c = 40. mm
v_c = 16.36 mm
$\sigma_c = -Mv/J_u$ = 112.6 N/mm^2
τ_c = 9.569 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 113.8 N/mm^2
S^* = 7646. mm^3

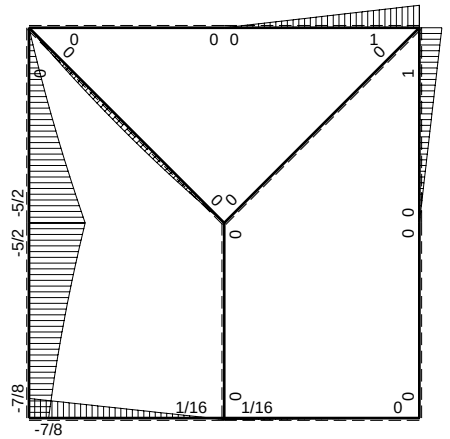

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3F
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Fb
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17/8F
5/2Fb
15/16F
I
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F
D
15/16F
7/8Fb
9/8F
A
B
C
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A
B
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7/8Fb
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1/16Fb
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B
C
9/8F
1/16Fb
1/16F
9/8F
1/16F


-1
-1
-√2/2
0
-1
-√2/2
15/16
0
-1
-1
15/16
-9/8
-9/8

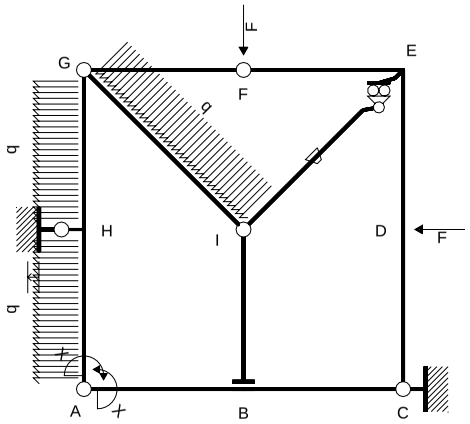

-1
0
-√2/2
0
1
-3
-√2/2
17/8
0
0
9/8
15/16
-1/16

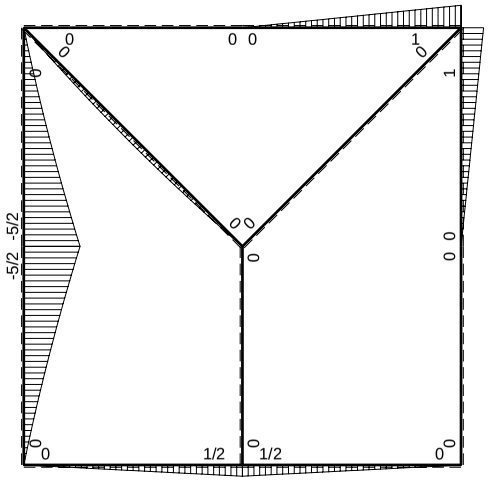

F


F

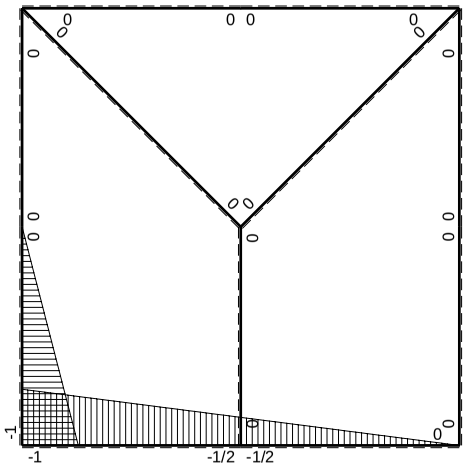

0
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0 0
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-5/2
-5/2
0 0
-7/8
1/16
0
1/16
0
0
-7/8


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 270433 CI04.xxxx.112

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PROCEDIMENTO E RISULTATI 270433 CI04.xxxx.112

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-1/2Fx$	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

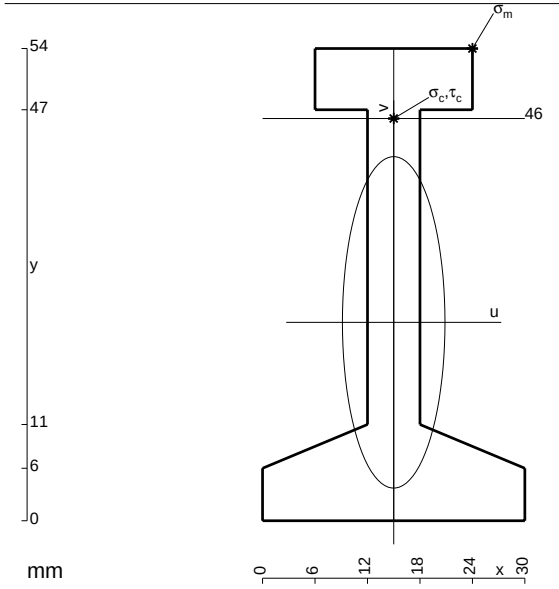
$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

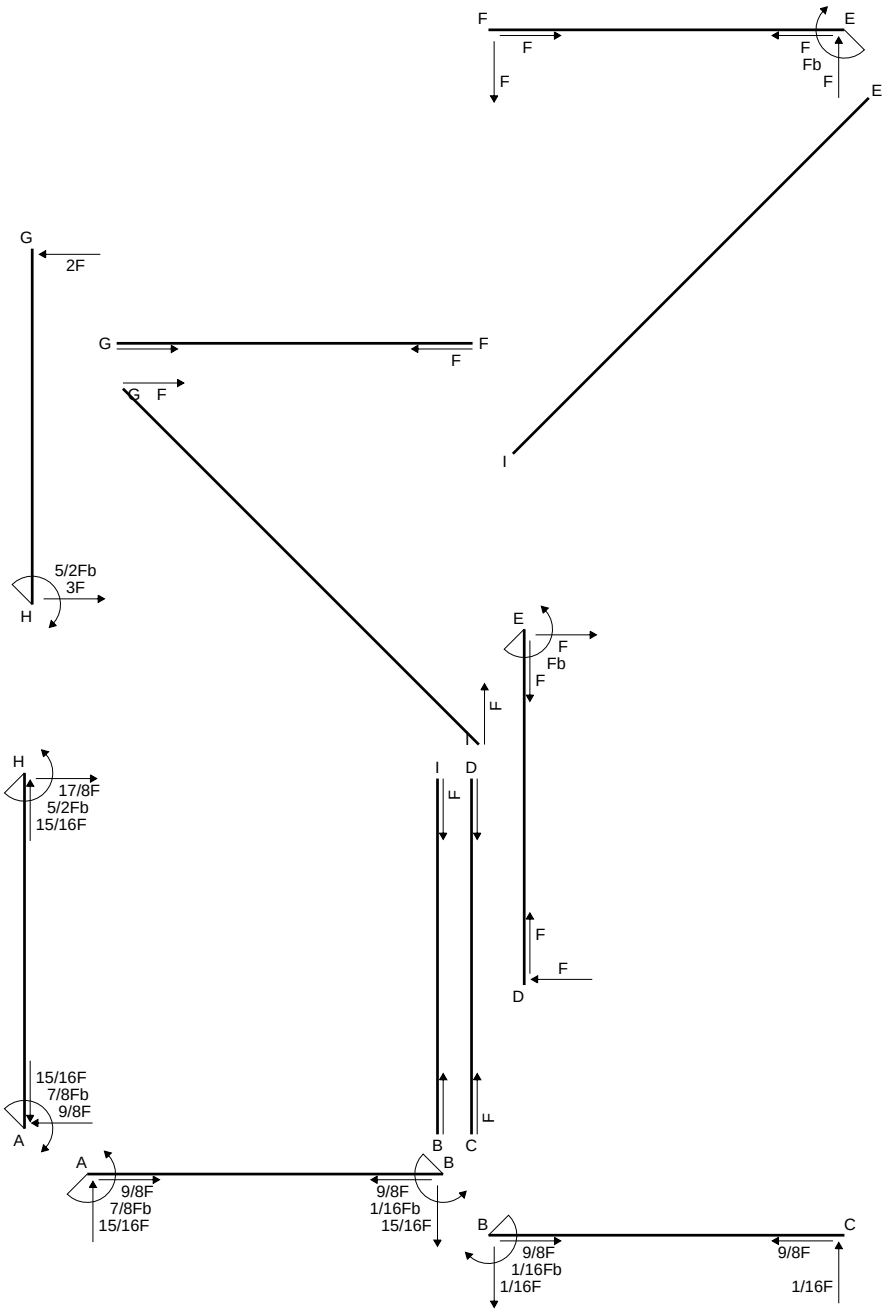
$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

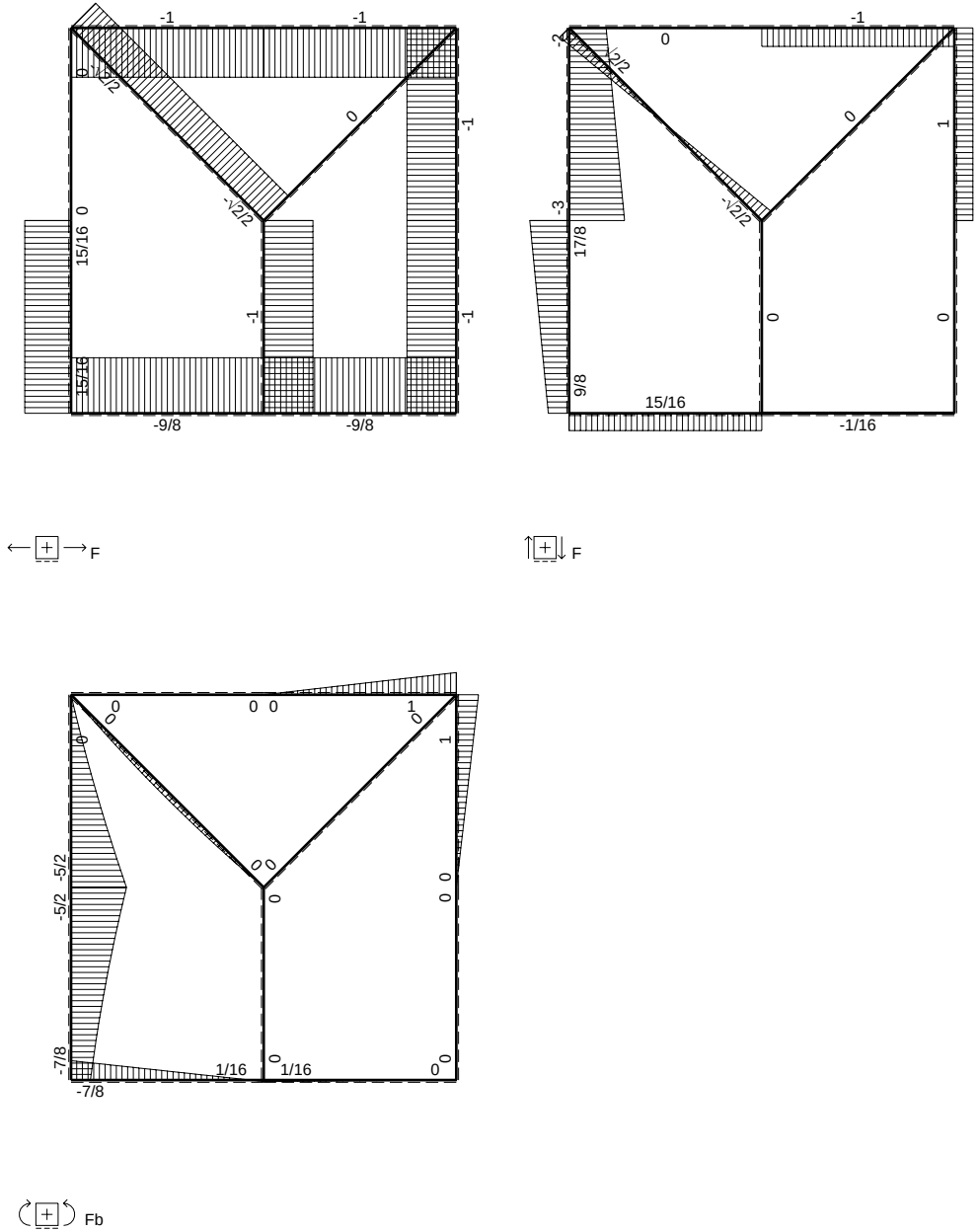
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

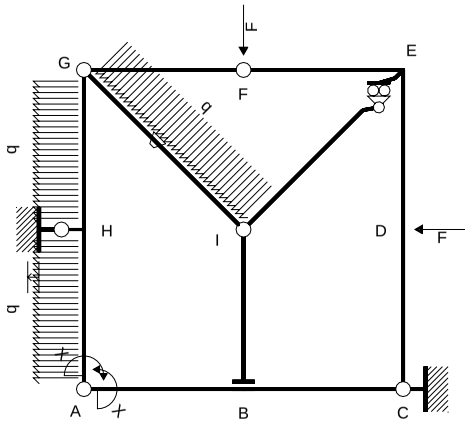
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

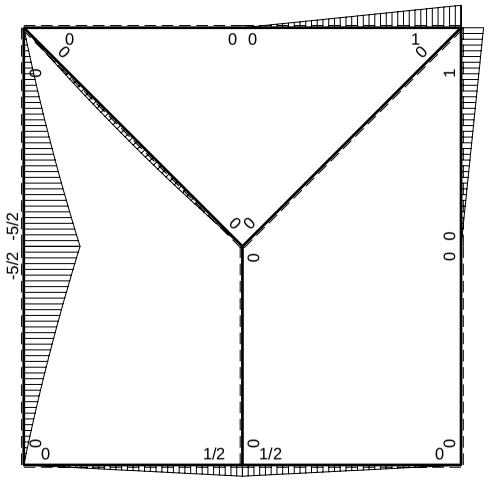


A = 612. mm^2
J_u = 219945. mm^4
J_v = 21060. mm^4
y_g = 22.68 mm
T_y = -3090. N
M_x = -1545000. Nmm
x_m = 24. mm
y_m = 54. mm
u_m = 9. mm
v_m = 31.32 mm
$\sigma_m = -Mv/J_u$ = 220. N/mm^2
x_c = 15. mm
y_c = 46. mm
v_c = 23.32 mm
$\sigma_c = -Mv/J_u$ = 163.8 N/mm^2
τ_c = 8.541 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 164.5 N/mm^2
S^* = 3648. mm^3

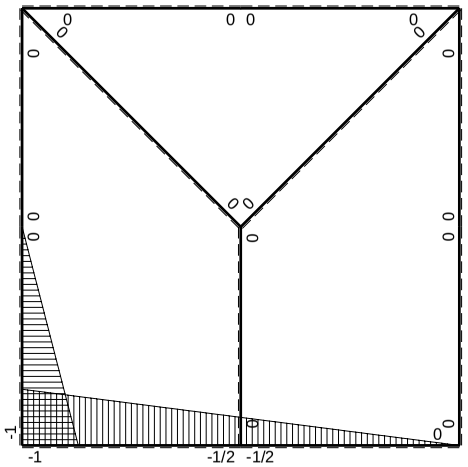

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Fb
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F
H
17/8F
5/2Fb
15/16F
I
D
F
F
F
D
15/16F
7/8Fb
9/8F
A
B
C
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A
B
9/8F
7/8Fb
15/16F
9/8F
1/16Fb
15/16F
B
C
9/8F
1/16Fb
1/16F
9/8F
1/16F


-1
-1
-√2/2
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-1
-√2/2
15/16
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-1
-1
15/16
-9/8
-9/8
F
-1
2
0
-√2/2
0
1
-3
-√2/2
17/8
0
0
9/8
15/16
-1/16
F
0
0 0
1
0
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1
0
0
0
0
-5/2
-5/2
0 0
0 0
-7/8
1/16
1/16
0
0
-7/8
Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 265736 CI04.xxxx.113

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PROCEDIMENTO E RISULTATI 265736 CI04.xxxx.113

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-1/2Fx$	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	-Fb/EJ	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b (-1/2\ x/b + 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/12\ b\ )\ Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b (-1/4 + 1/4\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-1/4\ x + 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/12\ b\ )\ Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b (-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/4\ b - 1/12\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-1/4\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/12\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

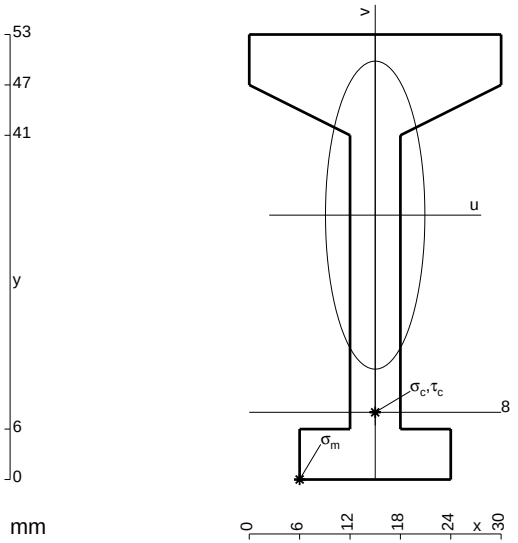
$L^{Xo}_{HA} = \int_o^b (5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (5/4\ b - b + 1/8\ b\ )\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b (2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

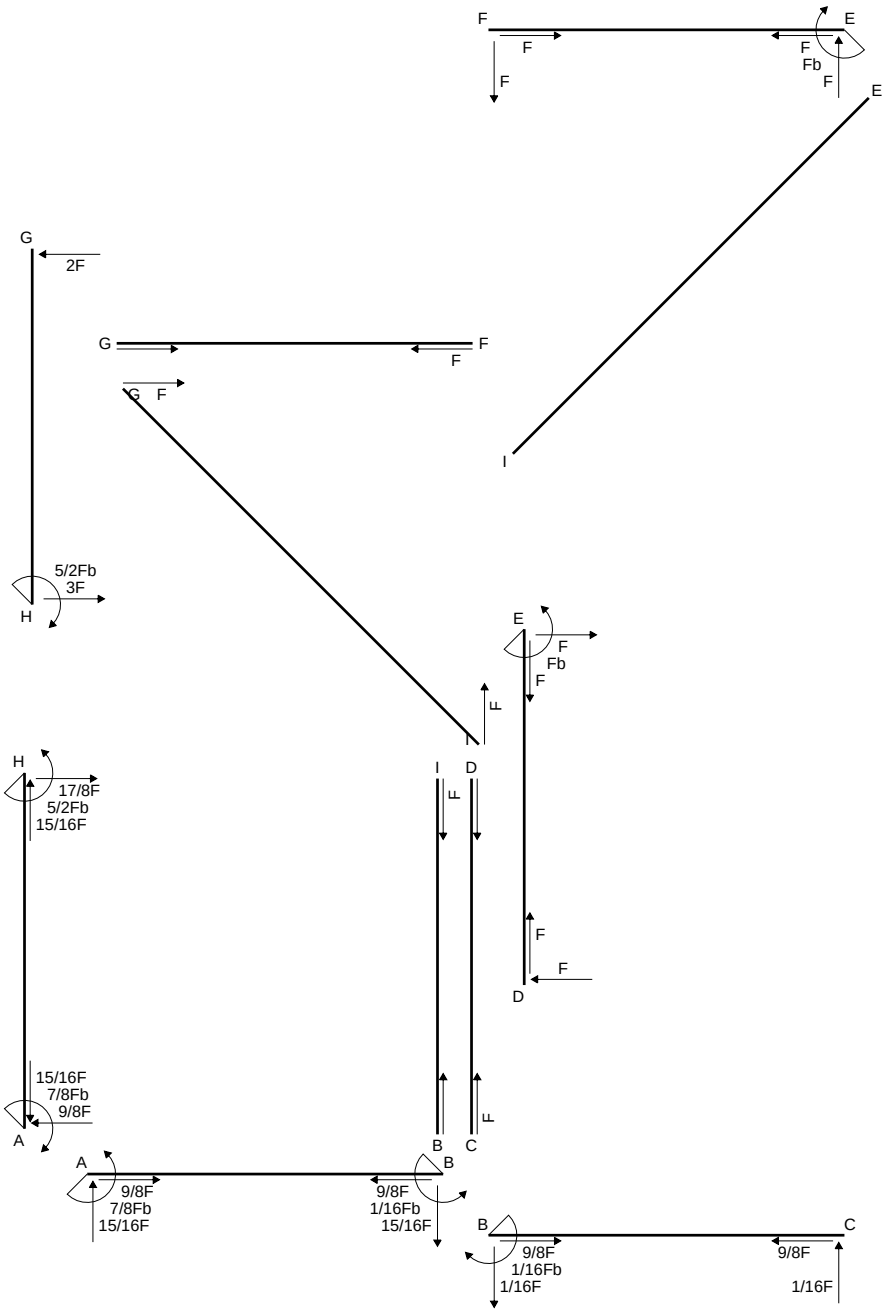
$= (\ b - 1/2\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

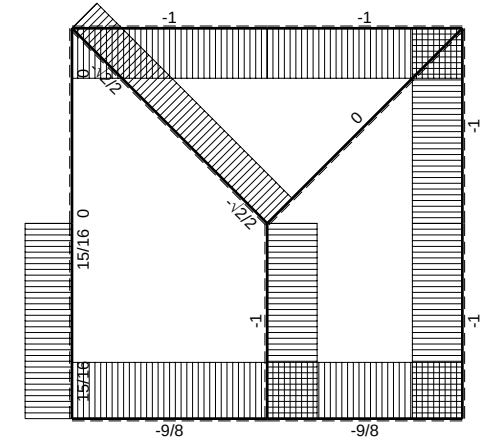
PROCEDIMENTO E RISULTATI 265736 CI04.xxxx.113

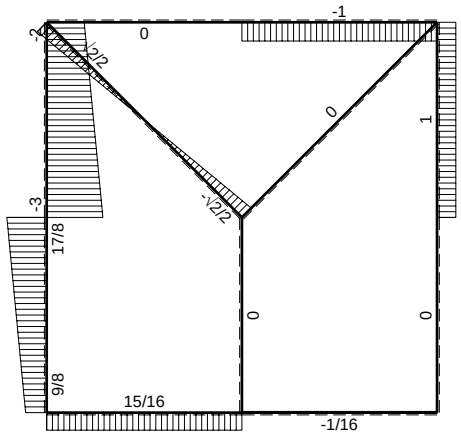


A = 606. mm^2
J_u = 204068. mm^4
J_v = 21258. mm^4
y_g = 31.49 mm
T_y = -2820. N
M_x = -1480500. Nmm
x_m = 6. mm
u_m = -9. mm
v_m = -31.49 mm
$\sigma_m = -Mv/J_u$ = -228.5 N/mm^2
x_c = 15. mm
y_c = 8. mm
v_c = -23.49 mm
$\sigma_c = -Mv/J_u$ = -170.4 N/mm^2
τ_c = 7.763 N/mm^2
$\sigma_0 = \sqrt{\sigma^2 + 3\tau^2}$ = 170.9 N/mm^2
S^* = 3371. mm^3

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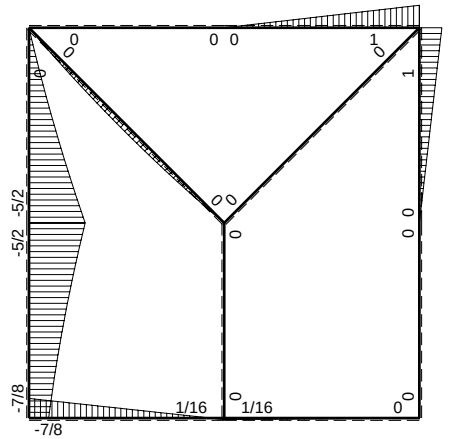

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15/16F
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1/16F


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15/16
-9/8
-9/8

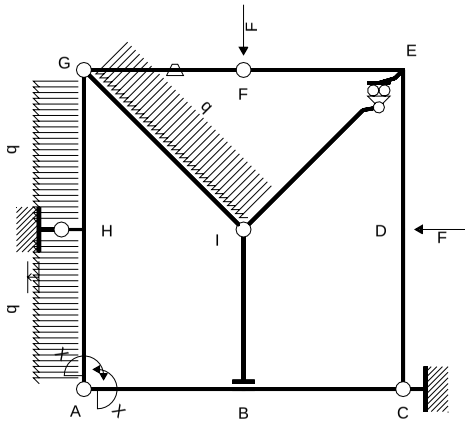

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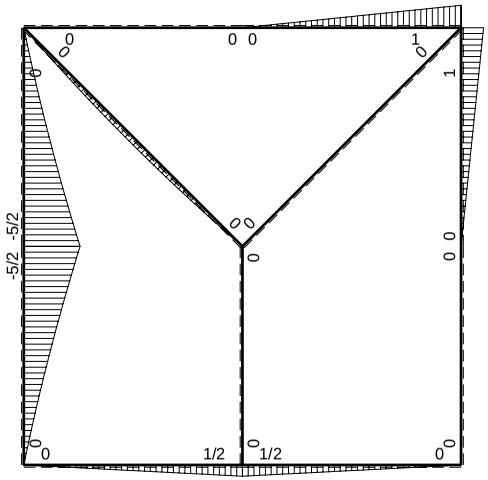
←□→ F

↑□↓ F

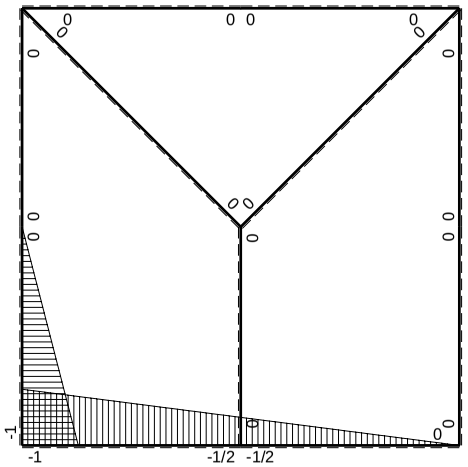

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-7/8
1/16
1/16
0
0
-7/8

↺□↻ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 939153 CI04.xxxx.114

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-1/2Fx$	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	-Fb/EJ	0	0	0	0+0	0
GF b	0	0	Fb/EJ	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

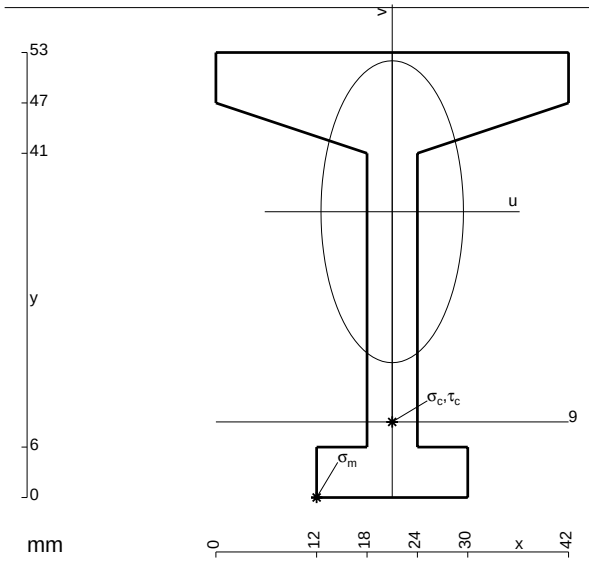
$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

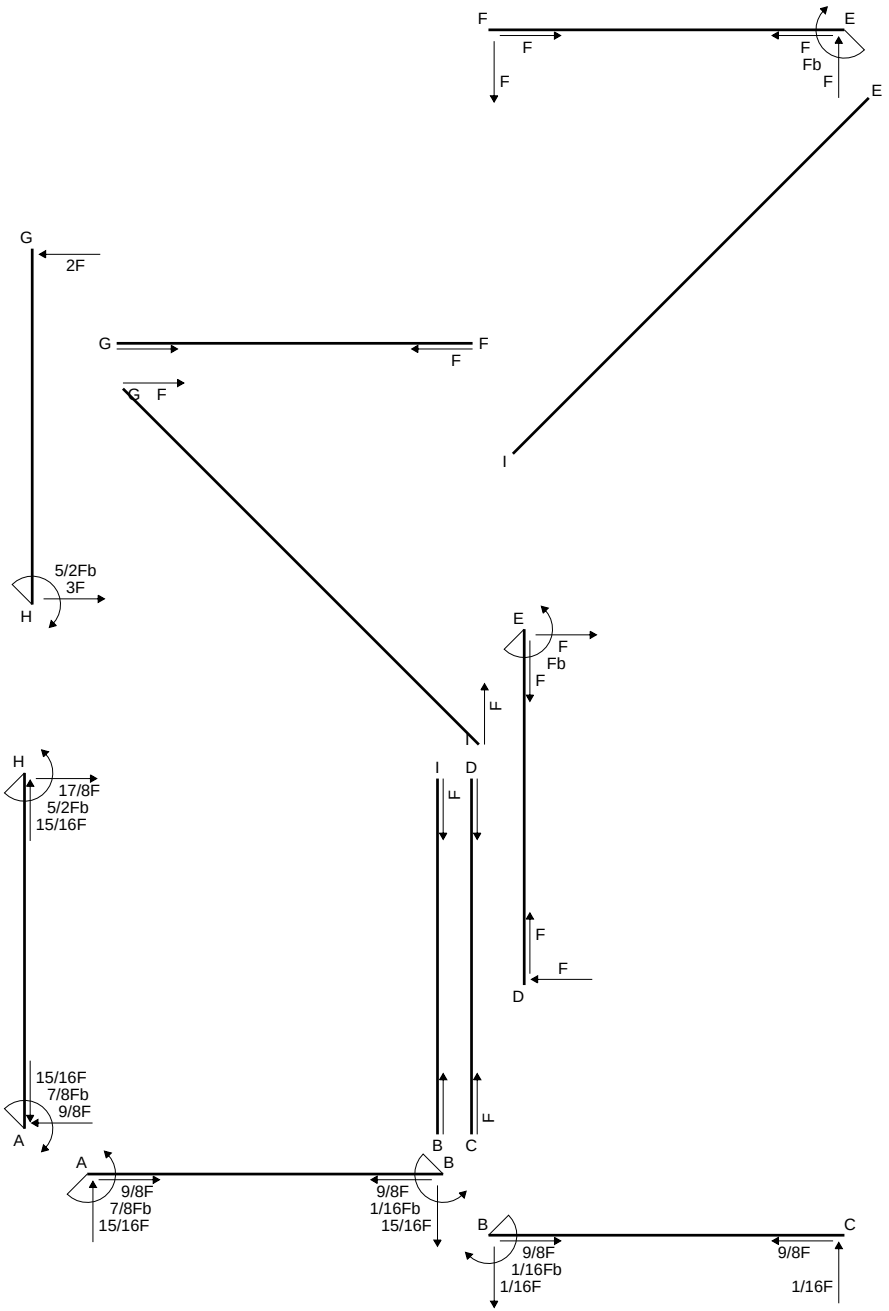
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

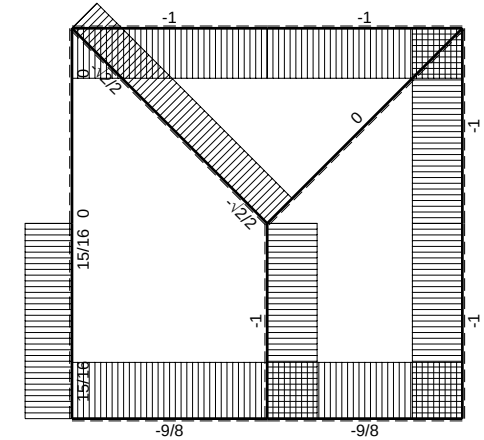
PROCEDIMENTO E RISULTATI 939153 CI04.xxxx.114

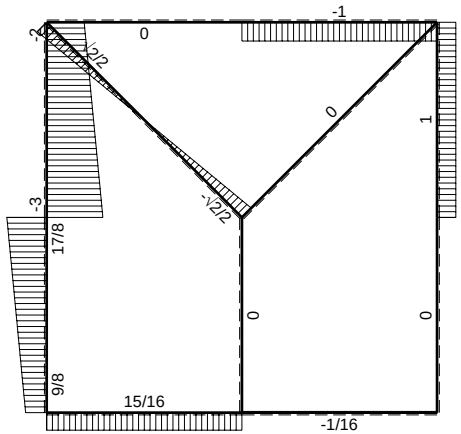


A = 714. mm^2
J_u = 230961. mm^4
J_v = 51390. mm^4
y_g = 34.04 mm
T_y = -2850. N
M_x = -1615000. Nmm
x_m = 12. mm
u_m = -9. mm
v_m = -34.04 mm
$\sigma_m = -Mv/J_u$ = -238. N/mm^2
x_c = 21. mm
y_c = 9. mm
v_c = -25.04 mm
$\sigma_c = -Mv/J_u$ = -175.1 N/mm^2
τ_c = 7.876 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 175.6 N/mm^2
S^* = 3830. mm^3

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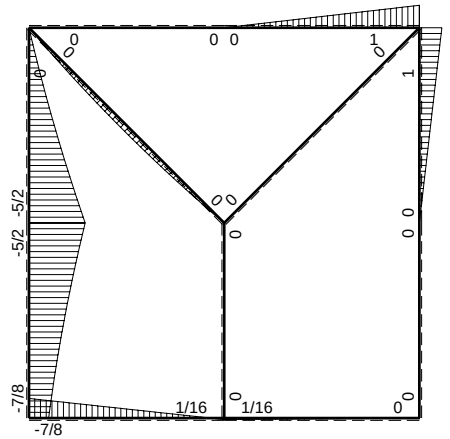

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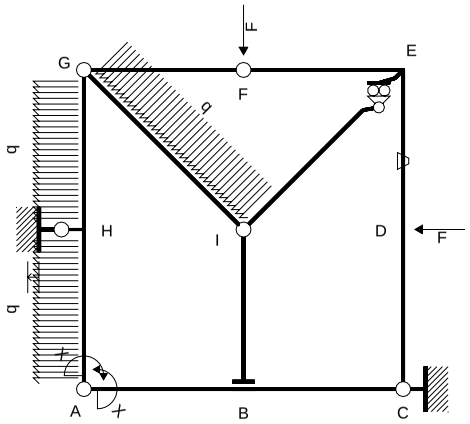

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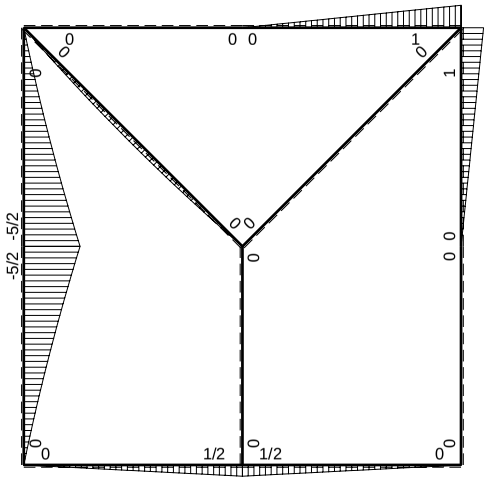
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↑□↓ F

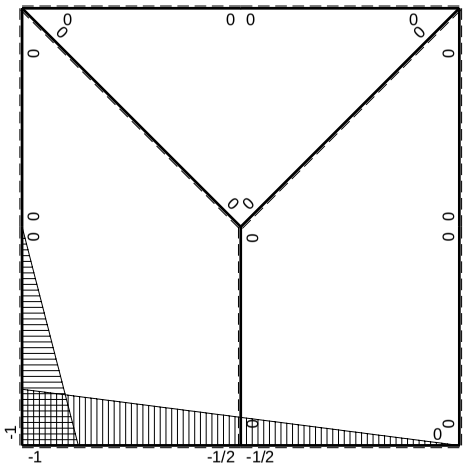

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1/16
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0
-7/8

↺□↻ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264484 CI04.xxxx.115

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PROCEDIMENTO E RISULTATI 264484 CI04.xxxx.115

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-1/2Fx$	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-Fb+Fx	Fb/EJ	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b (-1/2\ x/b + 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/12\ b)\ Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b (-1/4 + 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x + 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/12\ b)\ Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b (-1/4 + 1/2\ x/b - 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/4\ b - 1/12\ b)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/12\ b)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

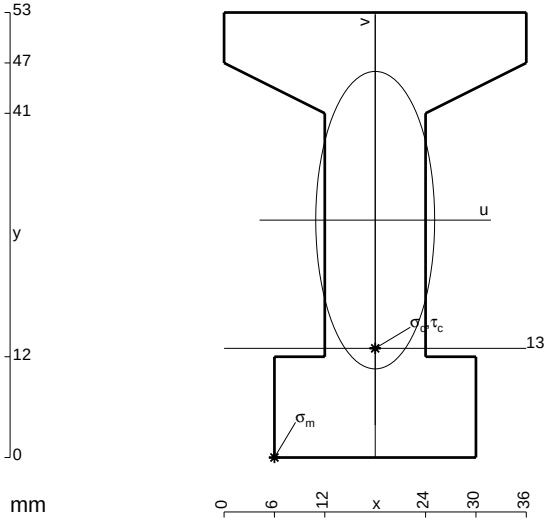
$L^{Xo}_{HA} = \int_o^b (5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (5/4\ b - b + 1/8\ b)\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b (2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (\ b - 1/2\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

PROCEDIMENTO E RISULTATI 264484 CI04.xxxx.115



$A = 996.\ mm^2$

$J_u = 312739.\ mm^4$

$J_v = 49968.\ mm^4$

$y_g = 28.27\ mm$

$T_y = -3630.\ N$

$M_x = -2208250.\ Nmm$

$x_m = 6.\ mm$

$u_m = -12.\ mm$

$v_m = -28.27\ mm$

$\sigma_m = -Mv/J_u = -199.6\ N/mm^2$

$x_c = 18.\ mm$

$y_c = 13.\ mm$

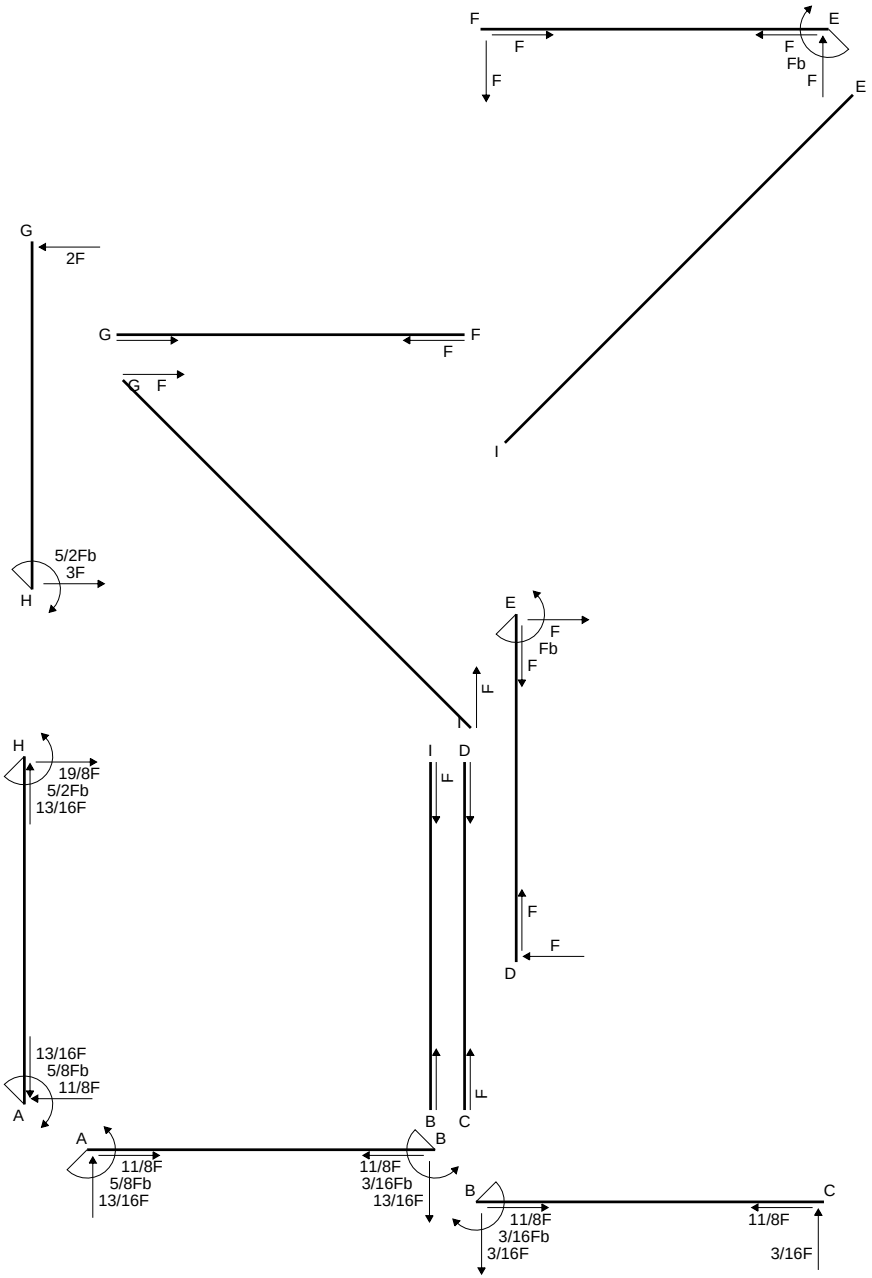
$v_c = -15.27\ mm$

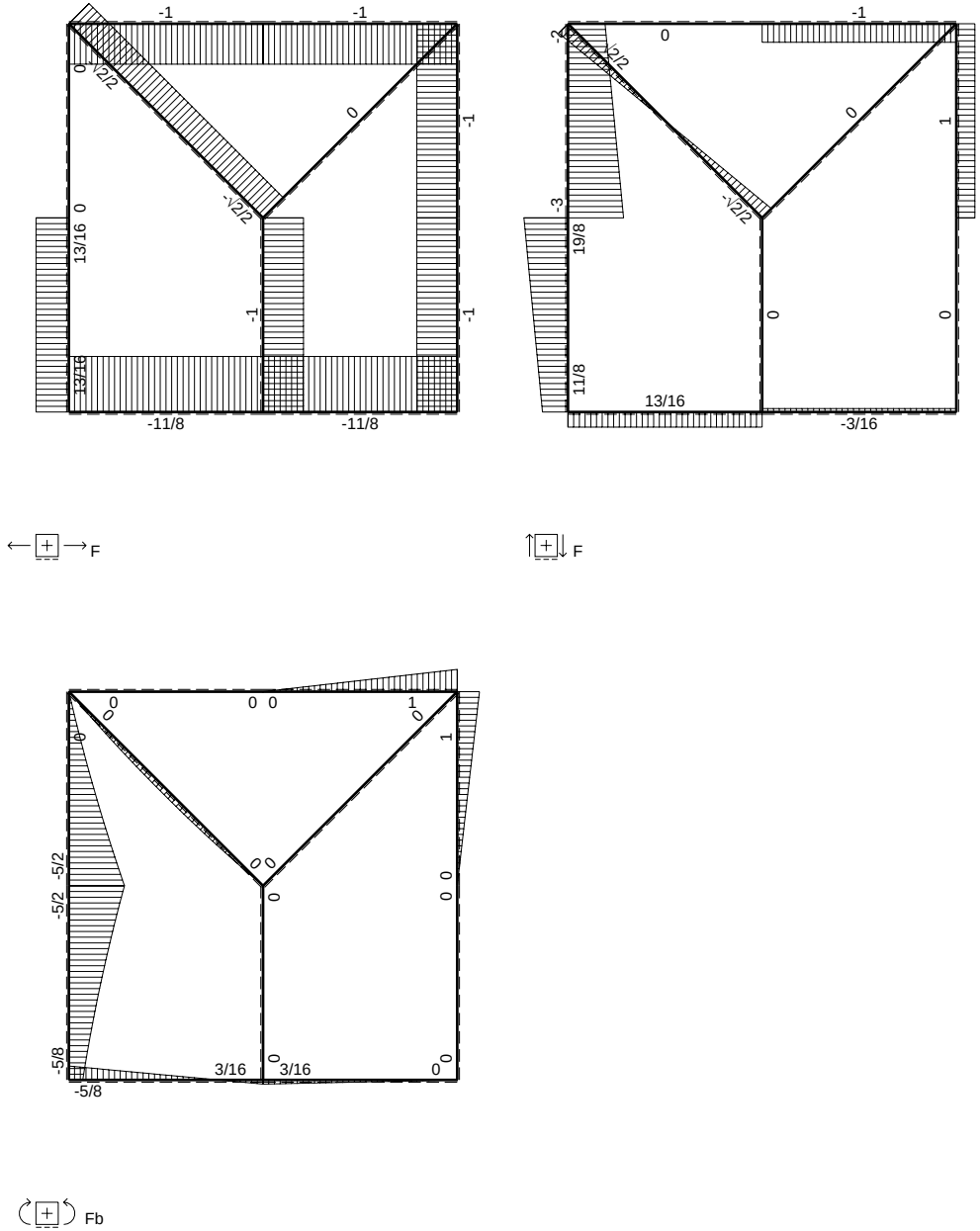
$\sigma_c = -Mv/J_u = -107.8\ N/mm^2$

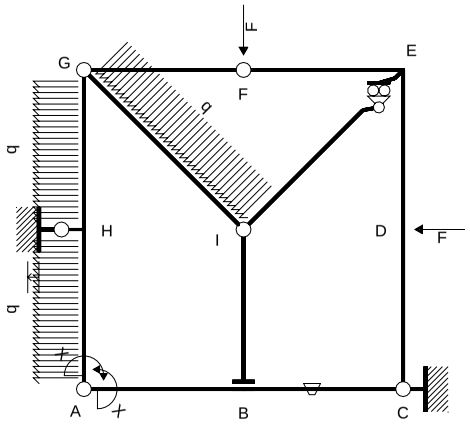
$\tau_c = 6.387\ N/mm^2$

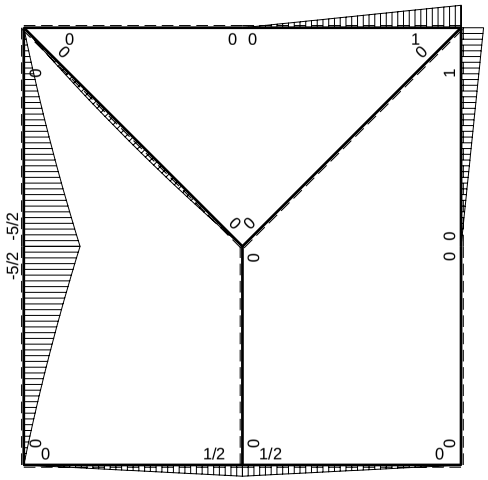
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2} = 108.4\ N/mm^2$

$S^* = 6603.\ mm^3$

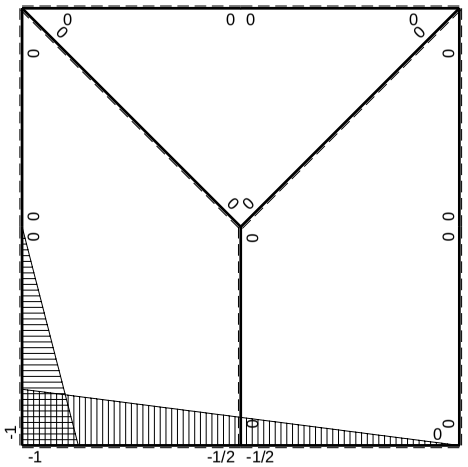

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5/2Fb
13/16F
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13/16F
5/8Fb
11/8F
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11/8F
5/8Fb
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11/8F
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13/16F
B
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3/16F
11/8F
3/16F


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F
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0
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1
-√2/2
19/8
0
0
11/8
13/16
-3/16
F
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1
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-5/2
-5/2
0
0 0
-5/8
3/16
3/16
0
0
-5/8
Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 990867 CI04.xxxx.116

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	-Fb/EJ	$-1/4Fb+1/2Fx-1/4Fx^2/b$	1/2Fb/EJ-1/2Fx/EJ	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	Fb/EJ	$-1/4Fx^2/b$	1/2Fx/EJ	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/8Fb	

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Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1/2 - 1/2\ x/b\ \right)\ \theta\ \ dx$

$= \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 1/6\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2\ x/b\ \right)\ \theta\ \ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/4\ x^2/b\ \right]_o^b\ \theta$

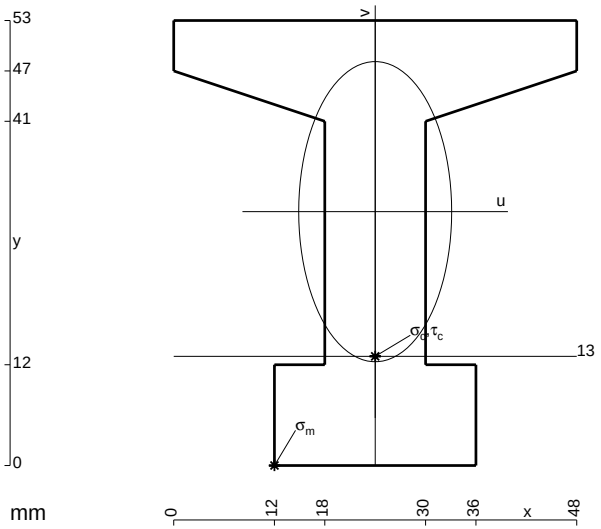
$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/4\ b\ \right)\ \theta\ \ = 1/6\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$



$A = 1104.\ mm^2$

$J_u = 352844.\ mm^4$

$J_v = 91656.\ mm^4$

$y_g = 30.23\ mm$

$T_y = -3750.\ N$

$M_x = -2437500.\ Nmm$

$x_m = 12.\ mm$

$u_m = -12.\ mm$

$v_m = -30.23\ mm$

$\sigma_m = -Mv/J_u = -208.9\ N/mm^2$

$x_c = 24.\ mm$

$y_c = 13.\ mm$

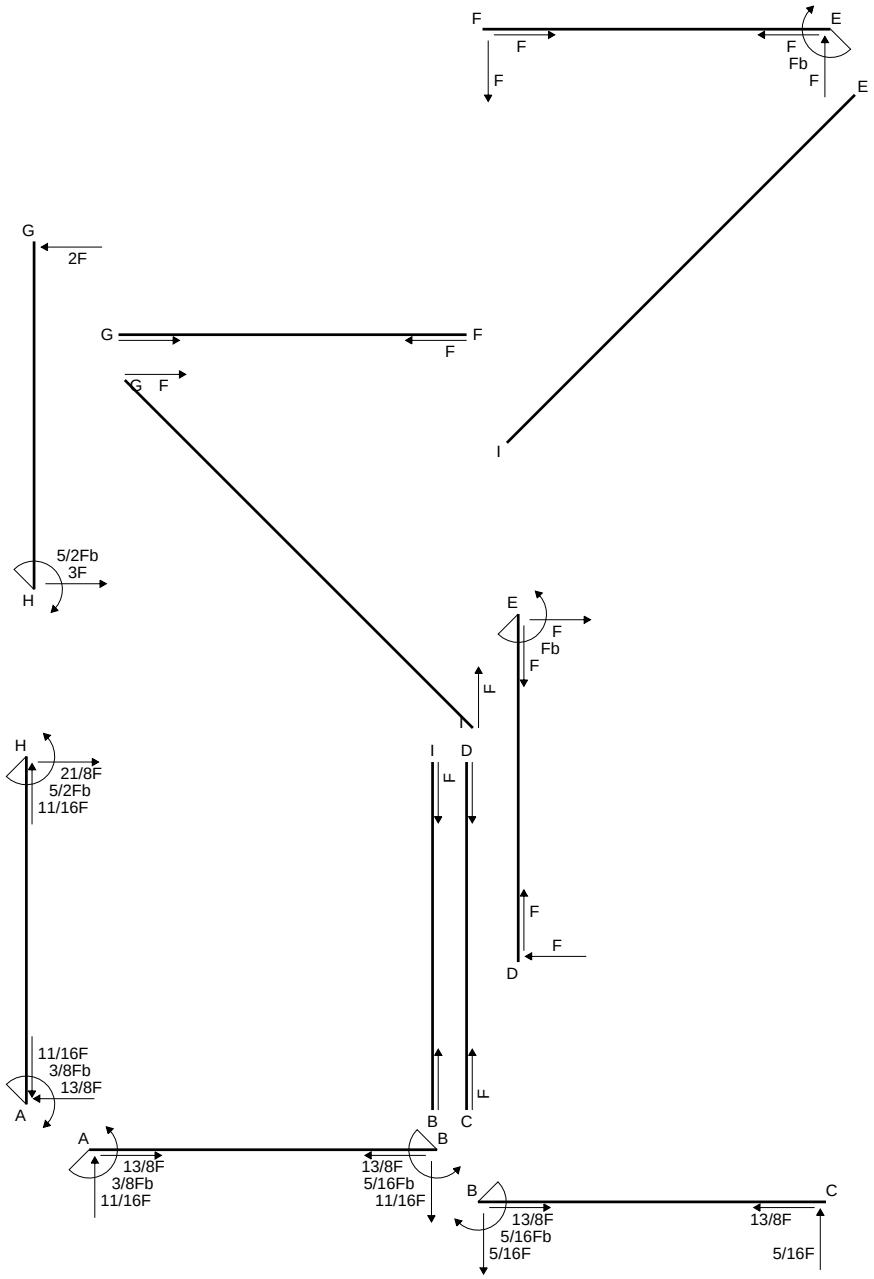
$v_c = -17.23\ mm$

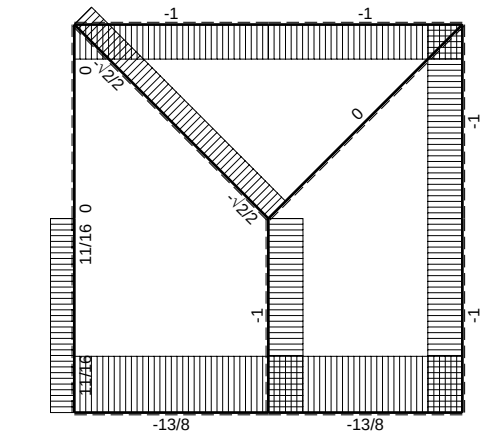
$\sigma_c = -Mv/J_u = -119.1\ N/mm^2$

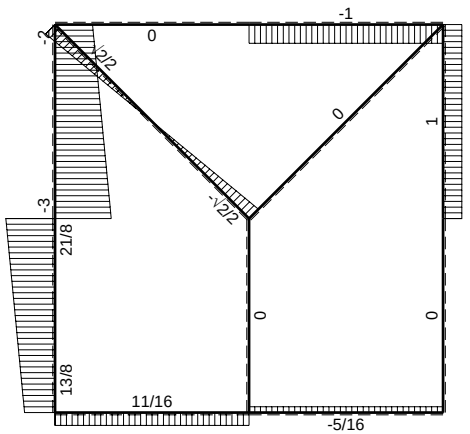
$\tau_c = 6.37\ N/mm^2$

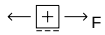
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2} = 119.6\ N/mm^2$

$S^* = 7192.\ mm^3$

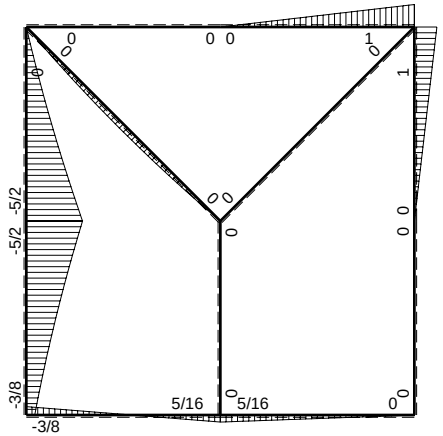

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-13/8

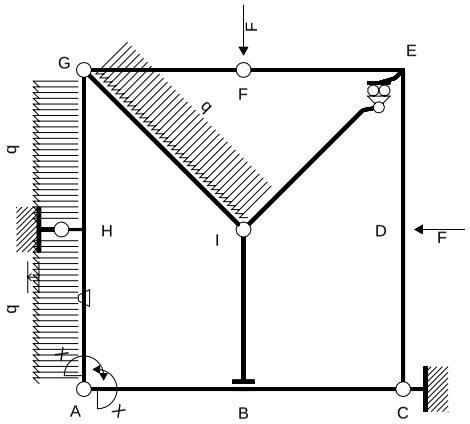

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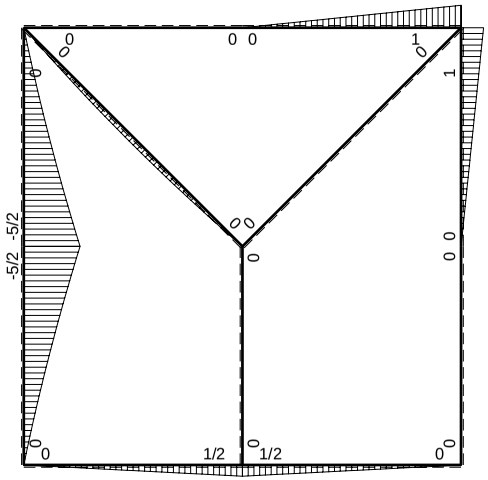

F


F

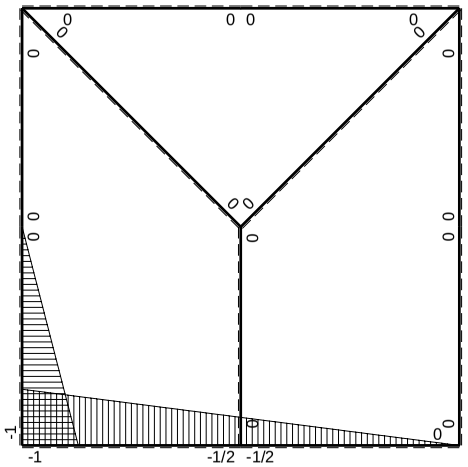

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0
-3/8


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 247897 CI04.xxxx.117

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	-Fb/EJ	$5/2Fx-3Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(3/8+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	Fb/EJ	$2Fx-3/2Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\ \theta\ \ dx$

$= \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b\ \theta$

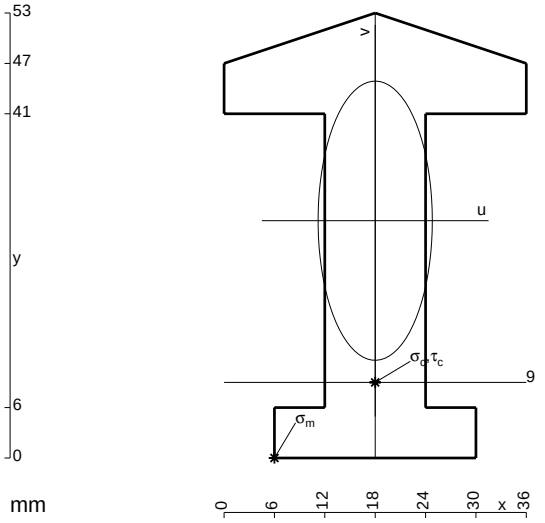
$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b\ \right)\ \theta\ \ = 7/8\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\ \theta\ \ dx$

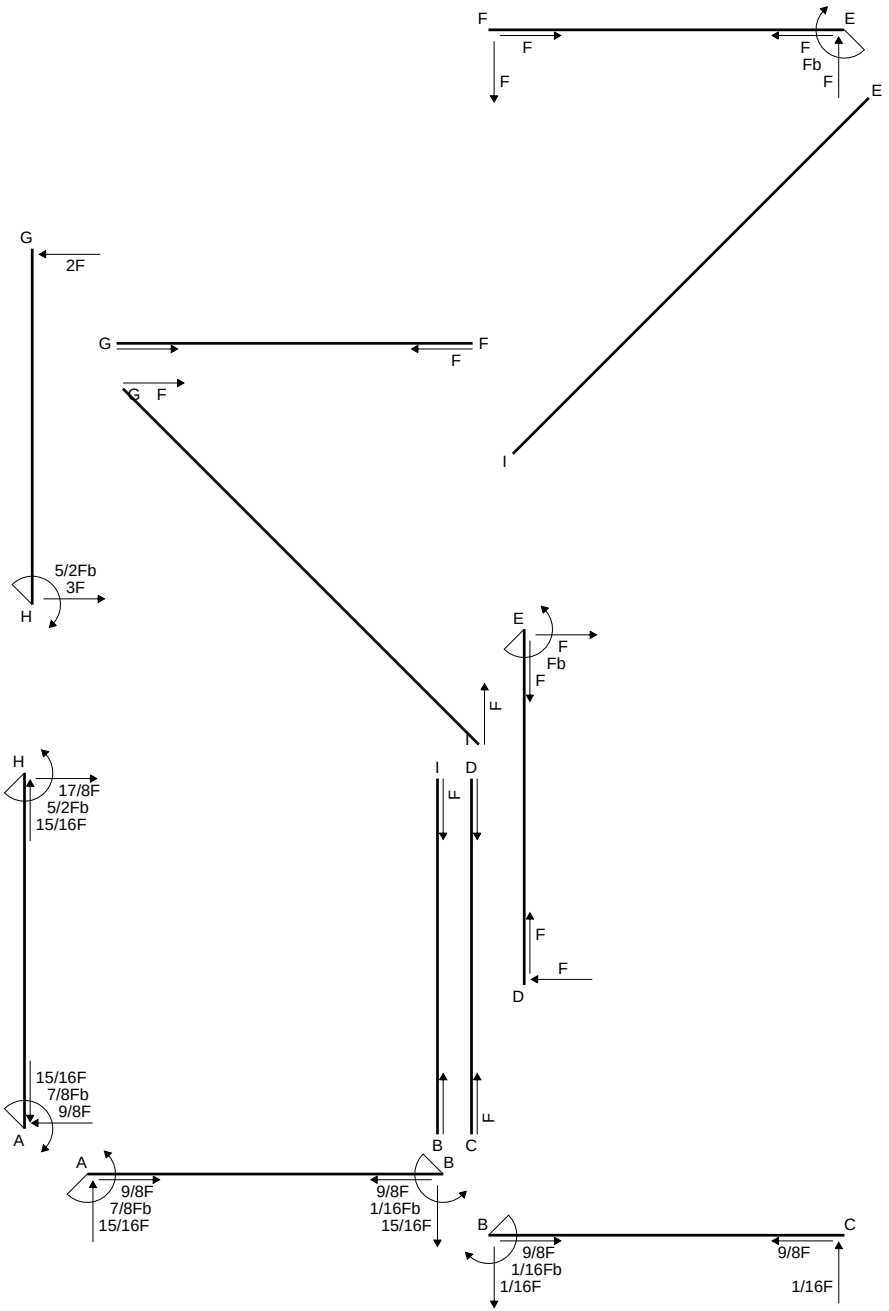
$= \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b\ \theta$

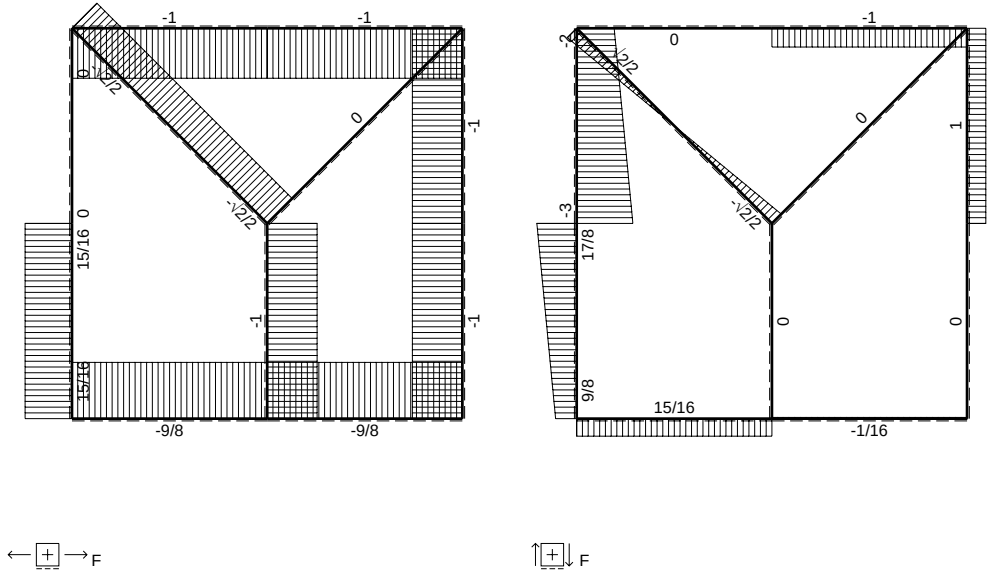
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\ \theta\ \ = 7/8\ \ Fb^2/EJ$

PROCEDIMENTO E RISULTATI 247897 CI04.xxxx.117

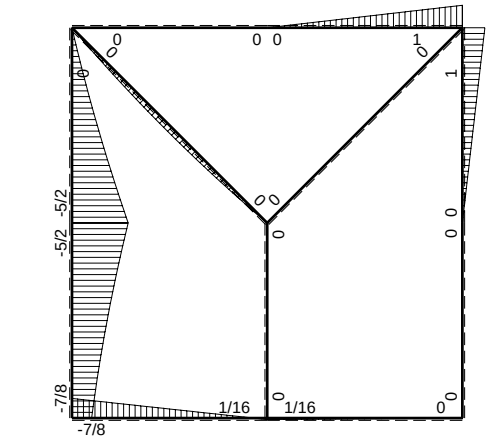


A = 888. mm^2
J_u = 245538. mm^4
J_v = 41112. mm^4
y_g = 28.26 mm
T_y = -2760. N
M_x = -1909000. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.26 mm
$\sigma_m = -Mv/J_u$ = -219.7 N/mm^2
x_c = 18. mm
y_c = 9. mm
v_c = -19.26 mm
$\sigma_c = -Mv/J_u$ = -149.8 N/mm^2
τ_c = 4.108 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 149.9 N/mm^2
S^* = 4385. mm^3

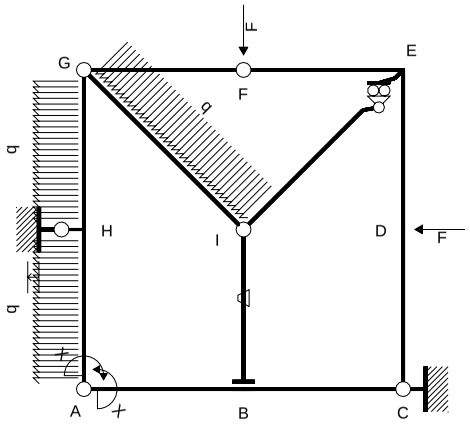

F
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F
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Fb
F
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2F
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G
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5/2Fb
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F
Fb
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H
17/8F
5/2Fb
15/16F
I
D
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F
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D
15/16F
7/8Fb
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C
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9/8F
1/16F

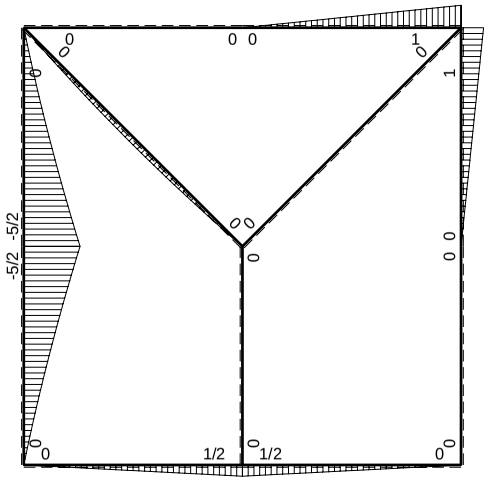

-1
-1
-√2/2
0
-1
-√2/2
0
-1
-1
15/16
-1
15/16
-9/8
-9/8
-1
2
0
-√2/2
0
1
-√2/2
-3
17/8
0
0
9/8
15/16
-1/16

F F

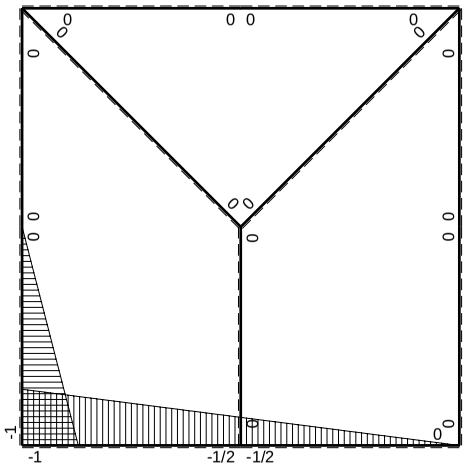

0
0 0
1
0
0
1
0
0
0
-5/2
-5/2
0
0 0
-7/8
1/16
1/16
0
0
-7/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 247861 CI04.xxxx.118

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PROCEDIMENTO E RISULTATI 247861 CI04.xxxx.118

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-1/2Fx$	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	-Fb/EJ	0	0	0	0+0	0
BI b	0	0	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b (-1/2\ x/b + 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/12\ b)\ Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b (-1/4 + 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x + 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/12\ b)\ Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b (-1/4 + 1/2\ x/b - 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/4\ b - 1/12\ b)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/12\ b)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

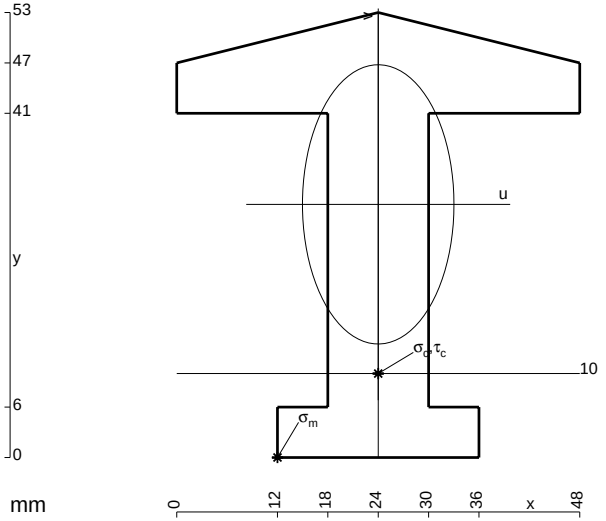
$L^{Xo}_{HA} = \int_o^b (5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (5/4\ b - b + 1/8\ b)\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

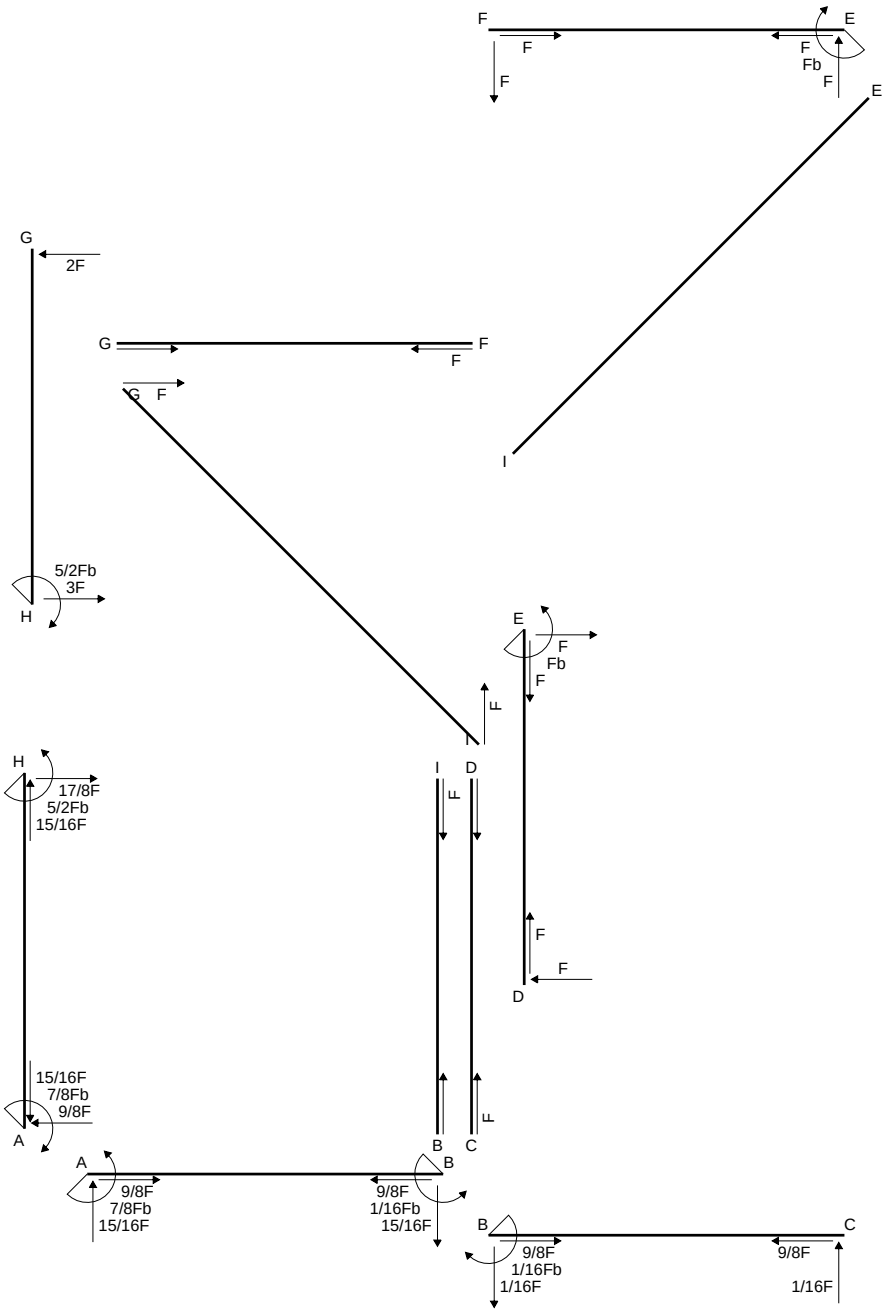
$L^{Xo}_{AH} = \int_o^b (2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

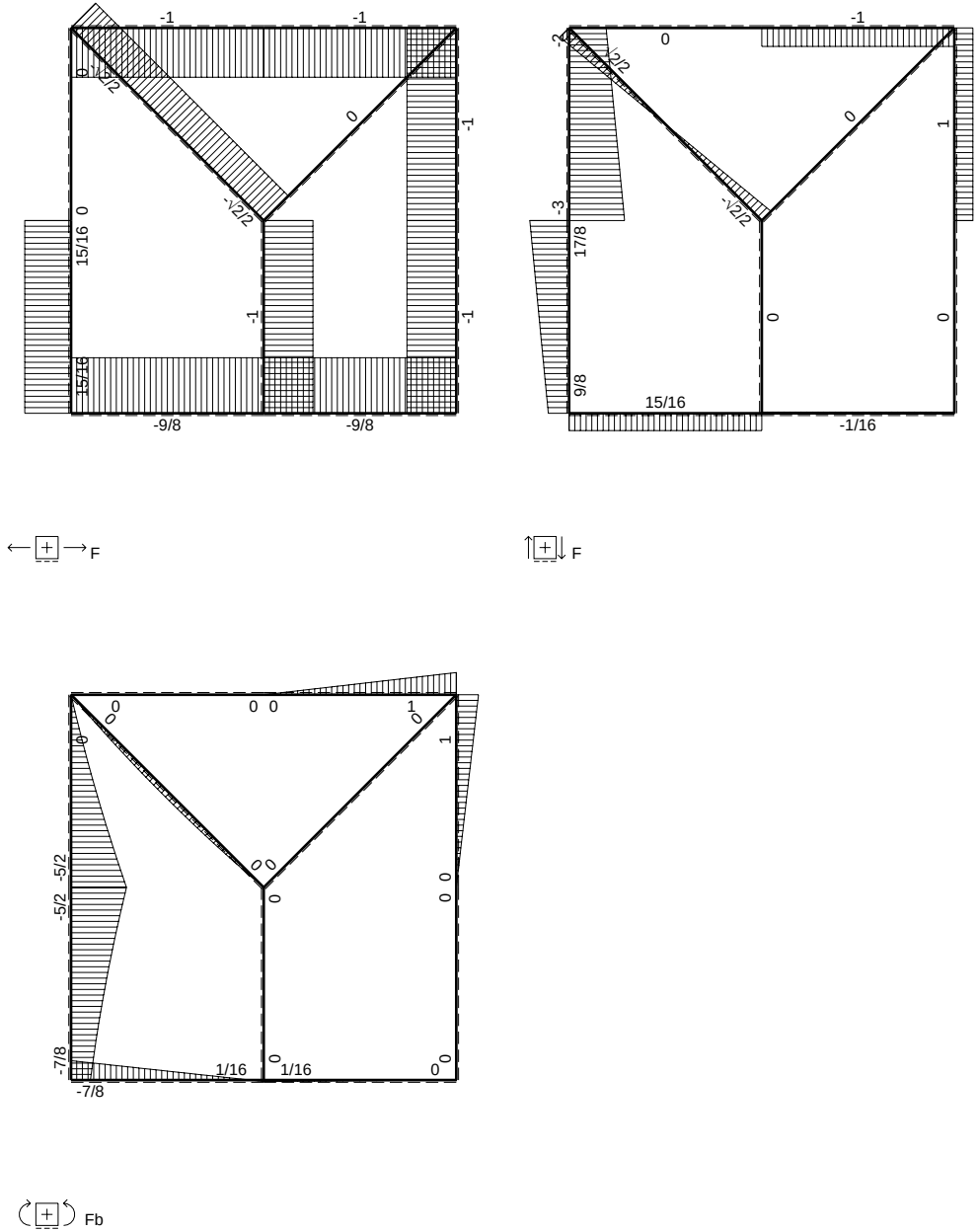
$= (\ b - 1/2\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

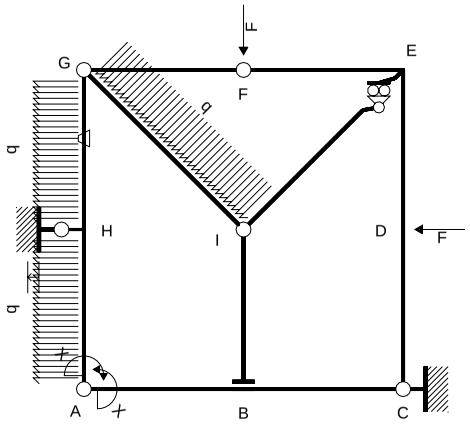
PROCEDIMENTO E RISULTATI 247861 CI04.xxxx.118

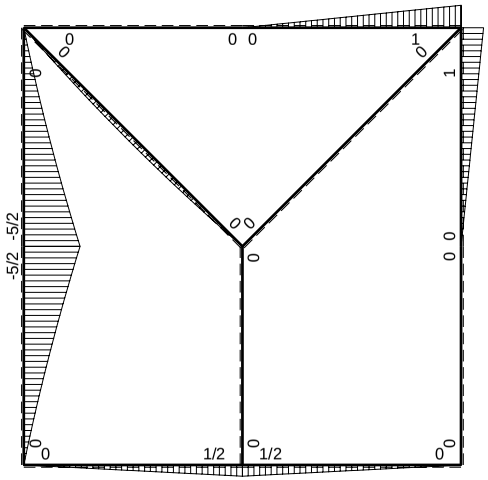


A = 996. mm^2
J_u = 275589. mm^4
J_v = 81072. mm^4
y_g = 30.15 mm
T_y = -2850. N
M_x = -2090000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.15 mm
$\sigma_m = -Mv/J_u$ = -228.7 N/mm^2
x_c = 24. mm
y_c = 10. mm
v_c = -20.15 mm
$\sigma_c = -Mv/J_u$ = -152.8 N/mm^2
τ_c = 4.286 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 153. N/mm^2
S^* = 4973. mm^3

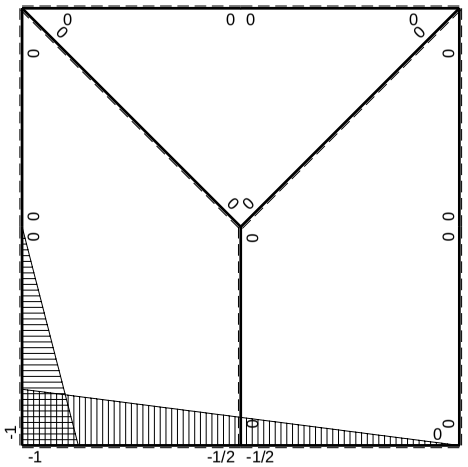

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3F
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Fb
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5/2Fb
15/16F
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9/8F
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15/16F
B
C
9/8F
1/16Fb
1/16F
9/8F
1/16F


-1
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1
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0
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-5/2
0
0 0
-7/8
1/16
1/16
0
0
-7/8
Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 215531 CI04.xxxx.119

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PROCEDIMENTO E RISULTATI 215531 CI04.xxxx.119

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

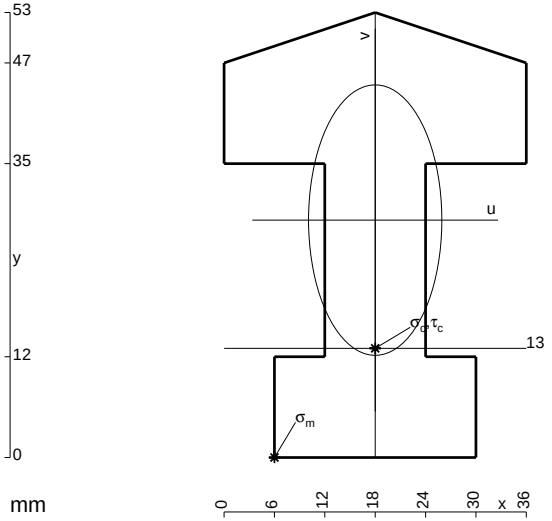
$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

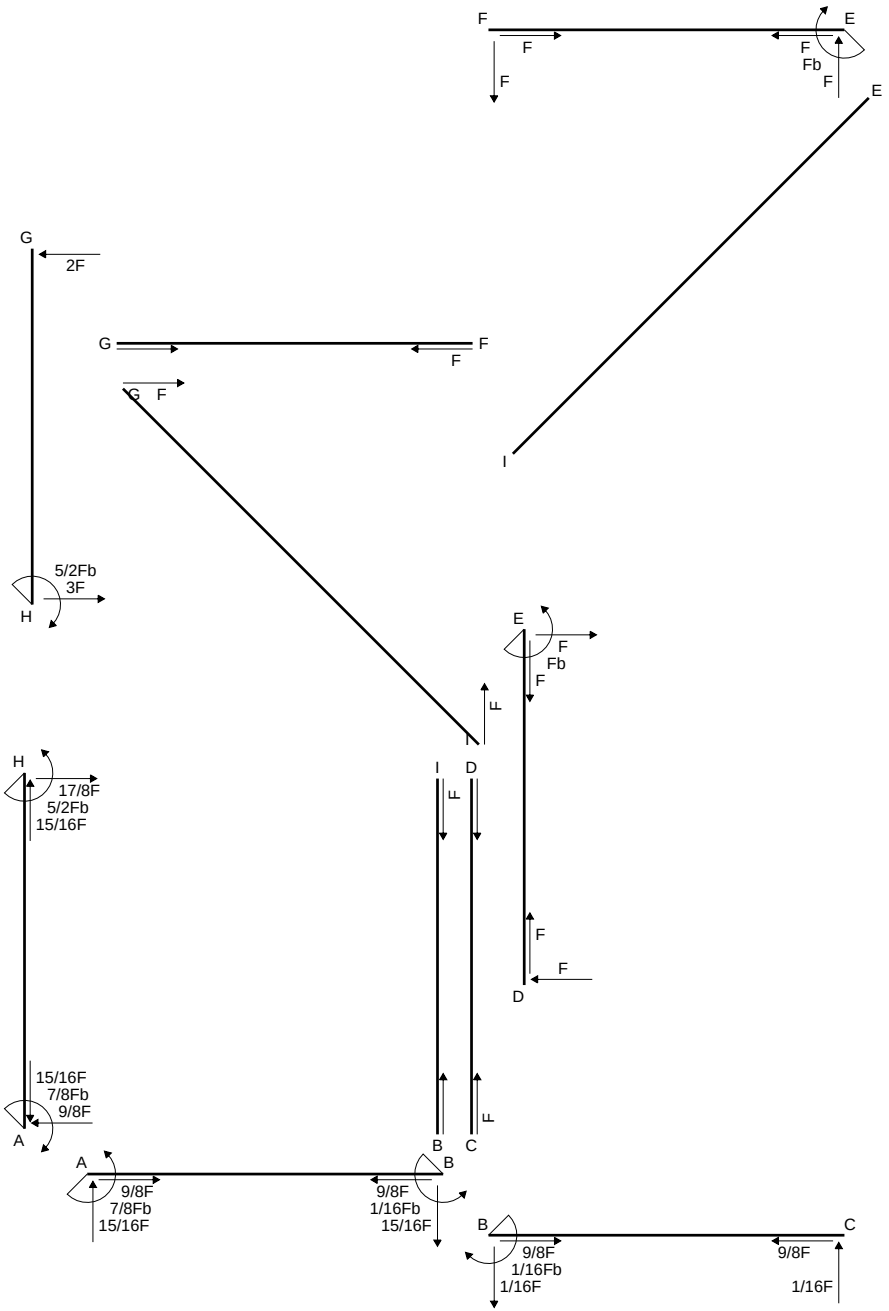
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

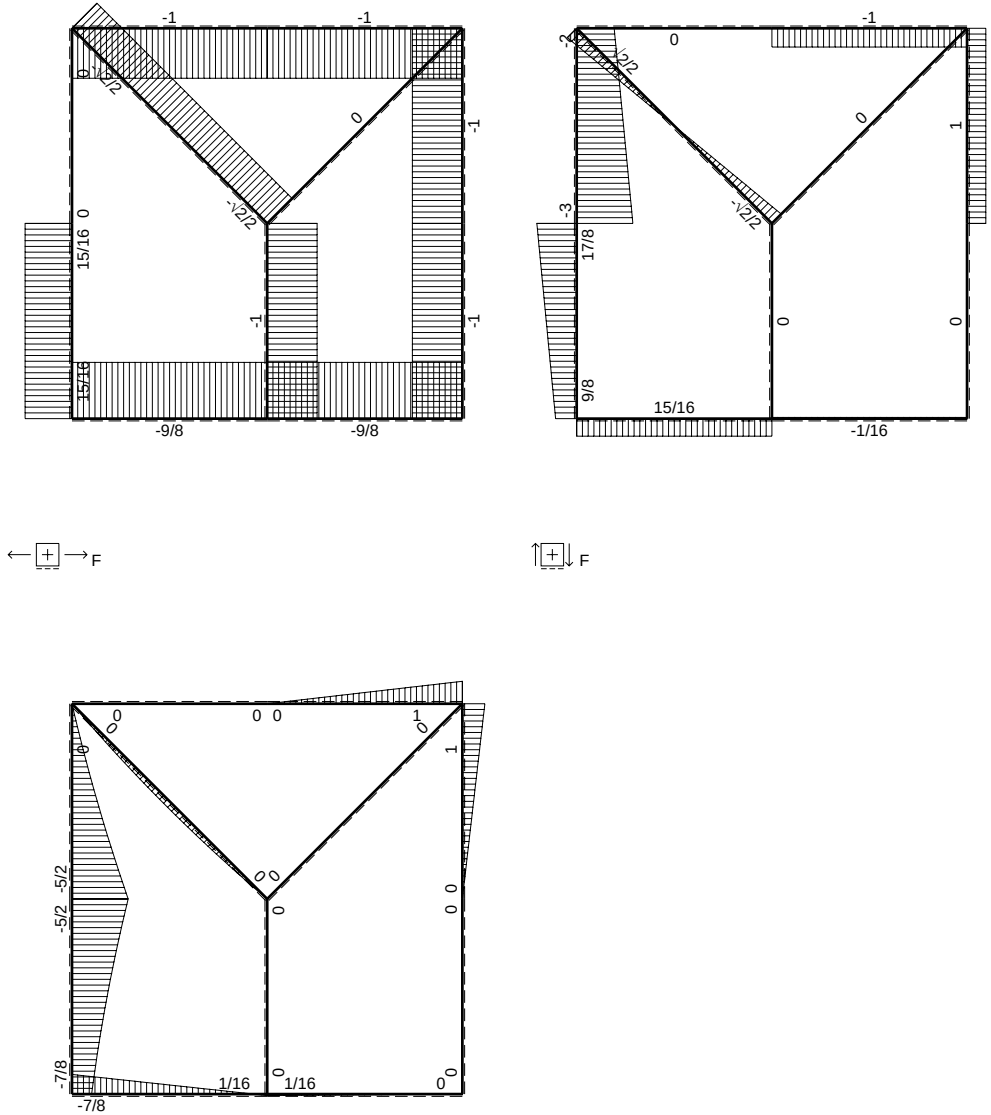
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

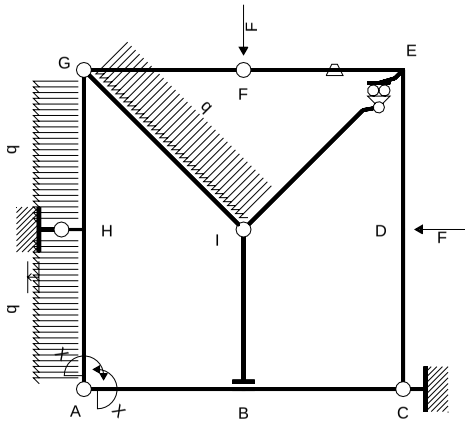
PROCEDIMENTO E RISULTATI 215531 CI04.xxxx.119

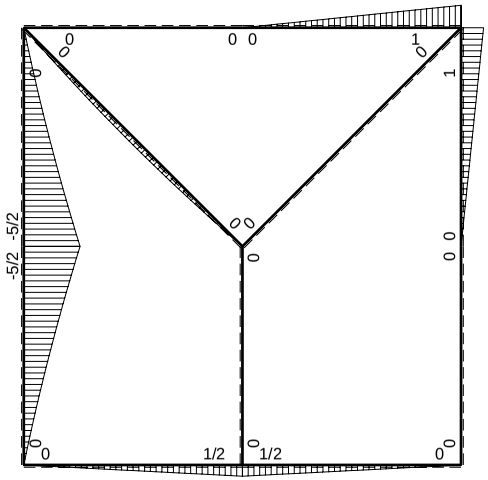


A = 1104. mm^2
J_u = 286555. mm^4
J_v = 69624. mm^4
y_g = 28.28 mm
T_y = -3120. N
M_x = -2418000. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.28 mm
$\sigma_m = -Mv/J_u$ = -238.6 N/mm^2
x_c = 18. mm
y_c = 13. mm
v_c = -15.28 mm
$\sigma_c = -Mv/J_u$ = -128.9 N/mm^2
τ_c = 5.993 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 129.3 N/mm^2
S^* = 6605. mm^3

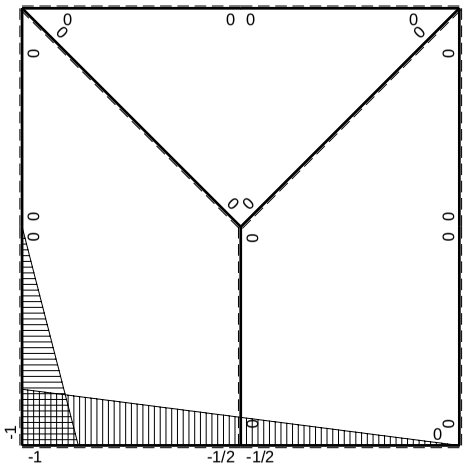

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E
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F
Fb
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E
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2F
G
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F
G
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I
5/2Fb
3F
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Fb
F
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H
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B
C
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1/16F
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1/16F


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-9/8
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1
0
0
1
0
0
-5/2
-5/2
0
0 0
0
-7/8
1/16
1/16
0
0
-7/8
Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264654 CI04.xxxx.120

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	0	0	0	0	0+0	0
DC b	0	0	0	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	-Fb/EJ	0	0	0	0+0	0
FE b	0	-Fx	Fb/EJ	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b (-1/2\ x/b + 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/12\ b)\ Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b (-1/4 + 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x + 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/12\ b)\ Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b (-1/4 + 1/2\ x/b - 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/4\ b - 1/12\ b)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/12\ b)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

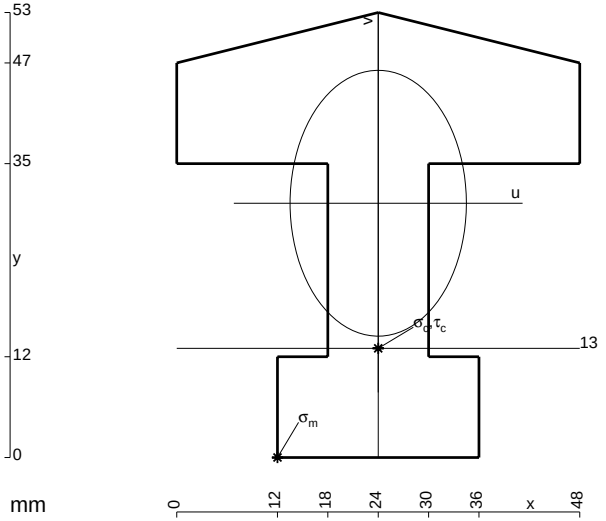
$L^{Xo}_{HA} = \int_o^b (5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (5/4\ b - b + 1/8\ b)\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

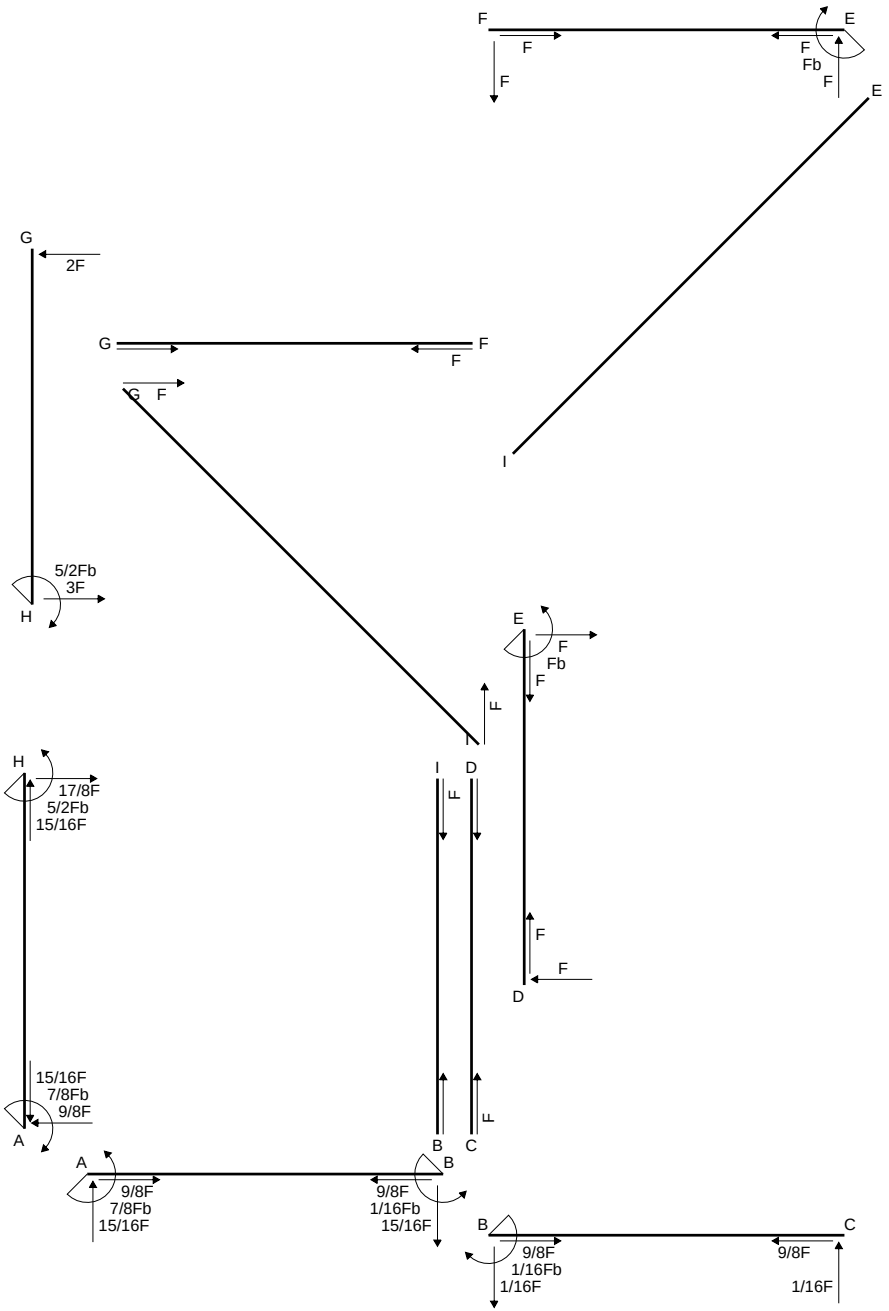
$L^{Xo}_{AH} = \int_o^b (2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

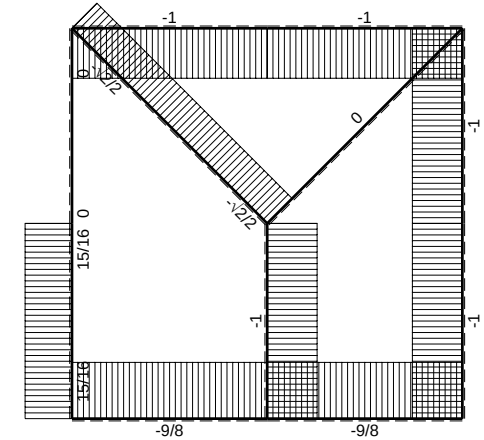
$= (\ b - 1/2\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = 3/8\ Fb^2/EJ$

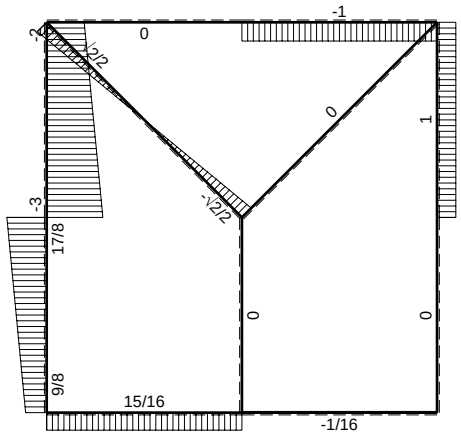
PROCEDIMENTO E RISULTATI 264654 CI04.xxxx.120

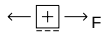


A = 1284. mm^2
J_u = 321948. mm^4
J_v = 141552. mm^4
y_g = 30.28 mm
T_y = -5190. N
M_x = -2119250. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.28 mm
$\sigma_m = -Mv/J_u$ = -199.4 N/mm^2
x_c = 24. mm
y_c = 13. mm
v_c = -17.28 mm
$\sigma_c = -Mv/J_u$ = -113.8 N/mm^2
τ_c = 9.682 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 115. N/mm^2
S^* = 7208. mm^3

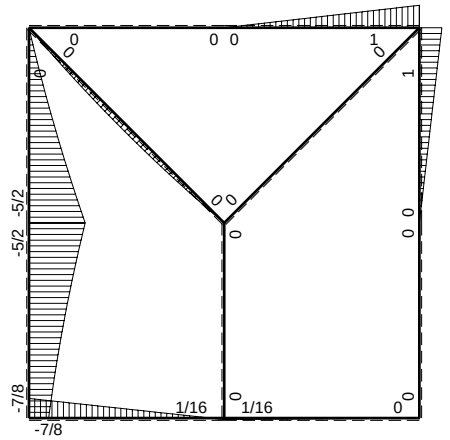

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Fb
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C
9/8F
1/16Fb
1/16F
9/8F
1/16F


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15/16
-1
-9/8
-9/8

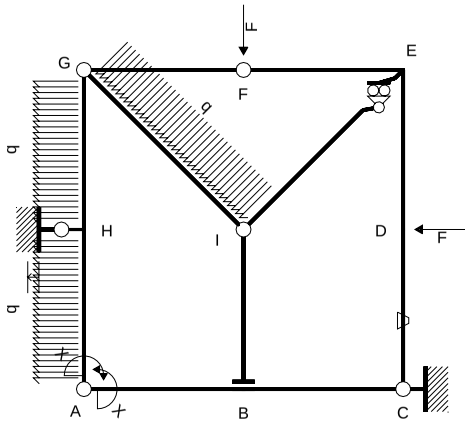

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0
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-1/16

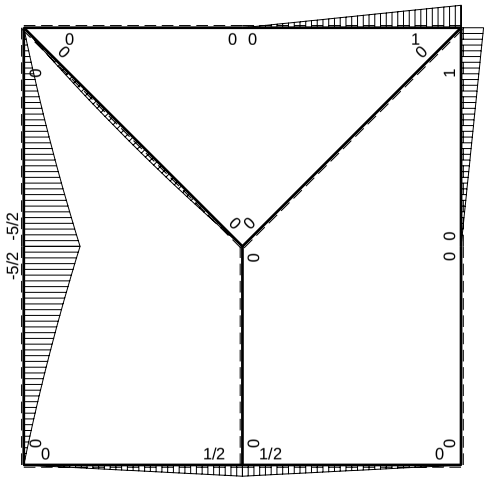

F


F

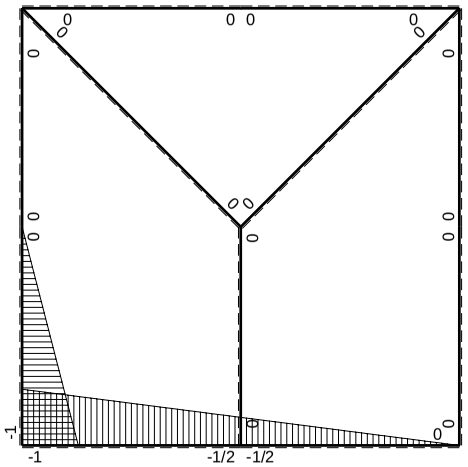

0
0 0
1
0
0
1
0
0
0
0
-5/2
-5/2
0
0 0
-7/8
1/16
0
1/16
0
0
-7/8


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 237158 CI04.xxxx.121

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PROCEDIMENTO E RISULTATI 237158 CI04.xxxx.121

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	$-1/2Fx$	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	0	-Fb/EJ	0	0	0	0+0	0
DC b	0	0	Fb/EJ	0	0	0		
DE b	0	Fx	0	0	0	0	0+0	0
ED b	0	-Fb+Fx	0	0	0	0		
EF b	0	Fb-Fx	0	0	0	0	0+0	0
FE b	0	-Fx	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-2Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$5/2Fb-3Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-5/2Fb+3Fx-1/2qx^2$	0	$5/2Fx-3Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(3/8+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$2Fx+1/2qx^2$	0	$2Fx-3/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

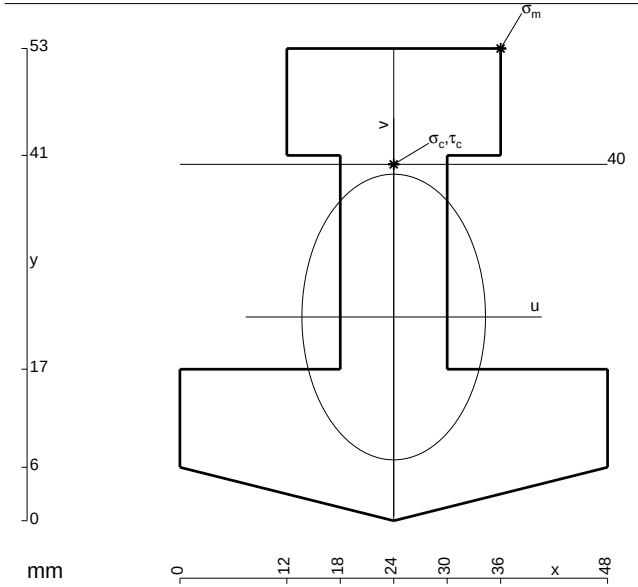
$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/2\ x/b - 3\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/4\ x^2/b - x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

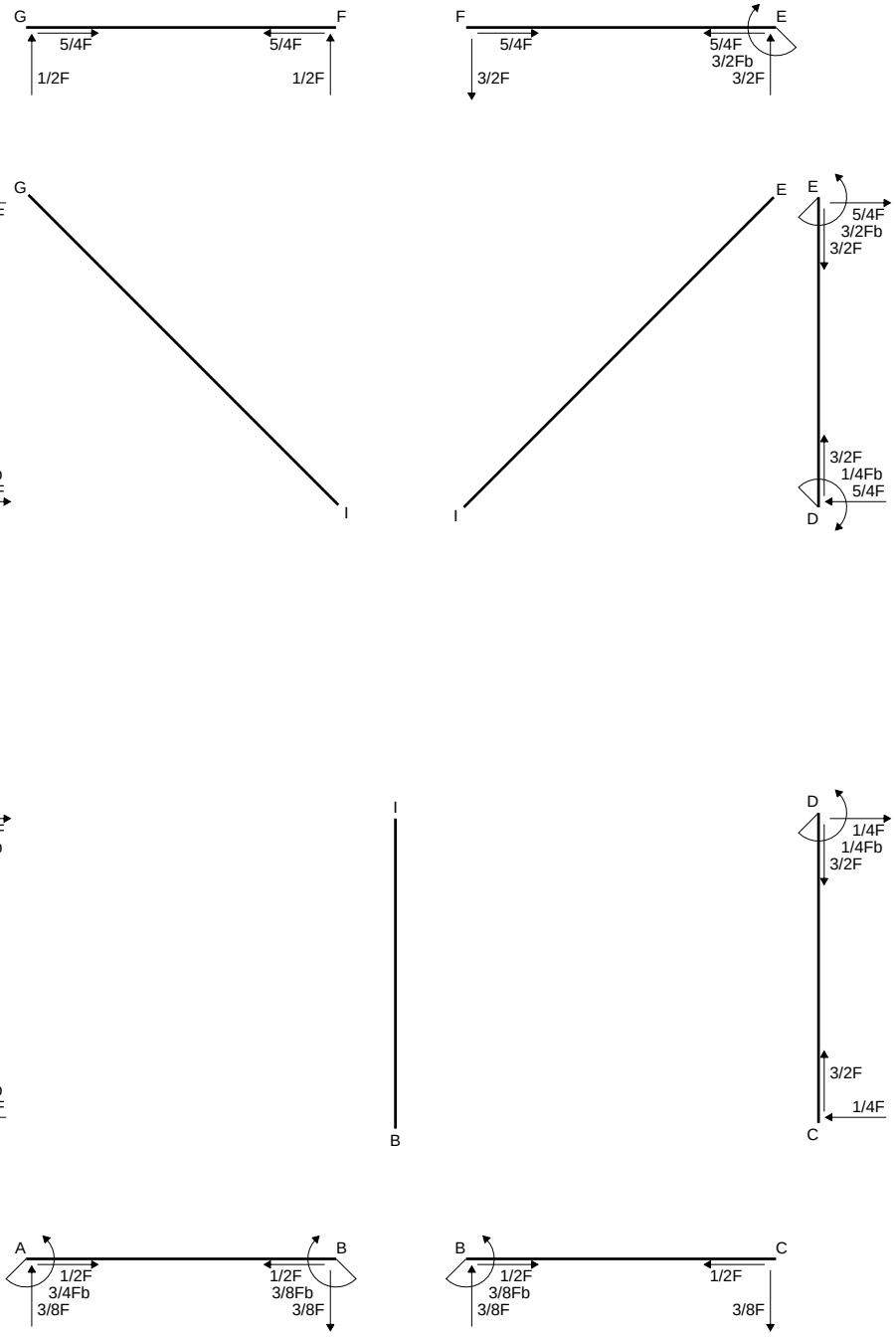
$= \left(5/4\ b - b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$

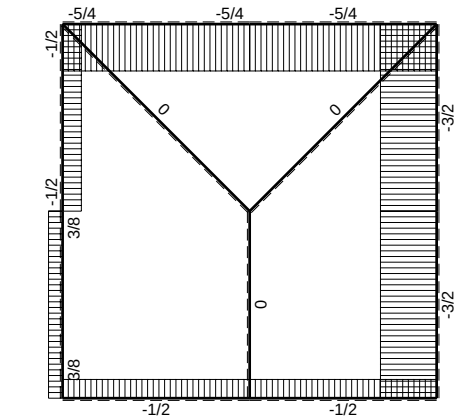
$L^{Xo}_{AH} = \int_o^b \left(2\ x/b - 3/2\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[\ x^2/b - 1/2\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

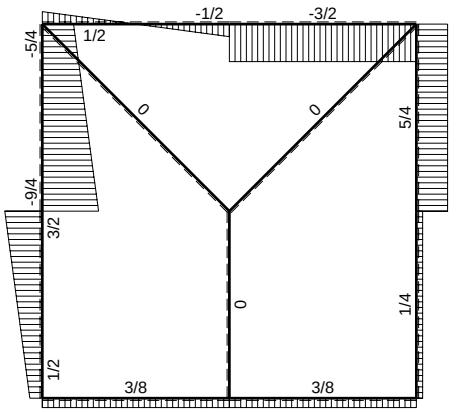
$= \left(\ b - 1/2\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 3/8\ \ Fb^2/EJ$



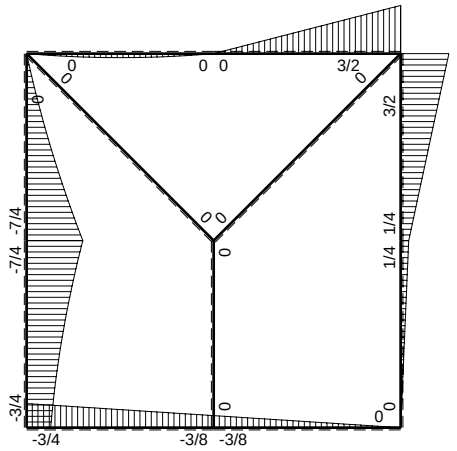
A = 1248. mm^2
J_u = 320937. mm^4
J_v = 132480. mm^4
y_g = 22.87 mm
T_y = -5040. N
M_x = -2226000. Nmm
x_m = 36. mm
y_m = 53. mm
u_m = 12. mm
v_m = 30.13 mm
$\sigma_m = -Mv/J_u$ = 209. N/mm^2
x_c = 24. mm
y_c = 40. mm
v_c = 17.13 mm
$\sigma_c = -Mv/J_u$ = 118.8 N/mm^2
τ_c = 9.373 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 119.9 N/mm^2
S^* = 7162. mm^3


G
F
5/4F
5/4F
1/2F
1/2F
F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
G
G
5/4F
1/2F
1/2F
7/4Fb
9/4F
H
I
E
E
5/4F
3/2Fb
3/2F
I
3/2F
1/4Fb
5/4F
D
H
3/2F
7/4Fb
3/8F
I
D
1/4F
1/4Fb
3/2F
3/8F
3/4Fb
1/2F
A
B
3/2F
1/4F
C
A
B
1/2F
3/4Fb
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3/8F
1/2F
3/8F

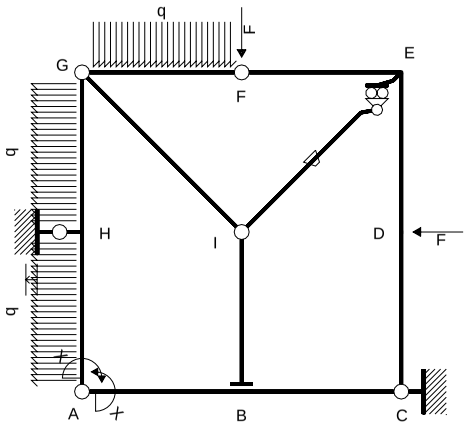

-5/4
-5/4
-5/4
-1/2
-1/2
-3/2
-1/2
3/8
3/8
-3/2
-1/2
-1/2
-1/2

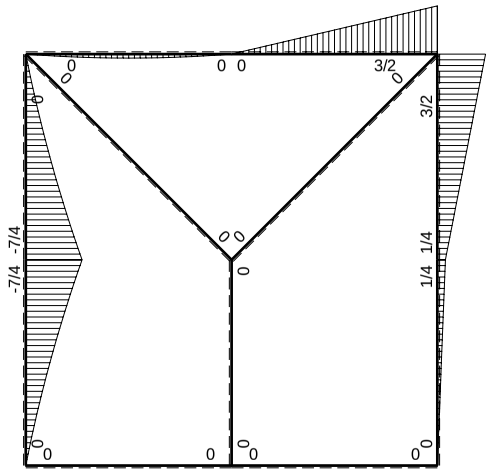

-1/2
-3/2
-5/4
1/2
5/4
-9/4
3/2
1/4
1/2
3/8
3/8

F F

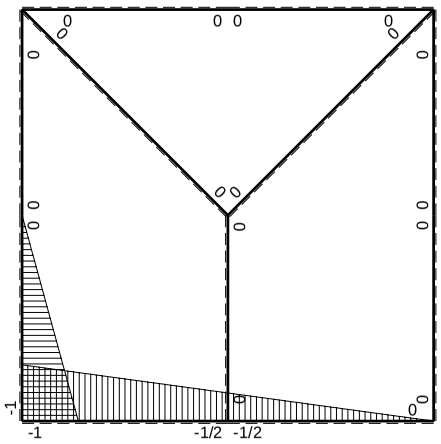

0
0 0
3/2
-7/4
-7/4
1/4
1/4
-3/4
-3/8
-3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264611 CI04.xxxx.122

@ Adolfo Zavelani Rossi, Politecnico di Milano, vers.27.03.13 16.04.26

PROCEDIMENTO E RISULTATI 264611 CI04.xxxx.122

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

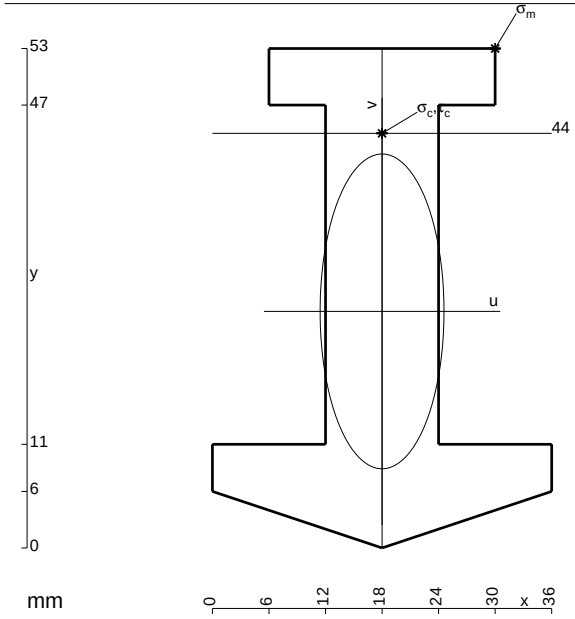
$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

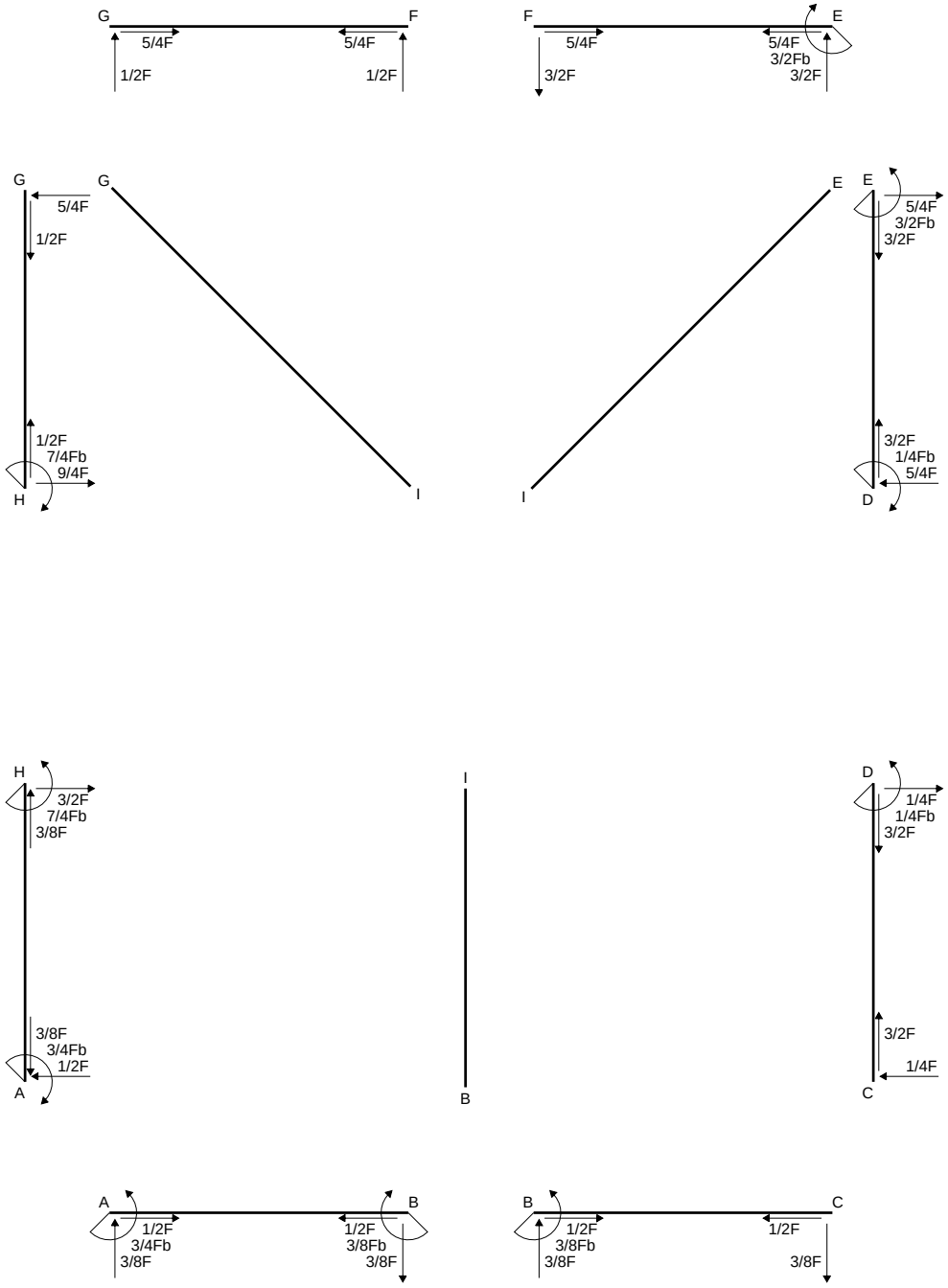
$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

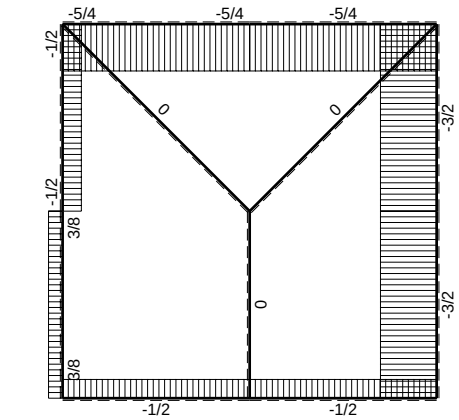
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

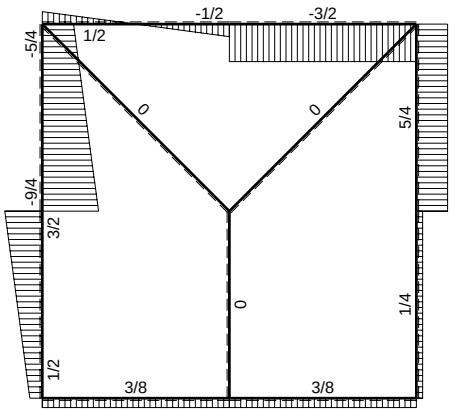
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

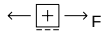


A = 864. mm^2
J_u = 241215. mm^4
J_v = 37368. mm^4
y_g = 25.1 mm
N = -940. N
T_y = -4230. N
M_x = -1908200. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 12. mm
v_m = 27.9 mm
$\sigma_m = N/A - Mv/J_u$ = 219.6 N/mm^2
x_c = 18. mm
y_c = 44. mm
v_c = 18.9 mm
$\sigma_c = N/A - Mv/J_u$ = 148.4 N/mm^2
τ_c = 6.312 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 148.8 N/mm^2
S^* = 4319. mm^3

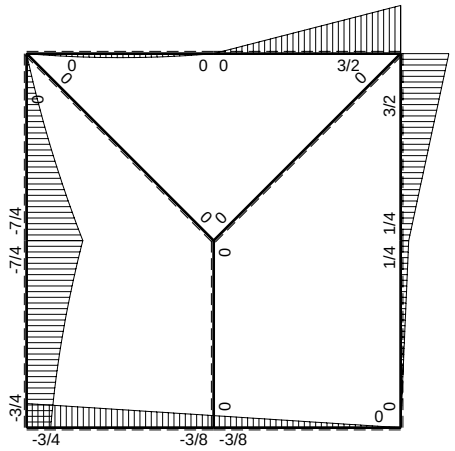

G
F
5/4F
5/4F
1/2F
1/2F
F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
G
G
5/4F
1/2F
1/2F
7/4Fb
9/4F
H
I
E
E
5/4F
3/2Fb
3/2F
I
3/2F
1/4Fb
5/4F
D
H
3/2F
7/4Fb
3/8F
I
D
1/4F
1/4Fb
3/2F
3/8F
3/4Fb
1/2F
A
B
3/2F
1/4F
C
A
B
1/2F
3/4Fb
3/8F
1/2F
3/8Fb
3/8F
B
C
1/2F
3/8Fb
3/8F
1/2F
3/8F


-5/4
-5/4
-5/4
-1/2
-1/2
-3/2
-1/2
3/8
3/8
-3/2
-1/2
-1/2
-1/2

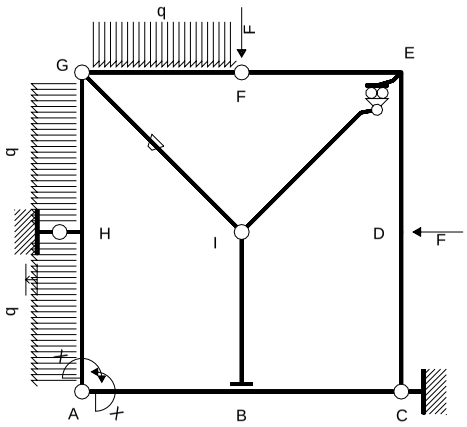

-1/2
-3/2
-5/4
1/2
5/4
-9/4
3/2
1/4
1/2
3/8
3/8

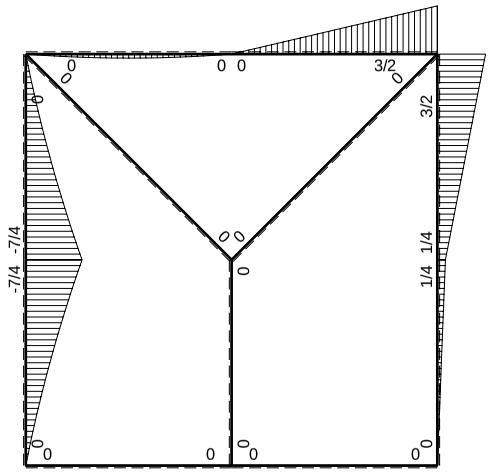

F


F

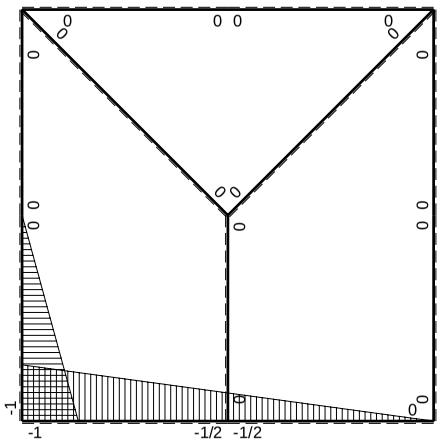

-7/4
-7/4
1/4
1/4
-3/4
-3/8
-3/8
-3/4


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 265166 CI04.xxxx.123

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

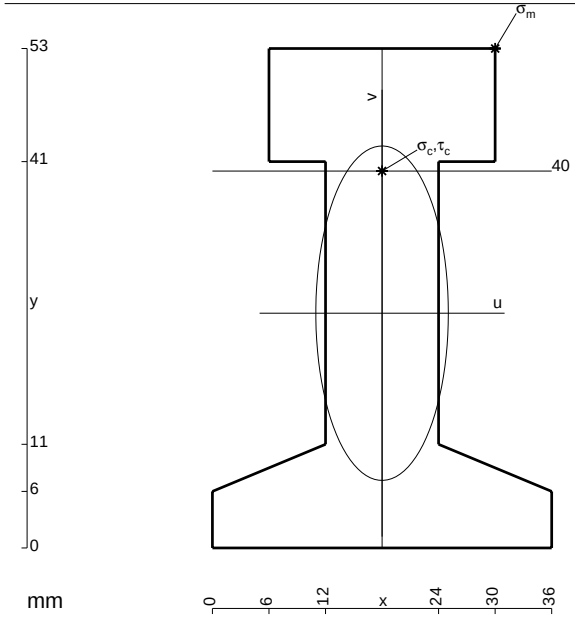
$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{HA} = \int_o^b (7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

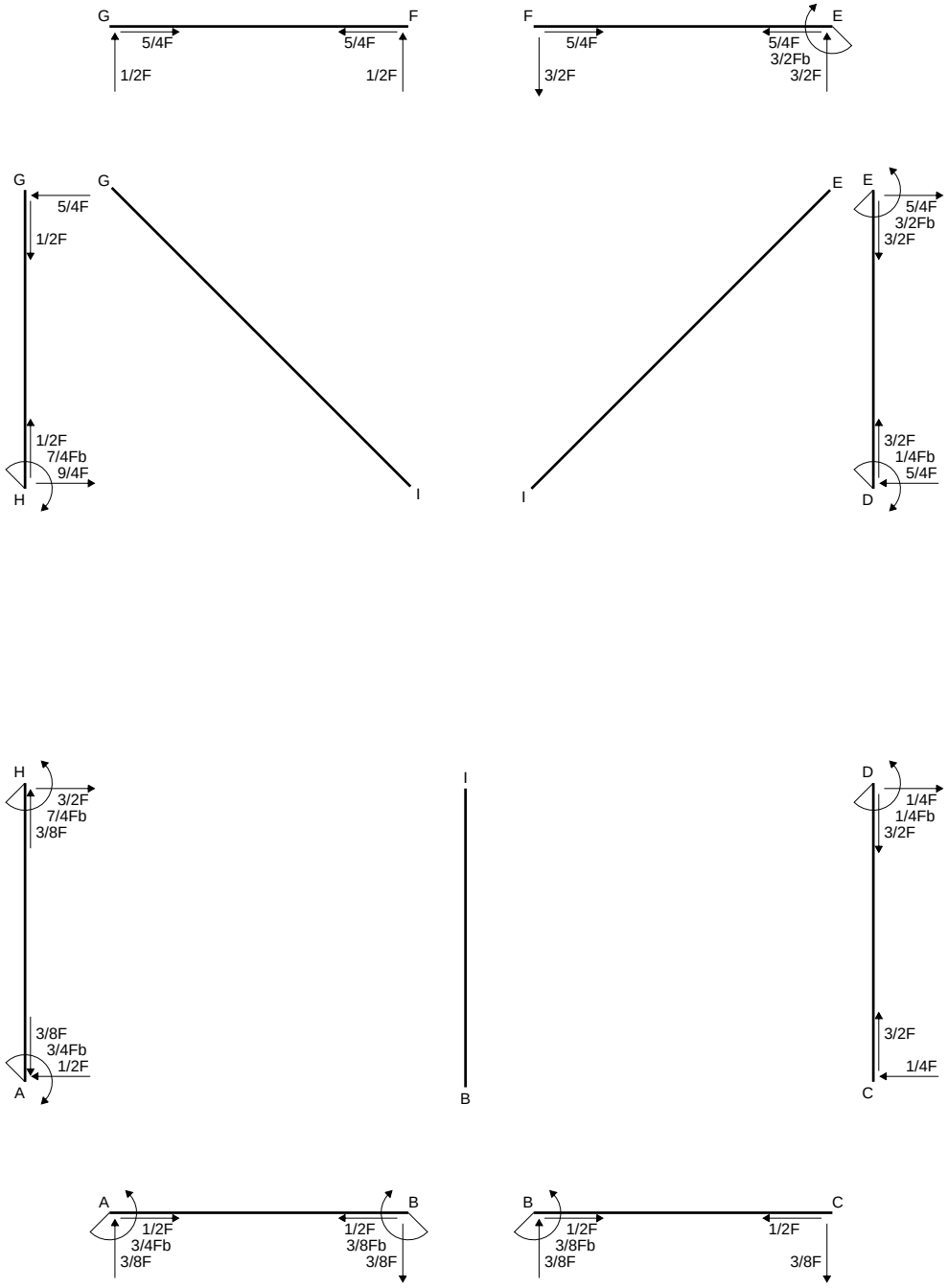
$= (7/8\ b - 3/4\ b + 1/8\ b)\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

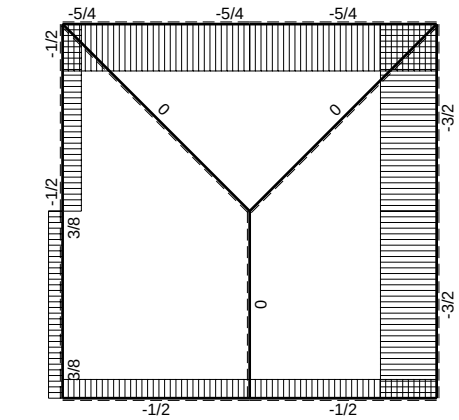
$L^{Xo}_{AH} = \int_o^b (5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

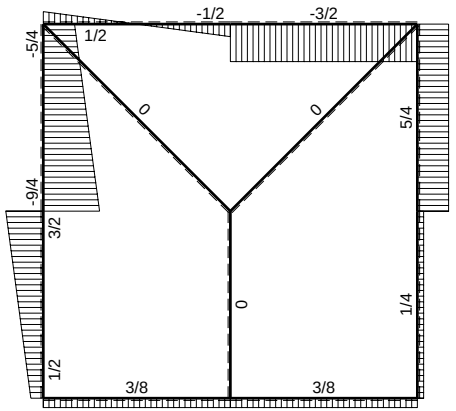
$= (5/8\ b - 1/4\ b - 1/8\ b)\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$



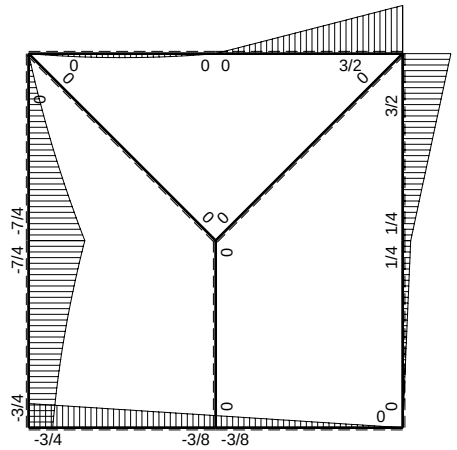
A = 984. mm^2
J_u = 309963. mm^4
J_v = 48672. mm^4
y_g = 24.91 mm
N = -1155. N
T_y = -5198. N
M_x = -2546780. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 12. mm
v_m = 28.09 mm
$\sigma_m = N/A - Mv/J_u$ = 229.6 N/mm^2
x_c = 18. mm
y_c = 40. mm
v_c = 15.09 mm
$\sigma_c = N/A - Mv/J_u$ = 122.8 N/mm^2
τ_c = 9.15 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 123.8 N/mm^2
S^* = 6548. mm^3


G
F
5/4F
5/4F
1/2F
1/2F
F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
G
G
5/4F
1/2F
1/2F
7/4Fb
9/4F
H
I
E
E
5/4F
3/2Fb
3/2F
I
3/2F
1/4Fb
5/4F
D
H
3/2F
7/4Fb
3/8F
I
D
1/4F
1/4Fb
3/2F
3/8F
3/4Fb
1/2F
A
B
3/2F
1/4F
C
A
B
1/2F
3/4Fb
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B
C
1/2F
3/8Fb
3/8F
1/2F
3/8F

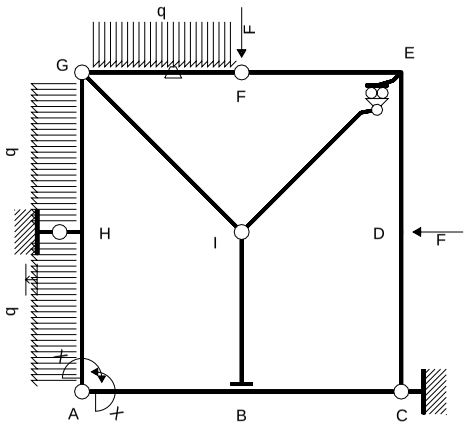

-5/4
-5/4
-5/4
-1/2
-1/2
-3/2
-1/2
3/8
-3/2
3/8
-1/2
-1/2

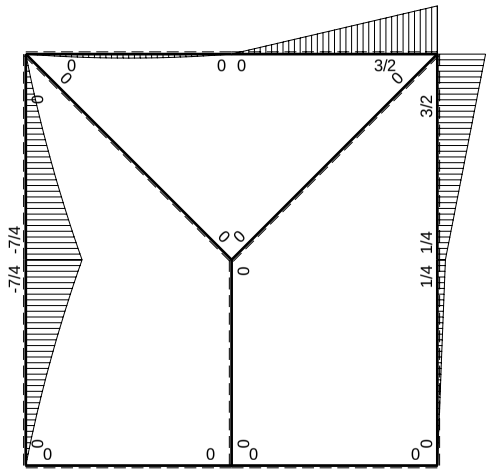

-1/2
-3/2
-5/4
1/2
5/4
-9/4
3/2
1/4
1/2
3/8
3/8

F F

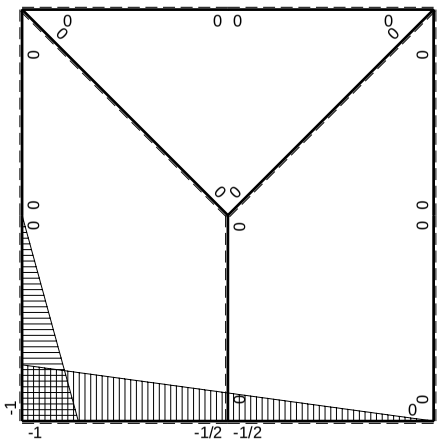

0
0 0
3/2
3/2
-7/4
-7/4
1/4
1/4
-3/4
-3/4
-3/8
-3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264142 CI04.xxxx.124

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PROCEDIMENTO E RISULTATI 264142 CI04.xxxx.124

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	Fb/EJ	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

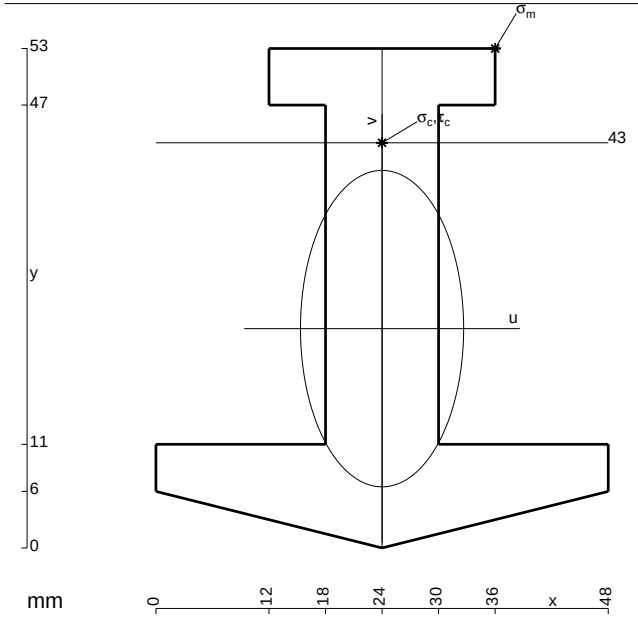
$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

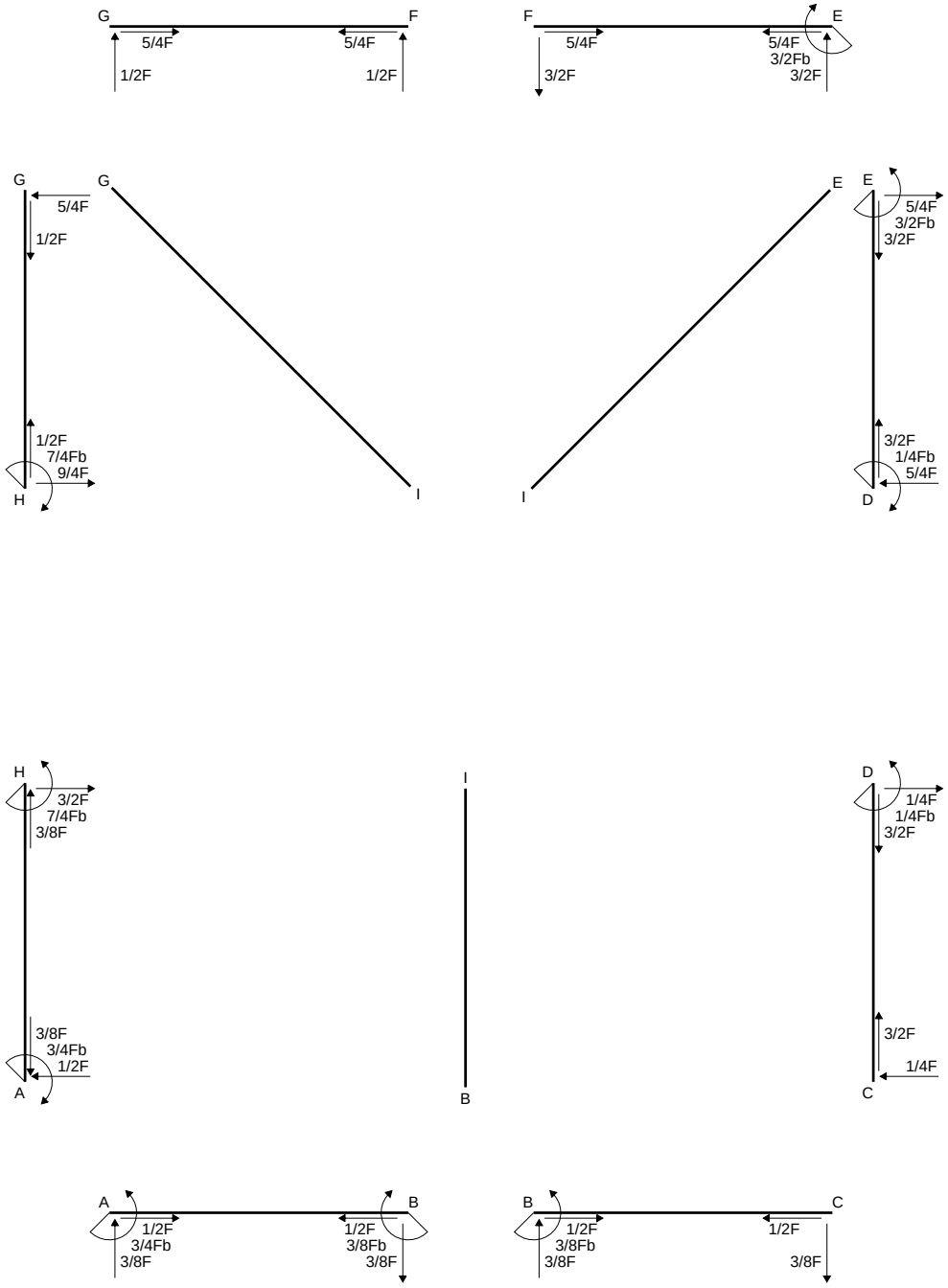
$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

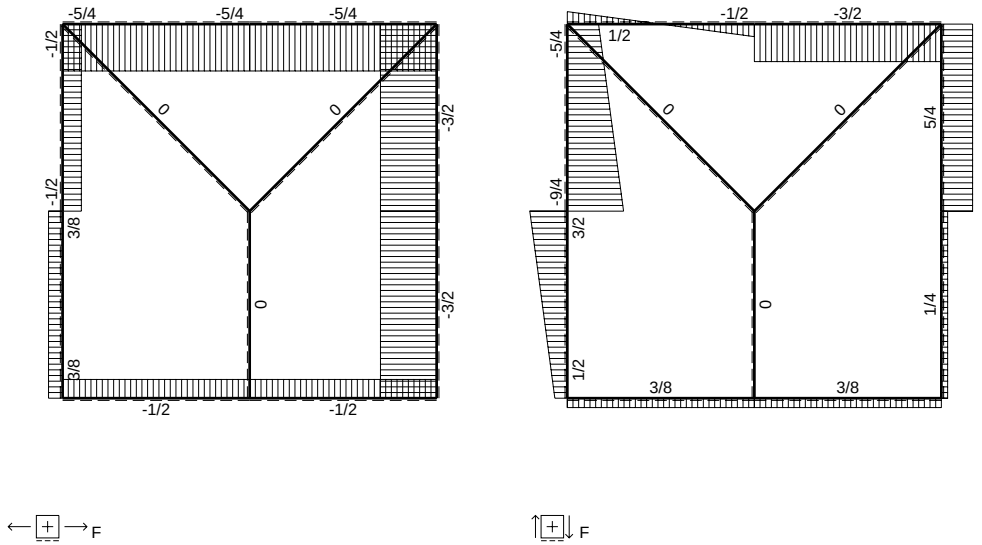
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

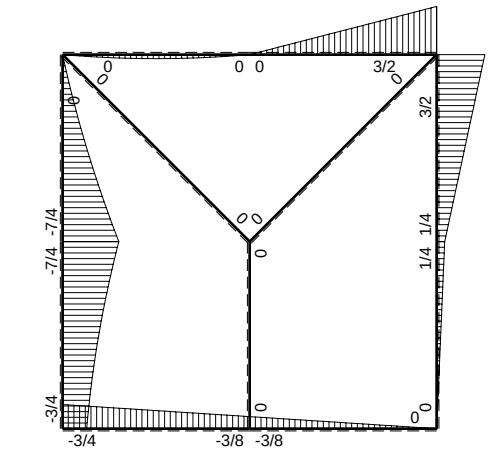
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

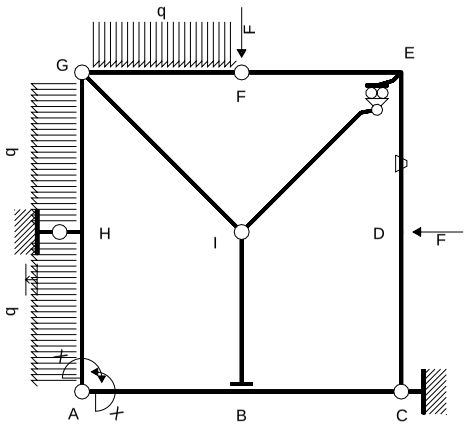


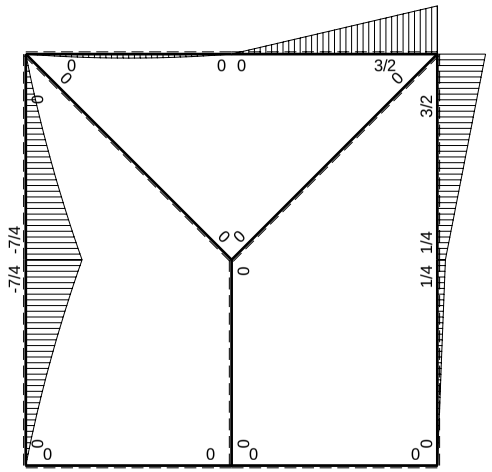
A = 960. mm^2
J_u = 270775. mm^4
J_v = 72000. mm^4
y_g = 23.27 mm
N = -920. N
T_y = -4140. N
M_x = -2189600. Nmm
x_m = 36. mm
y_m = 53. mm
u_m = 12. mm
v_m = 29.73 mm
$\sigma_m = N/A - Mv/J_u$ = 239.4 N/mm^2
x_c = 24. mm
y_c = 43. mm
v_c = 19.73 mm
$\sigma_c = N/A - Mv/J_u$ = 158.5 N/mm^2
τ_c = 6.232 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 158.9 N/mm^2
S^* = 4891. mm^3


G
F
5/4F
5/4F
1/2F
1/2F
F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
G
G
5/4F
1/2F
1/2F
7/4Fb
9/4F
H
I
E
E
5/4F
3/2Fb
3/2F
I
3/2F
1/4Fb
5/4F
D
H
3/2F
7/4Fb
3/8F
I
D
1/4F
1/4Fb
3/2F
3/8F
3/4Fb
1/2F
A
B
3/2F
1/4F
C
A
B
1/2F
3/4Fb
3/8F
1/2F
3/8Fb
3/8F
B
C
1/2F
3/8Fb
3/8F
1/2F
3/8F

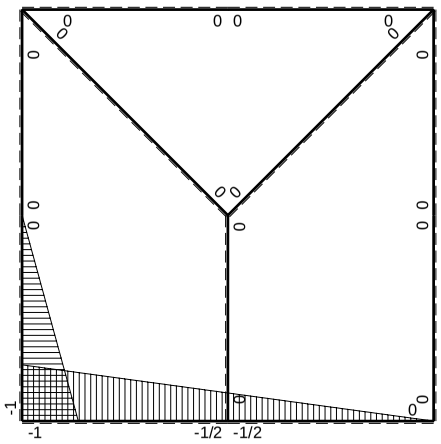

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3/8
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F
F


3/2
-7/4
-7/4
1/4
1/4
-3/4
-3/8
-3/8
Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 267320 CI04.xxxx.125

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PROCEDIMENTO E RISULTATI 267320 CI04.xxxx.125

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	Fb/EJ	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

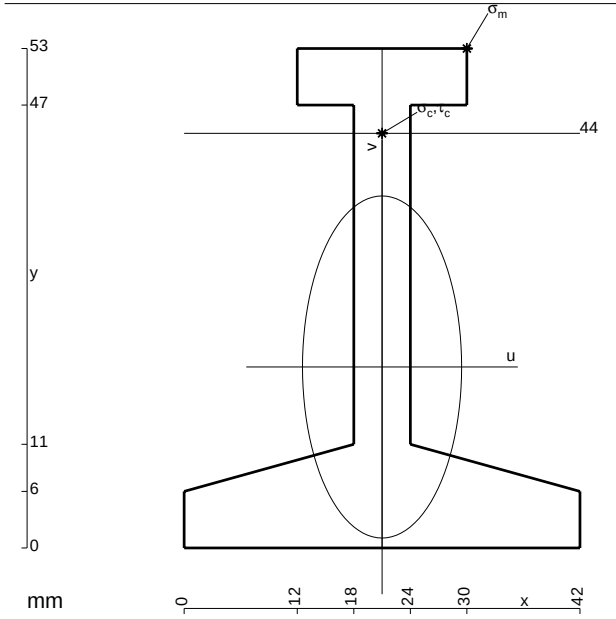
$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$$

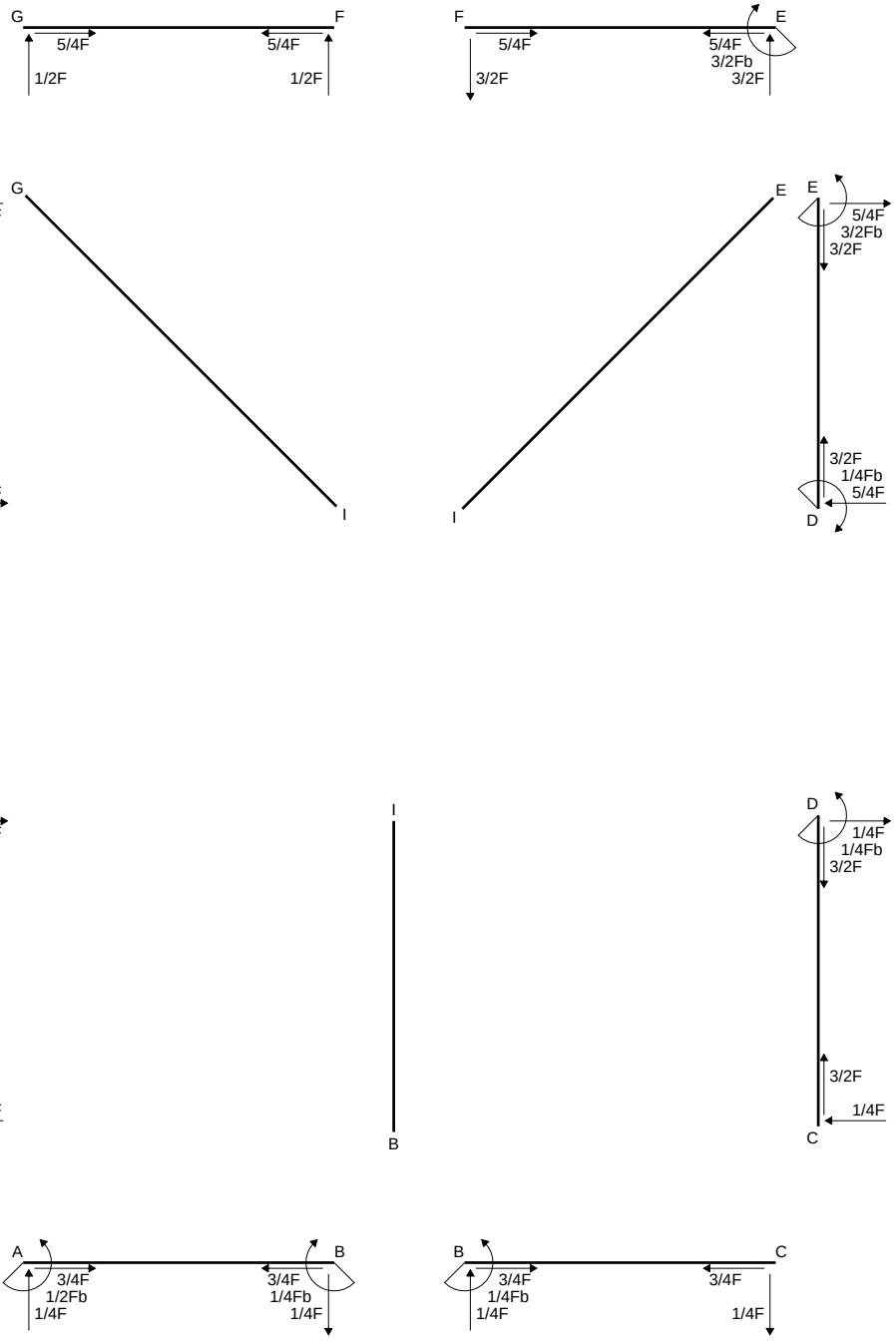
$$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$$

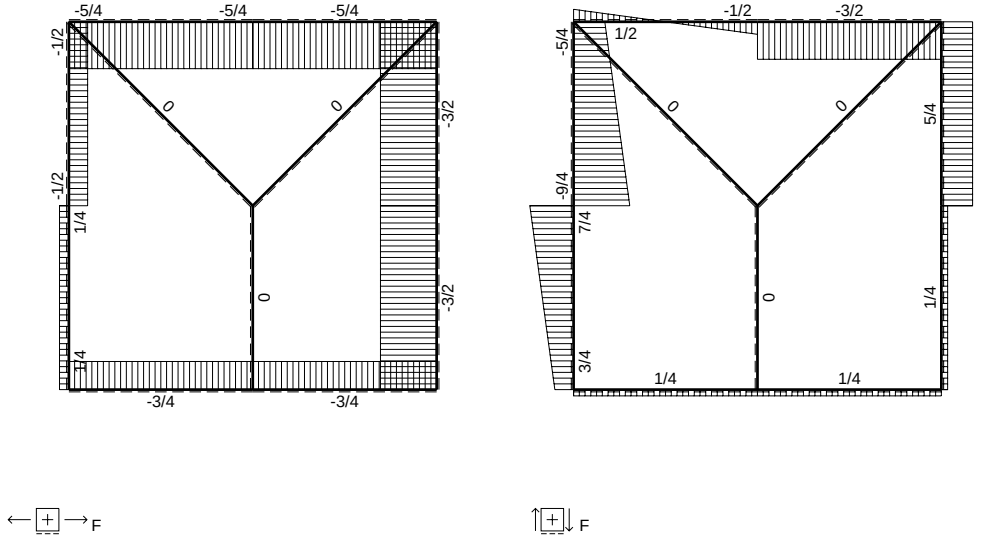
$$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$$

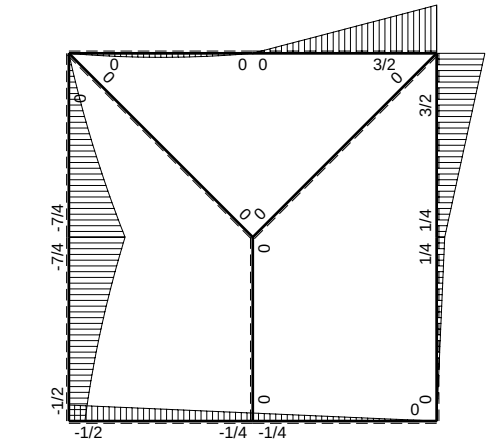
$$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$$

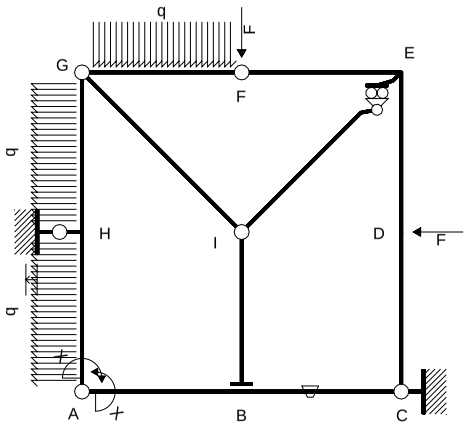


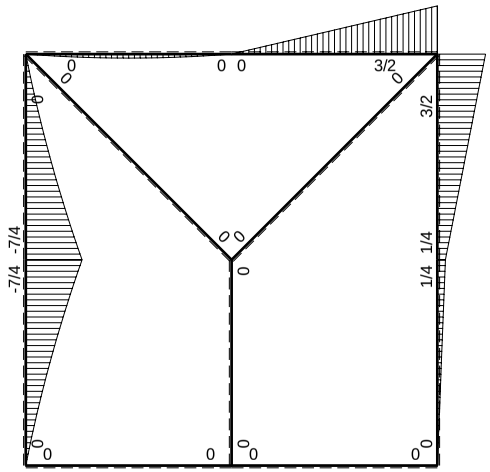
A = 696. mm^2
J_u = 229334. mm^4
J_v = 49608. mm^4
y_g = 19.2 mm
N = -530. N
T_y = -2385. N
M_x = -1354150. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 9. mm
v_m = 33.8 mm
$\sigma_m = N/A - Mv/J_u$ = 198.8 N/mm^2
x_c = 21. mm
y_c = 44. mm
v_c = 24.8 mm
$\sigma_c = N/A - Mv/J_u$ = 145.7 N/mm^2
τ_c = 6.586 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 146.1 N/mm^2
S^* = 3799. mm^3


G
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5/4F
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1/2F
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E
5/4F
5/4F
3/2Fb
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G
G
5/4F
1/2F
1/2F
7/4Fb
9/4F
H
I
E
E
5/4F
3/2Fb
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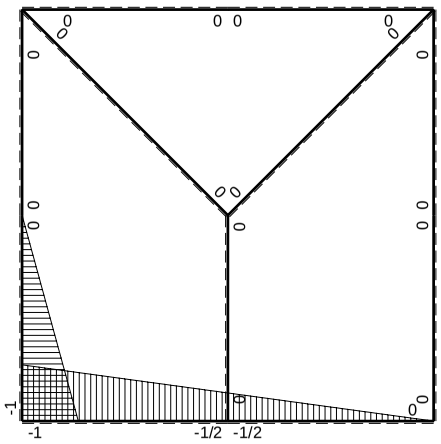

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-1/4





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 263840 CI04.xxxx.126

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PROCEDIMENTO E RISULTATI 263840 CI04.xxxx.126

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	-Fb/EJ	0	1/2Fb/EJ-1/2Fx/EJ	$1/4-1/2x/b+1/4x^2/b^2$	$(0+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	0	Fb/EJ	0	1/2Fx/EJ	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/2Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/2Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{BC} = \int_o^b \left(1/2 - 1/2\ x/b\ \right)\theta\ \ dx = \left[1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(1/2\ b - 1/4\ b\ \right)\theta\ \ = 1/4\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/2\ x/b\ \right)\theta\ \ dx = \left[-1/4\ x^2/b\ \right]_o^b\ \theta$

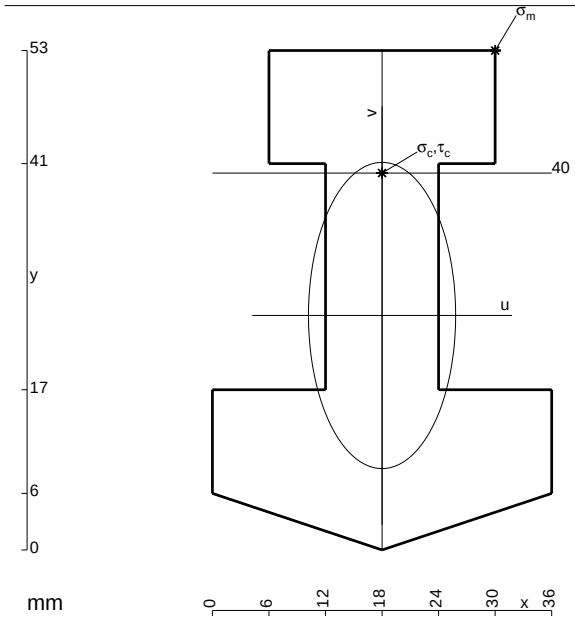
$= \left(-1/4\ b\ \right)\theta\ \ = 1/4\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

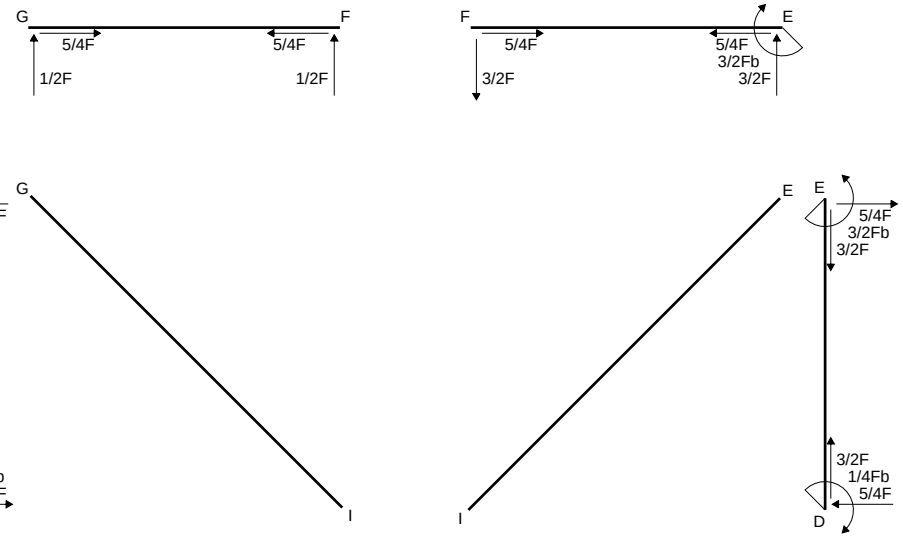
$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

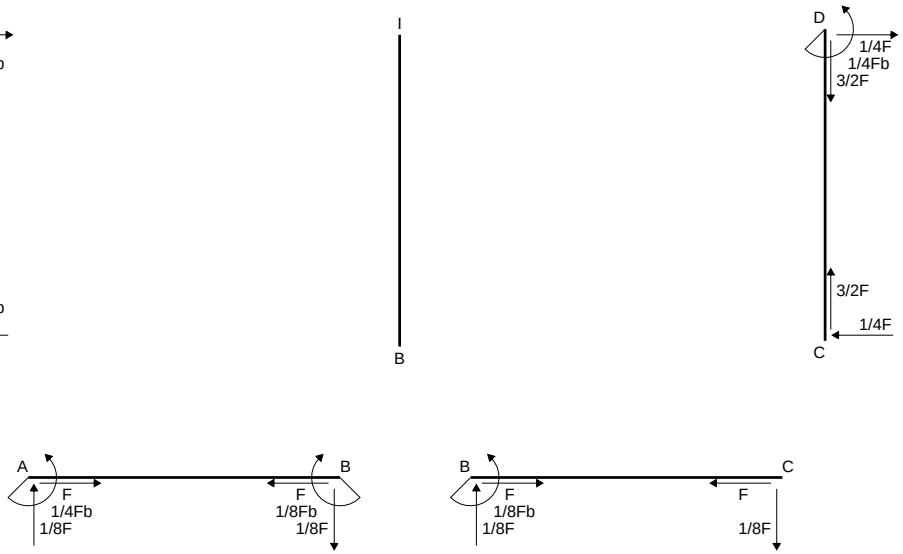
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

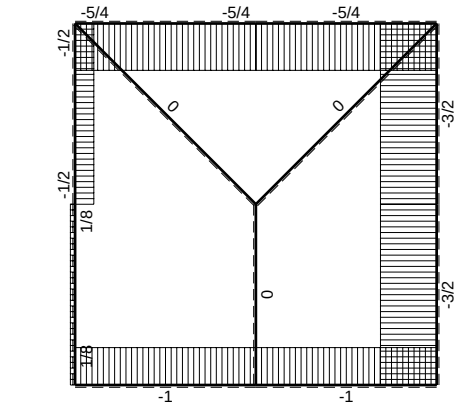
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

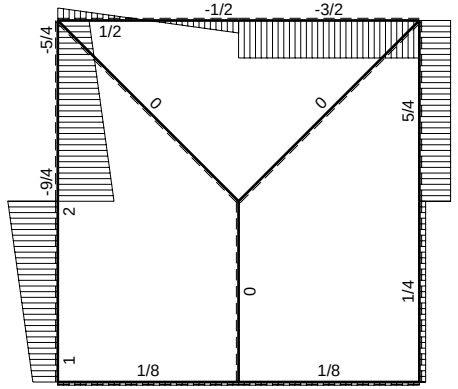


A = 1080. mm^2
J_u = 285273. mm^4
J_v = 65880. mm^4
y_g = 24.88 mm
N = -780. N
T_y = -3510. N
M_x = -2129400. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 12. mm
v_m = 28.12 mm
$\sigma_m = N/A - Mv/J_u$ = 209.2 N/mm^2
x_c = 18. mm
y_c = 40. mm
v_c = 15.12 mm
$\sigma_c = N/A - Mv/J_u$ = 112.1 N/mm^2
τ_c = 6.723 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 112.7 N/mm^2
S^* = 6557. mm^3

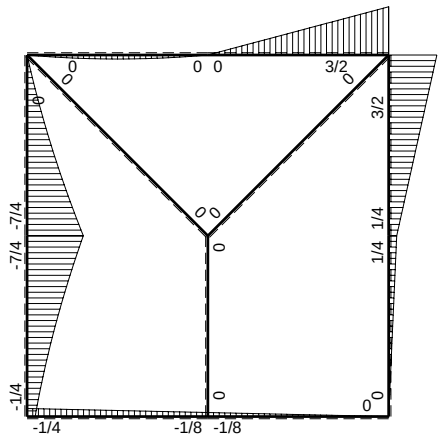

G
F
5/4F
5/4F
1/2F
1/2F
F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
G
G
5/4F
1/2F
1/2F
7/4Fb
9/4F
H
I
E
E
5/4F
3/2Fb
3/2F
I
3/2F
1/4Fb
5/4F
D


H
2F
7/4Fb
1/8F
I
D
1/4F
1/4Fb
3/2F
1/8F
1/4Fb
F
A
B
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1/4F
C
A
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1/8F
1/8F

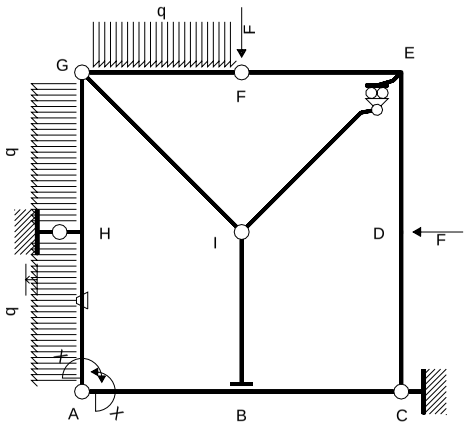

-5/4
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-1/2
-1/2
1/8
-3/2
-3/2
1/8
-1
-1

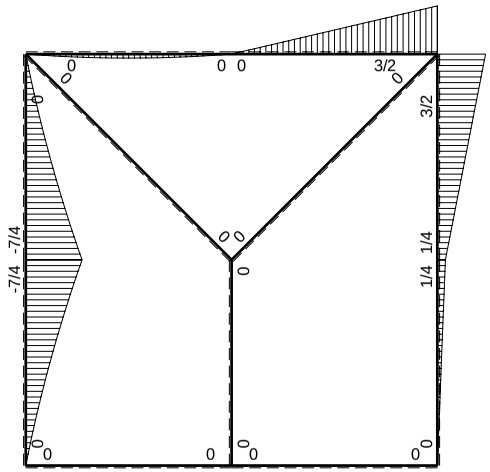

-1/2
-3/2
-5/4
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5/4
-9/4
2
1/4
1
1/8
1/8

F F

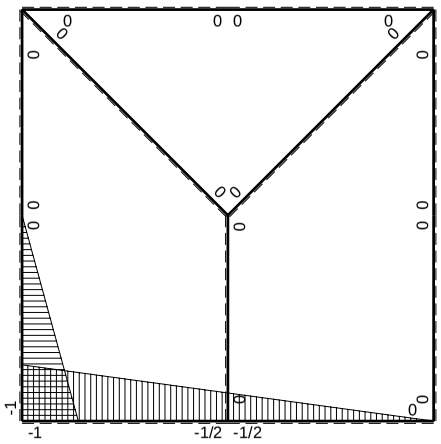

0
0 0
3/2
3/2
-7/4
-7/4
1/4
1/4
-1/4
-1/4
-1/8
-1/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	-Fb/EJ	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(1/4+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	Fb/EJ	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\ \theta\ \ dx$

$= \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b\ \theta$

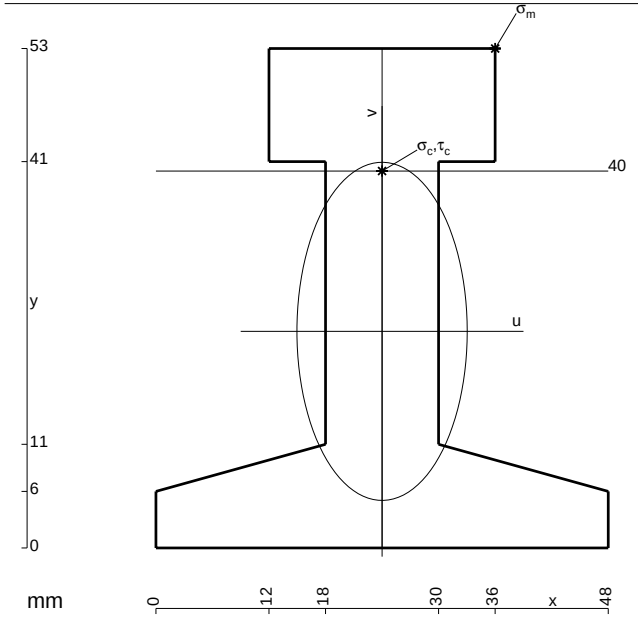
$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b\ \right)\ \theta\ \ = 3/4\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\ \theta\ \ dx$

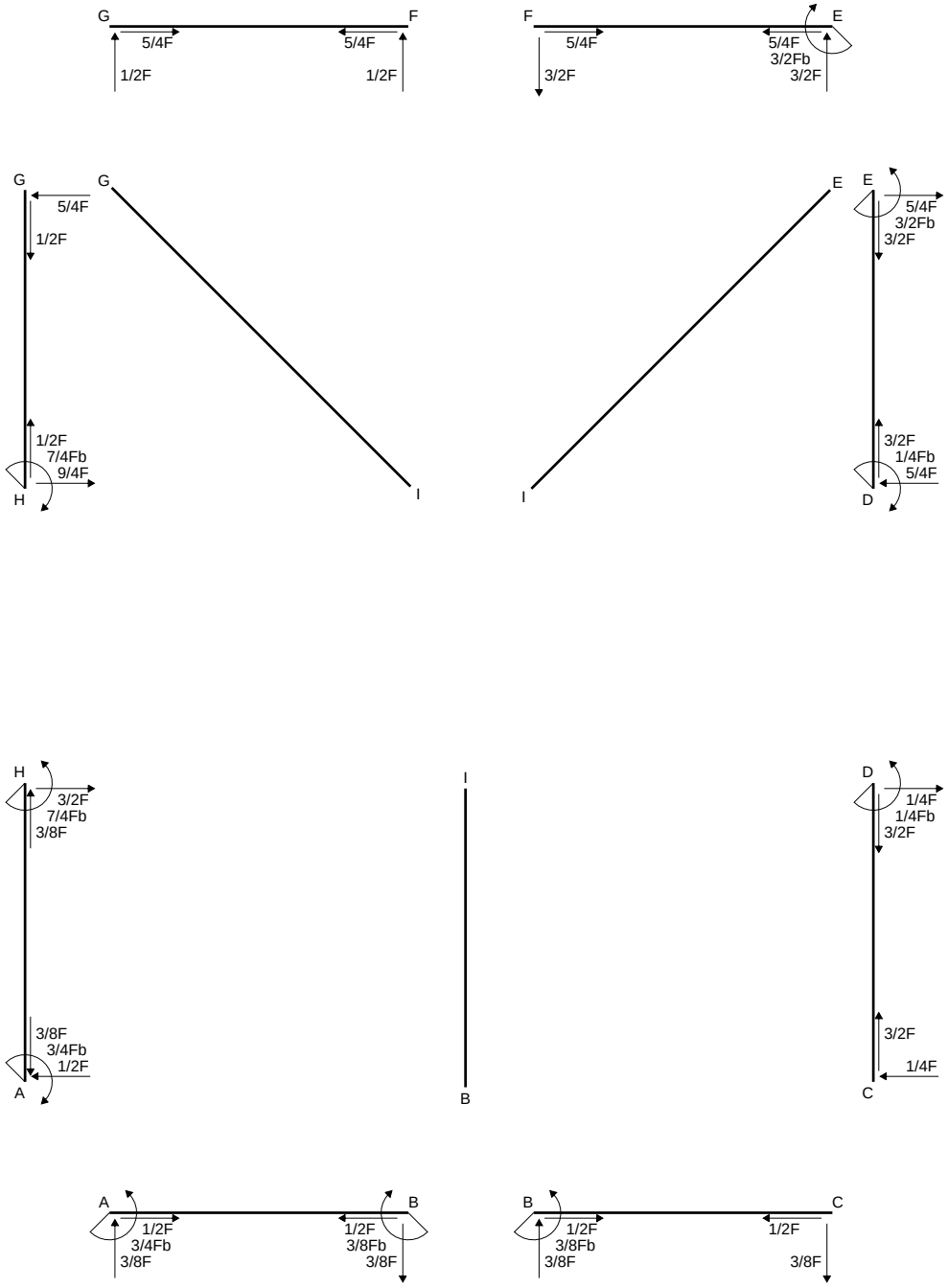
$= \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b\ \theta$

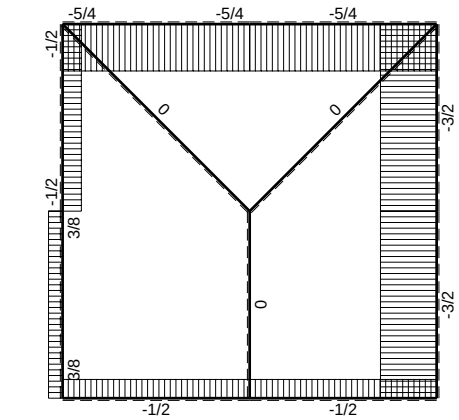
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\ \theta\ \ = 3/4\ \ Fb^2/EJ$

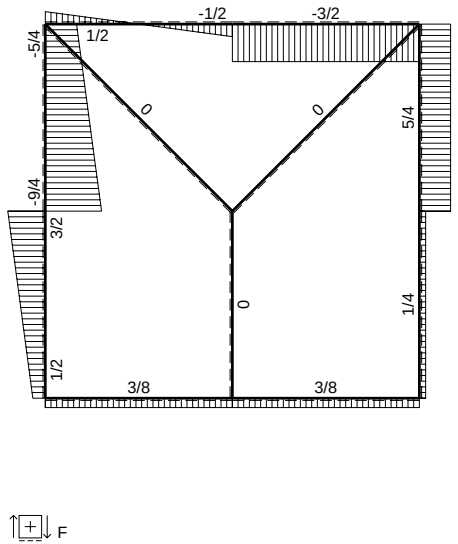
PROCEDIMENTO E RISULTATI 240551 CI04.xxxx.127

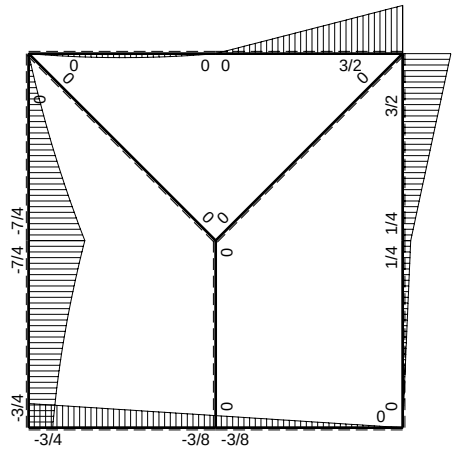


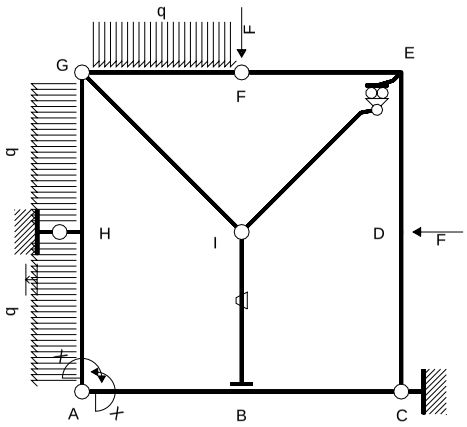
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J_u = 349673. mm^4
J_v = 88740. mm^4
y_g = 22.98 mm
N = -885. N
T_y = -3983. N
M_x = -2570930. Nmm
x_m = 36. mm
y_m = 53. mm
u_m = 12. mm
v_m = 30.02 mm
$\sigma_m = N/A - Mv/J_u$ = 219.9 N/mm^2
x_c = 24. mm
y_c = 40. mm
v_c = 17.02 mm
$\sigma_c = N/A - Mv/J_u$ = 124.3 N/mm^2
τ_c = 6.764 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 124.8 N/mm^2
S^* = 7127. mm^3

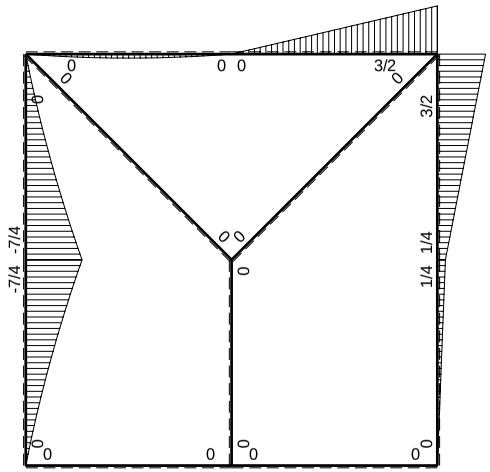

G
F
5/4F
5/4F
1/2F
1/2F
F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
G
G
5/4F
1/2F
1/2F
7/4Fb
9/4F
H
I
E
E
5/4F
3/2Fb
3/2F
I
3/2F
1/4Fb
5/4F
D
H
3/2F
7/4Fb
3/8F
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D
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1/4Fb
3/2F
3/8F
3/4Fb
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C
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B
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1/2F
3/8Fb
3/8F
B
C
1/2F
3/8Fb
3/8F
1/2F
3/8F


-5/4
-5/4
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3/8
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-1/2
F

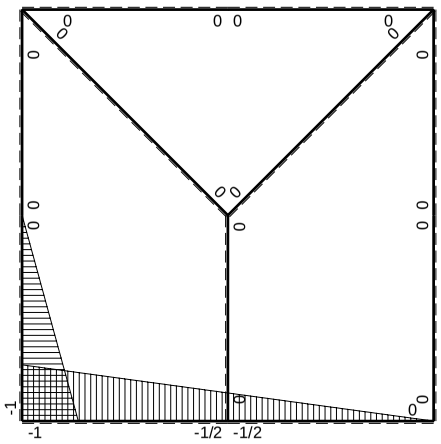

-1/2
-3/2
-5/4
1/2
5/4
-9/4
3/2
1/4
1/2
3/8
3/8
F


3/2
3/2
-7/4
-7/4
1/4
1/4
-3/4
-3/4
-3/8
-3/8
Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 271572 CI04.xxxx.128

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	-Fb/EJ	0	0	0	0+0	0
BI b	0	0	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

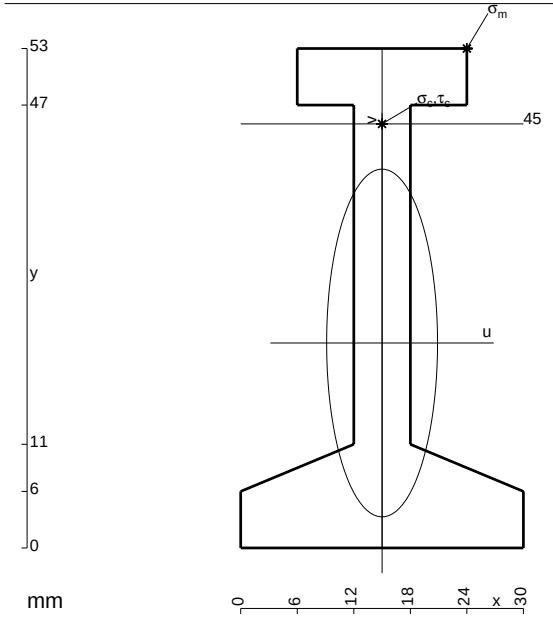
$$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$$

$$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

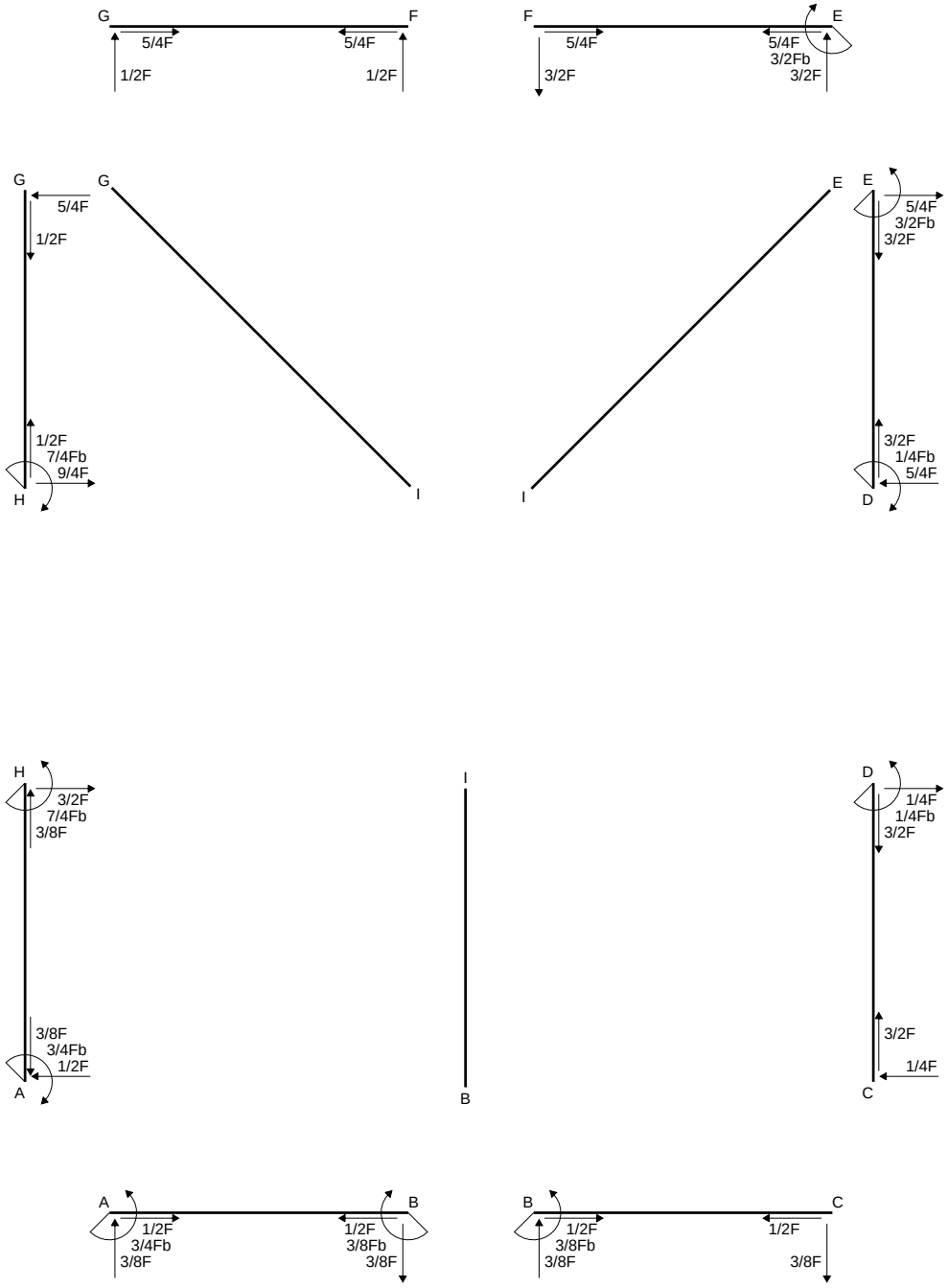
$$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$$

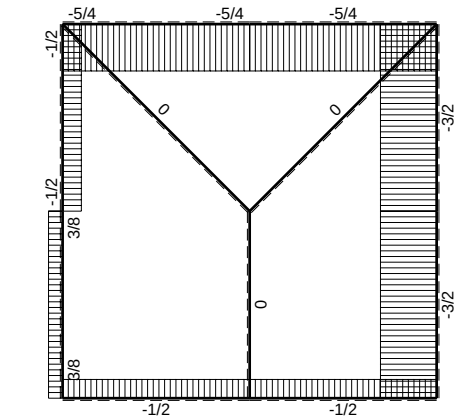
PROCEDIMENTO E RISULTATI 271572 CI04.xxxx.128

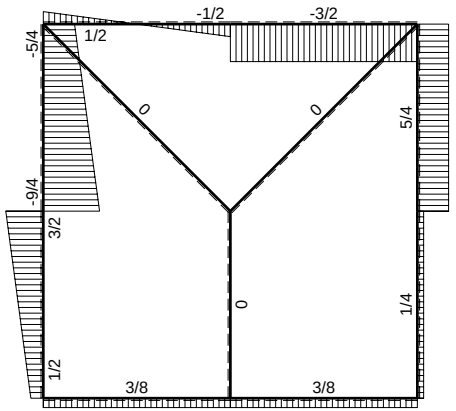


A = 594. mm^2
J_u = 202331. mm^4
J_v = 20574. mm^4
y_g = 21.75 mm
N = -485. N
T_y = -2183. N
M_x = -1493800. Nmm
x_m = 24. mm
y_m = 53. mm
u_m = 9. mm
v_m = 31.25 mm
$\sigma_m = N/A - Mv/J_u$ = 229.9 N/mm^2
x_c = 15. mm
y_c = 45. mm
v_c = 23.25 mm
$\sigma_c = N/A - Mv/J_u$ = 170.8 N/mm^2
τ_c = 6.008 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 171.2 N/mm^2
S^* = 3342. mm^3

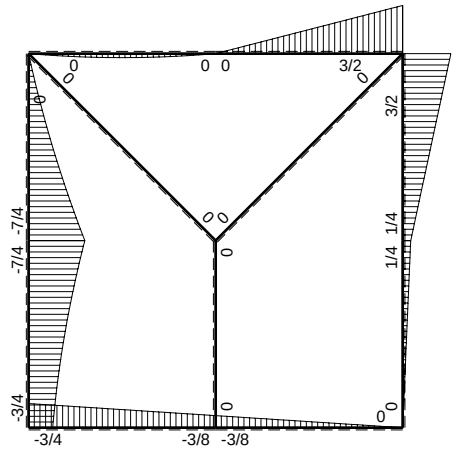
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G
F
5/4F
5/4F
1/2F
1/2F
F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
G
G
5/4F
1/2F
1/2F
7/4Fb
9/4F
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3/8F

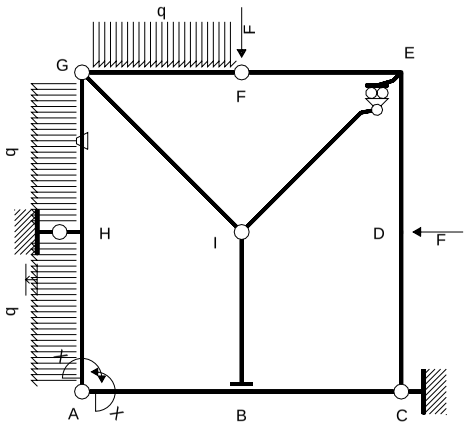

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-1/2

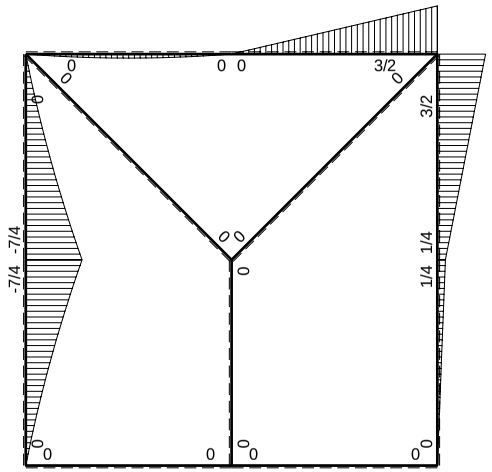

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-9/4
3/2
1/4
1/2
3/8
3/8

F F

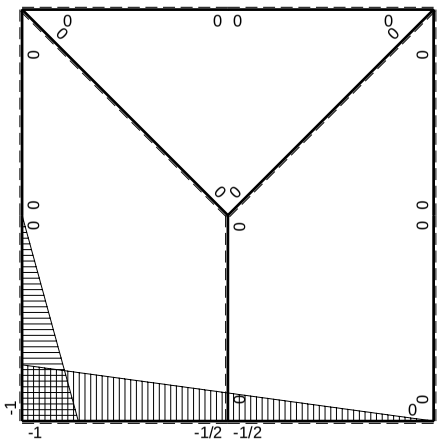

3/2
3/2
-7/4
-7/4
1/4
1/4
-3/4
-3/4
-3/8
-3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 248692 CI04.xxxx.129

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

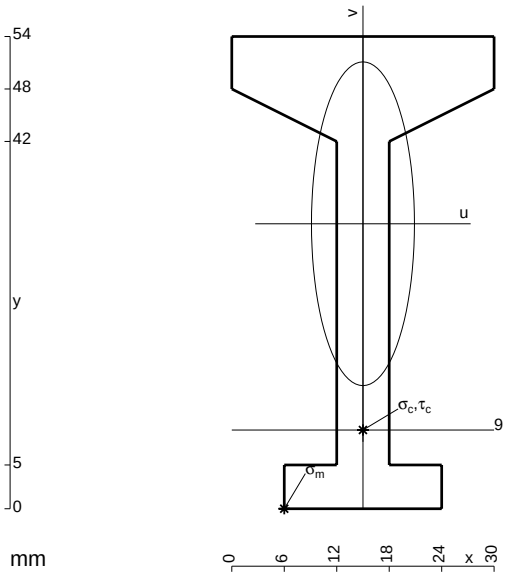
$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

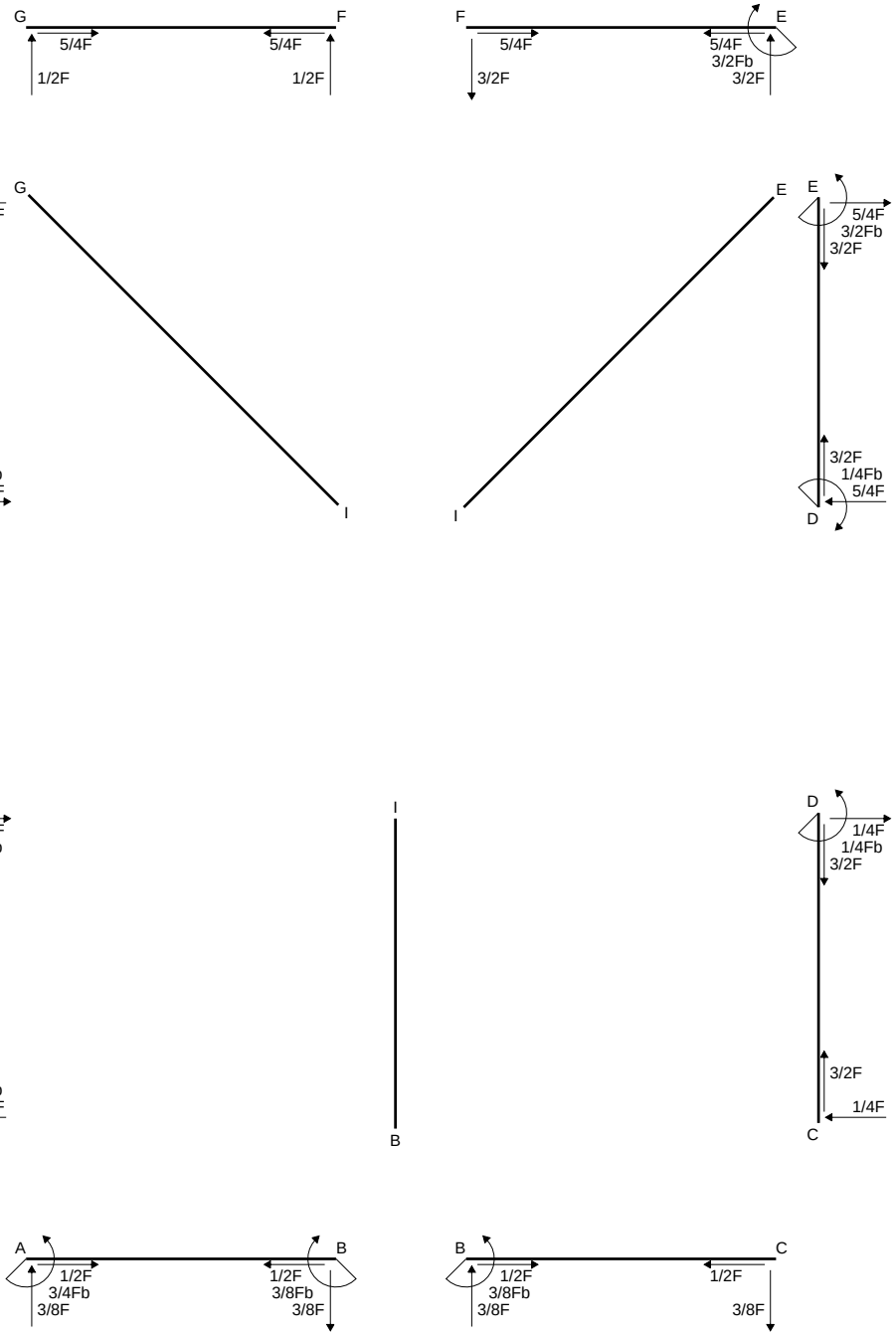
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

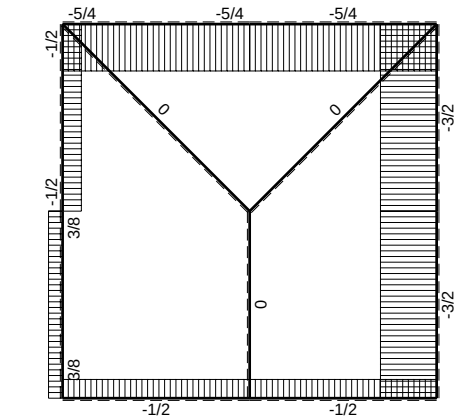
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

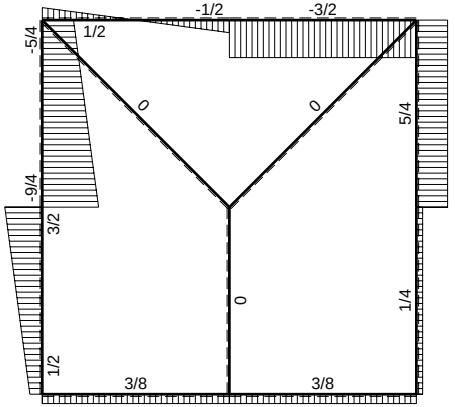
PROCEDIMENTO E RISULTATI 248692 CI04.xxxx.129



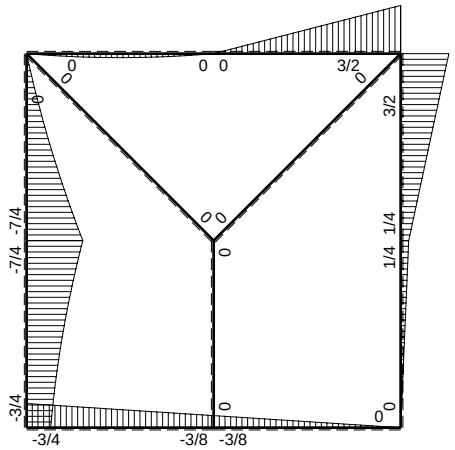
A = 600. mm^2
J_u = 205635. mm^4
J_v = 20808. mm^4
y_g = 32.59 mm
N = -450. N
T_y = -2025. N
M_x = -1496250. Nmm
x_m = 6. mm
u_m = -9. mm
v_m = -32.59 mm
$\sigma_m = N/A - Mv/J_u$ = -237.9 N/mm^2
x_c = 15. mm
y_c = 9. mm
v_c = -23.59 mm
$\sigma_c = N/A - Mv/J_u$ = -172.4 N/mm^2
τ_c = 5.453 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 172.7 N/mm^2
S^* = 3322. mm^3


G
F
5/4F
5/4F
1/2F
1/2F
F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
G
G
5/4F
1/2F
1/2F
7/4Fb
9/4F
H
I
E
E
5/4F
3/2Fb
3/2F
I
3/2F
1/4Fb
5/4F
D
H
3/2F
7/4Fb
3/8F
I
D
1/4F
1/4Fb
3/2F
3/8F
3/4Fb
1/2F
A
B
3/2F
1/4F
C
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B
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3/8F
1/2F
3/8F

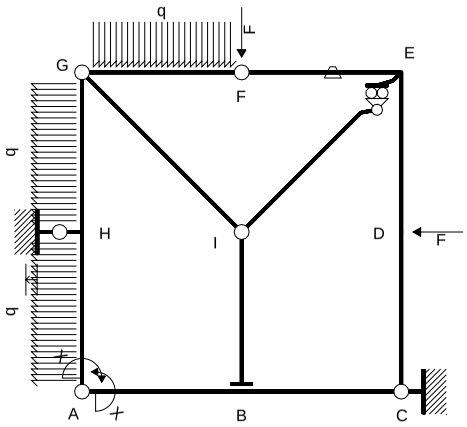

-5/4
-5/4
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-1/2
-1/2
-3/2
-1/2
3/8
-3/2
3/8
-1/2
-1/2

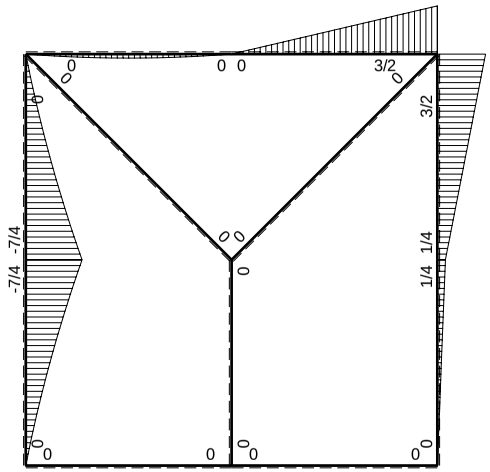

-1/2
-3/2
-5/4
1/2
5/4
-9/4
3/2
1/4
1/2
3/8
3/8

F F

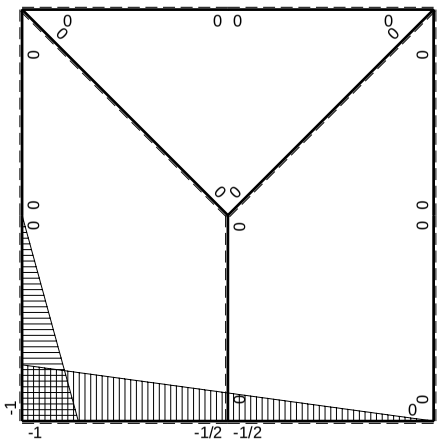

3/2
3/2
-7/4
-7/4
1/4
1/4
-3/4
-3/4
-3/8
-3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	-Fb/EJ	0	0	0	0+0	0
FE b	0	-3/2Fx	Fb/EJ	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\ \right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

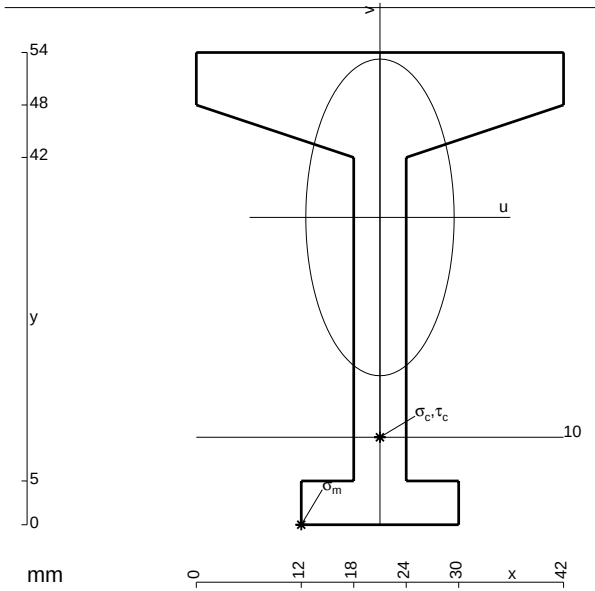
$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

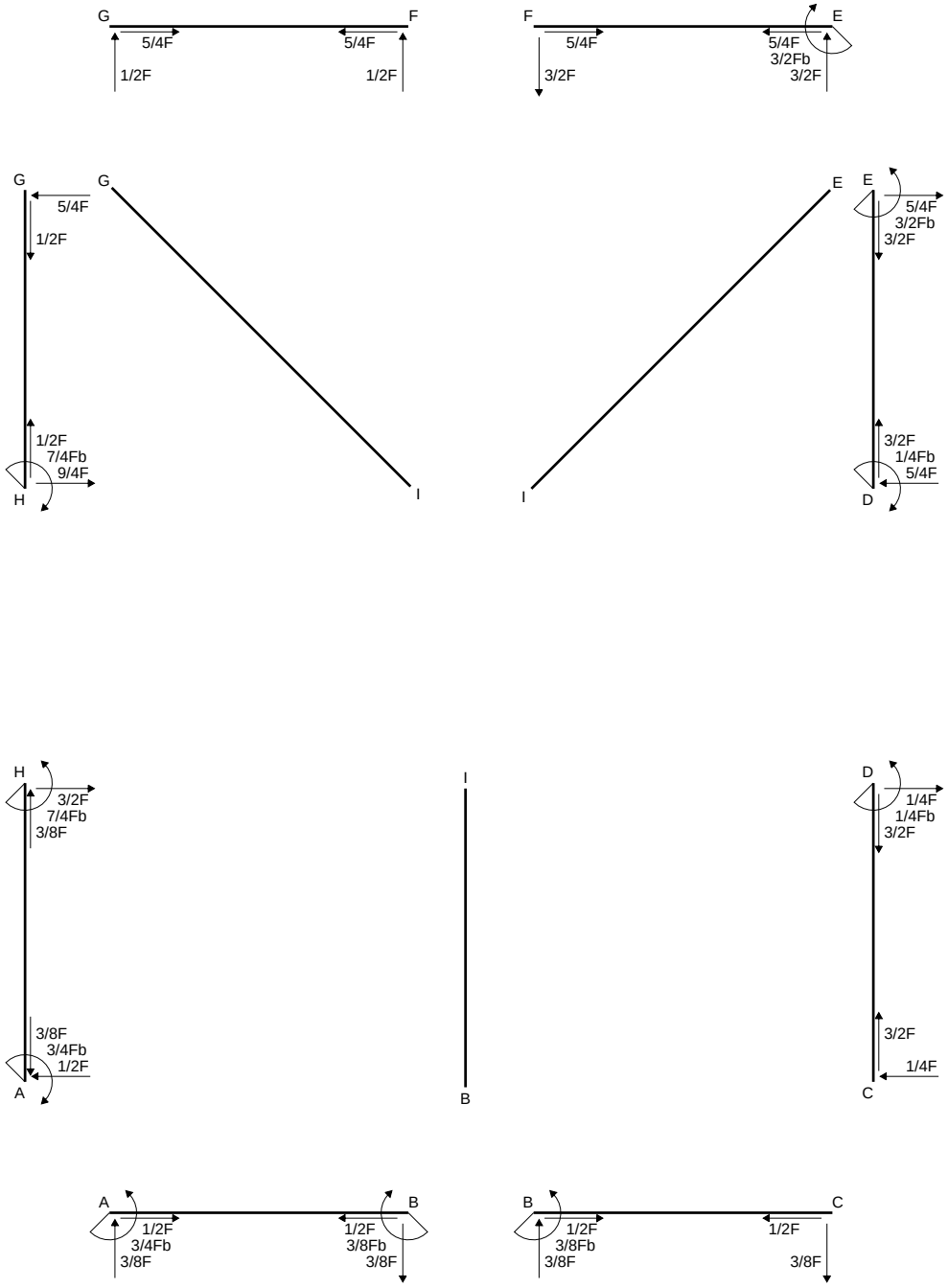
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

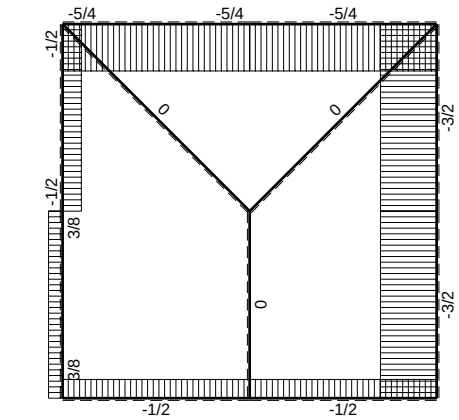
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

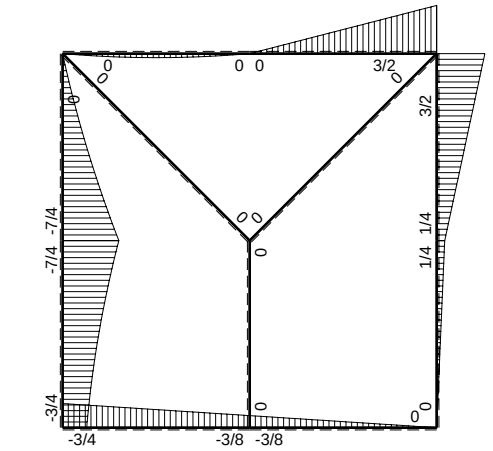
PROCEDIMENTO E RISULTATI 268836 CI04.xxxx.130

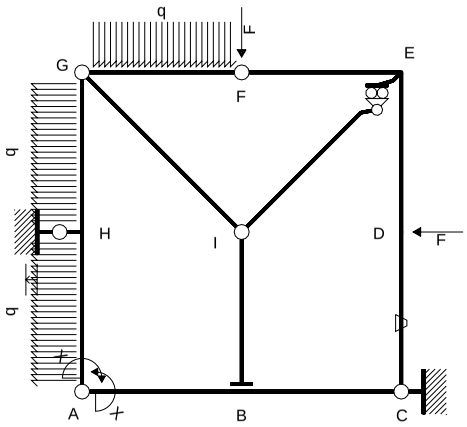


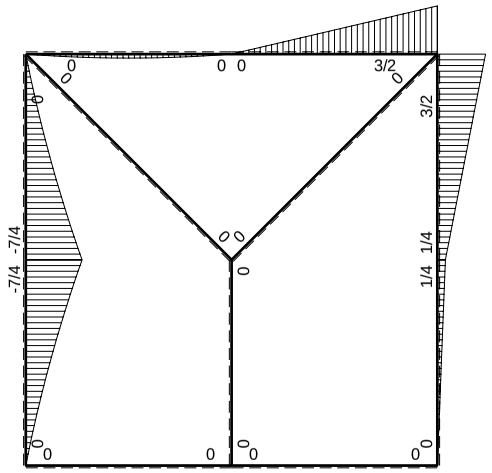
A = 708. mm^2
J_u = 232181. mm^4
J_v = 50940. mm^4
y_g = 35.14 mm
N = -750. N
T_y = -3375. N
M_x = -1312500. Nmm
x_m = 12. mm
u_m = -9. mm
v_m = -35.14 mm
$\sigma_m = N/A - Mv/J_u$ = -199.7 N/mm^2
x_c = 21. mm
y_c = 10. mm
v_c = -25.14 mm
$\sigma_c = N/A - Mv/J_u$ = -143.2 N/mm^2
τ_c = 9.127 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 144.1 N/mm^2
S^* = 3767. mm^3


G
F
5/4F
5/4F
1/2F
1/2F
F
E
5/4F
5/4F
3/2Fb
3/2F
3/2F
G
G
5/4F
1/2F
1/2F
7/4Fb
9/4F
H
I
E
E
5/4F
3/2Fb
3/2F
I
3/2F
1/4Fb
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D
H
3/2F
7/4Fb
3/8F
I
D
1/4F
1/4Fb
3/2F
3/8F
3/4Fb
1/2F
A
B
3/2F
1/4F
C
A
B
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3/4Fb
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1/2F
3/8F

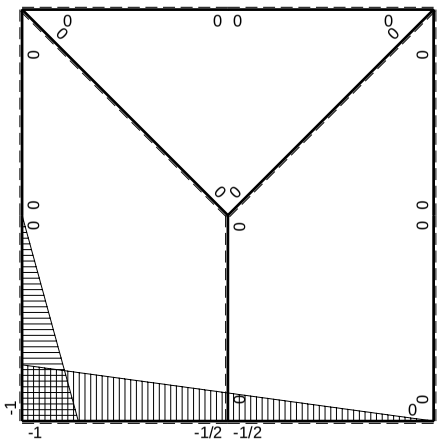

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F
F


3/2
3/2
-7/4
-7/4
1/4
1/4
-3/4
-3/4
-3/8
-3/8
Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 268787 CI04.xxxx.131

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PROCEDIMENTO E RISULTATI 268787 CI04.xxxx.131

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	-Fb/EJ	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	Fb/EJ	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-3/2Fx	0	0	0	0	0+0	0
FE b	0	-3/2Fx	0	0	0	0		
FG b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
GF b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

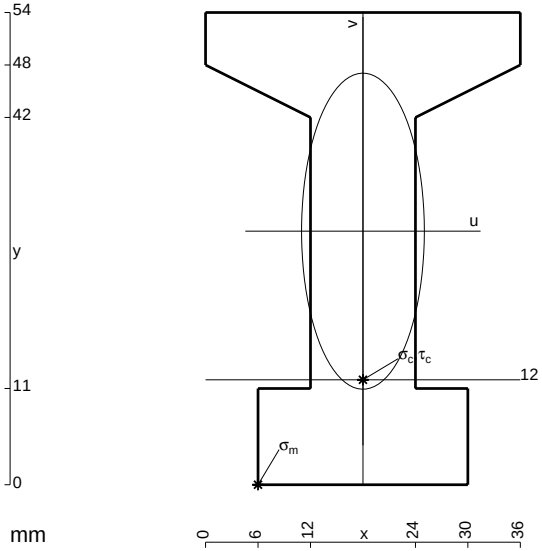
$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(7/8\ b - 3/4\ b + 1/8\ b\right)\ Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

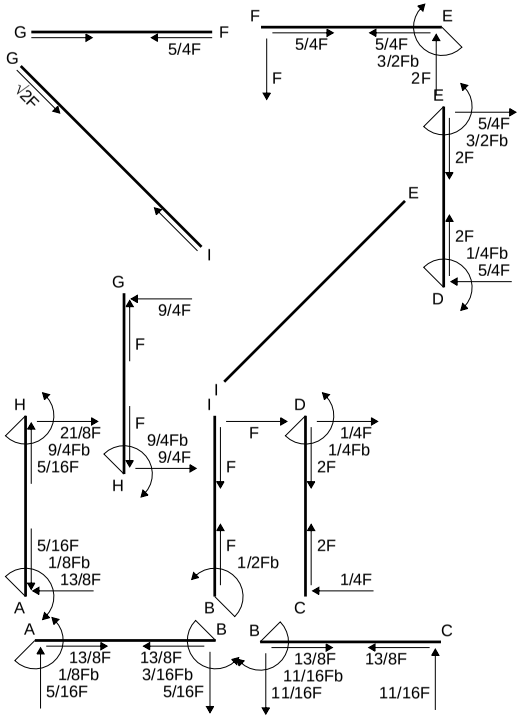
$= \left(5/8\ b - 1/4\ b - 1/8\ b\right)\ Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

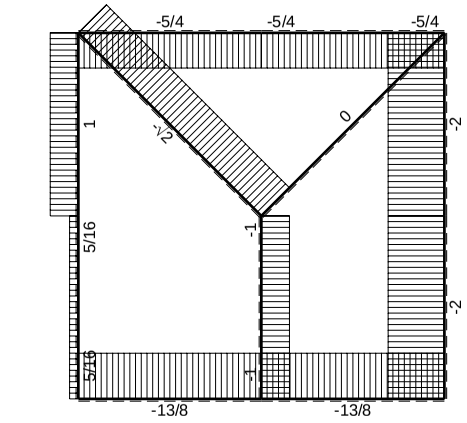
PROCEDIMENTO E RISULTATI 268787 CI04.xxxx.131

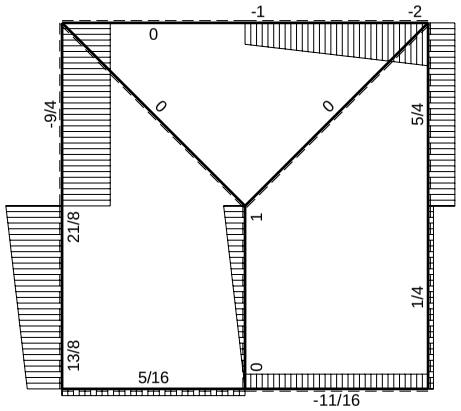


A = 996. mm^2
J_u = 325364. mm^4
J_v = 49104. mm^4
y_g = 28.99 mm
N = -1215. N
T_y = -5468. N
M_x = -2338880. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.99 mm
$\sigma_m = N/A - Mv/J_u$ = -209.6 N/mm^2
x_c = 18. mm
y_c = 12. mm
v_c = -16.99 mm
$\sigma_c = N/A - Mv/J_u$ = -123.4 N/mm^2
τ_c = 8.98 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 124.4 N/mm^2
S^* = 6412. mm^3

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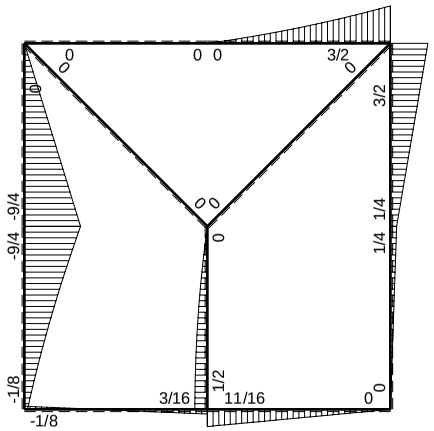

G
F
5/4F
G
√2F
I
F
5/4F
5/4F
3/2Fb
2F
F
E
E
5/4F
3/2Fb
2F
E
2F
1/4Fb
5/4F
D
G
9/4F
F
I
H
21/8F
9/4Fb
5/16F
F
9/4Fb
9/4F
H
I
F
F
D
1/4F
1/4Fb
2F
5/16F
1/8Fb
13/8F
A
F
1/2Fb
B
2F
1/4F
C
A
B
B
C
13/8F
1/8Fb
5/16F
13/8F
3/16Fb
5/16F
13/8F
11/16Fb
11/16F
13/8F
11/16F


-5/4
-5/4
-5/4
1
√2
0
-2
5/16
-1
-2
-1
5/16
-13/8
-13/8

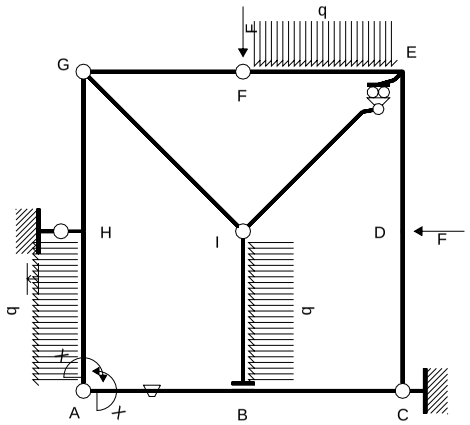

-1
-2
0
-9/4
0
0
5/4
1
21/8
1/4
13/8
5/16
0
-11/16

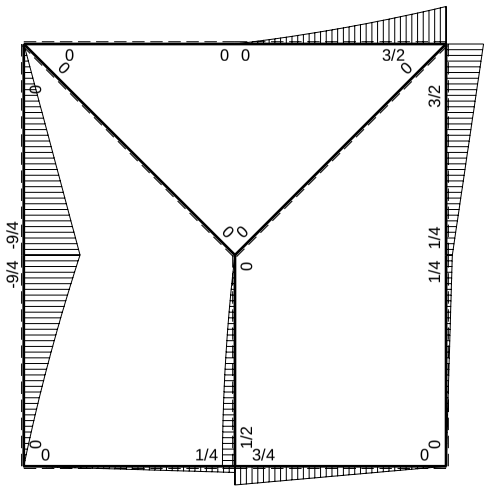
F

F

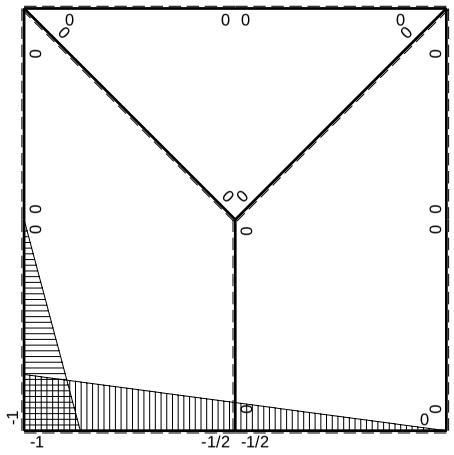

0
0 0
3/2
0
0
3/2
-9/4
0 0
0
-9/4
1/4
1/4
-1/8
3/16
-1/2
11/16
0
0
-1/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	-Fb/EJ	$-1/4Fx+1/8Fx^2/b$	Fb/EJ-1/2Fx/EJ	$1-x/b+1/4x^2/b^2$	$(-1/12+3/4)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb+1/4Fx	Fb/EJ	$-1/8Fb+1/8Fx^2/b$	1/2Fb/EJ+1/2Fx/EJ	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1 - 1/2\ x/b\right)\ \theta\ \ dx$

$= \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ + \left(\ b - 1/4\ b\ \right)\ \theta\ \ = 2/3\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2 - 1/2\ x/b\right)\ \theta\ \ dx$

$= \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 2/3\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

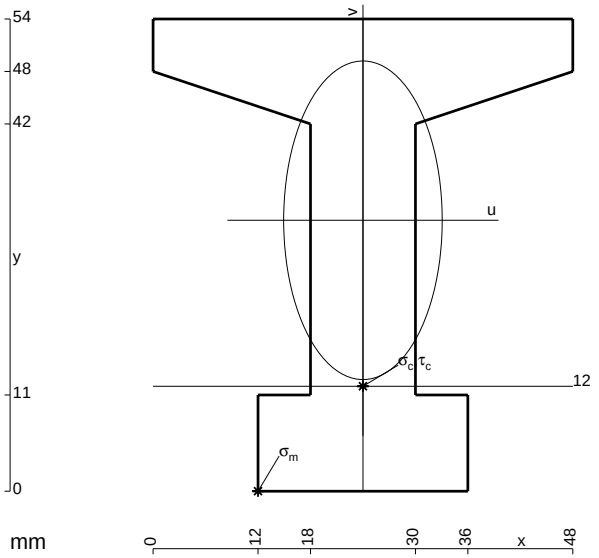
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

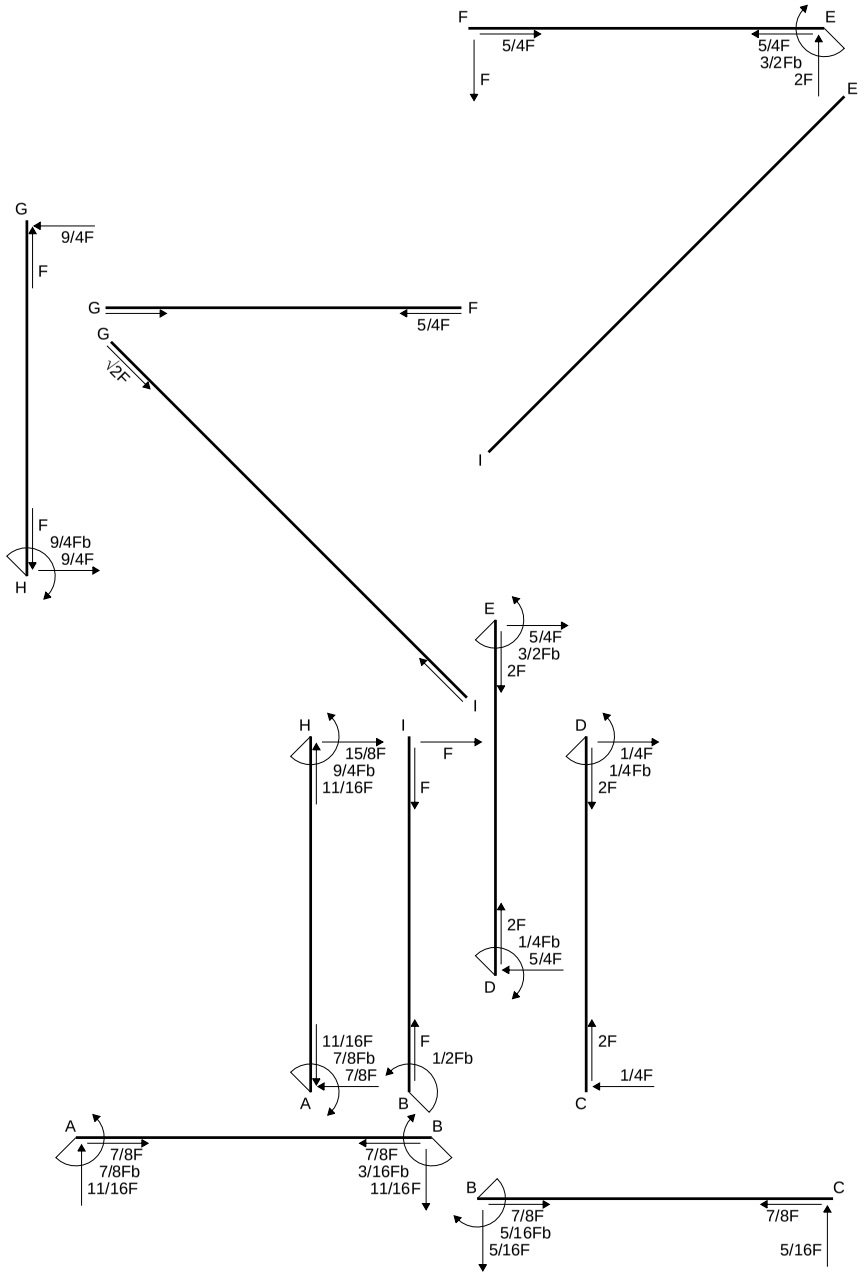
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

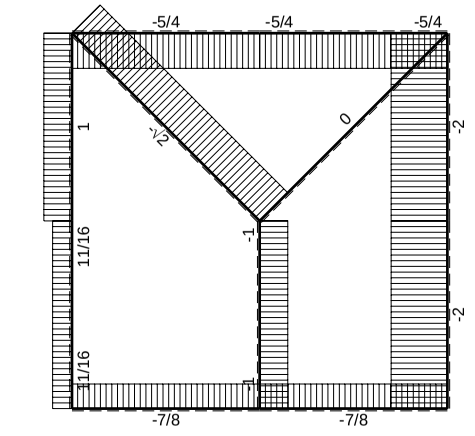
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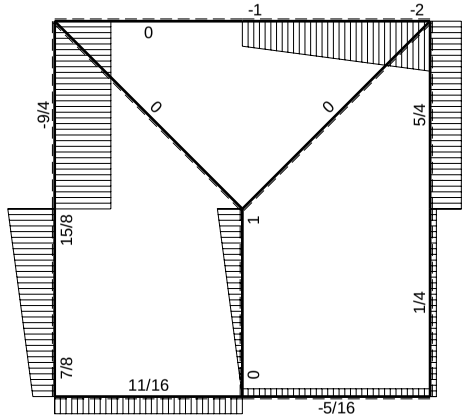


A = 1104. mm^2
J_u = 366560. mm^4
J_v = 90792. mm^4
y_g = 30.98 mm
N = 1940. N
T_y = -4365. N
M_x = -2619000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.98 mm
σ_m = N/A-Mv/J_u = -219.6 N/mm^2
x_c = 24. mm
y_c = 12. mm
v_c = -18.98 mm
σ_c = N/A-Mv/J_u = -133.9 N/mm^2
τ_c = 6.908 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 134.4 N/mm^2
S^* = 6962. mm^3

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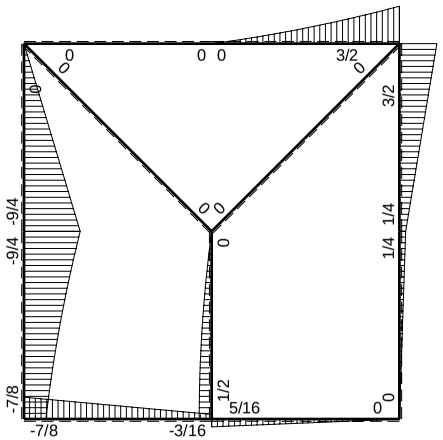

F
5/4F
E
5/4F
3/2Fb
2F
F
E
G
9/4F
F
G
F
5/4F
G
½F
I
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
I
H
15/8F
9/4Fb
11/16F
I
F
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
F
1/2Fb
2F
1/4F
A
B
C
A
B
7/8F
7/8Fb
11/16F
7/8F
3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
-5/4
-5/4
1
½
0
-2
-1
11/16
-2
11/16
-1
-7/8
-7/8

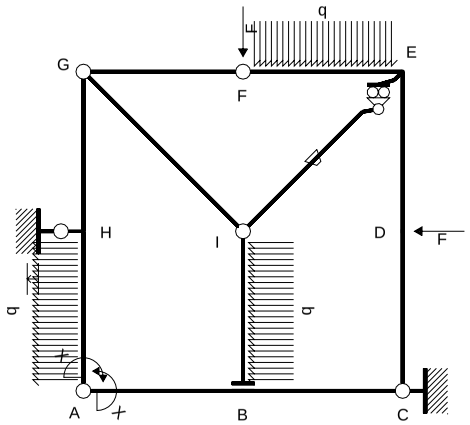

-1
-2
0
-9/4
0
0
5/4
15/8
1
1/4
7/8
0
11/16
0
-5/16

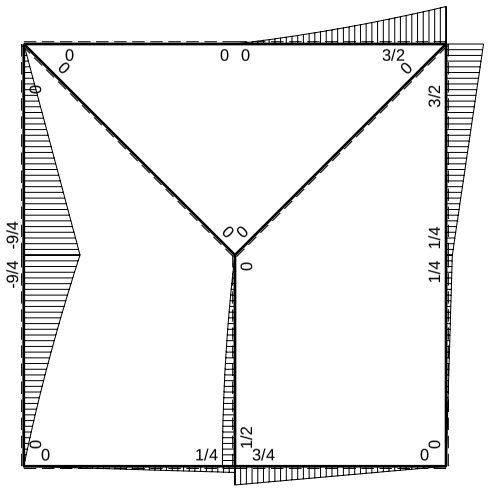
←□→ F

↑□↓ F

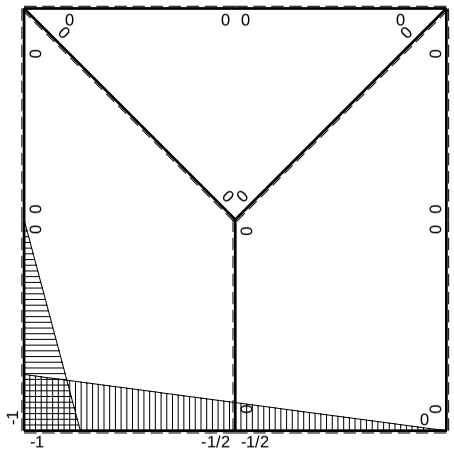

0
0 0
3/2
0
0
3/2
0
0
-9/4
-9/4
0
1/4
1/4
-9/4
0
-7/8
1/2
5/16
0
0
-7/8
-3/16

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 269676 CI04.xxxx.133

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

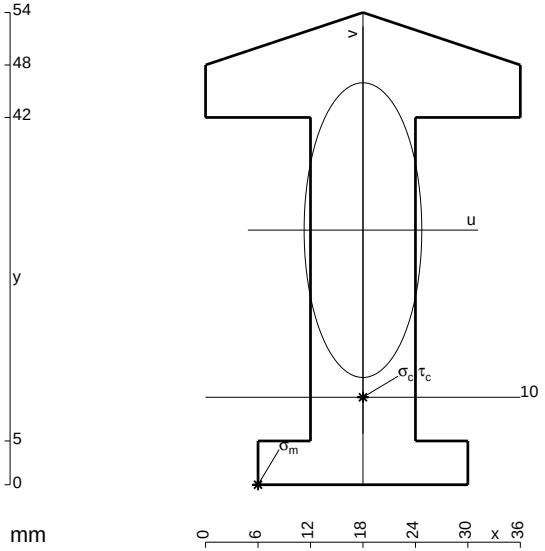
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

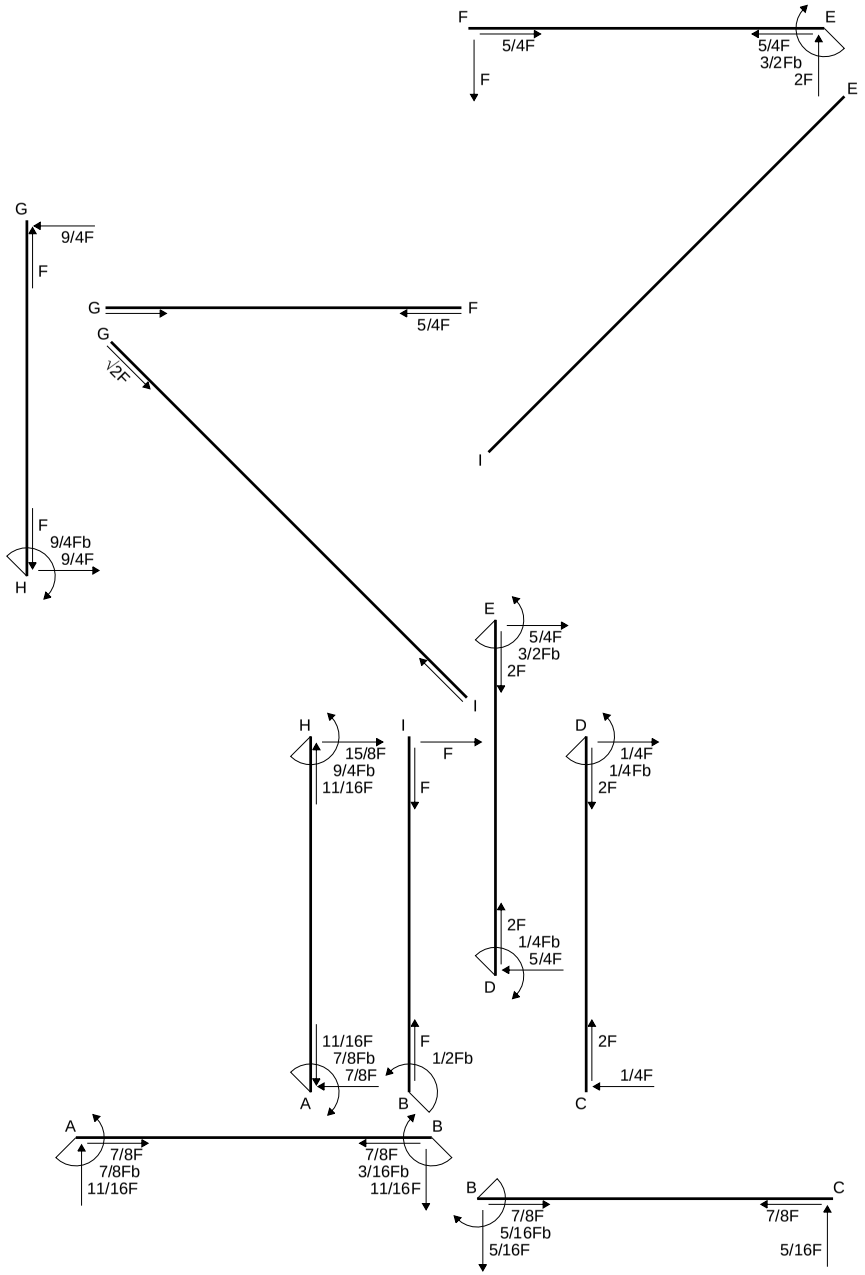
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

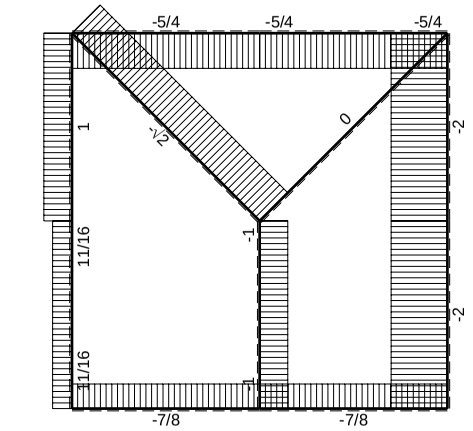
PROCEDIMENTO E RISULTATI 269676 CI04.xxxx.133

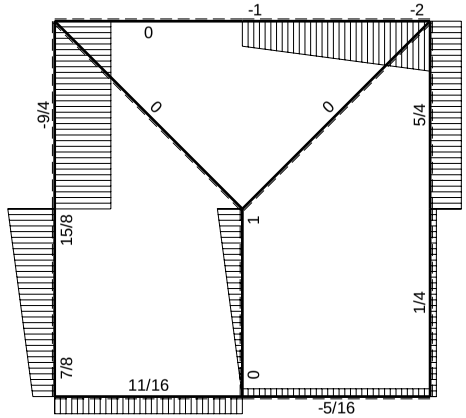


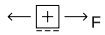
A = 888. mm^2
J_u = 252380. mm^4
J_v = 40248. mm^4
y_g = 29.11 mm
N = 1370. N
T_y = -3083. N
M_x = -2003630. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -29.11 mm
$\sigma_m = N/A - Mv/J_u$ = -229.6 N/mm^2
x_c = 18. mm
y_c = 10. mm
v_c = -19.11 mm
$\sigma_c = N/A - Mv/J_u$ = -150.2 N/mm^2
τ_c = 4.571 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 150.4 N/mm^2
S^* = 4491. mm^3

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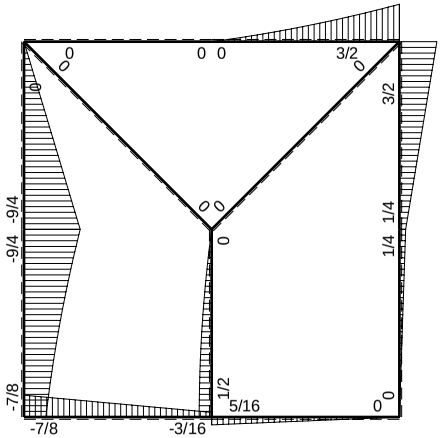

F
5/4F
E
5/4F
3/2Fb
2F
F
E
G
9/4F
F
G
F
5/4F
G
½F
I
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
I
H
15/8F
9/4Fb
11/16F
I
F
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
F
1/2Fb
A
B
2F
1/4F
C
A
B
7/8F
7/8Fb
11/16F
7/8F
3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
-5/4
-5/4
1
½
0
-2
-1
11/16
-2
11/16
-1
-7/8
-7/8

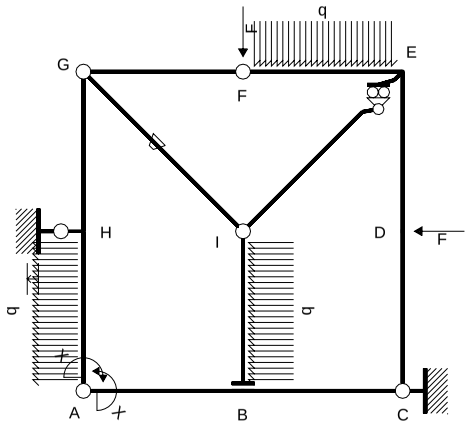

-1
-2
0
-9/4
0
0
5/4
1
15/8
1/4
7/8
0
11/16
-5/16

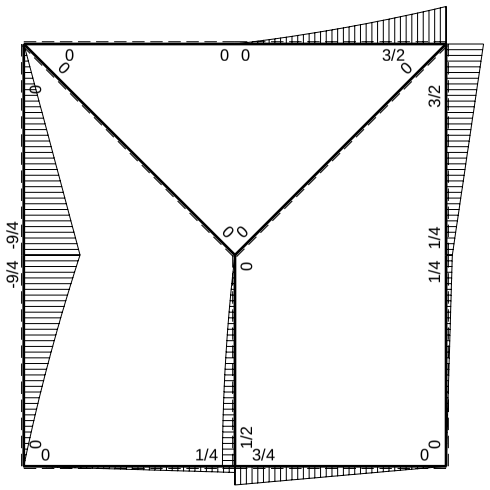

F


F

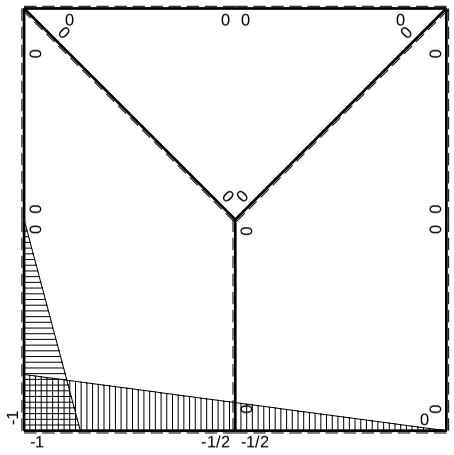

0
0 0
3/2
0
0
3/2
-9/4
0
0
-9/4
-9/4
1/4
1/4
0
-7/8
1/2
5/16
0
0
-7/8
-3/16


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264909 CI04.xxxx.134

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

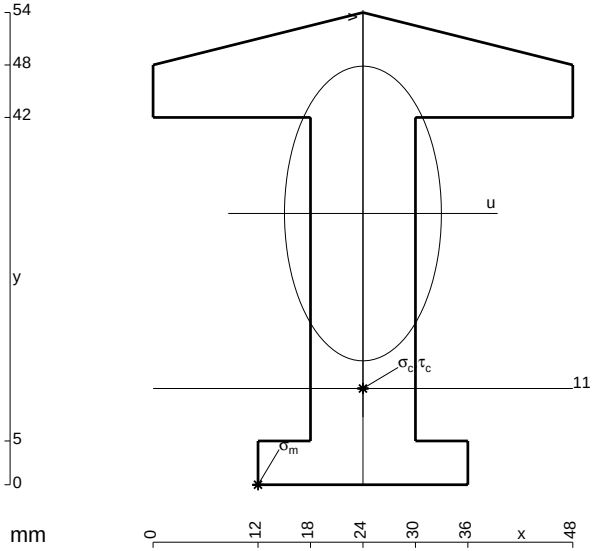
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

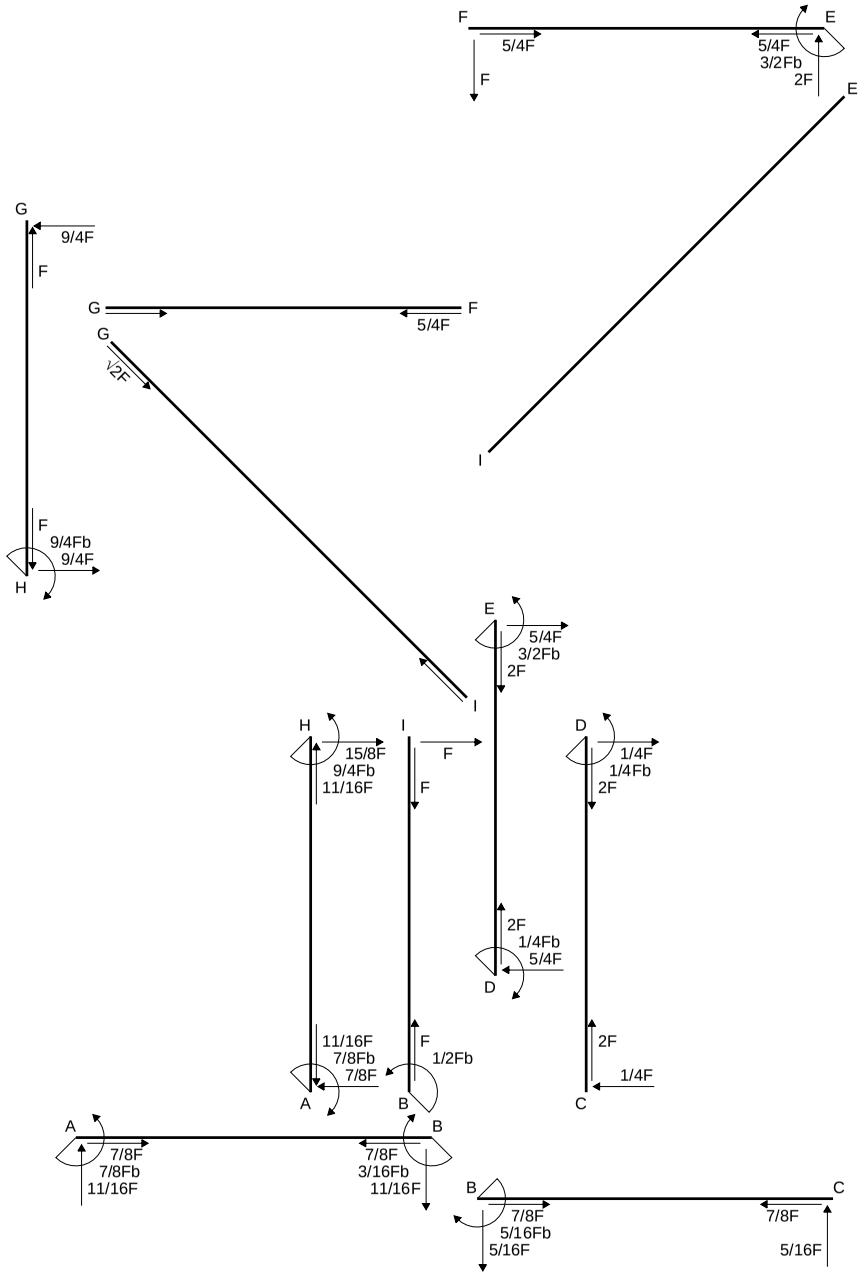
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

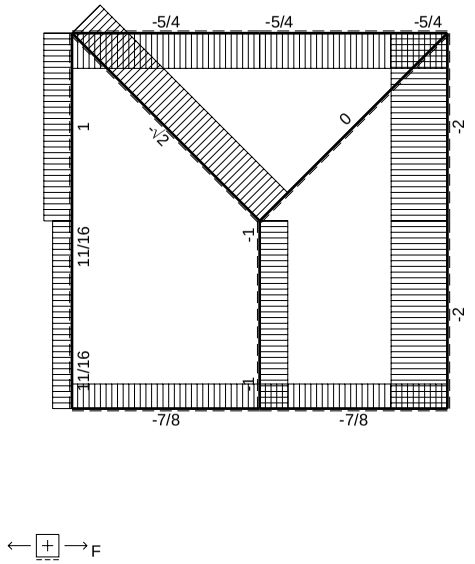
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

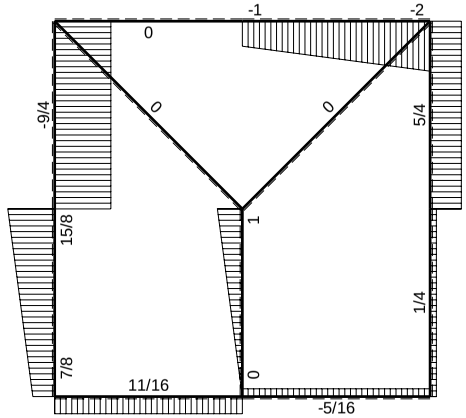
PROCEDIMENTO E RISULTATI 264909 CI04.xxxx.134



A = 996. mm^2
J_u = 282932. mm^4
J_v = 80208. mm^4
y_g = 31.02 mm
N = 1390. N
T_y = -3128. N
M_x = -2189250. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -31.02 mm
$\sigma_m = N/A - Mv/J_u$ = -238.6 N/mm^2
x_c = 24. mm
y_c = 11. mm
v_c = -20.02 mm
$\sigma_c = N/A - Mv/J_u$ = -153.5 N/mm^2
τ_c = 4.679 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 153.7 N/mm^2
S^* = 5079. mm^3

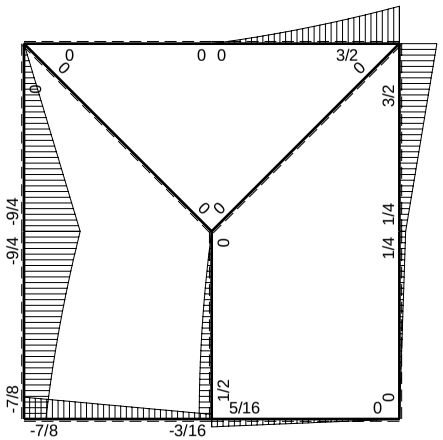

F
5/4F
E
5/4F
3/2Fb
2F
F
E
G
9/4F
F
G
F
5/4F
G
1/2F
I
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
I
H
15/8F
9/4Fb
11/16F
I
F
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
A
F
1/2Fb
B
2F
1/4F
C
A
7/8F
7/8Fb
11/16F
B
7/8F
3/16Fb
11/16F
B
7/8F
5/16Fb
5/16F
C
7/8F
5/16F


-5/4
-5/4
-5/4
1
1/2
0
-2
-1
11/16
-2
11/16
-1
-7/8
-7/8

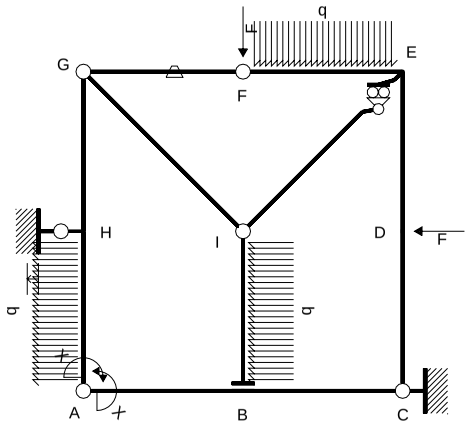

-1
-2
0
-9/4
0
0
5/4
1
15/8
1/4
7/8
0
11/16
-5/16

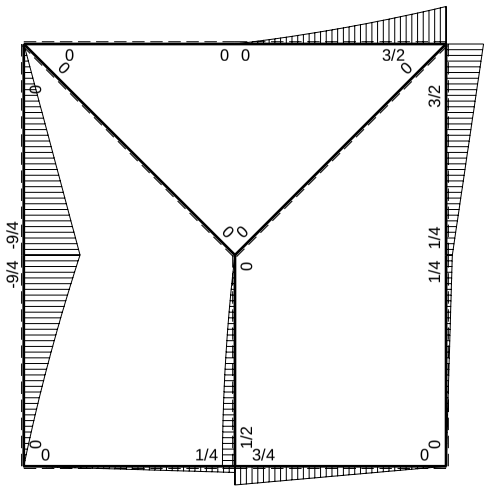
F

F

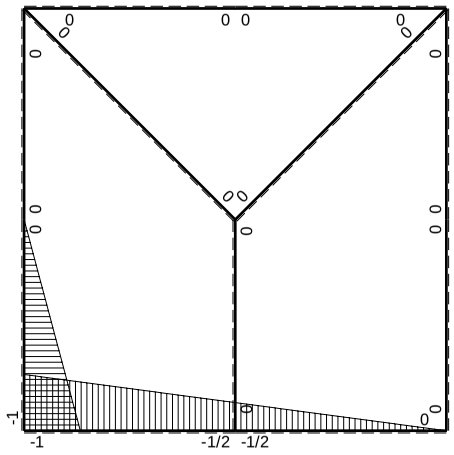

0
0 0
3/2
0
0
3/2
-9/4
0
0
-9/4
0
1/4
1/4
-7/8
1/2
5/16
0
0
-7/8
-3/16

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	-Fb/EJ	0	0	0	0+0	0
GF b	0	0	Fb/EJ	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

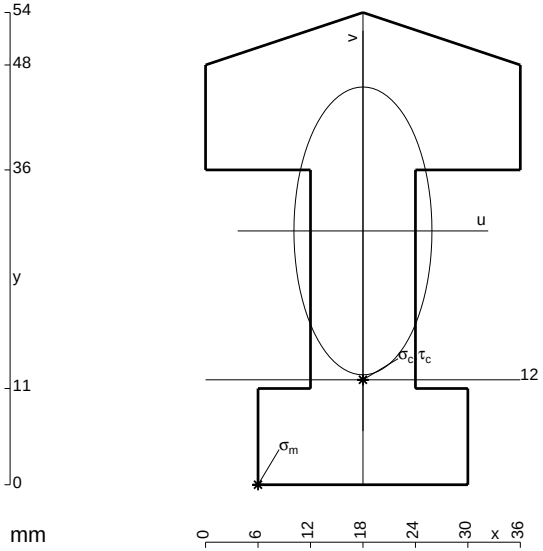
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

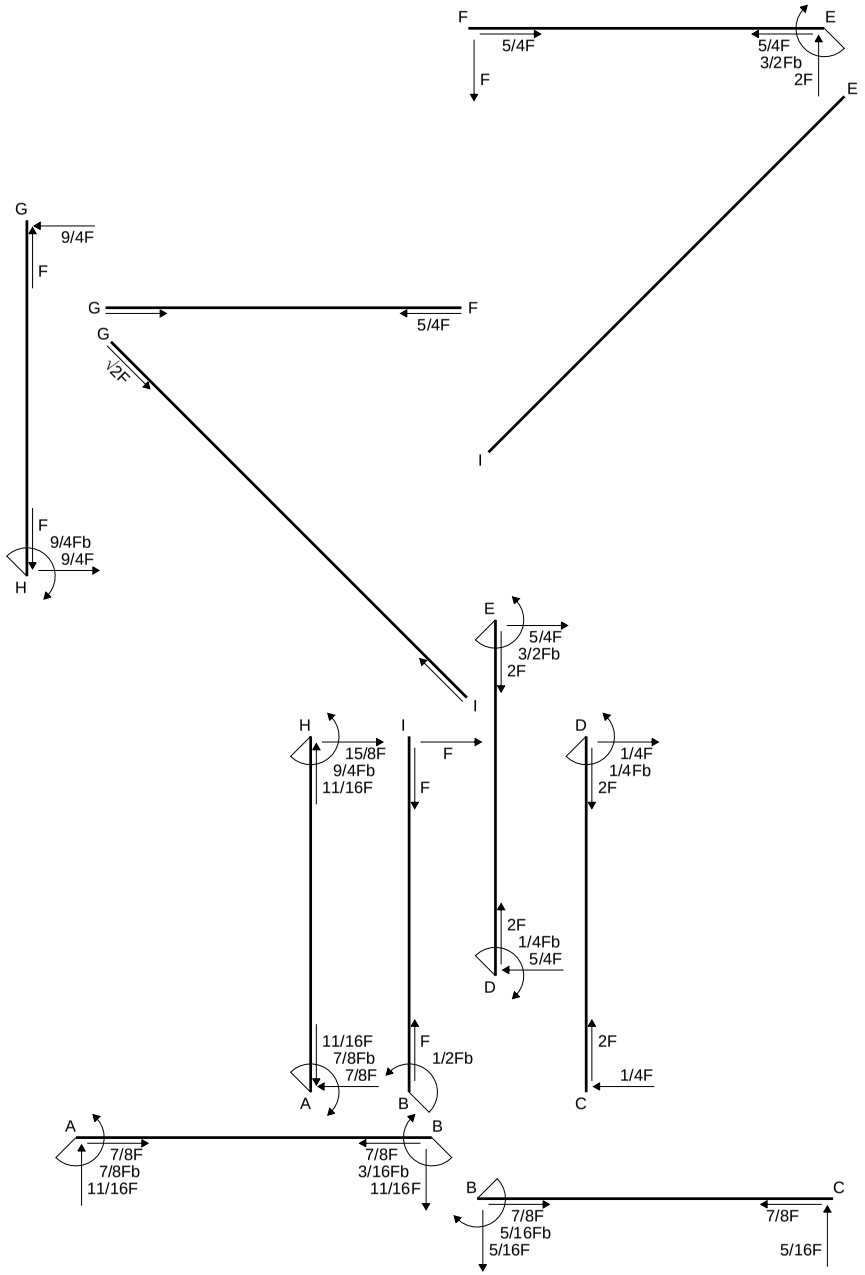
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

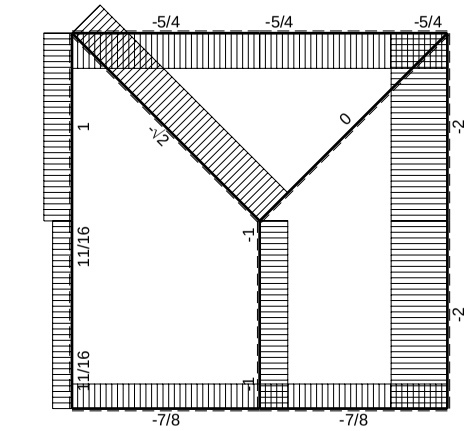
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

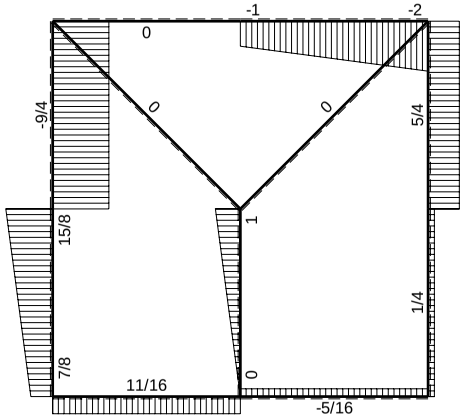
PROCEDIMENTO E RISULTATI 268139 CI04.xxxx.135

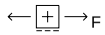


A = 1104. mm^2
J_u = 299191. mm^4
J_v = 68760. mm^4
y_g = 29.03 mm
N = 1220. N
T_y = -2745. N
M_x = -2058750. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -29.03 mm
$\sigma_m = N/A - Mv/J_u$ = -198.6 N/mm^2
x_c = 18. mm
y_c = 12. mm
v_c = -17.03 mm
$\sigma_c = N/A - Mv/J_u$ = -116.1 N/mm^2
τ_c = 4.91 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 116.4 N/mm^2
S^* = 6422. mm^3

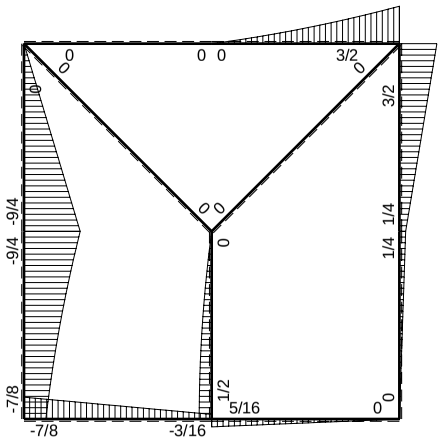






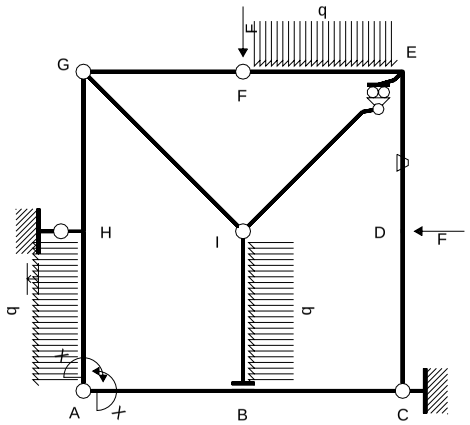


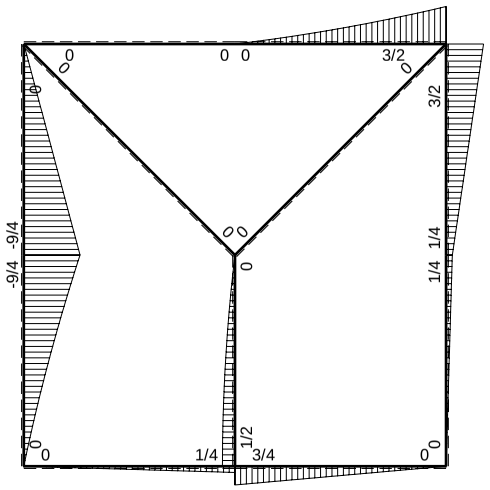




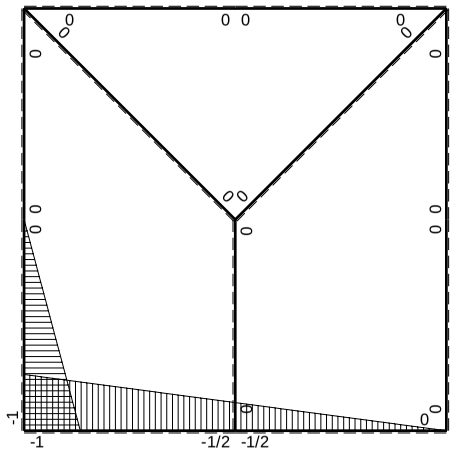


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 274782 CI04.xxxx.136

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PROCEDIMENTO E RISULTATI 274782 CI04.xxxx.136

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	Fb/EJ	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b\ )\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b\ )\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2\ )\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b (-1/4\ x/b + 1/8\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/8\ x^2/b + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b (-1/8 + 1/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-1/8\ x + 1/24\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b + 1/24\ b\ )\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b (-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-3/8\ b + 3/8\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-3/8\ x^2/b^2\ )\ Fb\ 1/EJ\ dx = [-1/8\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/8\ b\ )\ Fb\ 1/EJ\ = -1/8\ Fb^2/EJ$

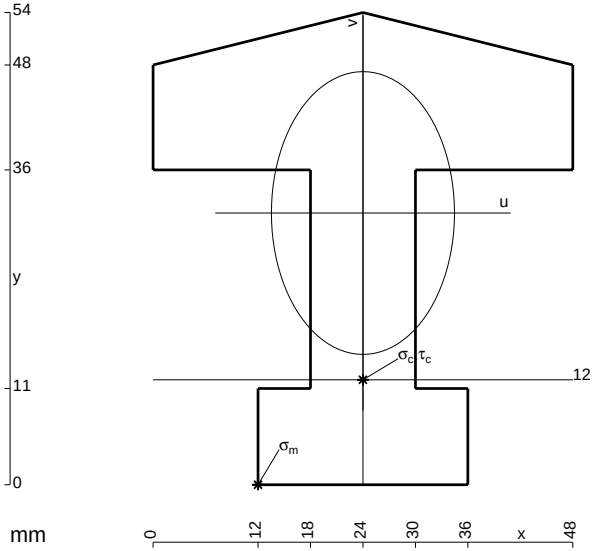
$L^{Xo}_{HA} = \int_o^b (9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (9/8\ b - 11/12\ b + 1/8\ b\ )\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

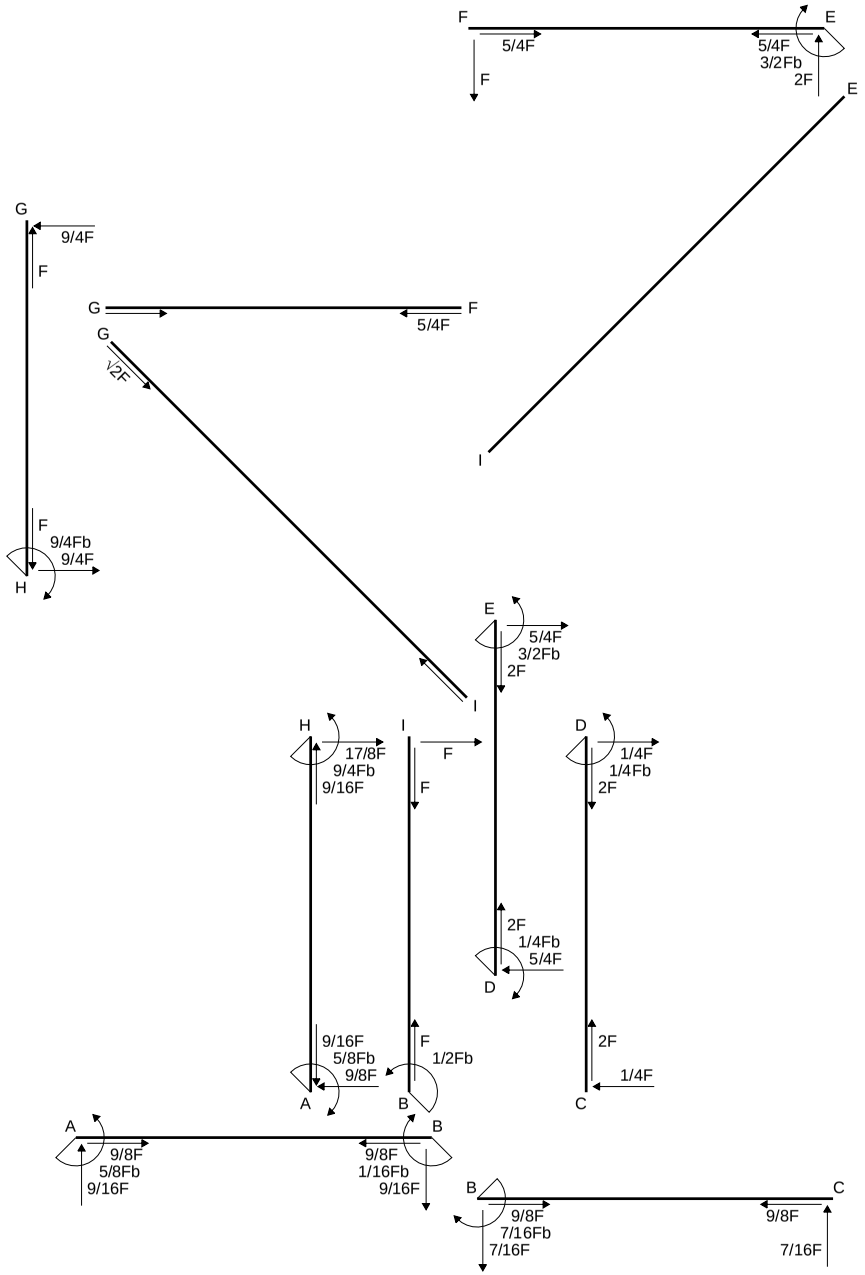
$L^{Xo}_{AH} = \int_o^b (7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

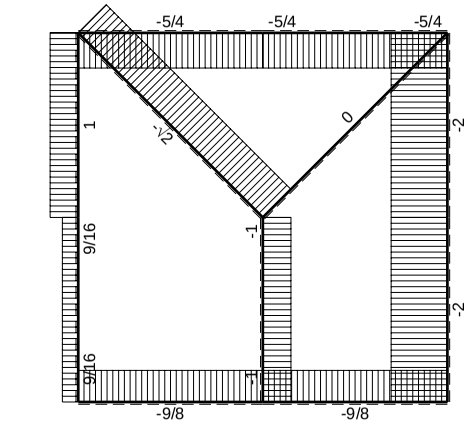
$= (7/8\ b - 5/12\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

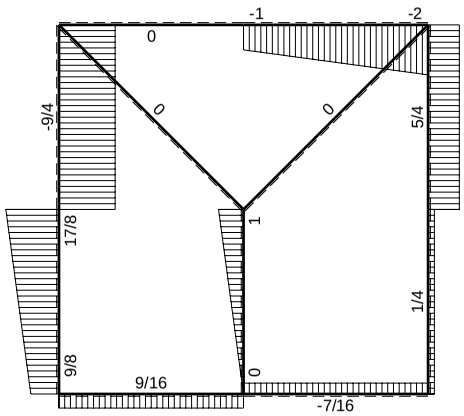
PROCEDIMENTO E RISULTATI 274782 CI04.xxxx.136



A = 1284. mm^2
J_u = 335702. mm^4
J_v = 140688. mm^4
y_g = 31.07 mm
N = 1260. N
T_y = -2835. N
M_x = -2268000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -31.07 mm
$\sigma_m = N/A - Mv/J_u$ = -208.9 N/mm^2
x_c = 24. mm
y_c = 12. mm
v_c = -19.07 mm
$\sigma_c = N/A - Mv/J_u$ = -127.9 N/mm^2
τ_c = 4.916 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 128.1 N/mm^2
S^* = 6985. mm^3

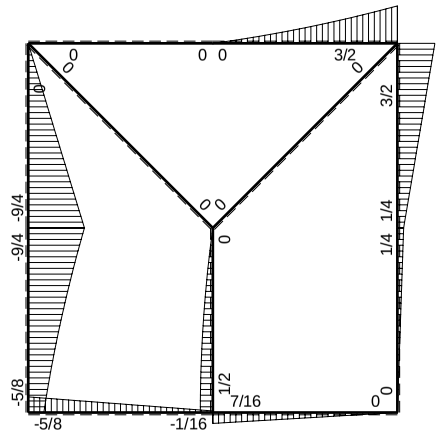

F
5/4F
E
5/4F
3/2Fb
2F
F
E
G
9/4F
F
G
F
5/4F
G
½F
I
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
I
H
17/8F
9/4Fb
9/16F
I
F
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
9/16F
5/8Fb
9/8F
A
F
1/2Fb
B
2F
1/4F
C
A
9/8F
5/8Fb
9/16F
B
9/8F
1/16Fb
9/16F
B
9/8F
7/16Fb
7/16F
C
9/8F
7/16F


-5/4
-5/4
-5/4
1
-½
0
-2
-2
9/16
-1
-1
9/16
-1
-9/8
-9/8

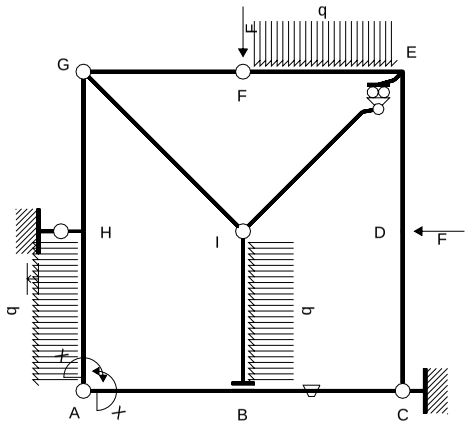

0
-1
-2
-9/4
0
0
5/4
1
17/8
1/4
9/8
9/16
0
-7/16

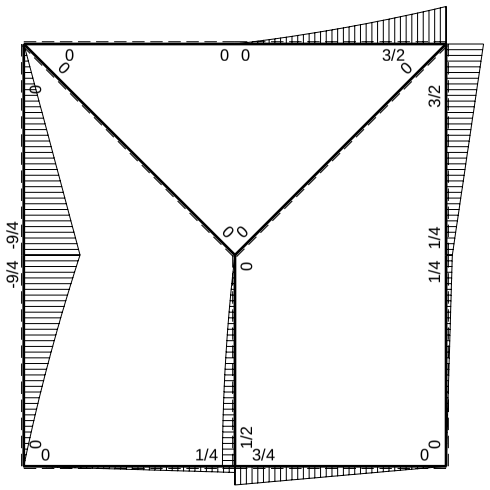
F

F

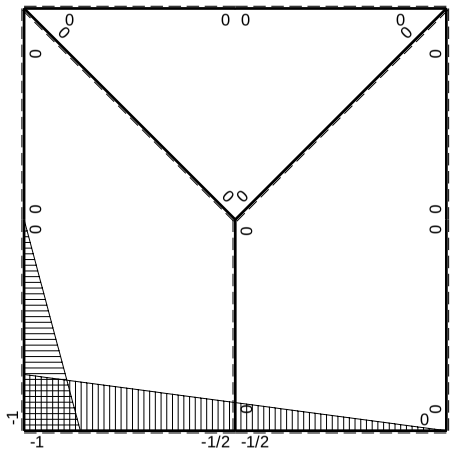

0
0 0
3/2
0
0
3/2
0 0
-9/4
-9/4
1/4
1/4
0
-5/8
1/2
7/16
0
0
-5/8
-1/16

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264070 CI04.xxxx.137

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PROCEDIMENTO E RISULTATI 264070 CI04.xxxx.137

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	-Fb/EJ	$-3/8Fb+3/4Fx-3/8Fx^2/b$	$1/2Fb/EJ-1/2Fx/EJ$	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	Fb/EJ	$-3/8Fx^2/b$	1/2Fx/EJ	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1/2 - 1/2\ x/b\ \right)\ \theta\ \ dx$

$= \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x - 1/4\ x^2/b\right]_o^b\ \theta$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2\ x/b\ \right)\ \theta\ \ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/4\ b\ \right)\ \theta\ \ = 1/8\ \ Fb^2/EJ$

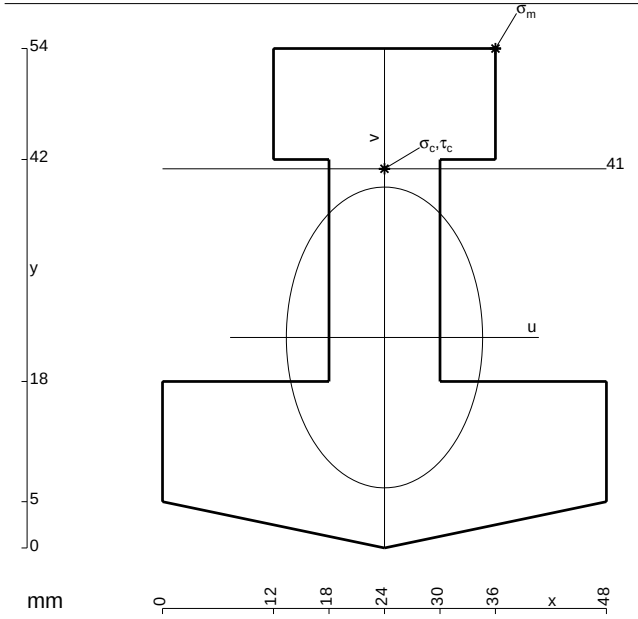
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

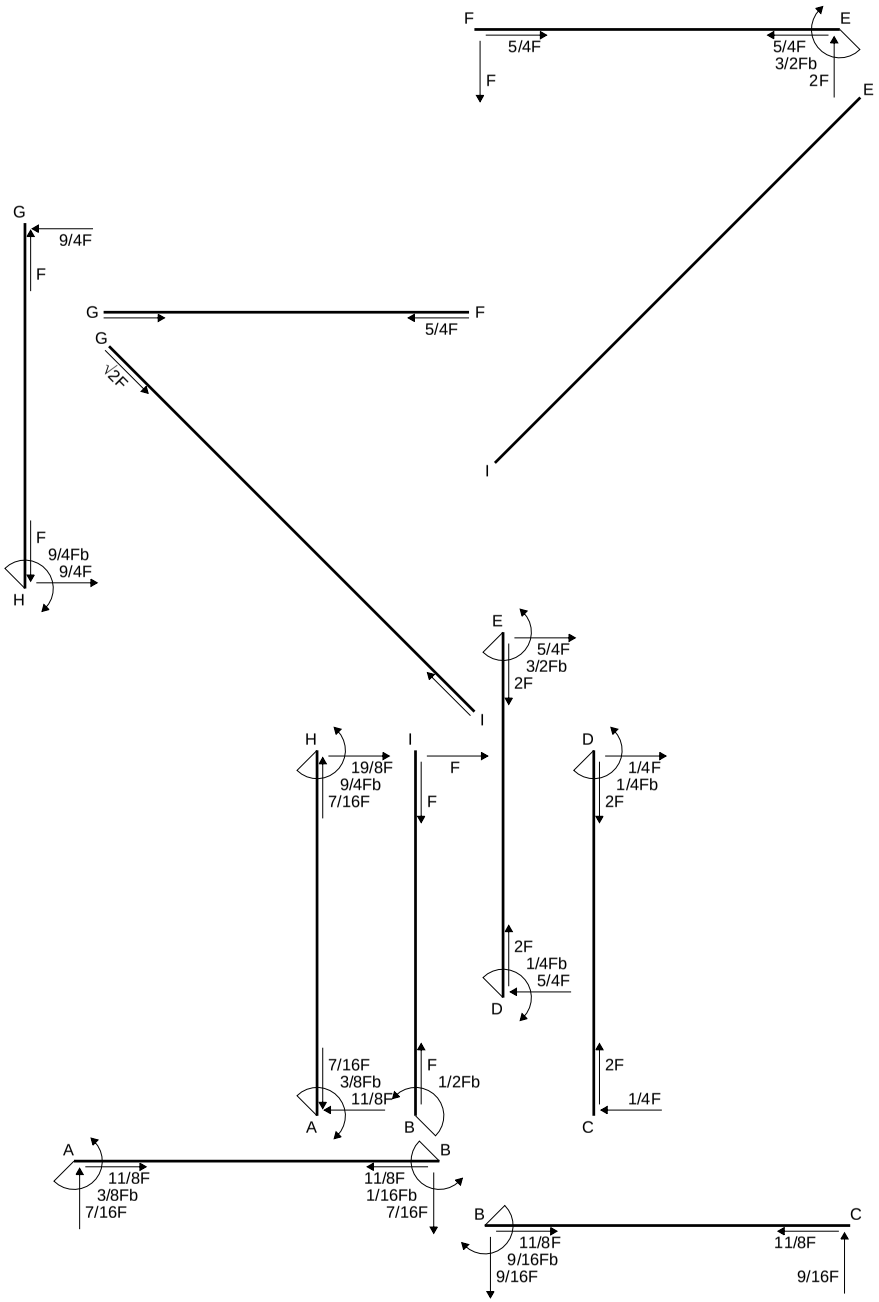
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

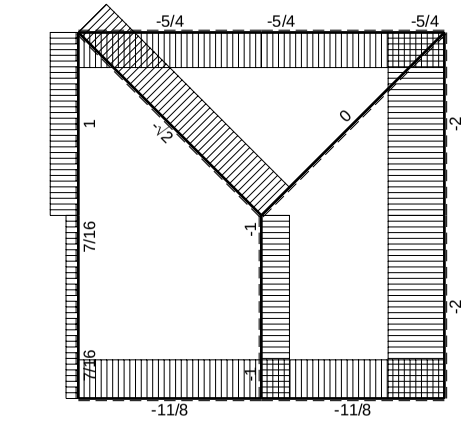
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

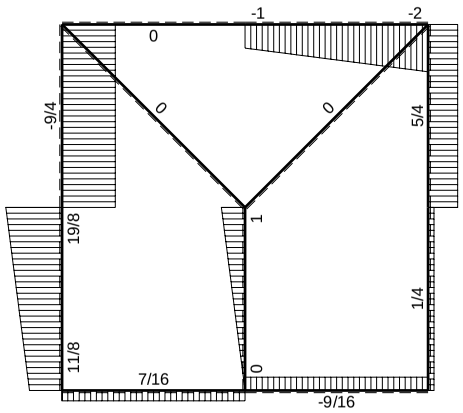
PROCEDIMENTO E RISULTATI 264070 CI04.xxxx.137



A = 1320. mm^2
J_u = 349206. mm^4
J_v = 148608. mm^4
y_g = 22.76 mm
N = 1280. N
T_y = -2880. N
M_x = -2448000. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 31.24 mm
$\sigma_m = N/A - Mv/J_u$ = 220. N/mm^2
x_c = 24. mm
y_c = 41. mm
v_c = 18.24 mm
$\sigma_c = N/A - Mv/J_u$ = 128.9 N/mm^2
τ_c = 5.151 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 129.2 N/mm^2
S^* = 7495. mm^3

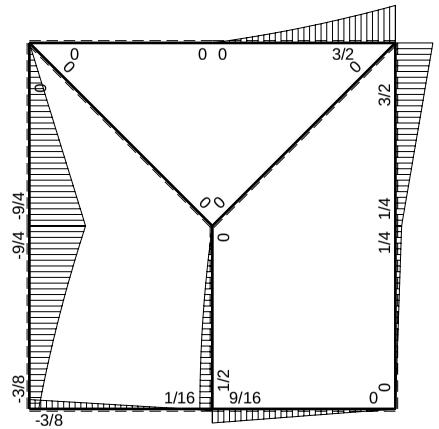

F
5/4F
F
E
5/4F
3/2Fb
2F
E
G
9/4F
F
G
F
5/4F
G
√2F
I
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
I
H
19/8F
9/4Fb
7/16F
I
F
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
7/16F
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11/8F
F
1/2Fb
A
B
2F
1/4F
C
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B
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3/8Fb
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1/16Fb
7/16F
B
C
11/8F
9/16Fb
9/16F
11/8F
9/16F


-5/4
-5/4
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7/16
-1
7/16
-1
-11/8
-11/8

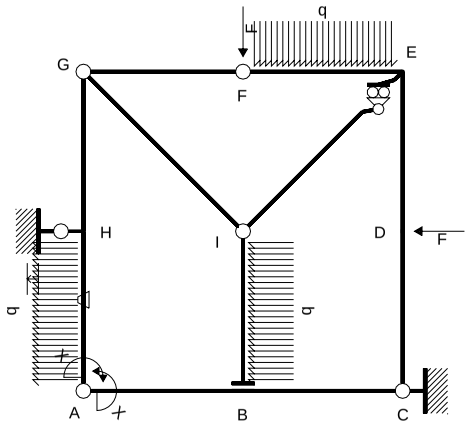

0
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0
0
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19/8
1
1/4
11/8
7/16
0
-9/16

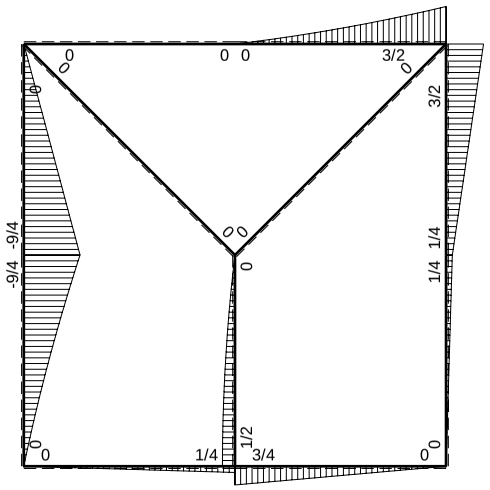
←□→ F

↑□↓ F

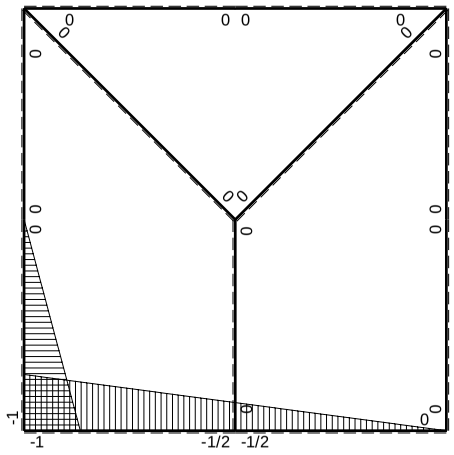

0
0 0
3/2
0
0
3/2
0 0
0
-9/4
-9/4
1/4
1/4
0
-3/8
1/16
-1/2
9/16
0
0
-3/8

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 310226 CI04.xxxx.138

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PROCEDIMENTO E RISULTATI 310226 CI04.xxxx.138

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	-Fb/EJ	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(1/3+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	Fb/EJ	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\ \theta\ \ dx$

$= \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b\ \theta$

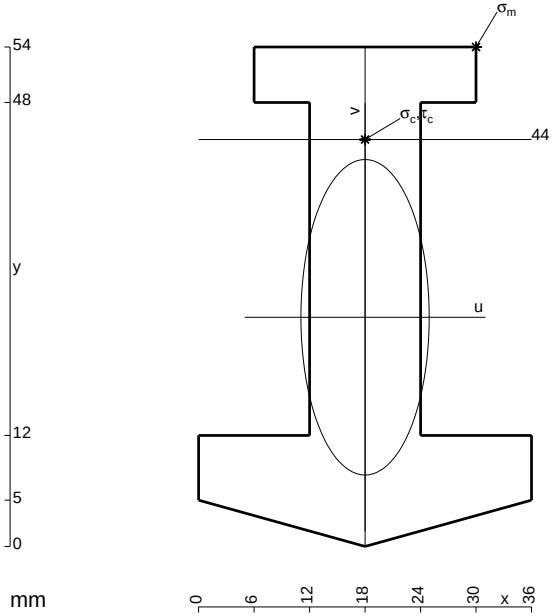
$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b\ \right)\ \theta\ \ = 5/6\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\ \theta\ \ dx$

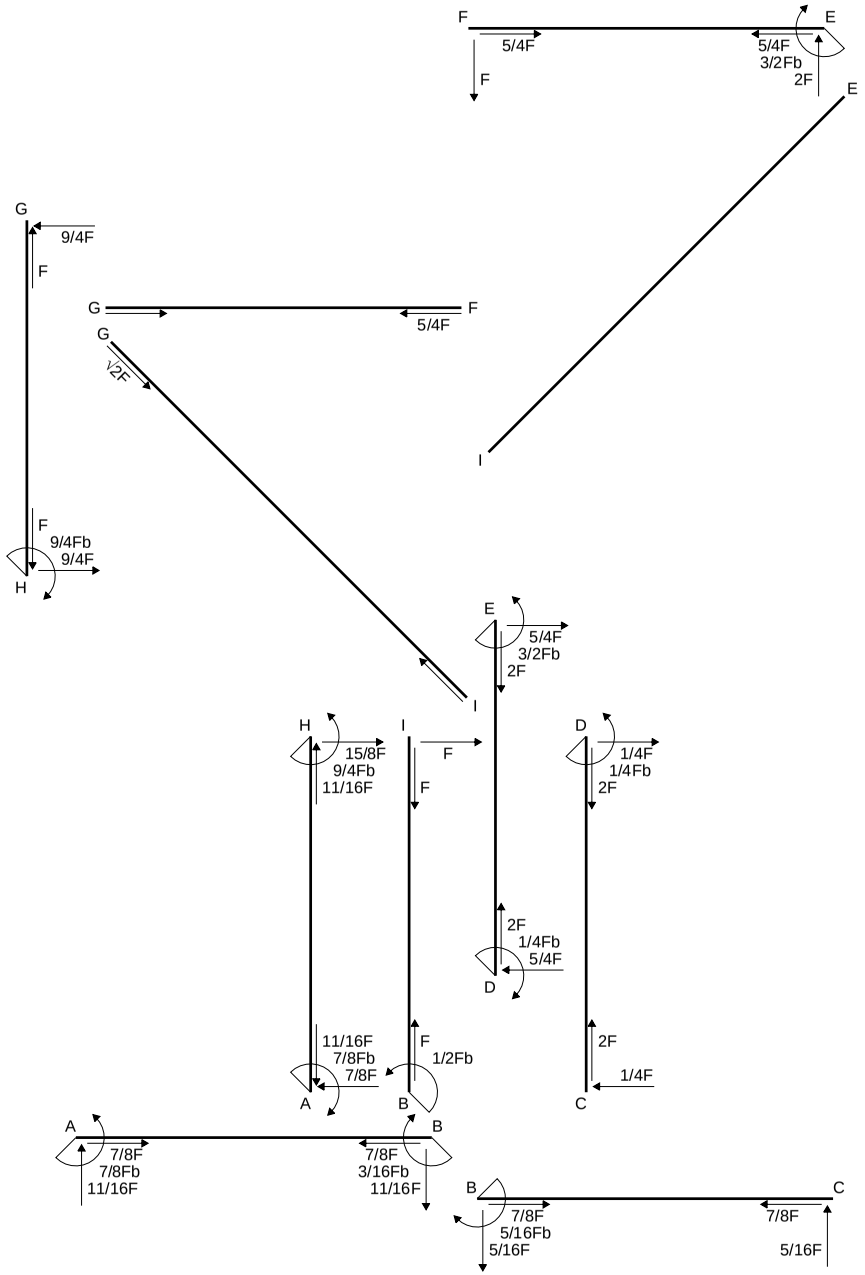
$= \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b\ \theta$

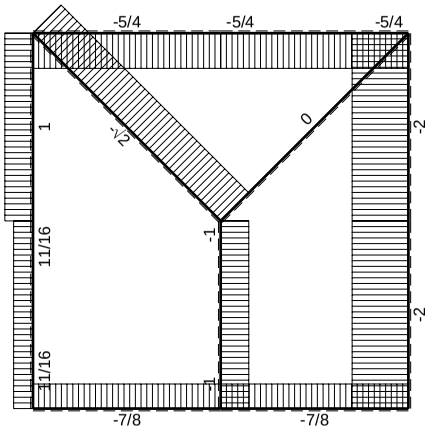
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\ \theta\ \ = 5/6\ \ Fb^2/EJ$

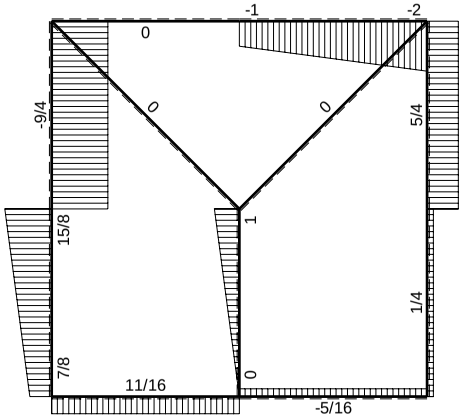
PROCEDIMENTO E RISULTATI 310226 CI04.xxxx.138

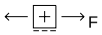


A = 918. mm^2
J_u = 267198. mm^4
J_v = 44172. mm^4
y_g = 24.78 mm
N = 1030. N
T_y = -2318. N
M_x = -2085750. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 29.22 mm
$\sigma_m = N/A - Mv/J_u$ = 229.2 N/mm^2
x_c = 18. mm
y_c = 44. mm
v_c = 19.22 mm
$\sigma_c = N/A - Mv/J_u$ = 151.2 N/mm^2
τ_c = 3.465 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 151.3 N/mm^2
S^* = 4795. mm^3

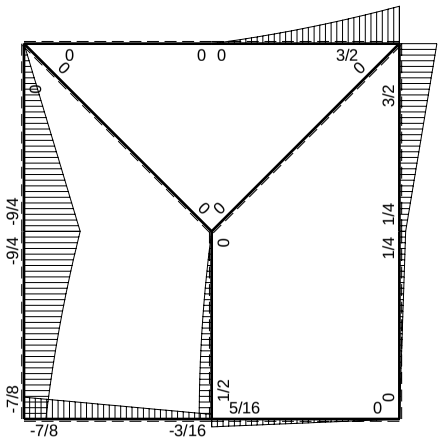

F
5/4F
E
5/4F
3/2Fb
2F
F
E
G
9/4F
F
G
F
5/4F
G
½F
I
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
I
H
15/8F
9/4Fb
11/16F
I
F
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
F
1/2Fb
2F
1/4F
A
B
C
A
B
7/8F
7/8Fb
11/16F
7/8F
3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
-5/4
-5/4
1
½
0
-2
-1
11/16
-2
11/16
-1
-7/8
-7/8

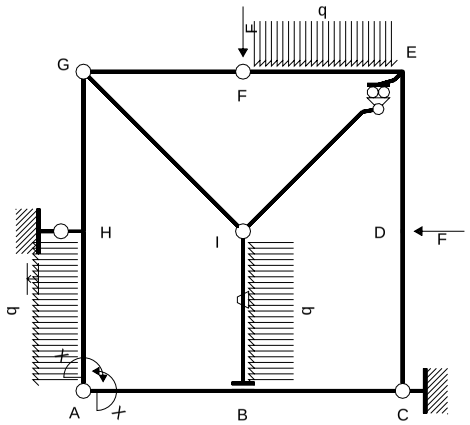

-1
-2
0
-9/4
0
0
5/4
1
15/8
1/4
7/8
0
11/16
-5/16

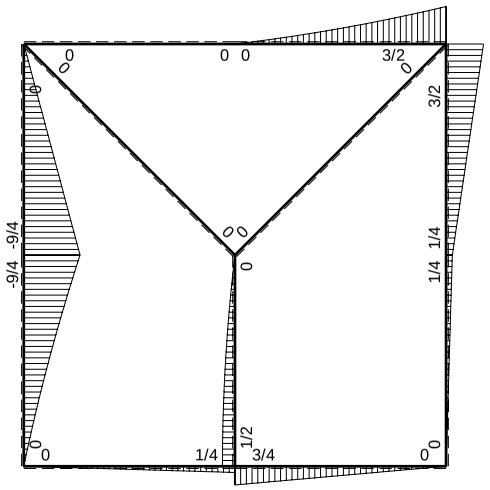

F


F

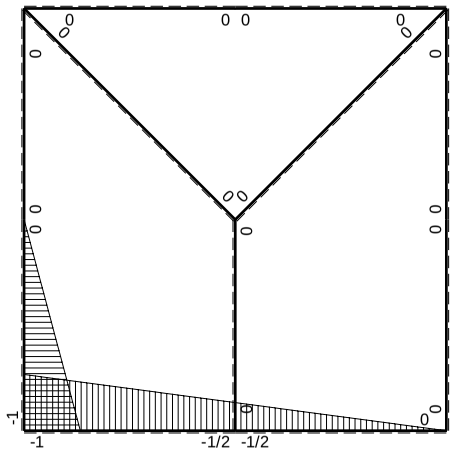

0
0 0
3/2
0
0
3/2
-9/4
0
0
-9/4
-9/4
0
1/4
1/4
1/4
-7/8
1/2
5/16
0
0
-7/8
-3/16


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

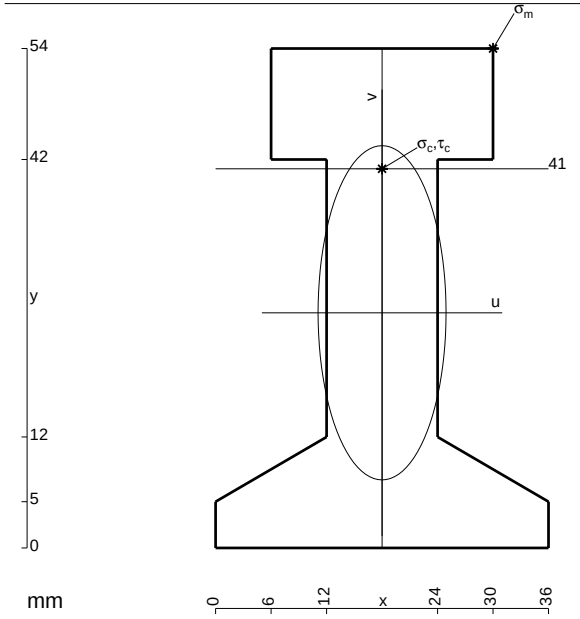
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

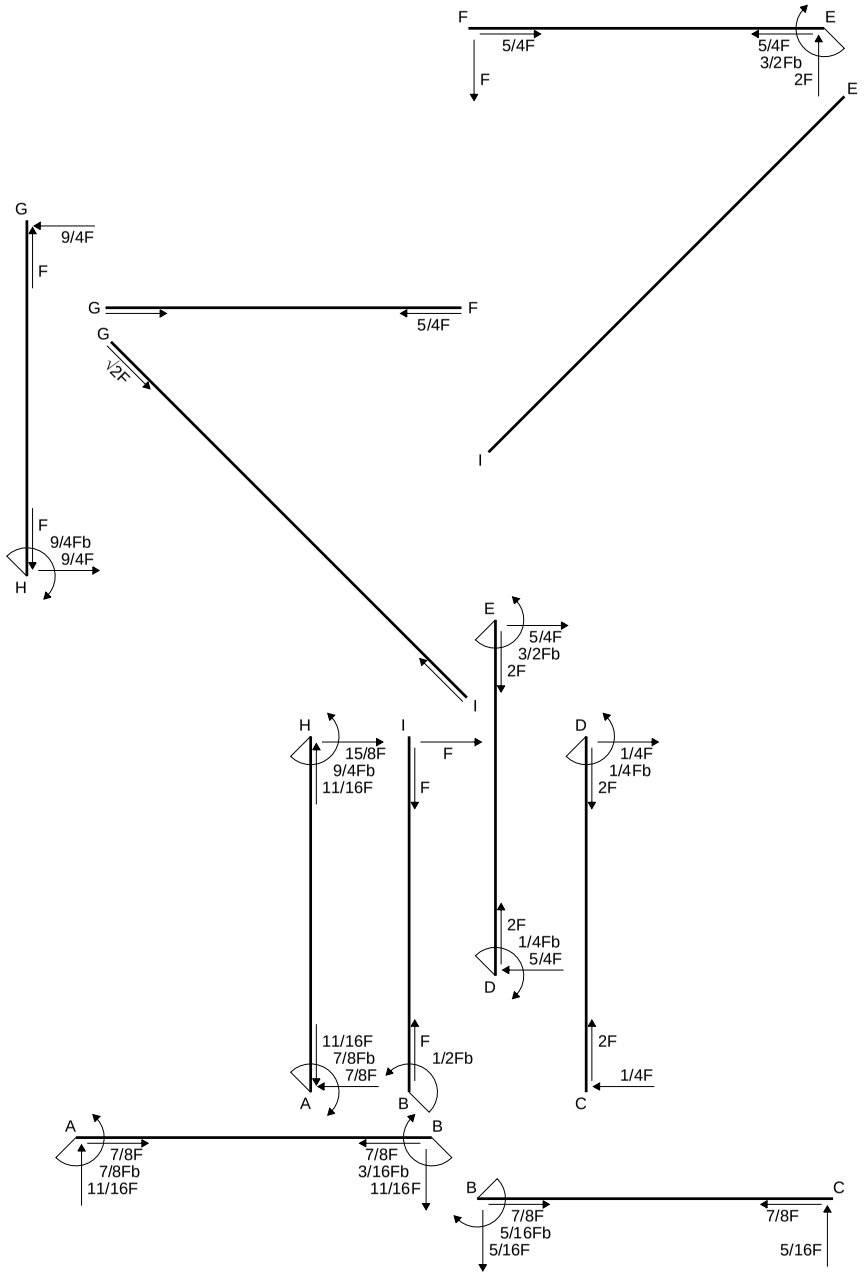
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

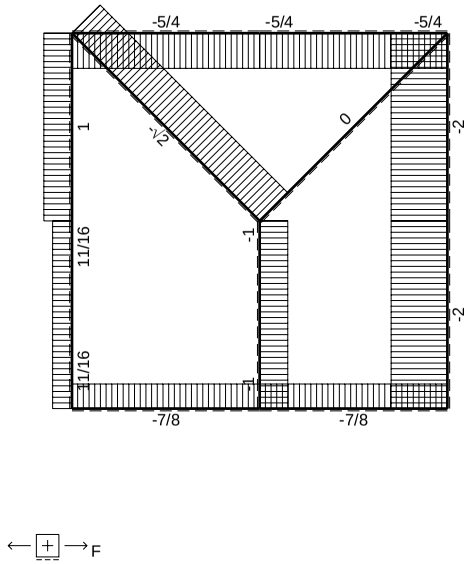
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

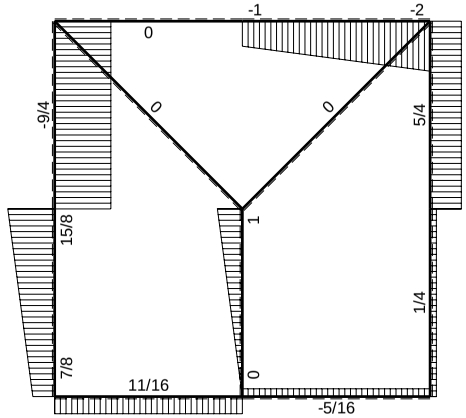
PROCEDIMENTO E RISULTATI 263941 CI04.xxxx.139



A = 996. mm^2
J_u = 325226. mm^4
J_v = 47664. mm^4
y_g = 25.43 mm
N = 1270. N
T_y = -2858. N
M_x = -2714630. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 28.57 mm
$\sigma_m = N/A - Mv/J_u$ = 239.8 N/mm^2
x_c = 18. mm
y_c = 41. mm
v_c = 15.57 mm
$\sigma_c = N/A - Mv/J_u$ = 131.3 N/mm^2
τ_c = 4.901 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 131.5 N/mm^2
S^* = 6694. mm^3

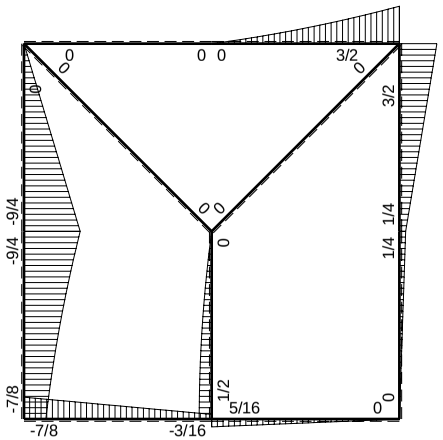

F
5/4F
E
5/4F
3/2Fb
2F
F
E
G
9/4F
F
G
F
5/4F
G
1/2F
I
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
I
H
15/8F
9/4Fb
11/16F
I
F
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
F
1/2Fb
2F
1/4F
A
B
C
A
B
7/8F
7/8Fb
11/16F
7/8F
3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
-5/4
-5/4
1
1/2
0
-2
-1
11/16
-2
11/16
-1
-7/8
-7/8

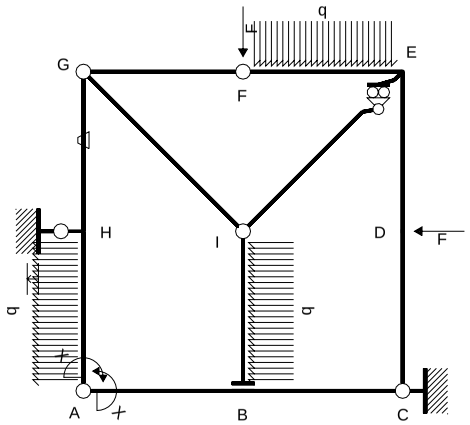

-1
-2
0
-9/4
0
0
5/4
1
15/8
1/4
7/8
0
11/16
-5/16

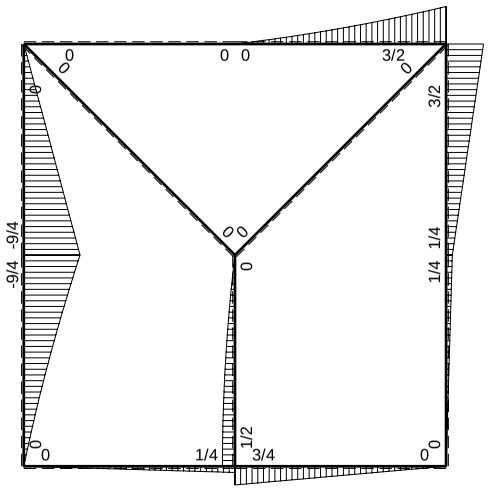
F

F

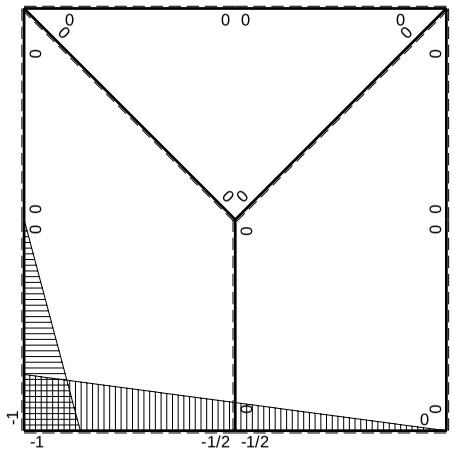

0
0 0
3/2
0
0
3/2
-9/4
0
0
-9/4
1/4
1/4
0
-7/8
1/2
5/16
0
0
-7/8
-3/16

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 218194 CI04.xxxx.140

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	-Fb/EJ	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

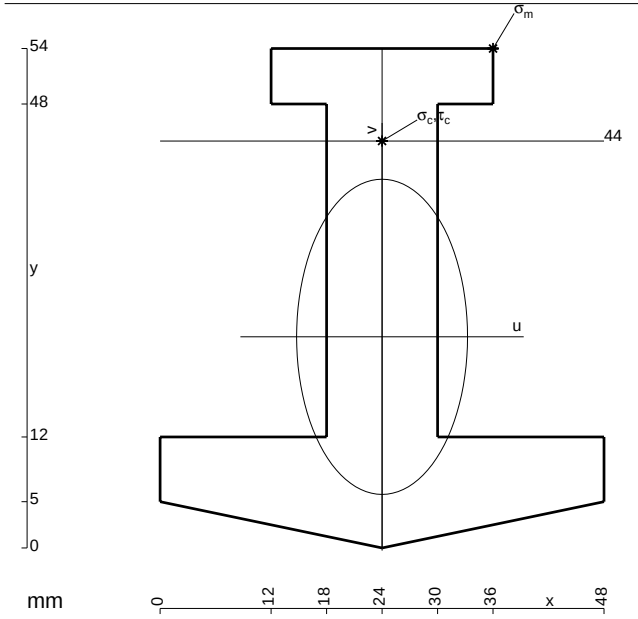
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

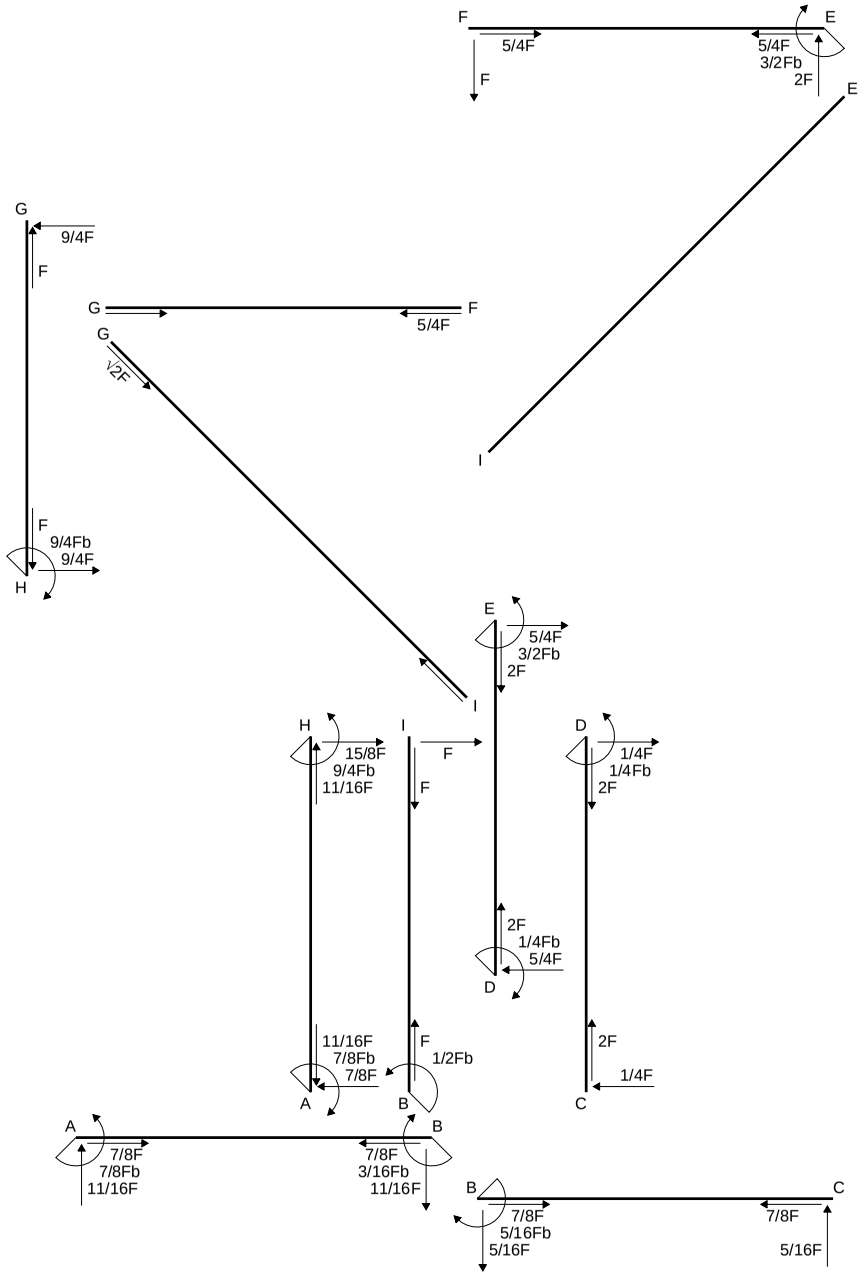
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

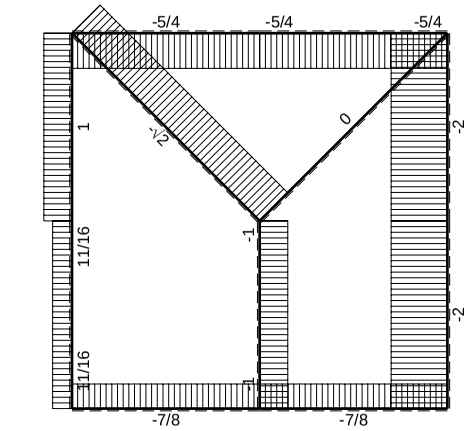
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

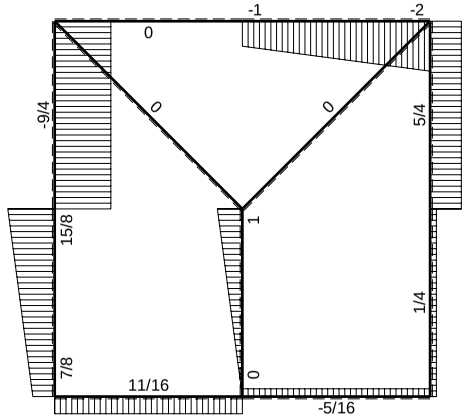
PROCEDIMENTO E RISULTATI 218194 CI04.xxxx.140



A = 1032. mm^2
J_u = 299718. mm^4
J_v = 88128. mm^4
y_g = 22.83 mm
N = 1690. N
T_y = -3803. N
M_x = -1901250. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 31.17 mm
$\sigma_m = N/A - Mv/J_u$ = 199.4 N/mm^2
x_c = 24. mm
y_c = 44. mm
v_c = 21.17 mm
$\sigma_c = N/A - Mv/J_u$ = 135.9 N/mm^2
τ_c = 5.465 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 136.3 N/mm^2
S^* = 5169. mm^3

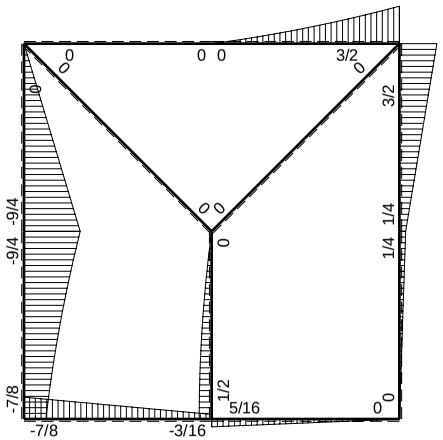

F
5/4F
E
5/4F
3/2Fb
2F
F
E
G
9/4F
F
G
F
5/4F
G
√2F
I
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
I
H
15/8F
9/4Fb
11/16F
I
F
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
A
F
1/2Fb
B
2F
1/4F
C
A
7/8F
7/8Fb
11/16F
B
7/8F
3/16Fb
11/16F
B
7/8F
5/16Fb
5/16F
C
7/8F
5/16F


-5/4
-5/4
-5/4
1
√2
0
-2
-1
11/16
-2
11/16
-1
-7/8
-7/8

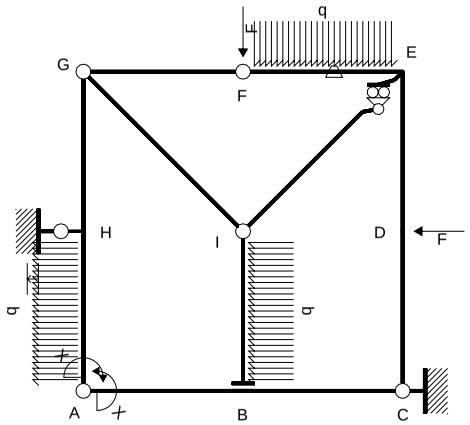

-1
-2
0
-9/4
0
0
5/4
15/8
1
1/4
7/8
0
11/16
-5/16

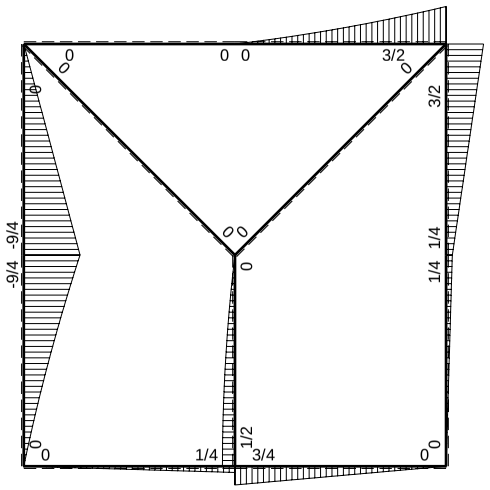
←+→ F

↑+↓ F

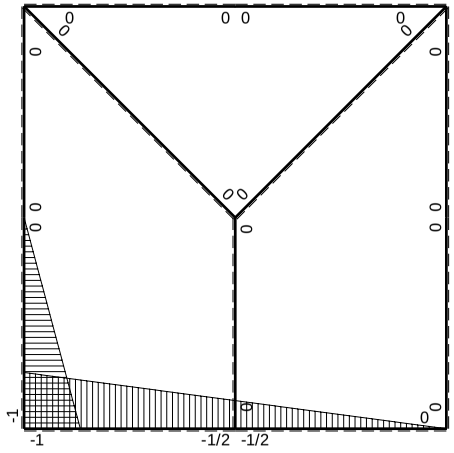

0
0 0
3/2
0
0
3/2
0
0
-9/4
-9/4
0
-9/4
1/4
1/4
1/4
-7/8
1/2
5/16
0
0
-7/8
-3/16

↻+↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 218622 CI04.xxxx.141

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PROCEDIMENTO E RISULTATI 218622 CI04.xxxx.141

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	Fb/EJ	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$$

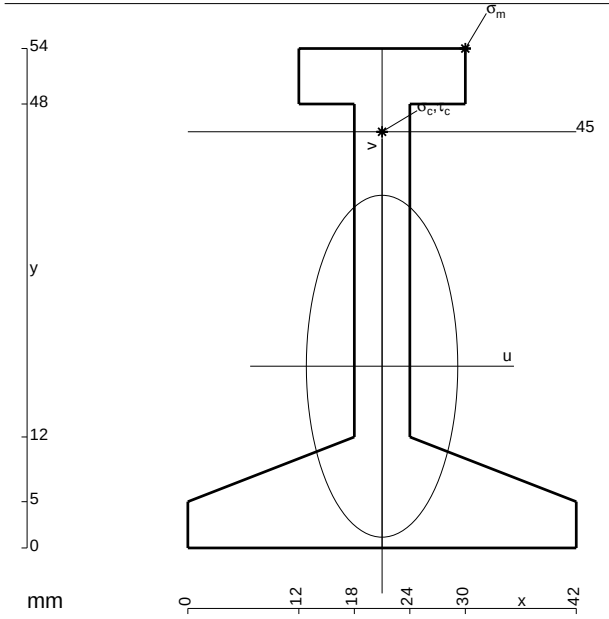
$$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

$$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

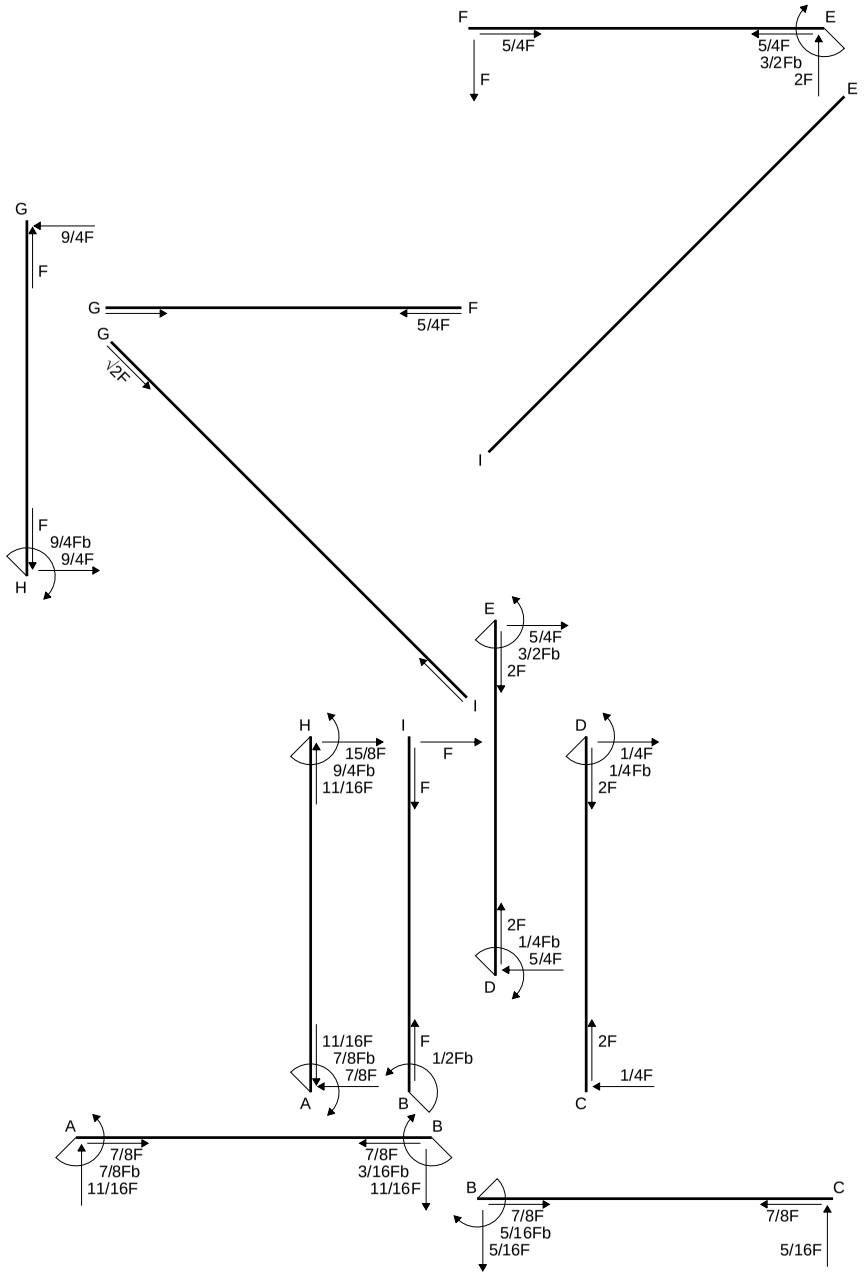
$$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

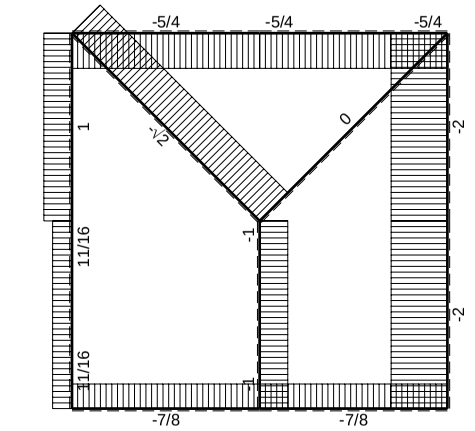
PROCEDIMENTO E RISULTATI 218622 CI04.xxxx.141

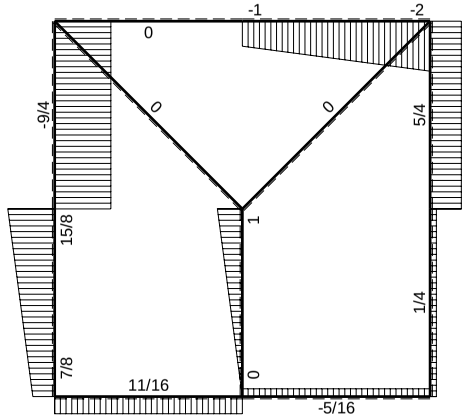


A = 702. mm^2
J_u = 239989. mm^4
J_v = 47034. mm^4
y_g = 19.65 mm
N = 1170. N
T_y = -2633. N
M_x = -1447880. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 9. mm
v_m = 34.35 mm
$\sigma_m = N/A - Mv/J_u$ = 208.9 N/mm^2
x_c = 21. mm
y_c = 45. mm
v_c = 25.35 mm
$\sigma_c = N/A - Mv/J_u$ = 154.6 N/mm^2
τ_c = 7.074 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 155.1 N/mm^2
S^* = 3869. mm^3

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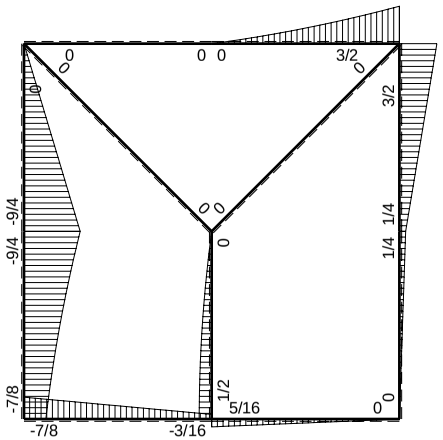

F
5/4F
E
5/4F
3/2Fb
2F
F
E
G
9/4F
F
G
F
5/4F
G
½F
I
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
I
H
15/8F
9/4Fb
11/16F
I
F
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
11/16F
7/8Fb
7/8F
F
1/2Fb
2F
1/4F
A
B
C
A
B
7/8F
7/8Fb
11/16F
7/8F
3/16Fb
11/16F
B
C
7/8F
5/16Fb
5/16F
7/8F
5/16F


-5/4
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½
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-2
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11/16
-2
11/16
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-7/8
-7/8

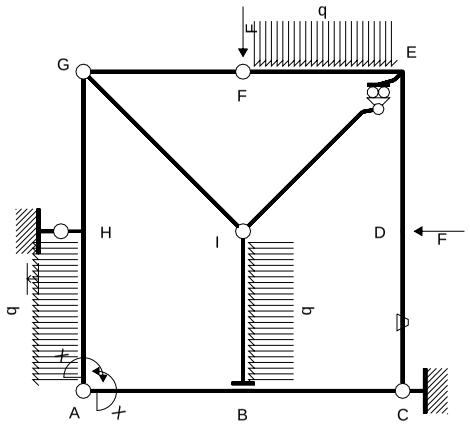

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-9/4
0
0
5/4
15/8
1
1/4
7/8
0
11/16
-5/16

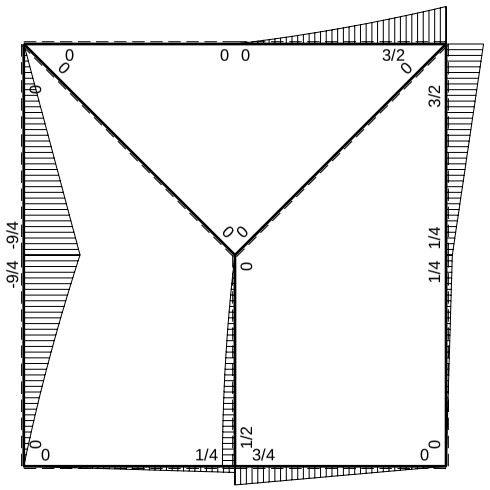
←+→ F

↑+↓ F

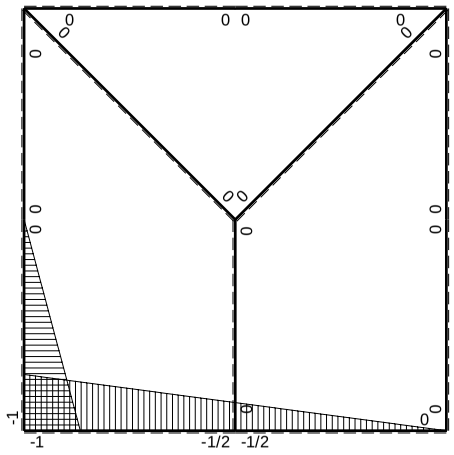

0
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3/2
0
0
3/2
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0
-9/4
-9/4
0
1/4
1/4
-9/4
0
1/2
5/16
0
0
-7/8
-7/8
-3/16

↻+↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/4Fx	0	$-1/4Fx+1/8Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/4Fb+1/4Fx$	0	$-1/8Fb+1/8Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	3/4Fb-3/4Fx	0	$-3/8Fb+3/4Fx-3/8Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/8+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-3/4Fx	0	$-3/8Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	-Fb/EJ	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	Fb/EJ	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	$Fx-1/2qx^2$	0	0	0	0	0+0	0
BI b	0	$-1/2Fb+1/2qx^2$	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/8Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/8Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/4\ x/b + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^2/b + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 + 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-3/8 + 3/4\ x/b - 3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x + 3/8\ x^2/b - 1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 3/8\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-3/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b\ \right)\ Fb\ 1/EJ\ = -1/8\ \ Fb^2/EJ$

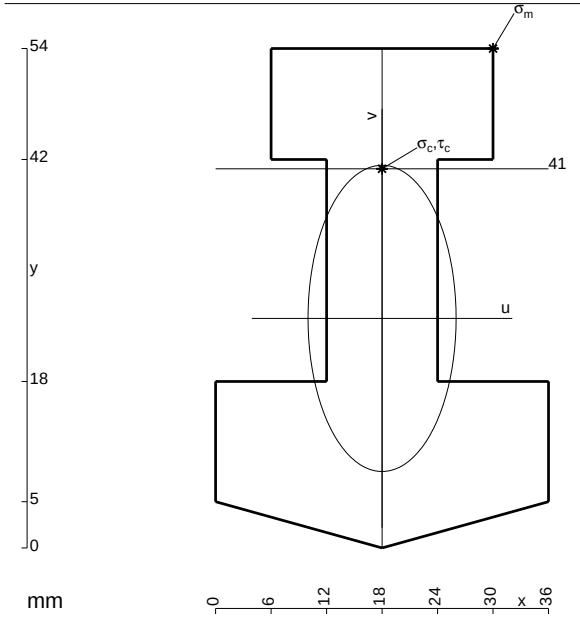
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

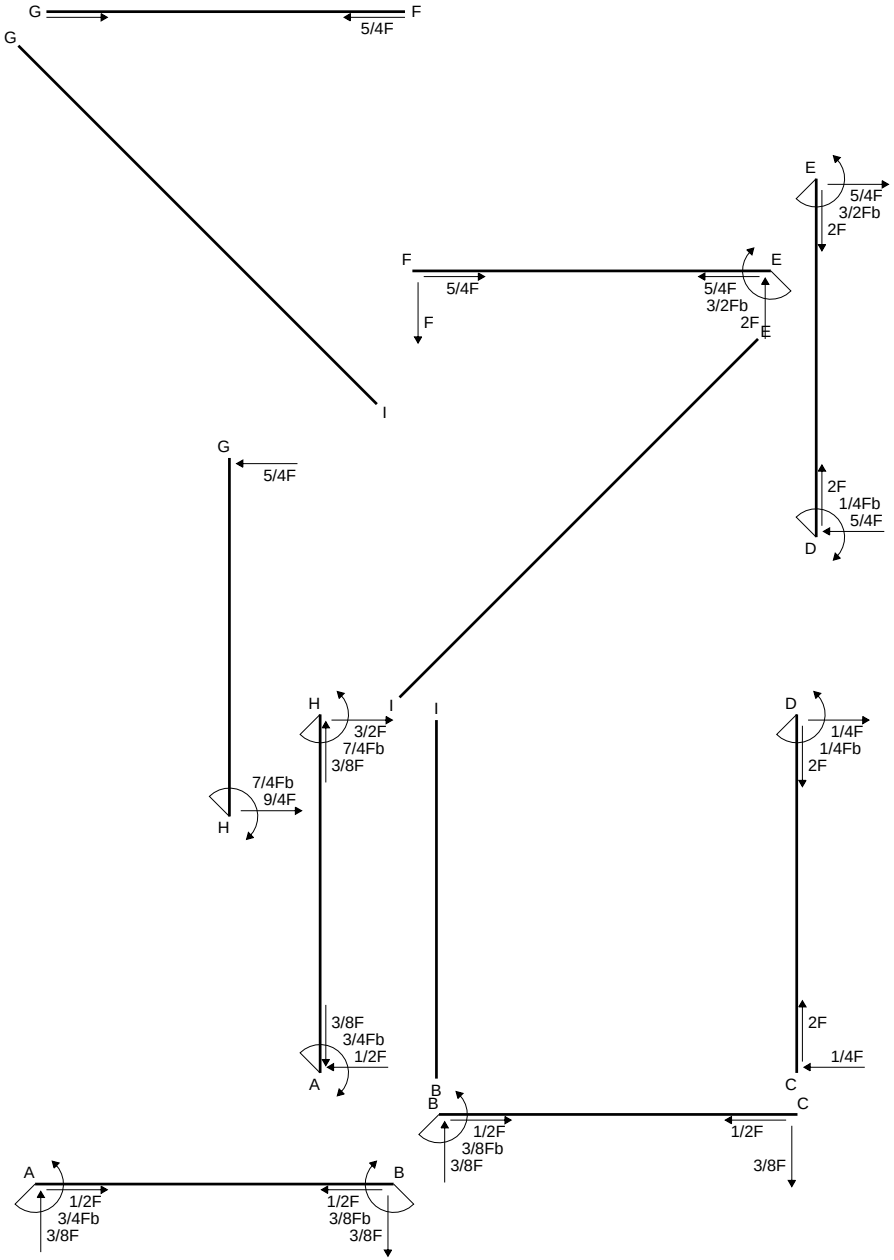
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

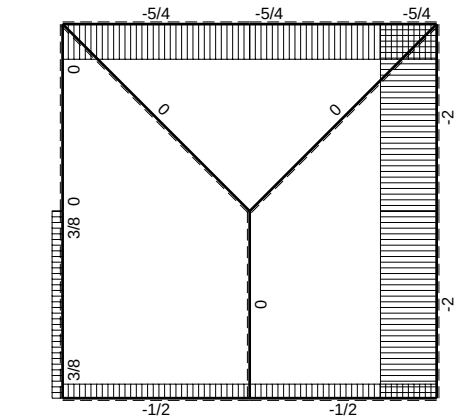
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

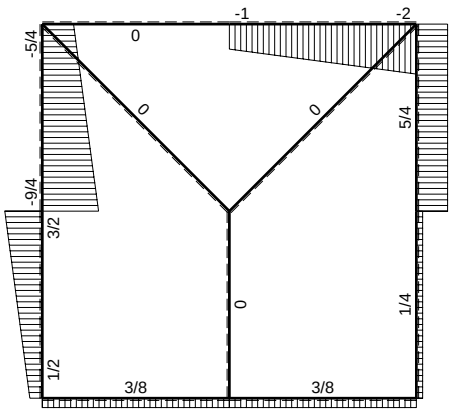
PROCEDIMENTO E RISULTATI 218087 CI04.xxxx.142



A = 1134. mm^2
J_u = 311054. mm^4
J_v = 72684. mm^4
y_g = 24.82 mm
N = 1720. N
T_y = -3870. N
M_x = -2322000. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 29.18 mm
$\sigma_m = N/A - Mv/J_u$ = 219.3 N/mm^2
x_c = 18. mm
y_c = 41. mm
v_c = 16.18 mm
$\sigma_c = N/A - Mv/J_u$ = 122.3 N/mm^2
τ_c = 7.129 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 122.9 N/mm^2
S^* = 6876. mm^3

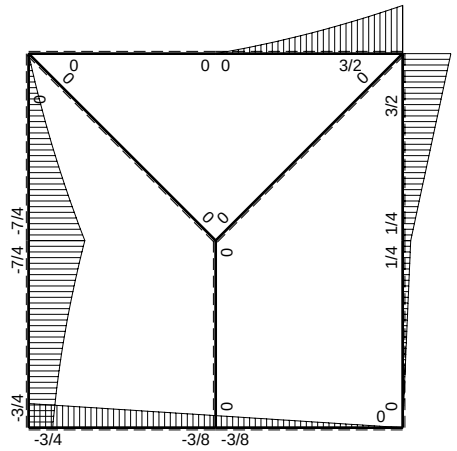

G
F
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G
I
E
5/4F
3/2Fb
2F
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5/4F
F
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5/4F
3/2Fb
2F
E
2F
1/4Fb
5/4F
D
G
5/4F
H
I
3/2F
7/4Fb
3/8F
7/4Fb
9/4F
H
I
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3/8Fb
3/8F


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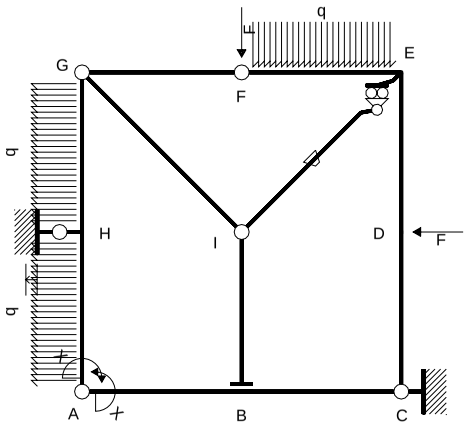

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3/8

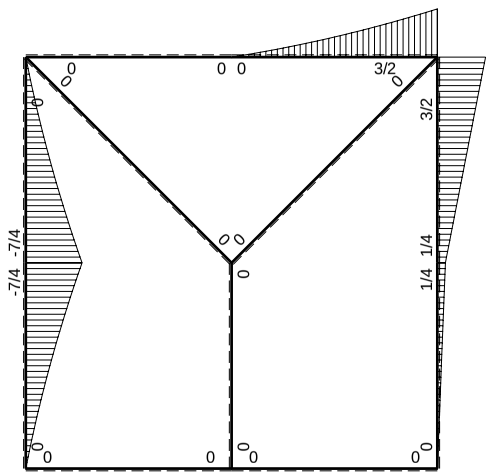
F

F

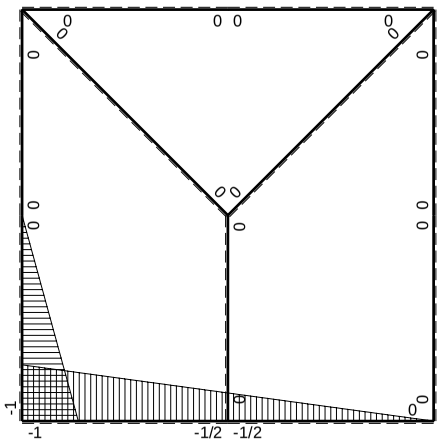

0
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3/2
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0
3/2
0
0
-7/4 -7/4
0
1/4 1/4
-3/4
0
0
0
-3/4
-3/8 -3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 249121 CI04.xxxx.143

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PROCEDIMENTO E RISULTATI 249121 CI04.xxxx.143

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

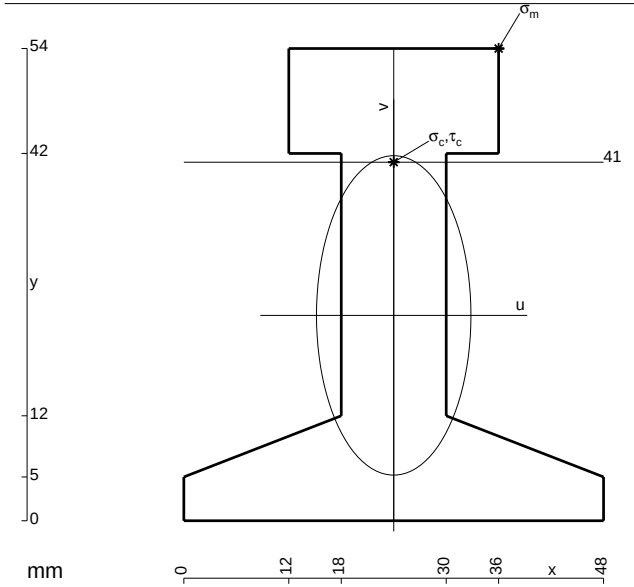
$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

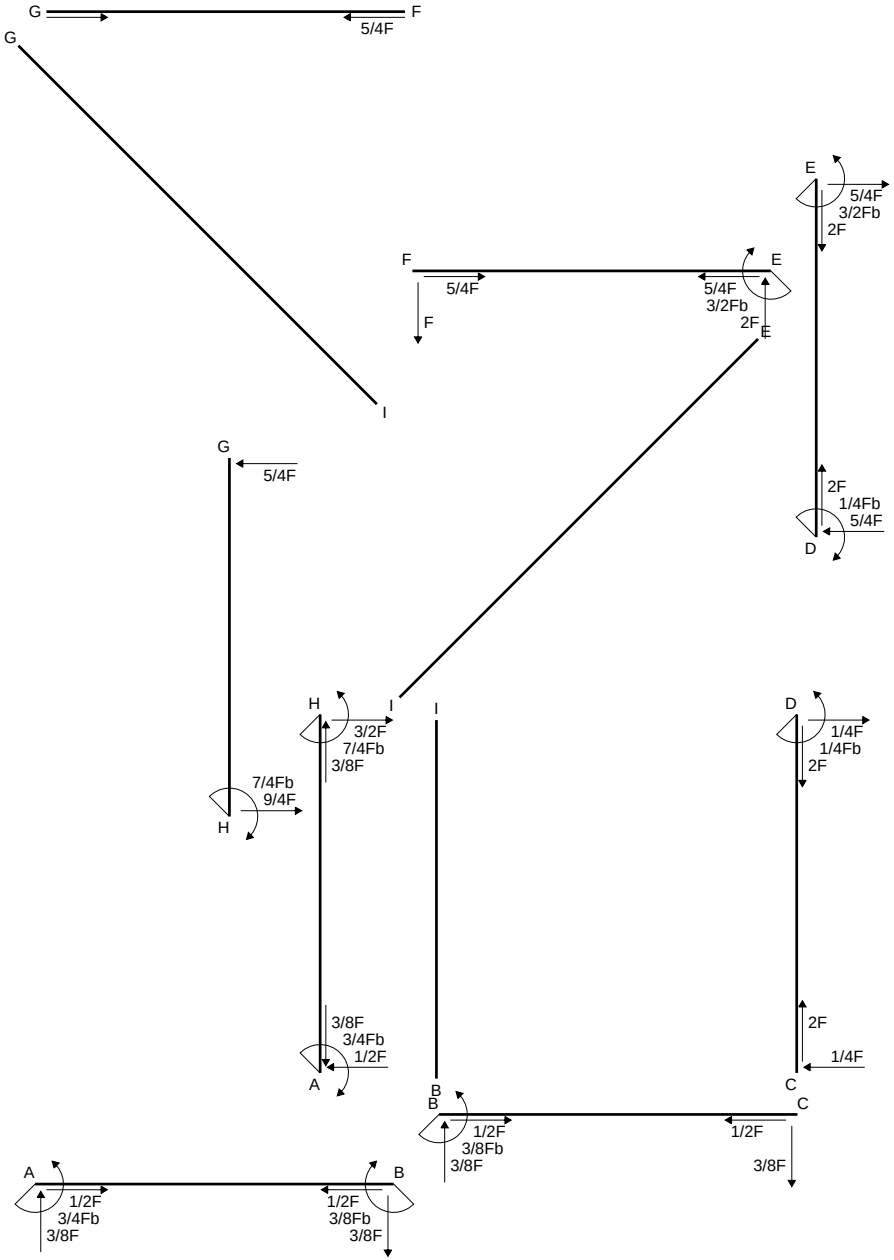
$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

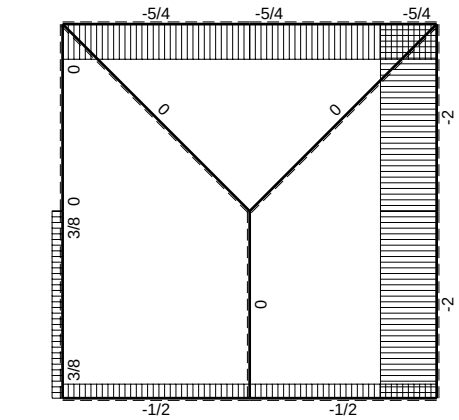
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

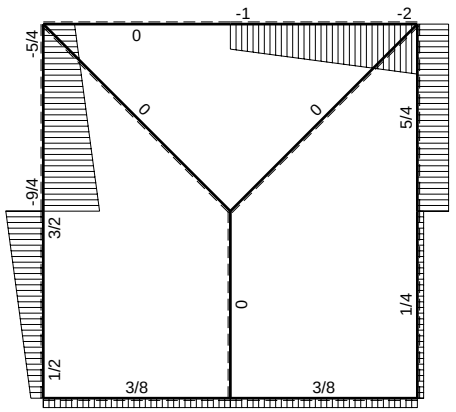
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$



A = 1098. mm^2
J_u = 366595. mm^4
J_v = 85644. mm^4
y_g = 23.48 mm
T_y = -5445. N
M_x = -2752750. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 30.52 mm
$\sigma_m = -Mv/J_u$ = 229.2 N/mm^2
x_c = 24. mm
y_c = 41. mm
v_c = 17.52 mm
$\sigma_c = -Mv/J_u$ = 131.6 N/mm^2
τ_c = 9.008 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 132.5 N/mm^2
S^* = 7278. mm^3

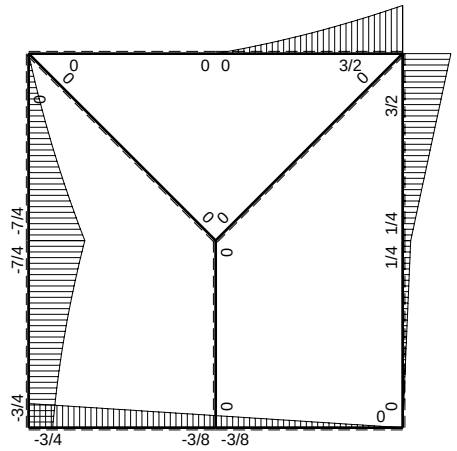

G
F
5/4F
G
I
E
5/4F
3/2Fb
2F
F
5/4F
F
5/4F
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2F
E
E
2F
1/4Fb
5/4F
D
G
5/4F
H
I
3/2F
7/4Fb
3/8F
7/4Fb
9/4F
H
I
D
1/4F
1/4Fb
2F
3/8F
3/4Fb
1/2F
A
2F
1/4F
B
C
B
C
1/2F
3/8Fb
3/8F
1/2F
3/8F
A
B
1/2F
3/4Fb
3/8F
1/2F
3/8Fb
3/8F


-5/4
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3/8
-1/2
-1/2

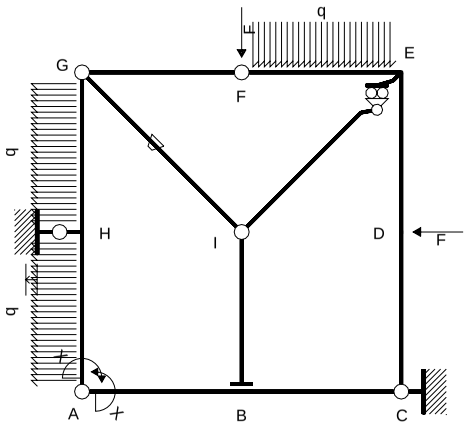

-1
-2
-5/4
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0
0
5/4
-9/4
3/2
0
1/4
1/2
3/8
3/8

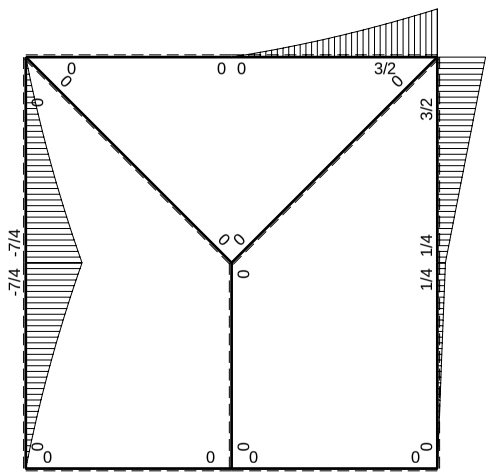
F

F

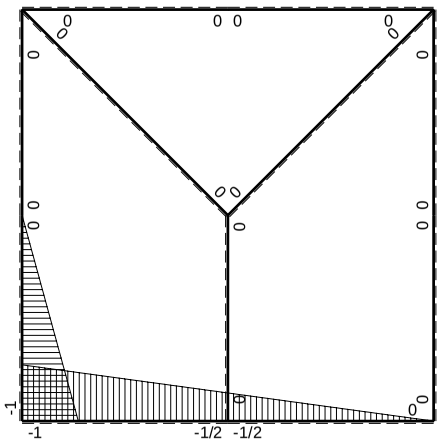

0
0 0
3/2
0
0
3/2
0
0
-7/4
-7/4
0
1/4
1/4
0
0
0
0
-3/4
-3/8
-3/8
-3/4

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 239853 CI04.xxxx.144

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

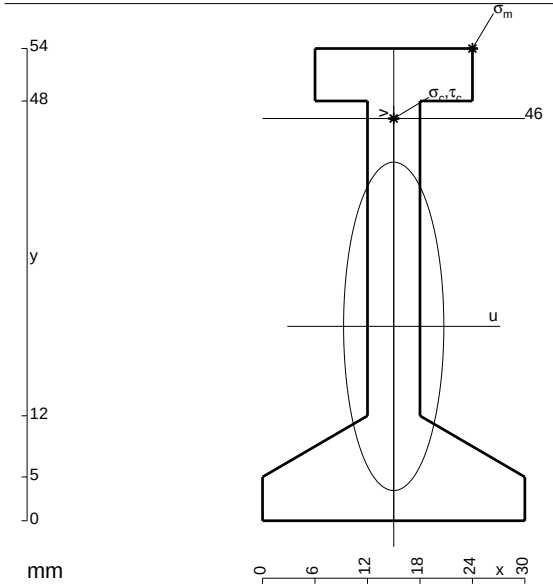
$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

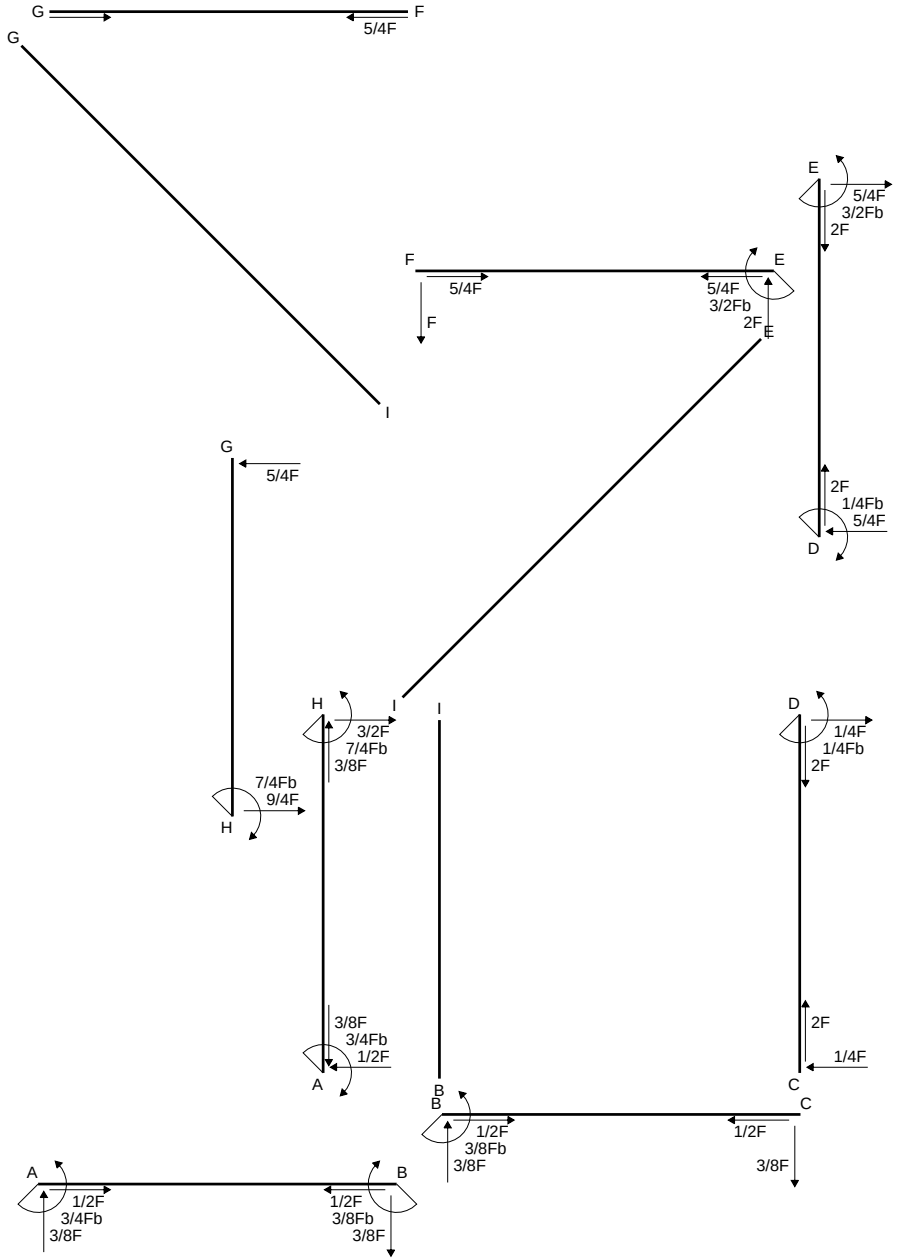
$= \left(7/8\ b - 3/4\ b + 1/8\ b\right) Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

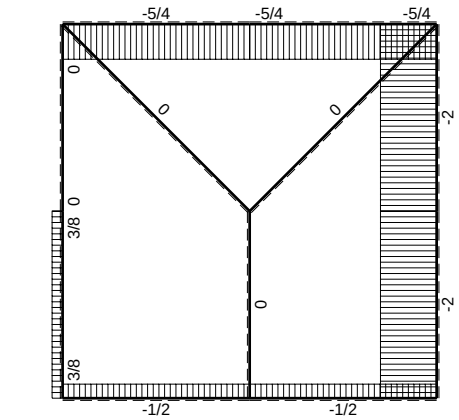
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

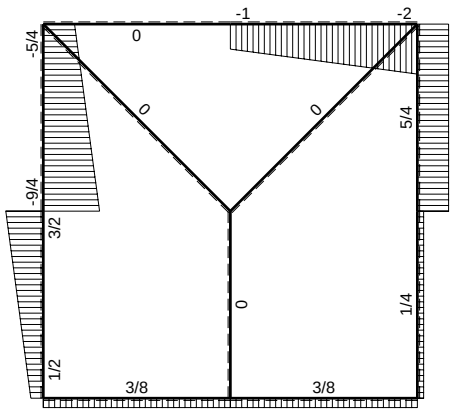
$= \left(5/8\ b - 1/4\ b - 1/8\ b\right) Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

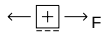


A = 600. mm^2
J_u = 211747. mm^4
J_v = 19728. mm^4
y_g = 22.23 mm
T_y = -2925. N
M_x = -1592500. Nmm
x_m = 24. mm
y_m = 54. mm
u_m = 9. mm
v_m = 31.77 mm
$\sigma_m = -Mv/J_u$ = 239. N/mm^2
x_c = 15. mm
y_c = 46. mm
v_c = 23.77 mm
$\sigma_c = -Mv/J_u$ = 178.8 N/mm^2
τ_c = 7.839 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 179.3 N/mm^2
S^* = 3405. mm^3

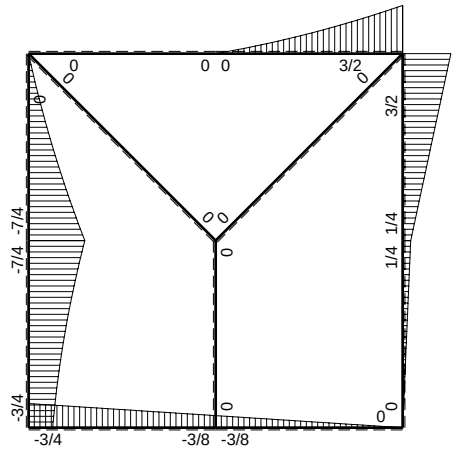






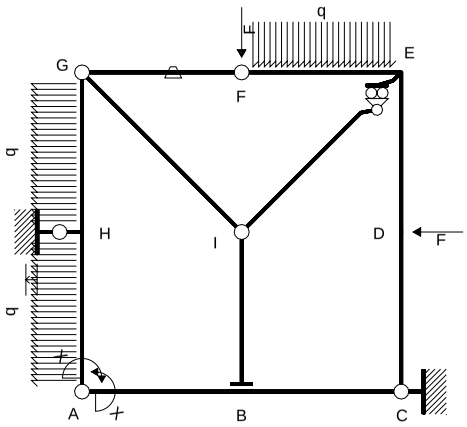


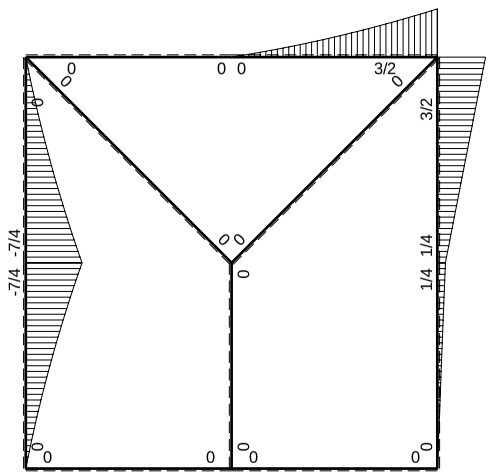




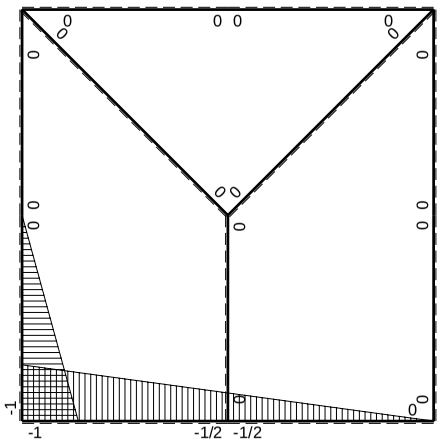


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 274905 CI04.xxxx.145

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PROCEDIMENTO E RISULTATI 274905 CI04.xxxx.145

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	-Fb/EJ	0	0	0	0+0	0
GF b	0	0	Fb/EJ	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

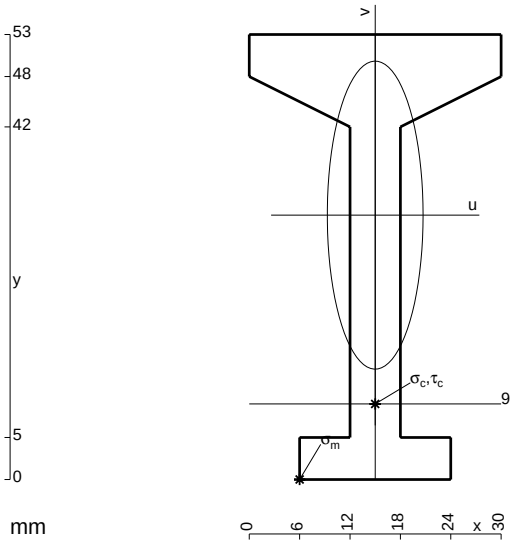
$L^{Xo}_{HA} = \int_o^b (7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (7/8\ b - 3/4\ b + 1/8\ b)\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b (5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

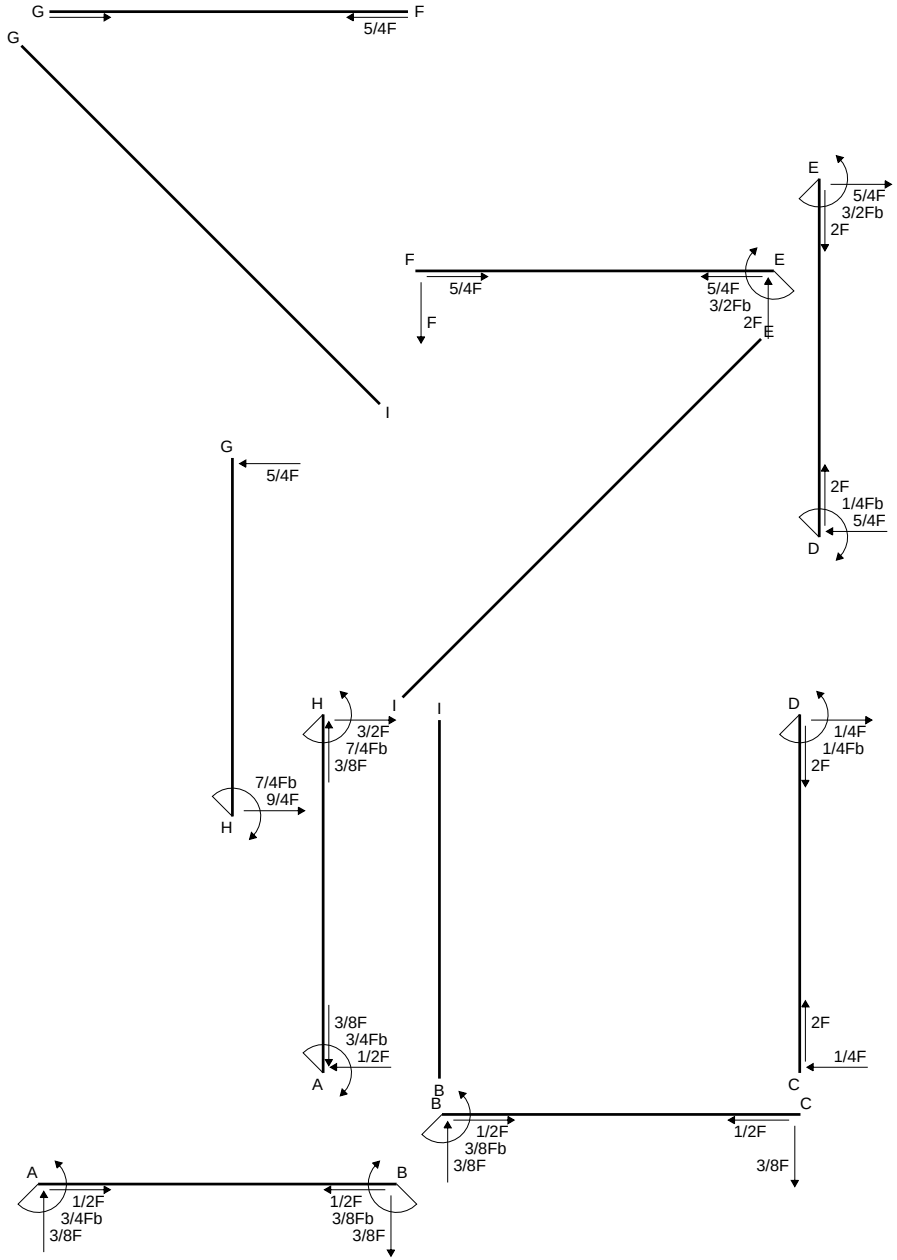
$= (5/8\ b - 1/4\ b - 1/8\ b)\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

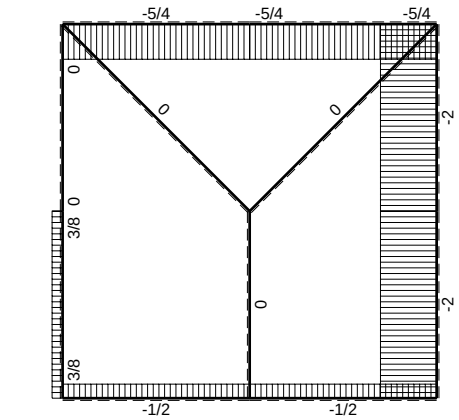
PROCEDIMENTO E RISULTATI 274905 CI04.xxxx.145

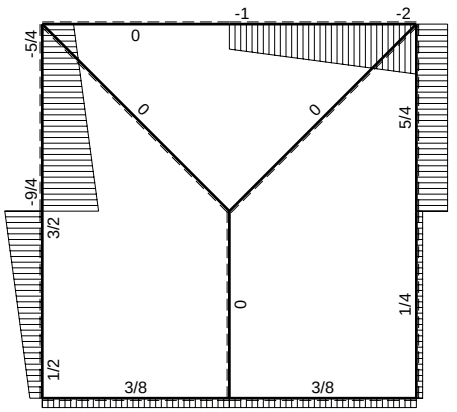


A = 570. mm^2
J_u = 191825. mm^4
J_v = 18558. mm^4
y_g = 31.49 mm
T_y = -2138. N
M_x = -1213630. Nmm
x_m = 6. mm
u_m = -9. mm
v_m = -31.49 mm
$\sigma_m = -Mv/J_u$ = -199.2 N/mm^2
x_c = 15. mm
y_c = 9. mm
v_c = -22.49 mm
$\sigma_c = -Mv/J_u$ = -142.3 N/mm^2
τ_c = 5.937 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 142.7 N/mm^2
S^* = 3197. mm^3

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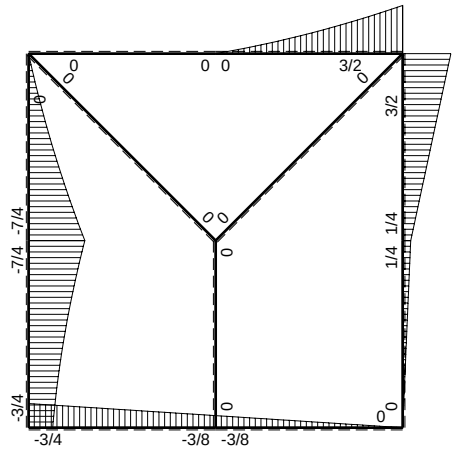

G
F
5/4F
G
I
E
5/4F
3/2Fb
2F
F
5/4F
F
E
5/4F
3/2Fb
2F
E
2F
1/4Fb
5/4F
D
G
5/4F
H
I
3/2F
7/4Fb
3/8F
7/4Fb
9/4F
H
I
D
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1/4Fb
2F
3/8F
3/4Fb
1/2F
A
2F
1/4F
B
C
B
C
1/2F
3/8Fb
3/8F
1/2F
3/8F
A
B
1/2F
3/4Fb
3/8F
1/2F
3/8Fb
3/8F


-5/4
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-2
3/8
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0
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3/8
-1/2
-1/2

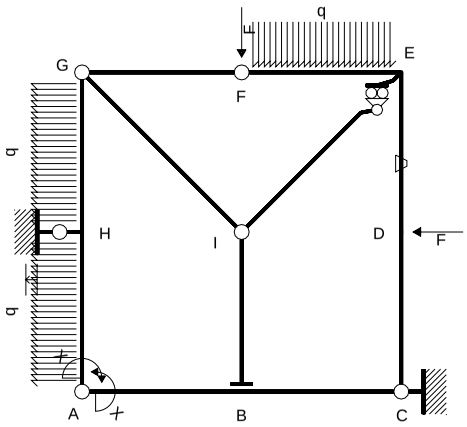

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0
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5/4
-9/4
3/2
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1/4
1/2
3/8
3/8

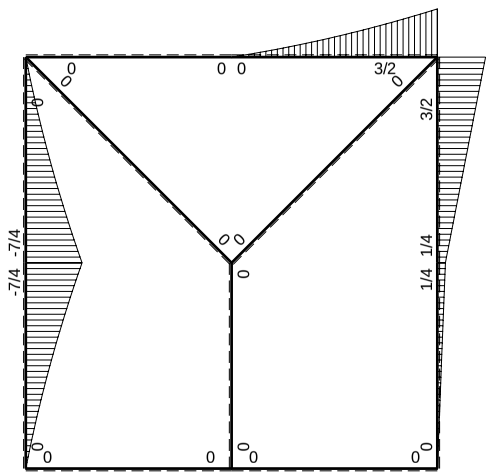
F

F

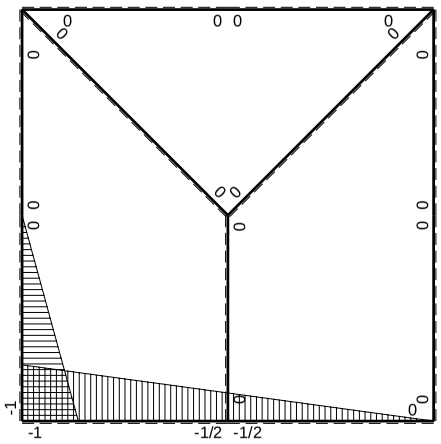

0
0 0
3/2
0
0
3/2
0
0
-7/4 -7/4
0
1/4 1/4
-3/4
0
0
0
-3/4
-3/8 -3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264372 CI04.xxxx.146

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	Fb/EJ	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

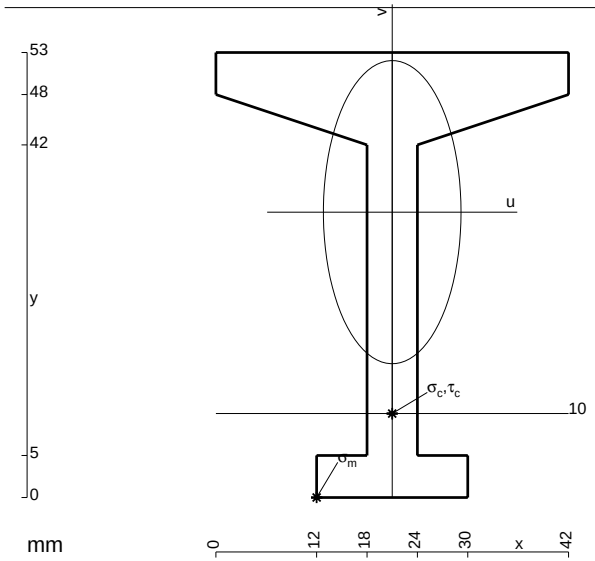
$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

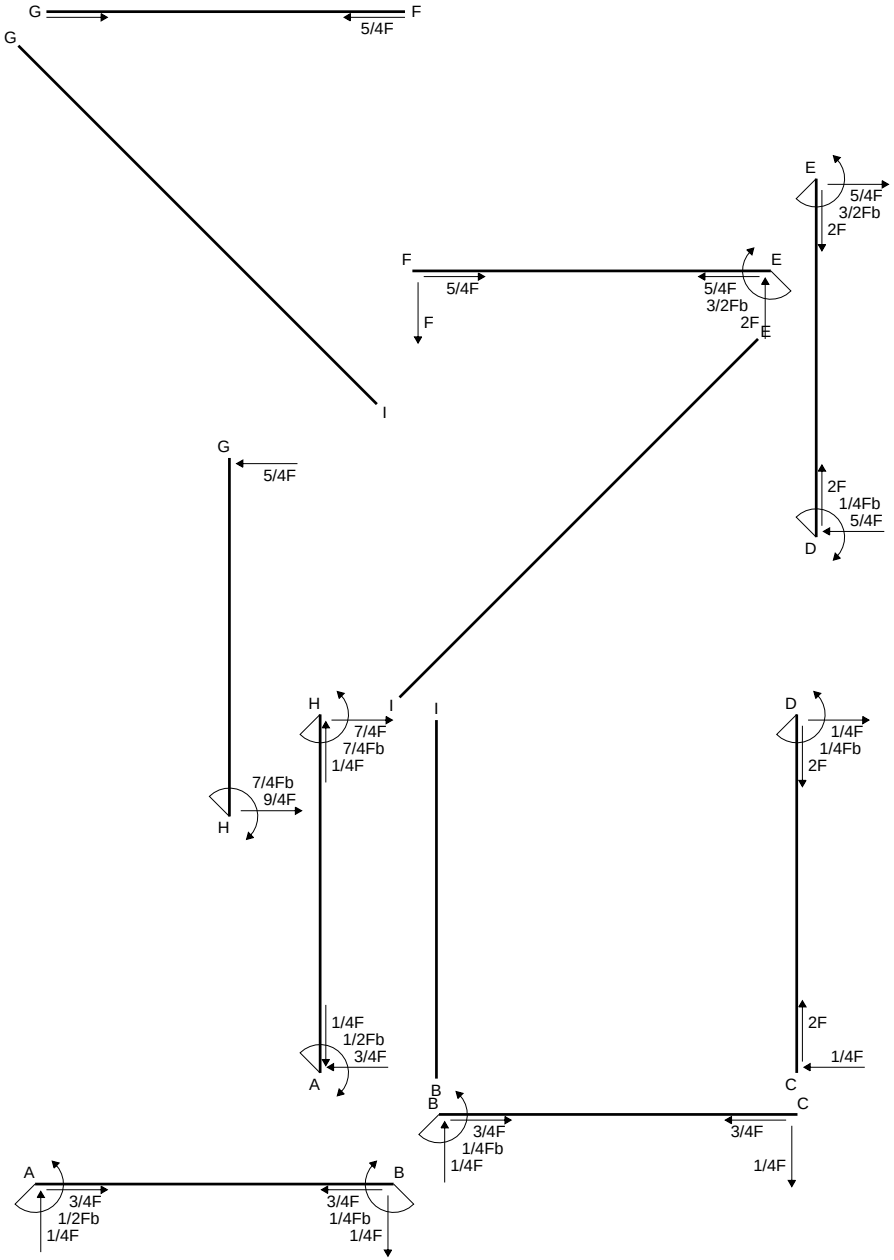
$= \left(7/8\ b - 3/4\ b + 1/8\ b\right)\ Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

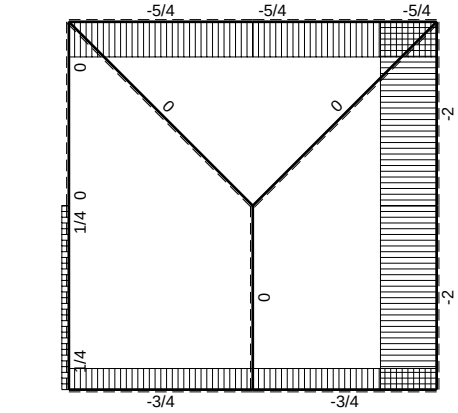
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

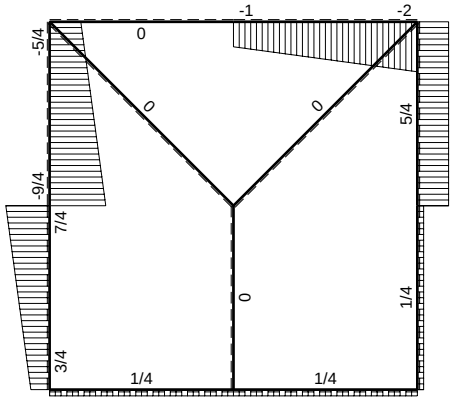
$= \left(5/8\ b - 1/4\ b - 1/8\ b\right)\ Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$



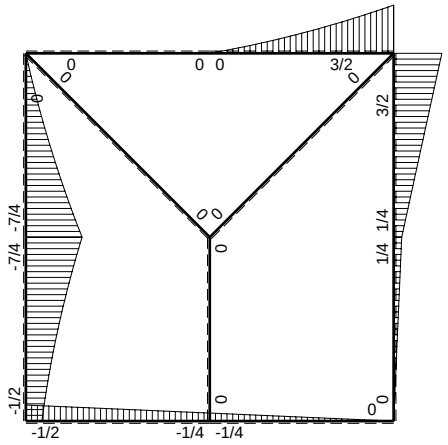
A = 666. mm^2
J_u = 217134. mm^4
J_v = 44766. mm^4
y_g = 33.99 mm
T_y = -2205. N
M_x = -1337700. Nmm
x_m = 12. mm
u_m = -9. mm
v_m = -33.99 mm
$\sigma_m = -Mv/J_u$ = -209.4 N/mm^2
x_c = 21. mm
y_c = 10. mm
v_c = -23.99 mm
$\sigma_c = -Mv/J_u$ = -147.8 N/mm^2
τ_c = 6.141 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 148.2 N/mm^2
S^* = 3628. mm^3


G
F
5/4F
G
I
E
5/4F
3/2Fb
2F
F
5/4F
F
5/4F
3/2Fb
2F
E
E
2F
1/4Fb
5/4F
D
G
5/4F
H
I
7/4F
7/4Fb
1/4F
7/4Fb
9/4F
H
I
D
1/4F
1/4Fb
2F
1/4F
1/2Fb
3/4F
A
2F
1/4F
B
C
B
C
3/4F
1/4Fb
1/4F
3/4F
1/4F
A
B
3/4F
1/2Fb
1/4F
3/4F
1/4Fb
1/4F

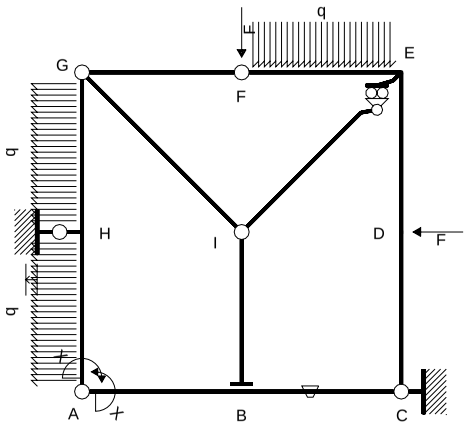

-5/4
-5/4
-5/4
0
0
0
-2
1/4 0
0
-2
1/4
-3/4
-3/4

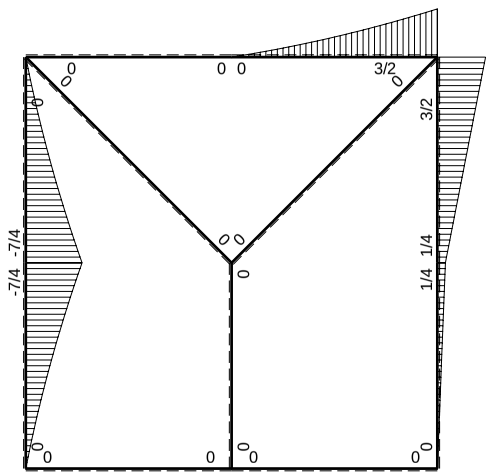

-1
-2
-5/4
0
0
0
5/4
-9/4
7/4
0
1/4
3/4
1/4
1/4

F F

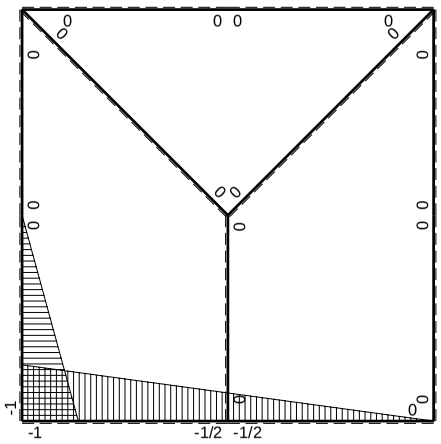

0
0 0
3/2
0
0
3/2
-7/4 -7/4
0 0
0
1/4 1/4
-1/2
0
0 0
-1/2
-1/4 -1/4

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264631 CI04.xxxx.147

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PROCEDIMENTO E RISULTATI 264631 CI04.xxxx.147

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	-Fb/EJ	0	1/2Fb/EJ-1/2Fx/EJ	$1/4-1/2x/b+1/4x^2/b^2$	$(0+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	0	Fb/EJ	0	1/2Fx/EJ	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/2Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/2Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{BC} = \int_o^b \left(1/2 - 1/2\ x/b\ \right)\theta\ \ dx = \left[1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(1/2\ b - 1/4\ b\ \right)\theta\ \ = 1/4\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/2\ x/b\ \right)\theta\ \ dx = \left[-1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/4\ b\ \right)\theta\ \ = 1/4\ \ Fb^2/EJ$

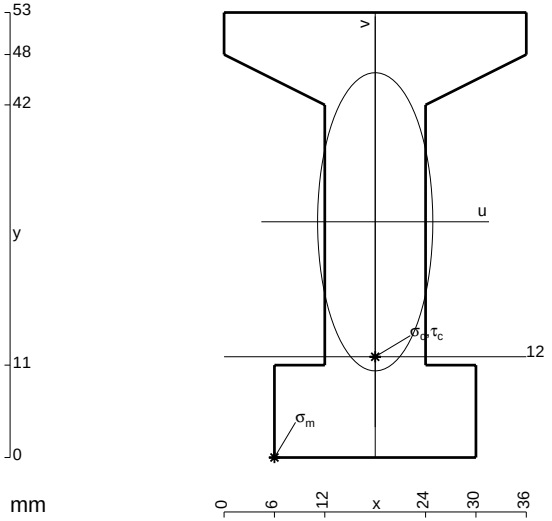
$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

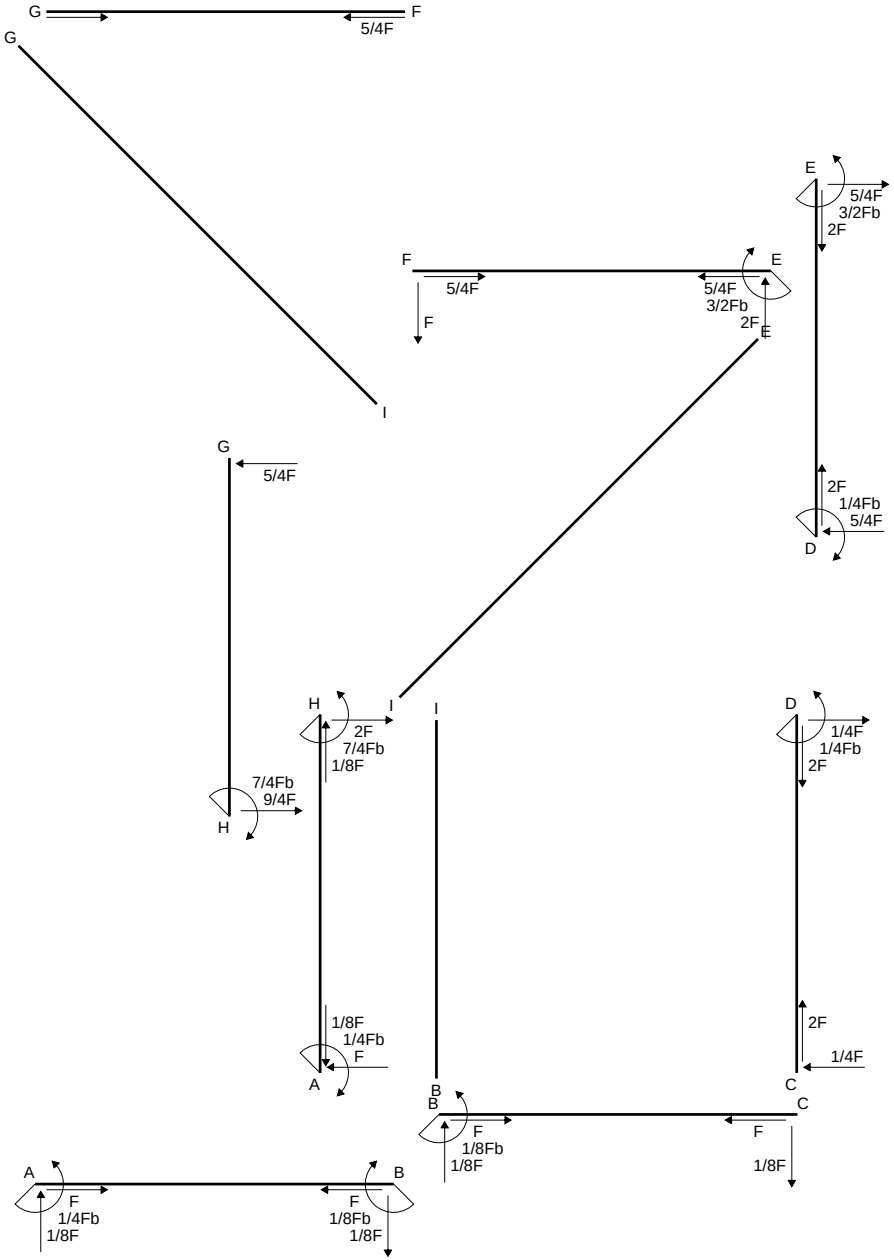
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

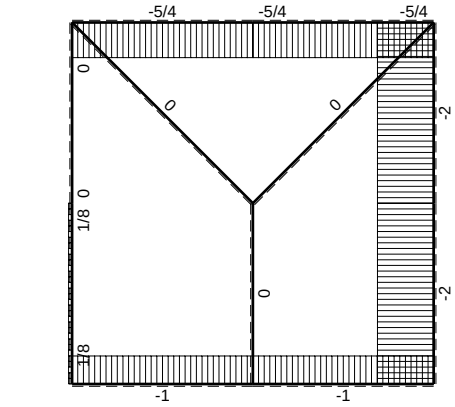
PROCEDIMENTO E RISULTATI 264631 CI04.xxxx.147

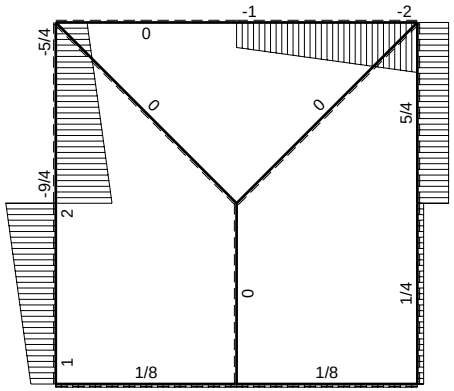


A = 960. mm^2
J_u = 302931. mm^4
J_v = 45216. mm^4
y_g = 28.08 mm
T_y = -3668. N
M_x = -2367580. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.08 mm
$\sigma_m = -Mv/J_u$ = -219.4 N/mm^2
x_c = 18. mm
y_c = 12. mm
v_c = -16.08 mm
$\sigma_c = -Mv/J_u$ = -125.6 N/mm^2
τ_c = 6.213 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 126.1 N/mm^2
S^* = 6159. mm^3

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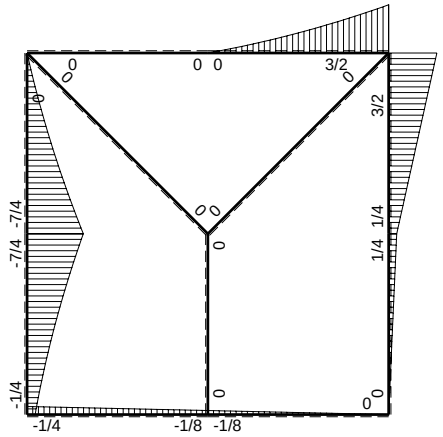

G
F
5/4F
G
I
E
5/4F
3/2Fb
2F
F
5/4F
F
5/4F
3/2Fb
2F
E
E
2F
1/4Fb
5/4F
D
G
5/4F
H
I
2F
7/4Fb
1/8F
7/4Fb
9/4F
H
I
D
1/4F
1/4Fb
2F
1/8F
1/4Fb
F
A
B
C
2F
1/4F
B
C
F
1/8Fb
1/8F
F
1/8F
A
B
F
1/4Fb
1/8F
F
1/8Fb
1/8F


-5/4
-5/4
-5/4
0
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1/8 0
0
-2
1/8
-1
-1

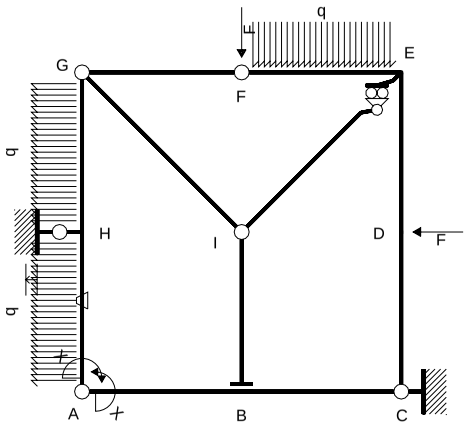

-1
-2
-5/4
0
0
0
5/4
-9/4
2
0
1/4
1
1/8
1/8

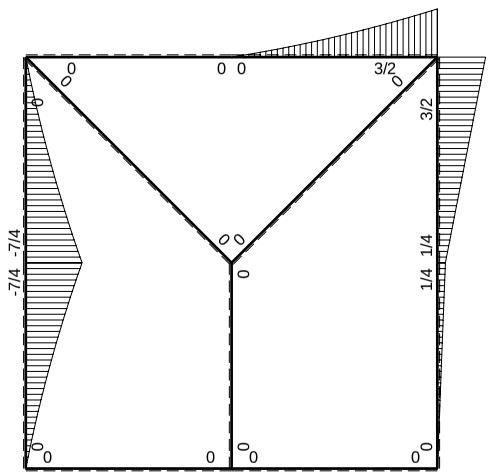
F

F

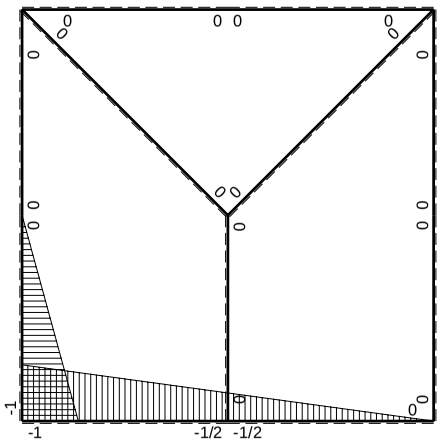

0
0 0
3/2
0
0
3/2
0 0
-7/4 -7/4
1/4 1/4
0
0
0
0
0
-1/4
-1/4
-1/8 -1/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 267798 CI04.xxxx.148

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PROCEDIMENTO E RISULTATI 267798 CI04.xxxx.148

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	-Fb/EJ	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(1/4+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	Fb/EJ	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{HA} = \int_o^b (7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx + \int_o^b (\ x/b\ )\ \theta\ dx$

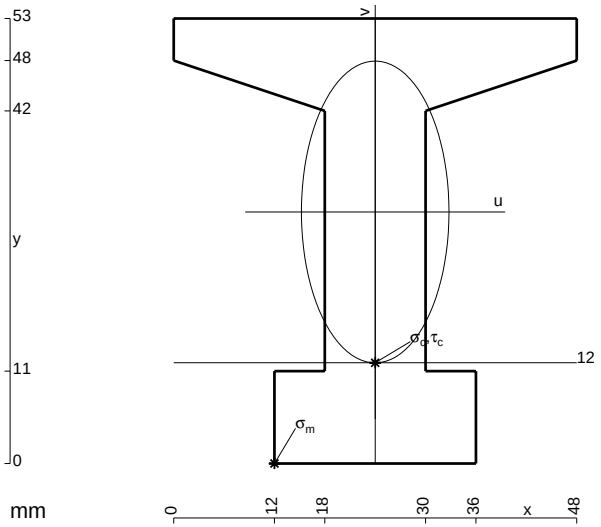
$= [7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ\ + [1/2\ x^2/b\ ]_o^b\ \theta$

$= (7/8\ b - 3/4\ b + 1/8\ b\ )\ Fb\ 1/EJ\ + (1/2\ b\ )\ \theta\ = 3/4\ Fb^2/EJ$

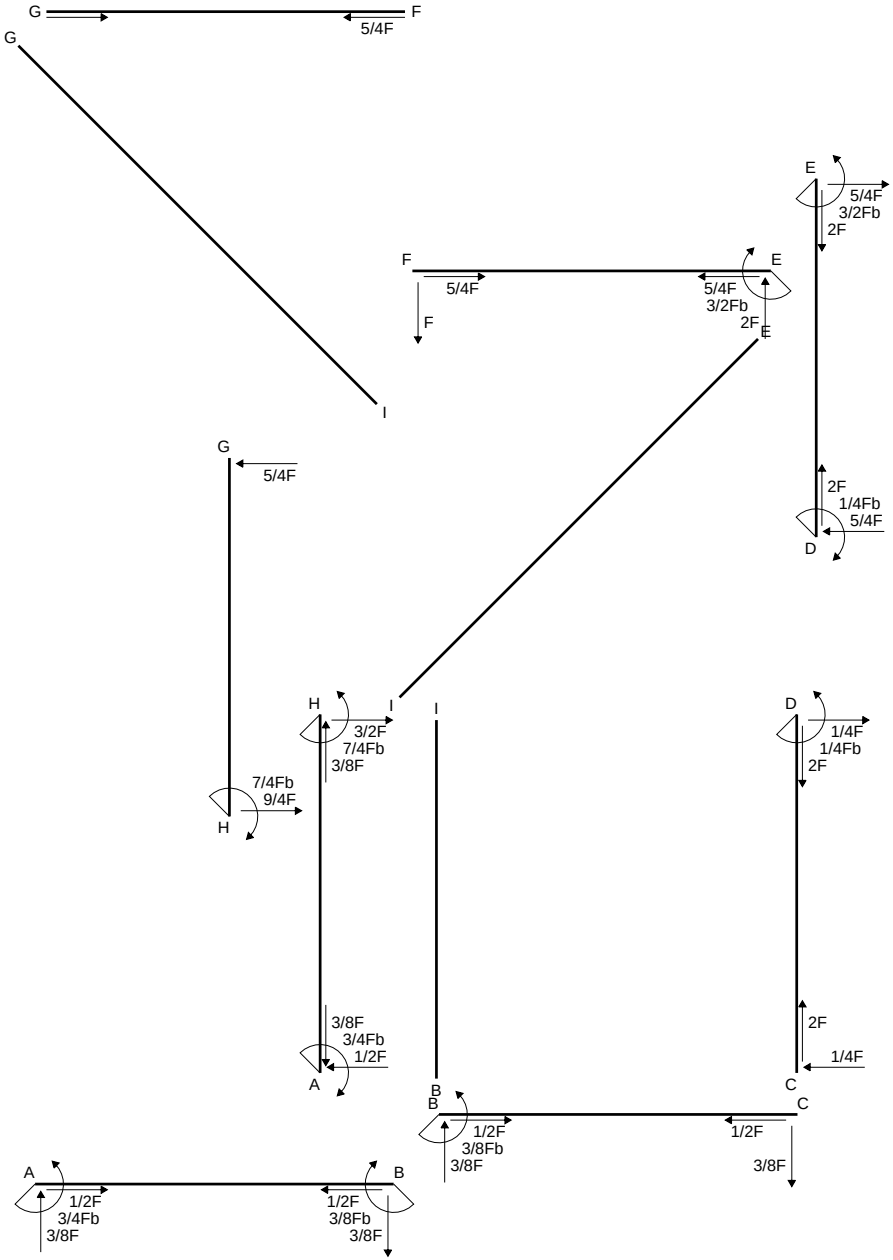
$L^{Xo}_{AH} = \int_o^b (5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx + \int_o^b (-1 + x/b\ )\ \theta\ dx$

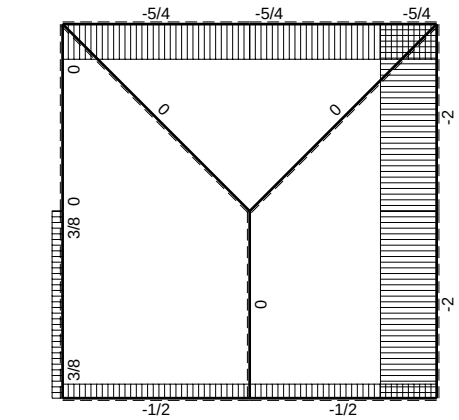
$= [5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ\ + [-\ x + 1/2\ x^2/b\ ]_o^b\ \theta$

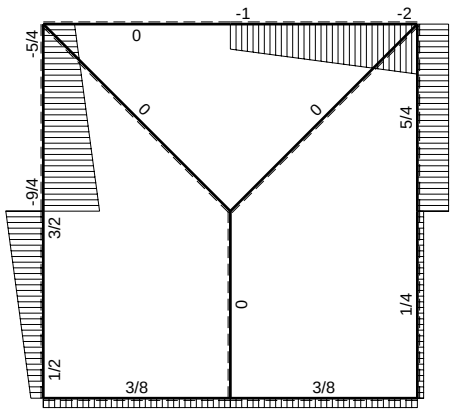
$= (5/8\ b - 1/4\ b - 1/8\ b\ )\ Fb\ 1/EJ\ + (-\ b + 1/2\ b\ )\ \theta\ = 3/4\ Fb^2/EJ$

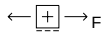


A = 1056. mm^2
J_u = 341114. mm^4
J_v = 81576. mm^4
y_g = 29.96 mm
T_y = -3825. N
M_x = -2618000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -29.96 mm
$\sigma_m = -Mv/J_u$ = -229.9 N/mm^2
x_c = 24. mm
y_c = 12. mm
v_c = -17.96 mm
$\sigma_c = -Mv/J_u$ = -137.8 N/mm^2
τ_c = 6.241 N/mm^2
$\sigma_0 = \sqrt{\sigma^2 + 3\tau^2}$ = 138.3 N/mm^2
S^* = 6679. mm^3

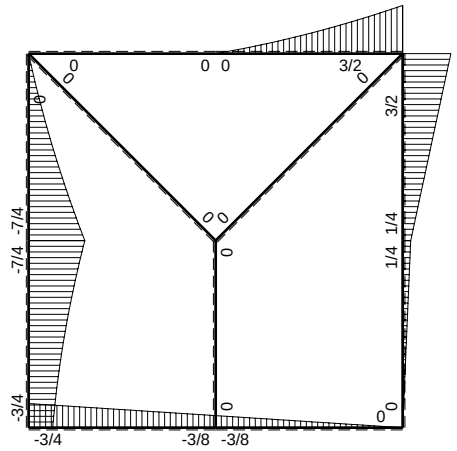






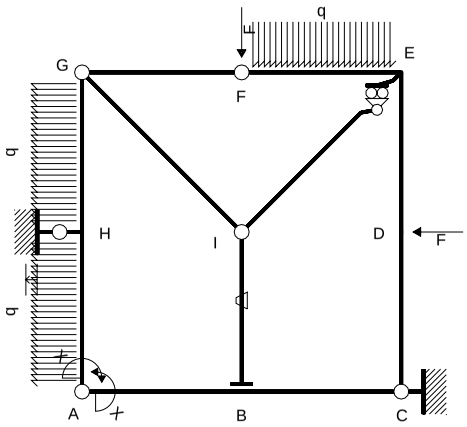


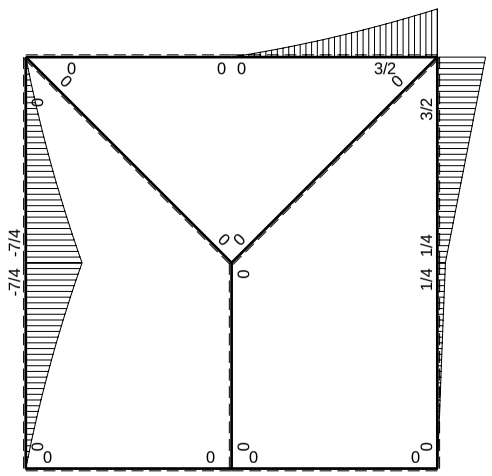




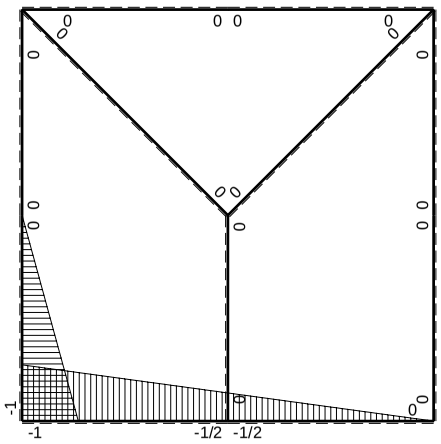


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264866 CI04.xxxx.149

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PROCEDIMENTO E RISULTATI 264866 CI04.xxxx.149

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	-Fb/EJ	0	0	0	0+0	0
BI b	0	0	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

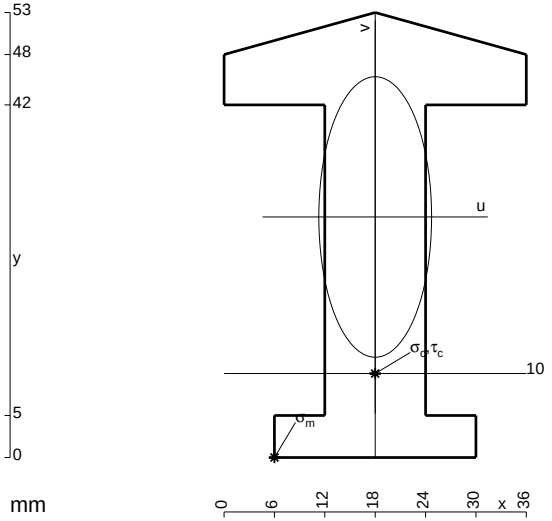
$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

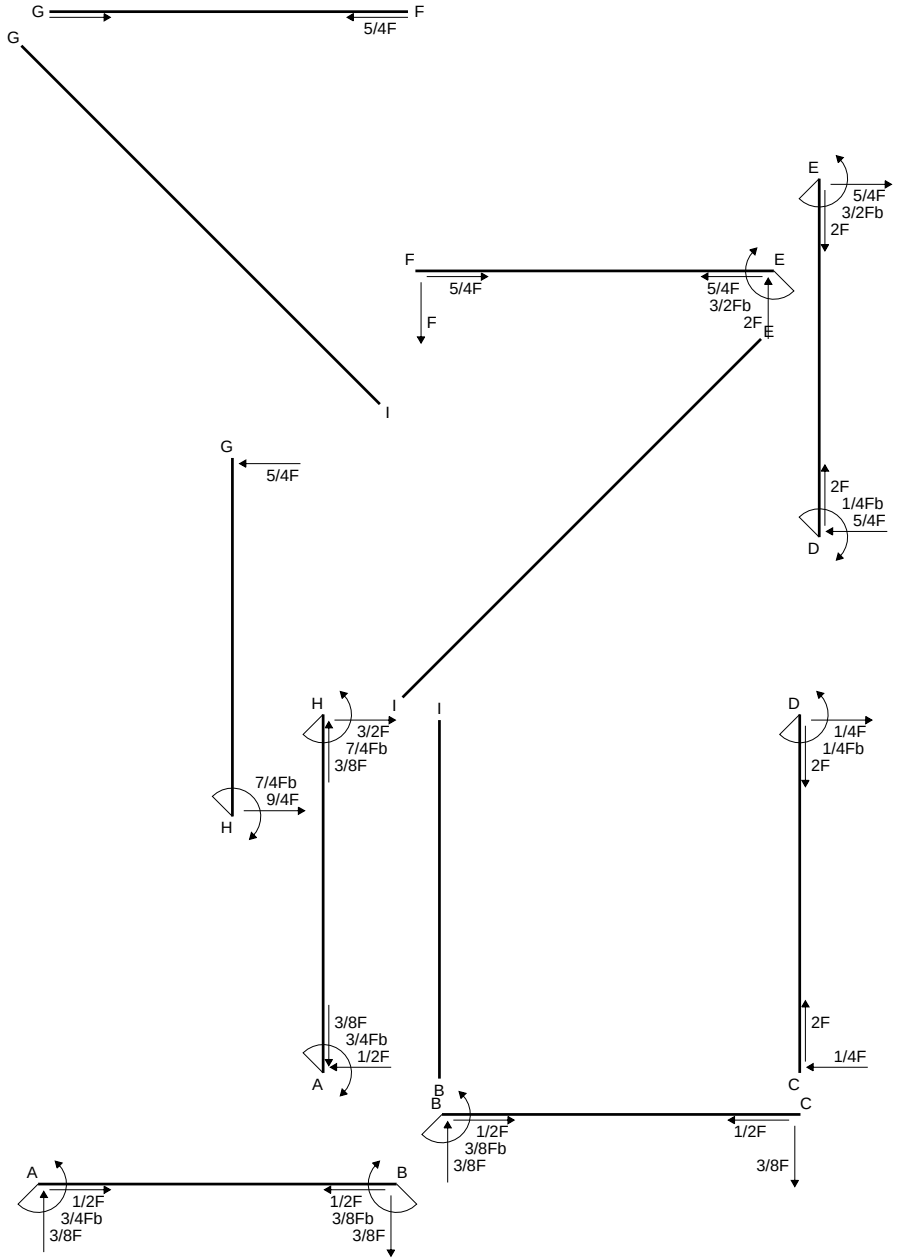
$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

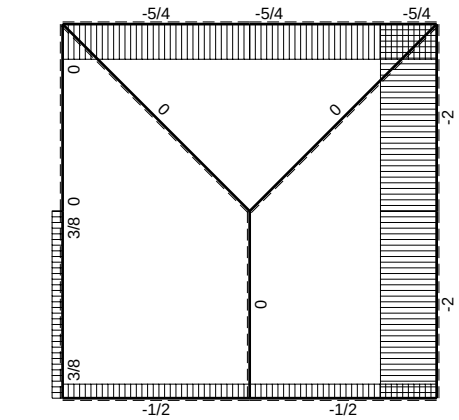
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

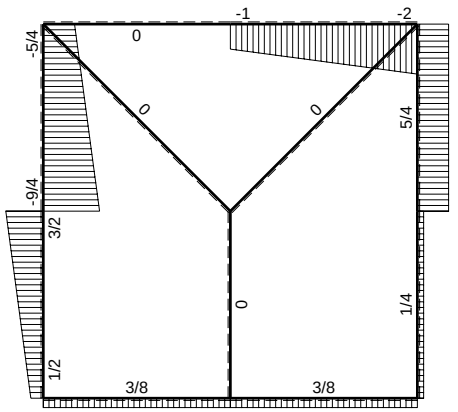
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$



A = 870. mm^2
J_u = 243005. mm^4
J_v = 39276. mm^4
y_g = 28.65 mm
T_y = -2813. N
M_x = -2034380. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.65 mm
$\sigma_m = -Mv/J_u$ = -239.8 N/mm^2
x_c = 18. mm
y_c = 10. mm
v_c = -18.65 mm
$\sigma_c = -Mv/J_u$ = -156.1 N/mm^2
τ_c = 4.25 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 156.3 N/mm^2
S^* = 4407. mm^3



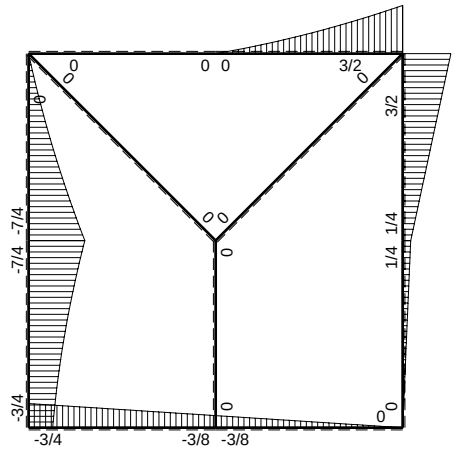




F



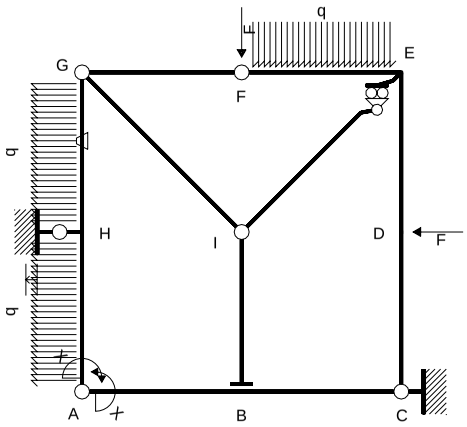
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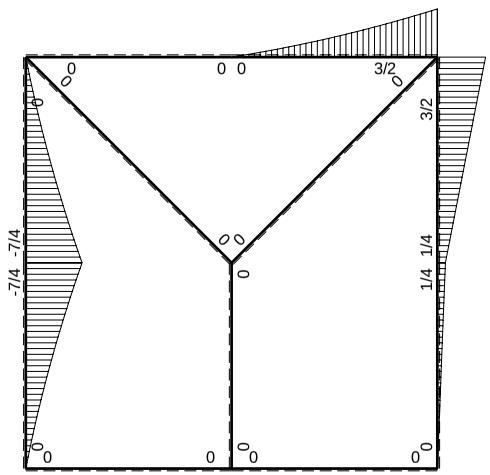




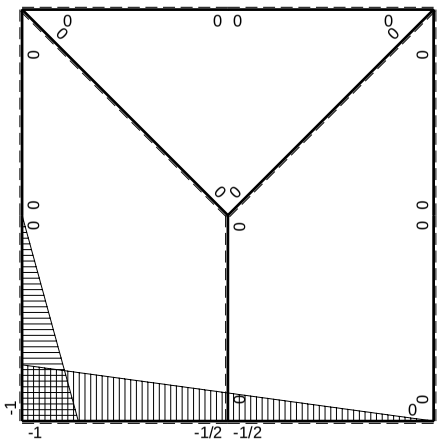
Fb

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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

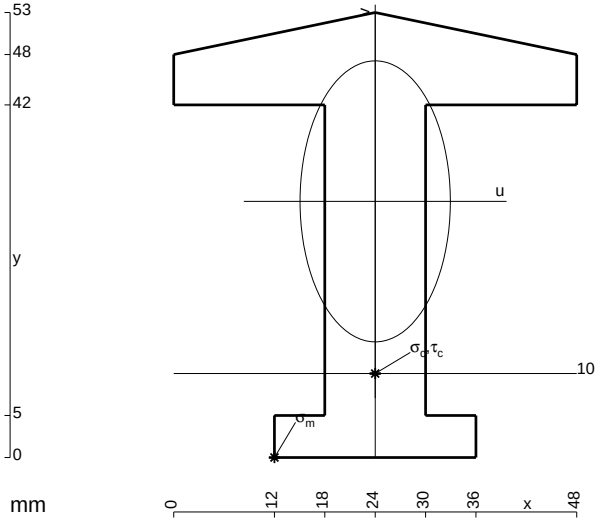
$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

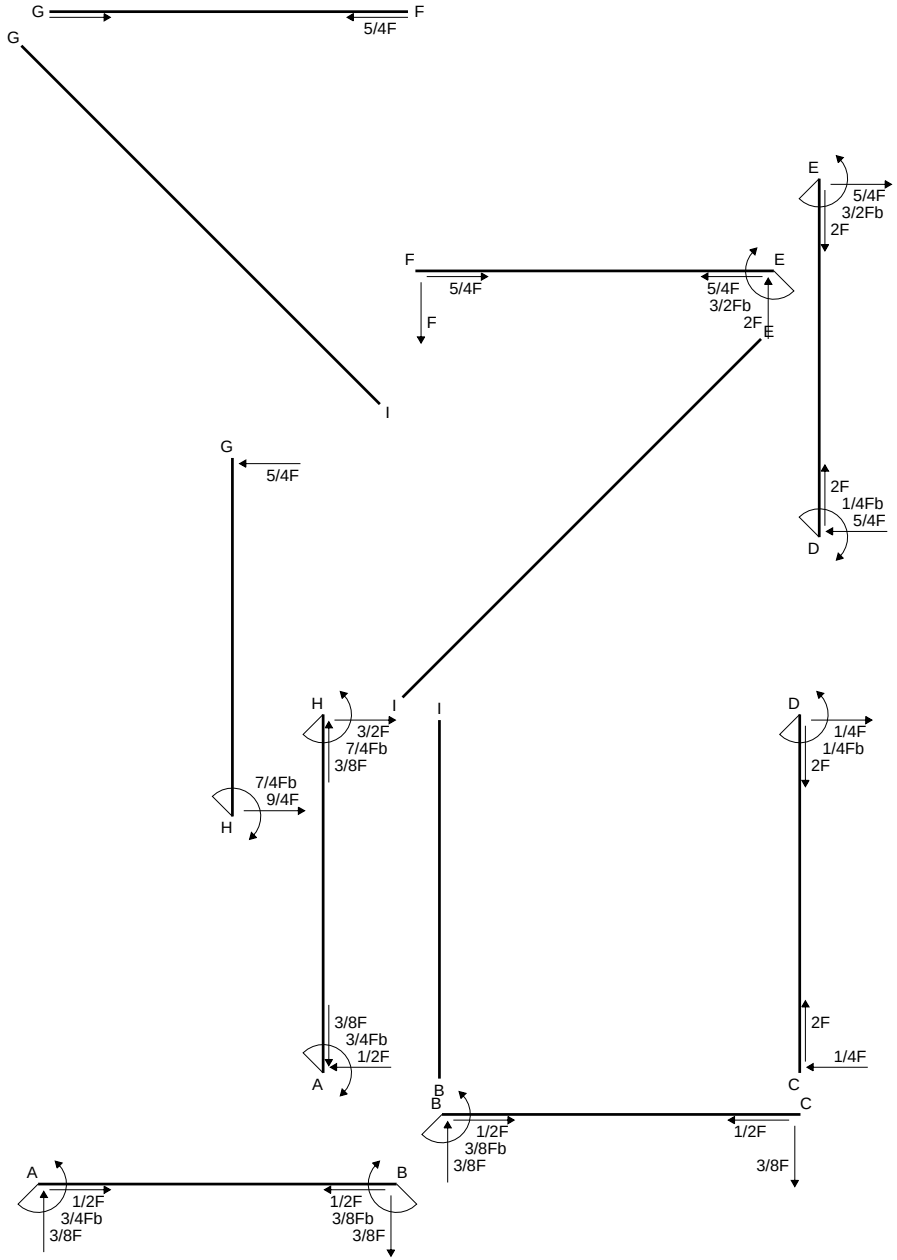
$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

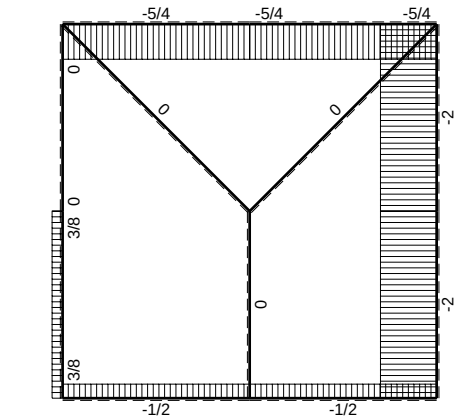
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

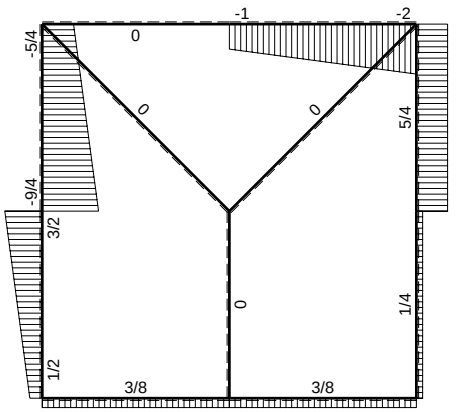
PROCEDIMENTO E RISULTATI 264990 CI04.xxxx.150



A = 972. mm^2
J_u = 272405. mm^4
J_v = 77904. mm^4
y_g = 30.51 mm
T_y = -4680. N
M_x = -1783600. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.51 mm
$\sigma_m = -Mv/J_u$ = -199.8 N/mm^2
x_c = 24. mm
y_c = 10. mm
v_c = -20.51 mm
$\sigma_c = -Mv/J_u$ = -134.3 N/mm^2
τ_c = 6.788 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 134.8 N/mm^2
S^* = 4741. mm^3

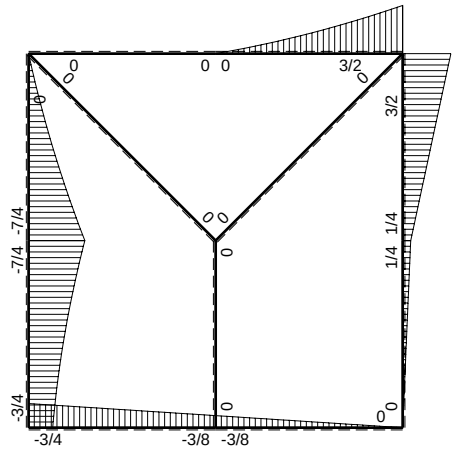

G
F
5/4F
G
I
E
5/4F
3/2Fb
2F
F
5/4F
F
5/4F
3/2Fb
2F
E
E
2F
1/4Fb
5/4F
D
G
5/4F
H
I
3/2F
7/4Fb
3/8F
7/4Fb
9/4F
H
I
D
1/4F
1/4Fb
2F
3/8F
3/4Fb
1/2F
A
2F
1/4F
B
B
C
C
1/2F
1/2F
3/8Fb
3/8F
3/8F
A
B
1/2F
3/4Fb
3/8F
1/2F
3/8Fb
3/8F


-5/4
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3/8
-1/2
-1/2

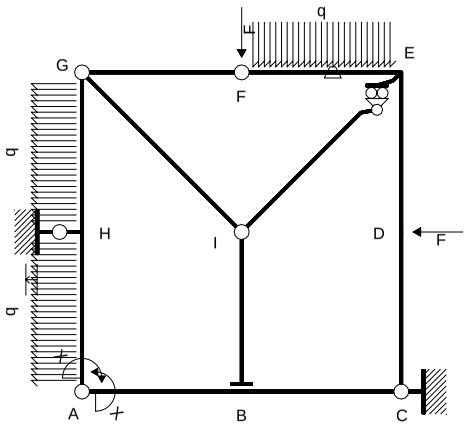

-1
-2
-5/4
0
0
0
5/4
-9/4
3/2
0
1/4
1/2
3/8
3/8

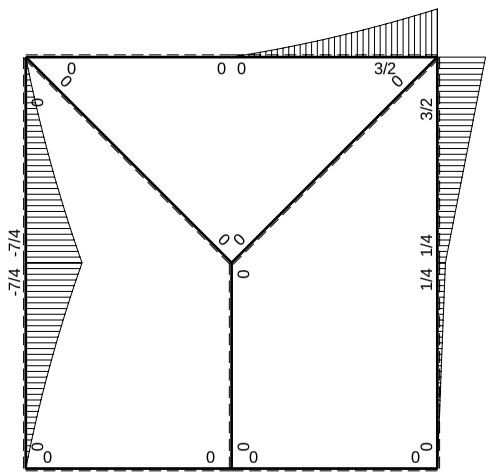
F

F

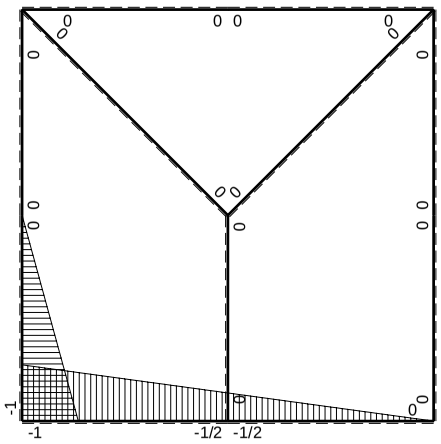

0
0 0
3/2
0
0
3/2
0
0
0
-7/4
-7/4
1/4
1/4
0
0
0
0
-3/4
-3/4
-3/8
-3/8

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 263702 CI04.xxxx.151

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PROCEDIMENTO E RISULTATI 263702 CI04.xxxx.151

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	Fb/EJ	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

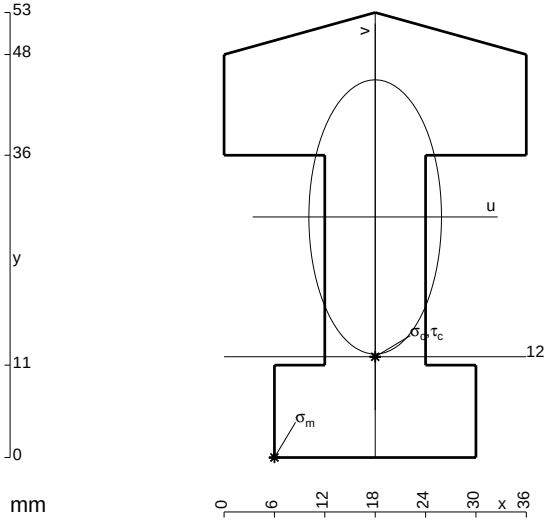
$L^{Xo}_{HA} = \int_o^b \left(7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(7/8\ b - 3/4\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

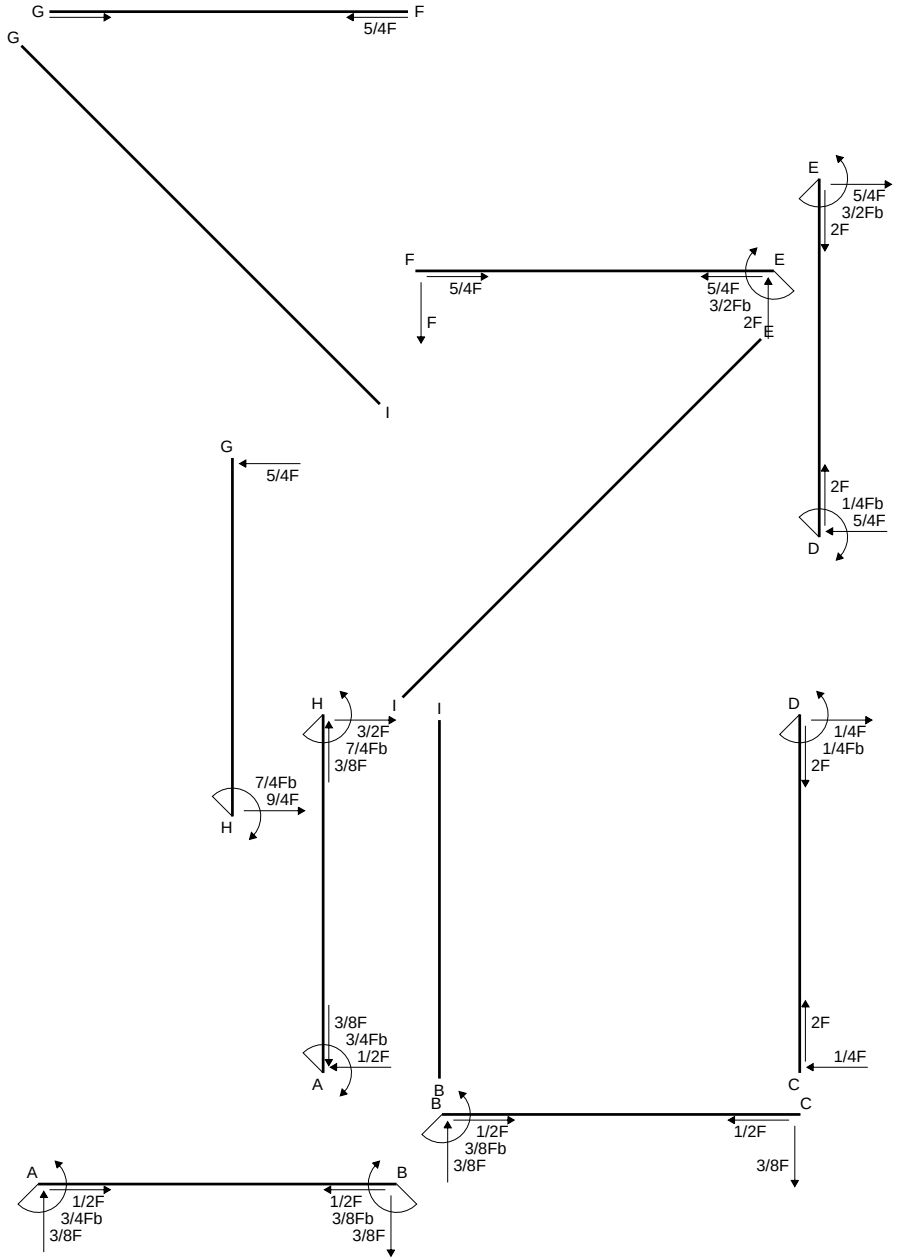
$= \left(5/8\ b - 1/4\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/4\ \ Fb^2/EJ$

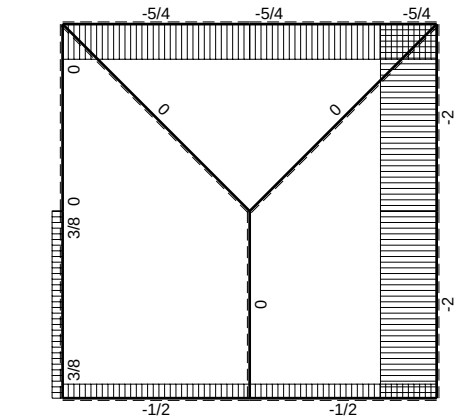
PROCEDIMENTO E RISULTATI 263702 CI04.xxxx.151

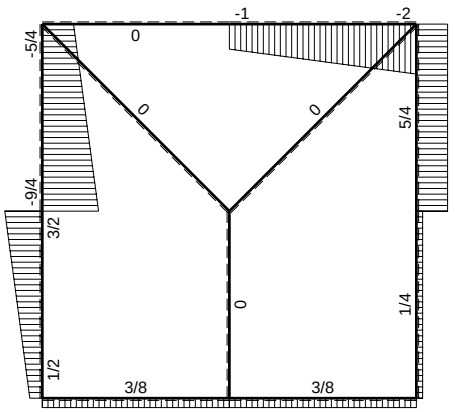


A = 1086. mm^2
J_u = 289781. mm^4
J_v = 67788. mm^4
y_g = 28.65 mm
T_y = -5130. N
M_x = -2114700. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.65 mm
$\sigma_m = -Mv/J_u$ = -209.1 N/mm^2
x_c = 18. mm
y_c = 12. mm
v_c = -16.65 mm
$\sigma_c = -Mv/J_u$ = -121.5 N/mm^2
τ_c = 9.321 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 122.6 N/mm^2
S^* = 6318. mm^3

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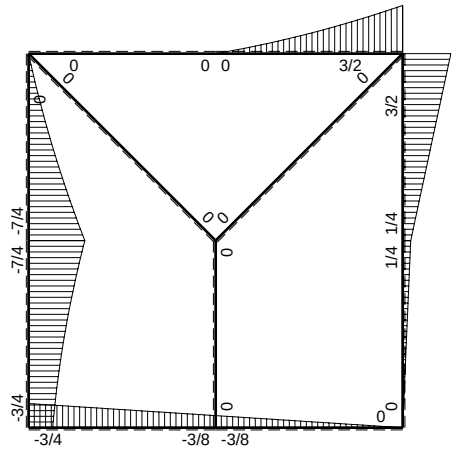

G
F
5/4F
G
I
E
5/4F
3/2Fb
2F
F
5/4F
F
E
5/4F
3/2Fb
2F
E
2F
1/4Fb
5/4F
D
G
5/4F
H
I
3/2F
7/4Fb
3/8F
7/4Fb
9/4F
H
I
D
1/4F
1/4Fb
2F
3/8F
3/4Fb
1/2F
A
2F
1/4F
B
C
B
C
1/2F
3/8Fb
3/8F
1/2F
3/8F
A
B
1/2F
3/4Fb
3/8F
1/2F
3/8Fb
3/8F


-5/4
-5/4
-5/4
0
0
0
0
-2
3/8
0
0
-2
3/8
-1/2
-1/2

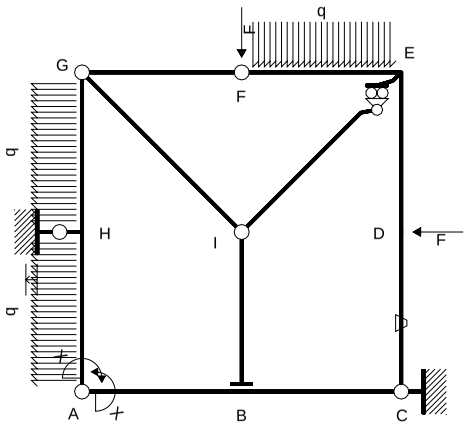

-1
-2
0
-5/4
0
0
5/4
-9/4
3/2
0
1/4
1/2
3/8
3/8

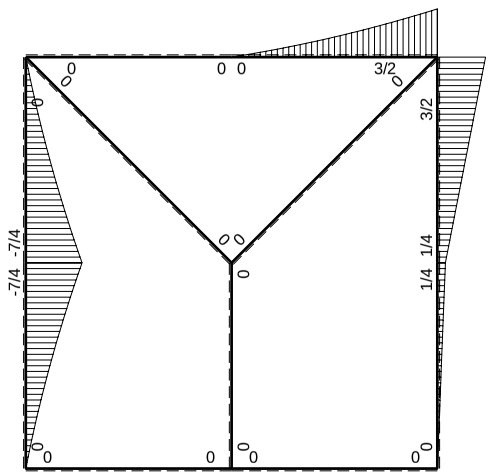
F

F

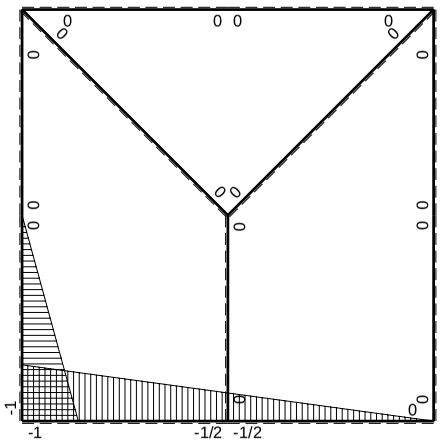

0
0 0
3/2
0
0
3/2
0
0
-7/4
-7/4
0
1/4
1/4
-7/4
0
0
0
0
-3/4
-3/8
-3/8
-3/4

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	-Fb/EJ	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	Fb/EJ	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	$-5/4Fx-1/2qx^2$	0	0	0	0	0+0	0
HG b	0	$7/4Fb-9/4Fx+1/2qx^2$	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-7/4Fb+9/4Fx-1/2qx^2$	0	$7/4Fx-9/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/4+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$5/4Fx+1/2qx^2$	0	$5/4Fx-3/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-3/4Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						3/4Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

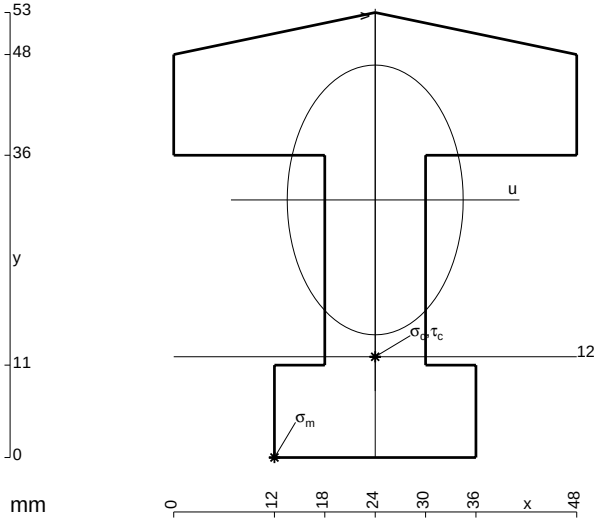
$L^{Xo}_{HA} = \int_o^b (7/4\ x/b - 9/4\ x^2/b^2 + 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 3/4\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (7/8\ b - 3/4\ b + 1/8\ b\ )\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b (5/4\ x/b - 3/4\ x^2/b^2 - 1/2\ x^3/b^3\ )\ Fb\ 1/EJ\ dx = [5/8\ x^2/b - 1/4\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

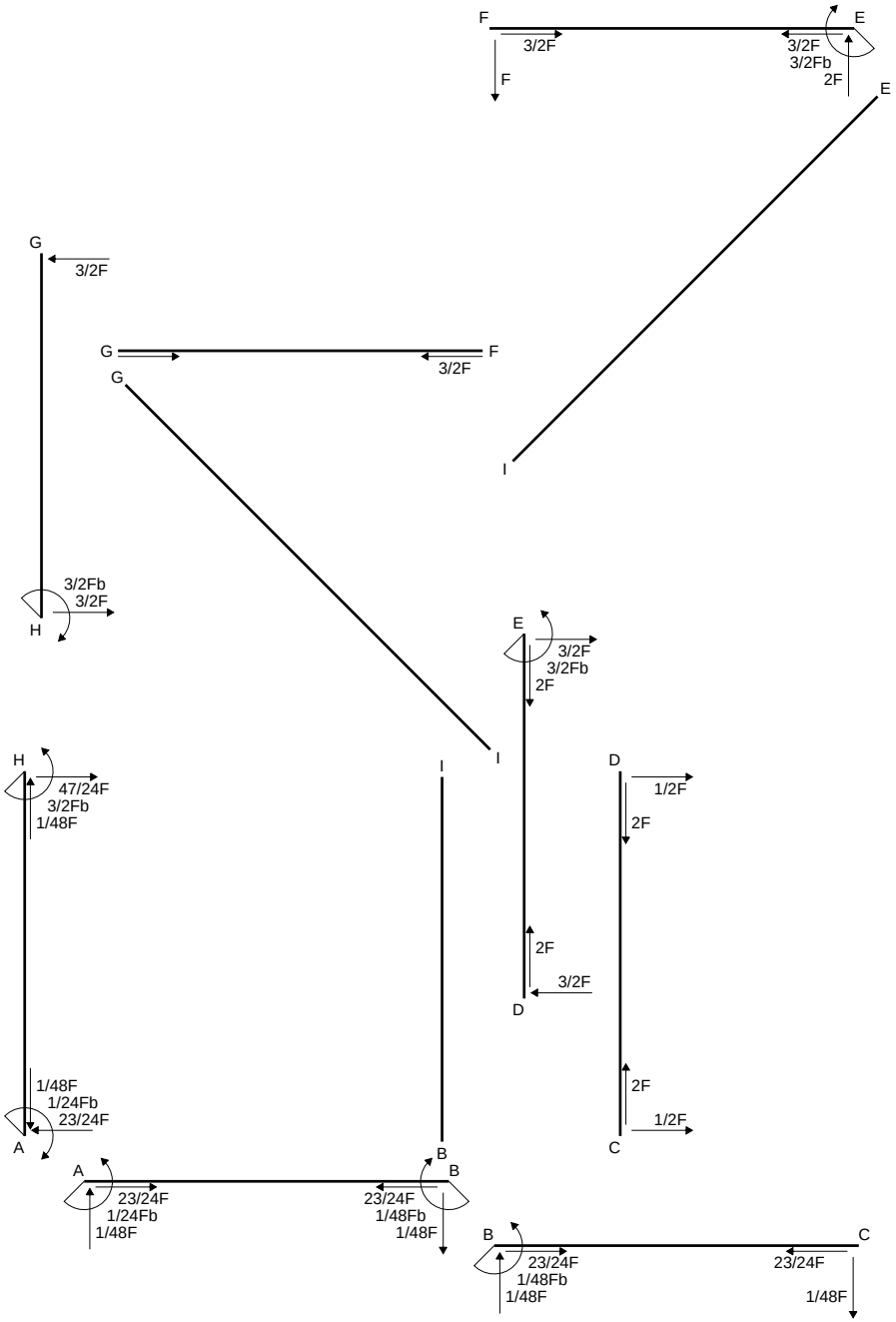
$= (5/8\ b - 1/4\ b - 1/8\ b\ )\ Fb\ 1/EJ\ = 1/4\ Fb^2/EJ$

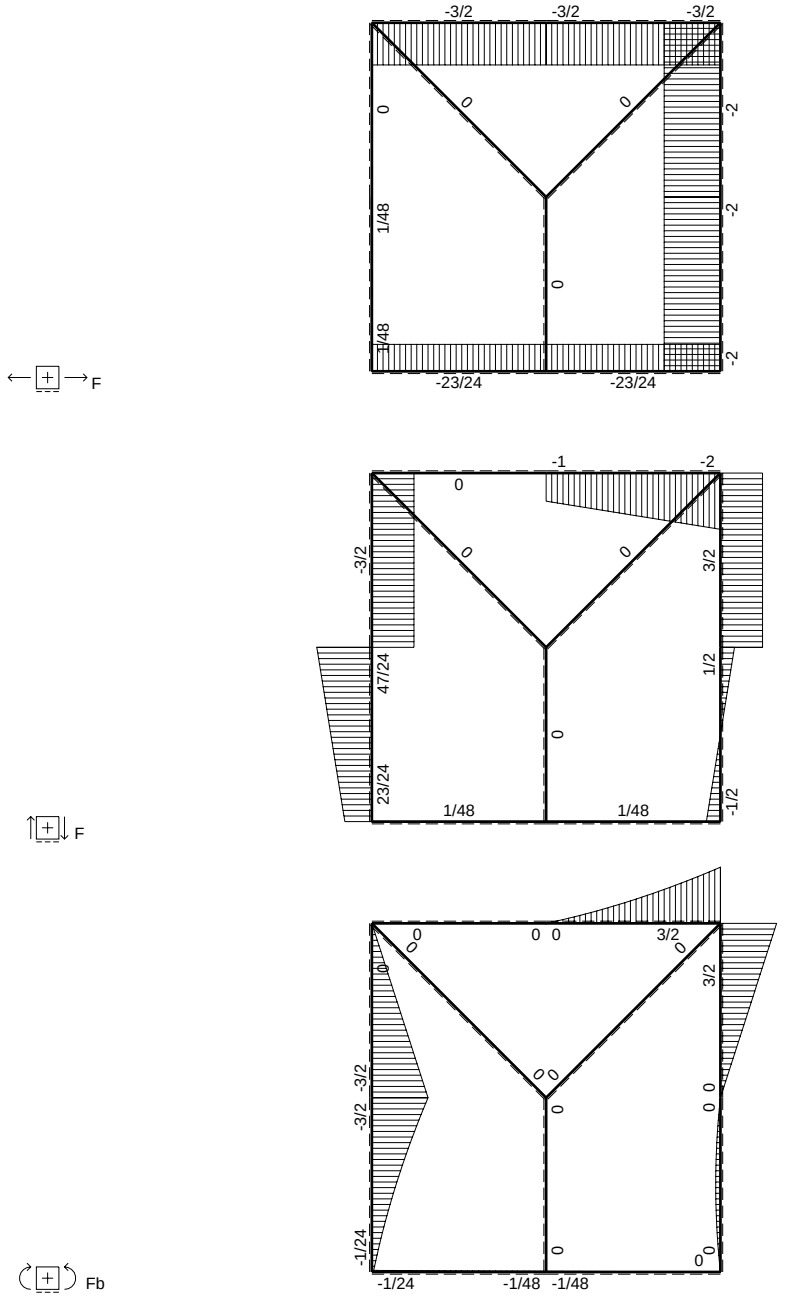
PROCEDIMENTO E RISULTATI 271087 CI04.xxxx.152

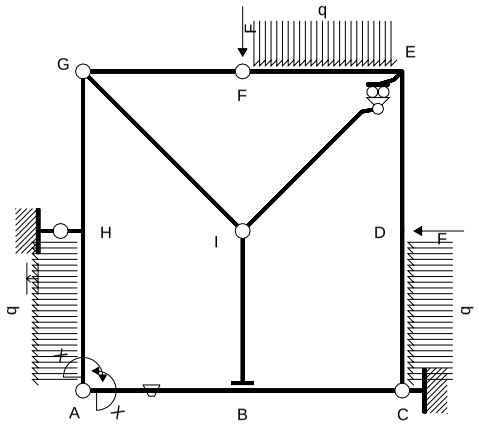


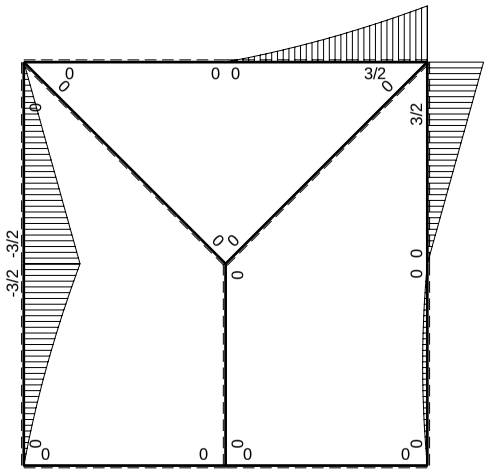
A = 1260. mm^2
J_u = 325285. mm^4
J_v = 138384. mm^4
y_g = 30.68 mm
T_y = -5153. N
M_x = -2324350. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.68 mm
$\sigma_m = -Mv/J_u$ = -219.2 N/mm^2
x_c = 24. mm
y_c = 12. mm
v_c = -18.68 mm
$\sigma_c = -Mv/J_u$ = -133.5 N/mm^2
τ_c = 9.078 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 134.4 N/mm^2
S^* = 6877. mm^3

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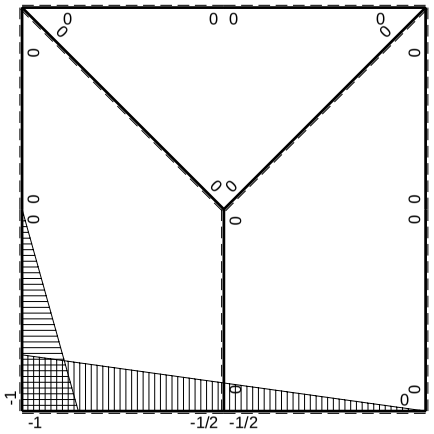

F
E
3/2F
3/2F
3/2Fb
2F
F
E
G
3/2F
G
F
3/2F
G
I
3/2Fb
3/2F
H
E
3/2F
3/2Fb
2F
H
I
I
D
47/24F
3/2Fb
1/48F
1/2F
2F
2F
3/2F
D
1/48F
1/24Fb
23/24F
2F
1/2F
A
B
C
A
B
23/24F
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B
C
23/24F
1/48Fb
1/48F
23/24F
1/48F


F
-3/2
-3/2
-3/2
0
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1/48
-1/2
Fb
0
0 0
3/2
0
0
3/2
-3/2
-3/2
0 0
0
0
0
0
-1/24
-1/48 -1/48





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 249262 CI04.xxxx.153

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PROCEDIMENTO E RISULTATI 249262 CI04.xxxx.153

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	-Fb/EJ	0	Fb/EJ-1/2Fx/EJ	$1-x/b+1/4x^2/b^2$	$(0+3/4)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	0	Fb/EJ	0	1/2Fb/EJ+1/2Fx/EJ	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
DE b	0	3/2Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+3/2Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3/2Fx	0	0	0	0	0+0	0
HG b	0	3/2Fb-3/2Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3/2Fb+2Fx-1/2qx^2$	0	$3/2Fx-2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(5/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$Fx+1/2qx^2$	0	$Fx-1/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/24Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/24Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(1 - 1/2\ x/b\right)\theta\ \ dx = \left[\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(\ b - 1/4\ b\ \right)\theta\ \ = 3/4\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/2 - 1/2\ x/b\right)\theta\ \ dx = \left[-1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/2\ b - 1/4\ b\ \right)\theta\ \ = 3/4\ \ Fb^2/EJ$

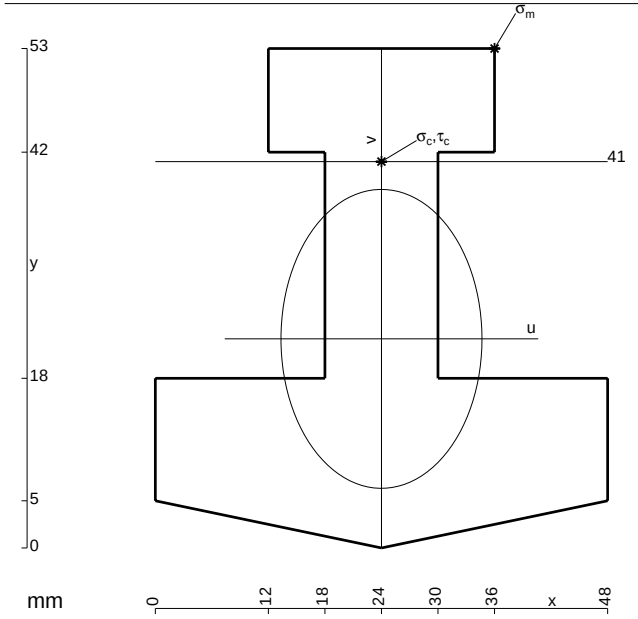
$L^{Xo}_{HA} = \int_o^b \left(3/2\ x/b - 2\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[3/4\ x^2/b - 2/3\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/4\ b - 2/3\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ \ Fb^2/EJ$

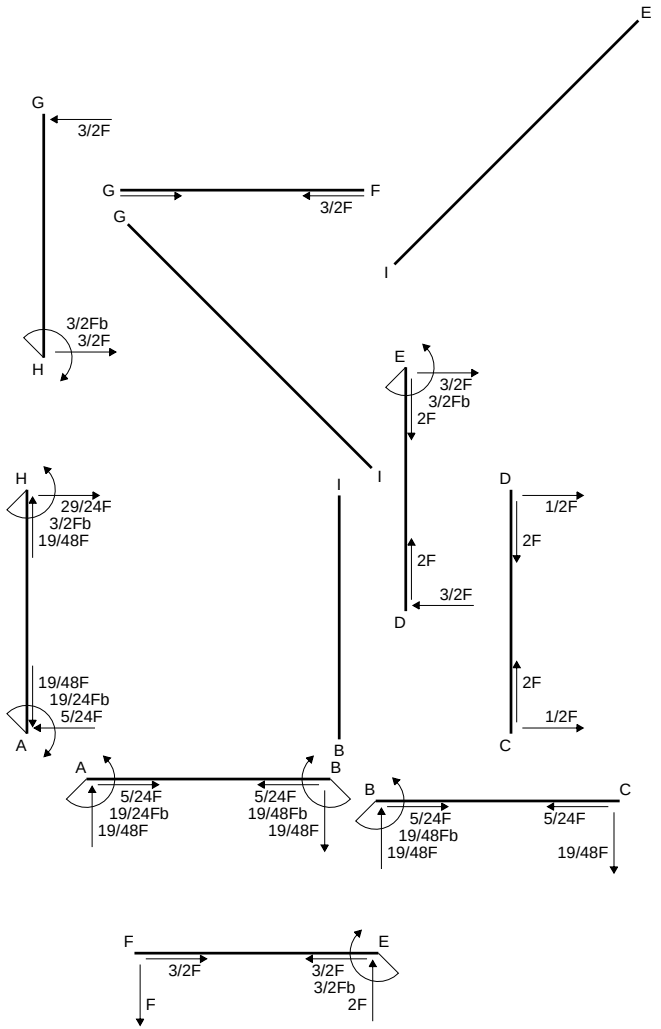
$L^{Xo}_{AH} = \int_o^b \left(\ x/b - 1/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[1/2\ x^2/b - 1/6\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

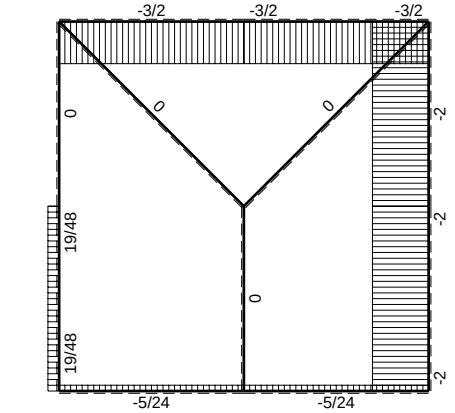
$= \left(1/2\ b - 1/6\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ \ Fb^2/EJ$

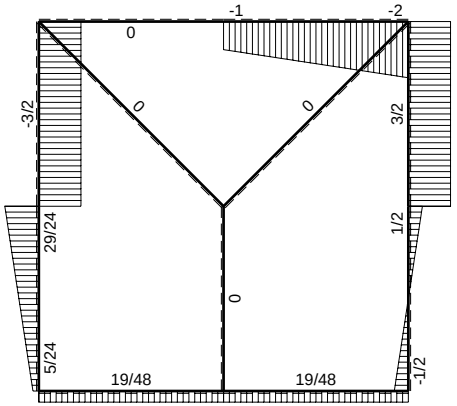
PROCEDIMENTO E RISULTATI 249262 CI04.xxxx.153

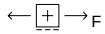


A = 1296. mm^2
J_u = 326102. mm^4
J_v = 147456. mm^4
y_g = 22.19 mm
N = -3810. N
T_y = -5080. N
M_x = 2400300. Nmm
x_m = 36. mm
y_m = 53. mm
u_m = 12. mm
v_m = 30.81 mm
$\sigma_m = N/A - Mv/J_u$ = -229.7 N/mm^2
x_c = 24. mm
y_c = 41. mm
v_c = 18.81 mm
$\sigma_c = N/A - Mv/J_u$ = -141.4 N/mm^2
τ_c = 8.976 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 142.3 N/mm^2
S^* = 6914. mm^3

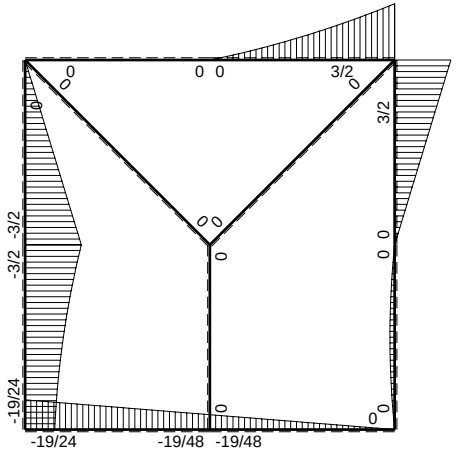






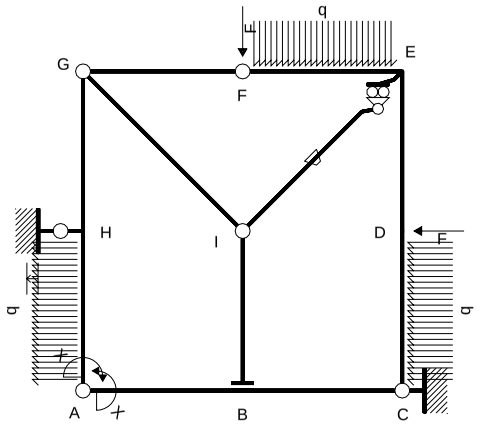


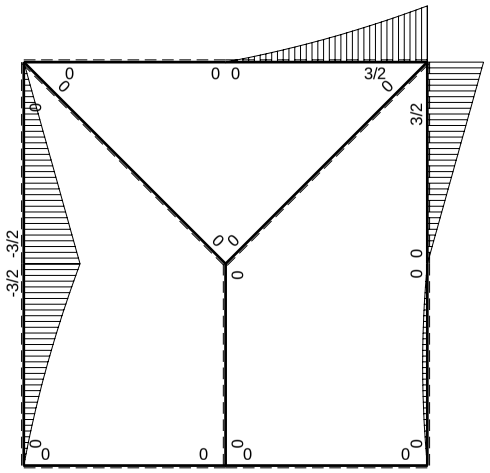




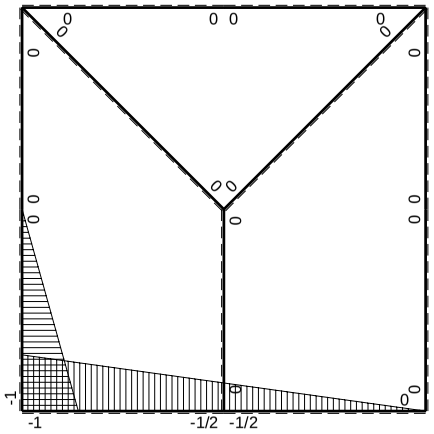


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 309525 CI04.xxxx.154

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PROCEDIMENTO E RISULTATI 309525 CI04.xxxx.154

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
DE b	0	3/2Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+3/2Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3/2Fx	0	0	0	0	0+0	0
HG b	0	3/2Fb-3/2Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-3/2Fb+2Fx-1/2qx^2$	0	$3/2Fx-2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(5/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$Fx+1/2qx^2$	0	$Fx-1/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-19/24Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						19/24Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

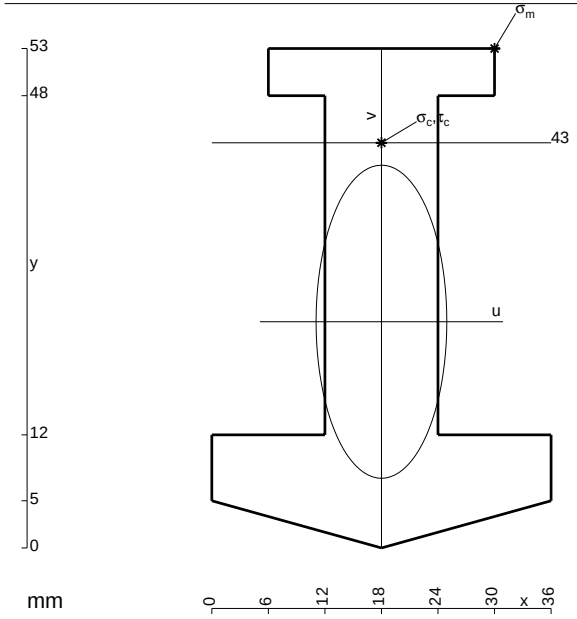
$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(3/2\ x/b - 2\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[3/4\ x^2/b - 2/3\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

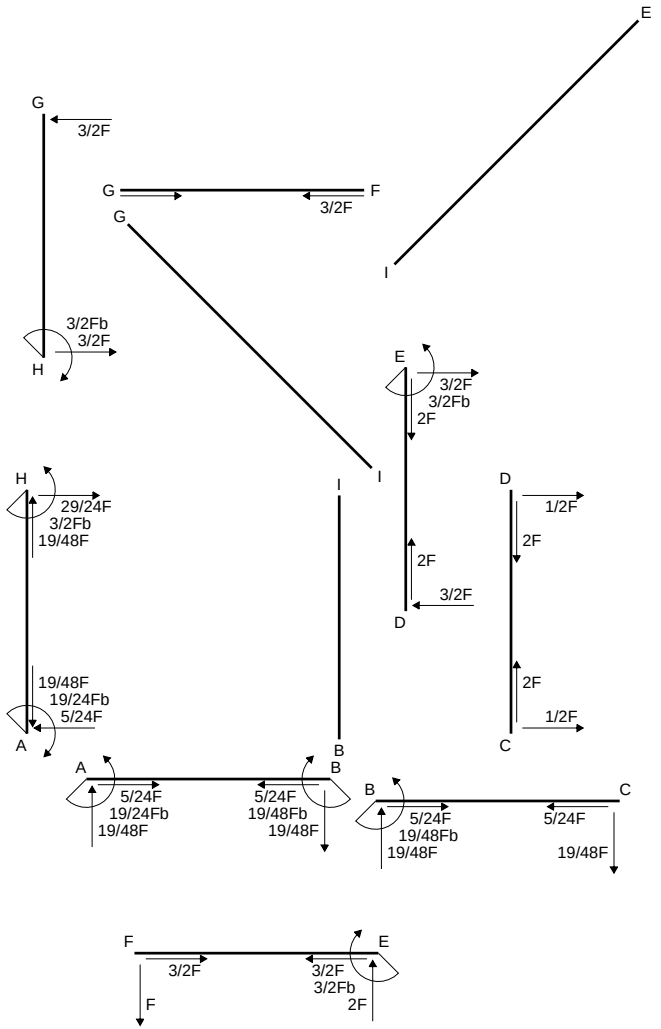
$= \left(3/4\ b - 2/3\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ Fb^2/EJ$

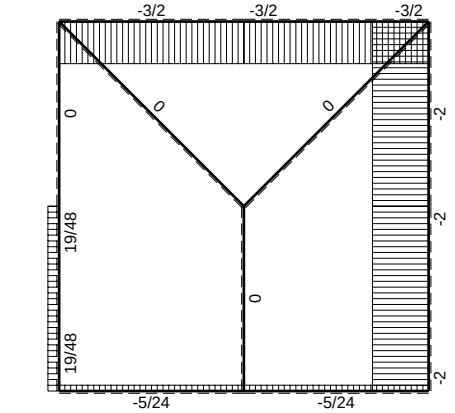
$L^{Xo}_{AH} = \int_o^b \left(\ x/b - 1/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[1/2\ x^2/b - 1/6\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

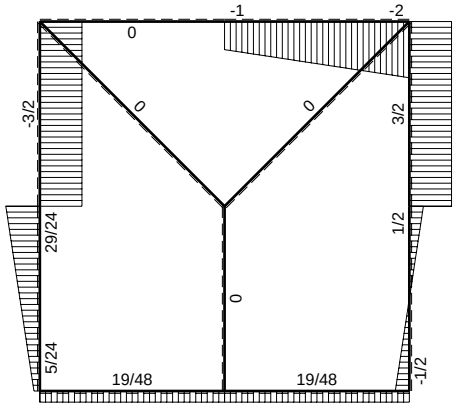
$= \left(1/2\ b - 1/6\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ Fb^2/EJ$

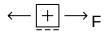


A = 894. mm^2
J_u = 246865. mm^4
J_v = 43020. mm^4
y_g = 24.01 mm
N = -2955. N
T_y = -3940. N
M_x = 2009400. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 12. mm
v_m = 28.99 mm
$\sigma_m = N/A - Mv/J_u$ = -239.3 N/mm^2
x_c = 18. mm
y_c = 43. mm
v_c = 18.99 mm
$\sigma_c = N/A - Mv/J_u$ = -157.9 N/mm^2
τ_c = 5.944 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 158.2 N/mm^2
S^* = 4469. mm^3

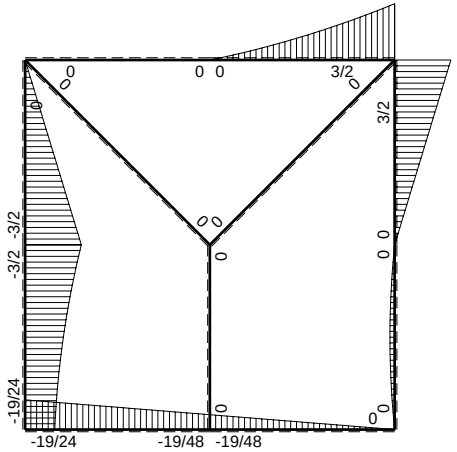






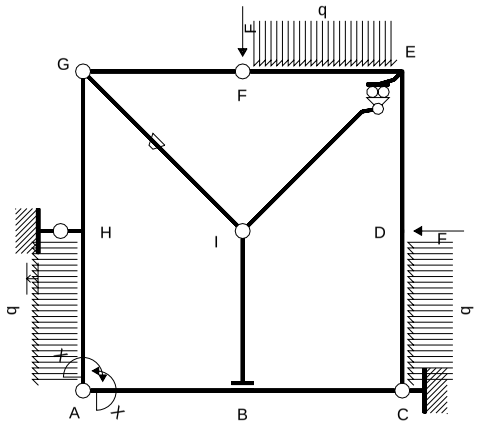


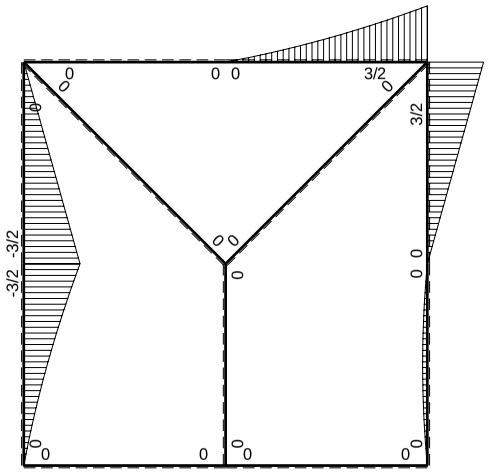




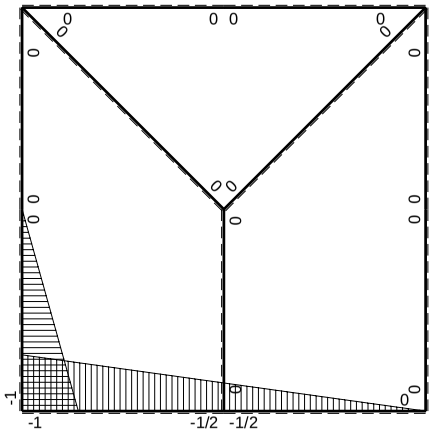


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 274656 CI04.xxxx.155

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PROCEDIMENTO E RISULTATI 274656 CI04.xxxx.155

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
DE b	0	3/2Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+3/2Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3/2Fx	0	0	0	0	0+0	0
HG b	0	3/2Fb-3/2Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3/2Fb+2Fx-1/2qx^2$	0	$3/2Fx-2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(5/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$Fx+1/2qx^2$	0	$Fx-1/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-19/24Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						19/24Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

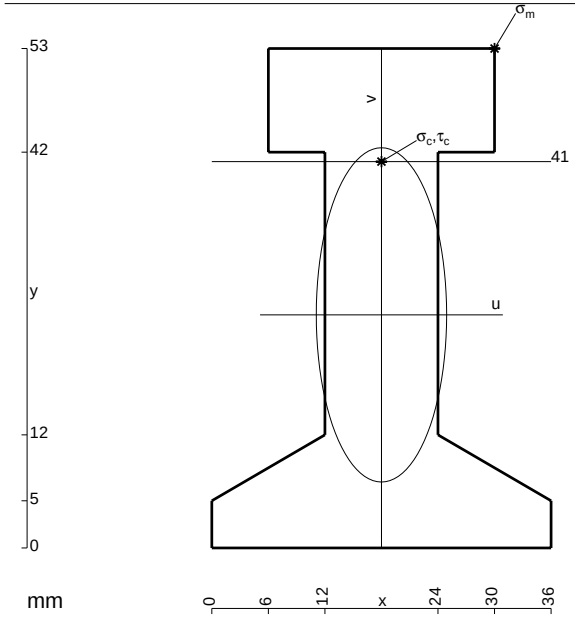
$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(3/2\ x/b - 2\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[3/4\ x^2/b - 2/3\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

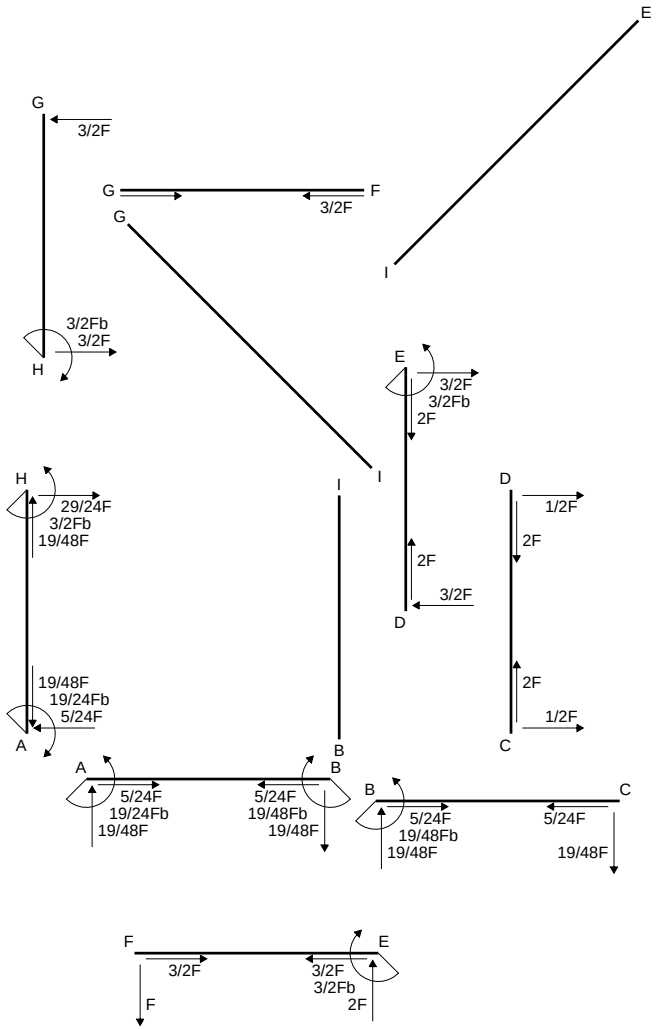
$= \left(3/4\ b - 2/3\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ Fb^2/EJ$

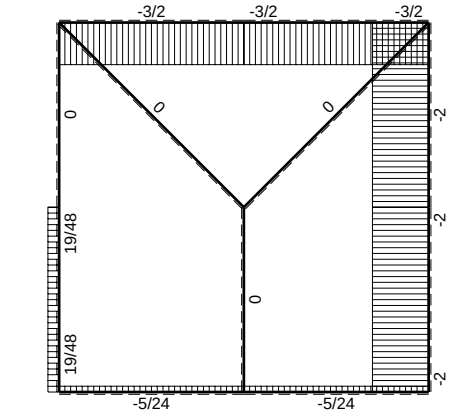
$L^{Xo}_{AH} = \int_o^b \left(\ x/b - 1/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[1/2\ x^2/b - 1/6\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

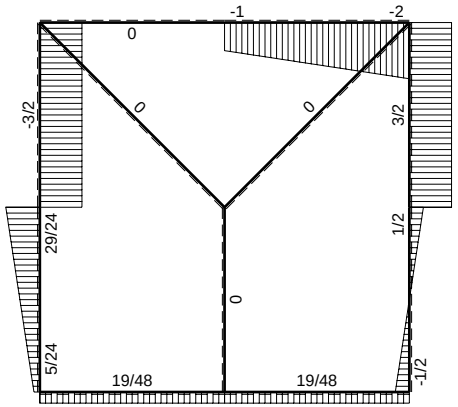
$= \left(1/2\ b - 1/6\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ Fb^2/EJ$



A = 972. mm^2
J_u = 305841. mm^4
J_v = 46512. mm^4
y_g = 24.73 mm
N = -2910. N
T_y = -3880. N
M_x = 2124300. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 12. mm
v_m = 28.27 mm
$\sigma_m = N/A - Mv/J_u$ = -199.3 N/mm^2
x_c = 18. mm
y_c = 41. mm
v_c = 16.27 mm
$\sigma_c = N/A - Mv/J_u$ = -116. N/mm^2
τ_c = 6.567 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 116.5 N/mm^2
S^* = 6212. mm^3

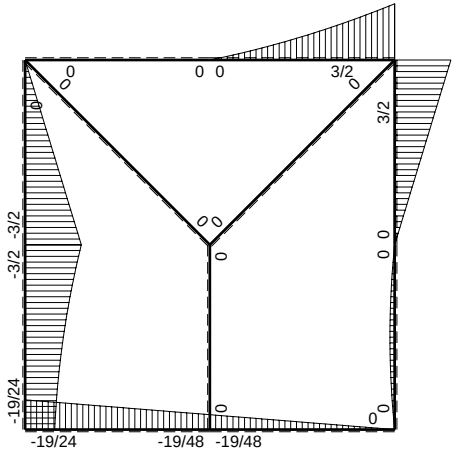

G
3/2F
G
F
3/2F
G
I
E
3/2Fb
3/2F
H
E
3/2F
3/2Fb
2F
I
I
H
29/24F
3/2Fb
19/48F
D
1/2F
2F
2F
3/2F
D
19/48F
19/24Fb
5/24F
2F
1/2F
A
B
C
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B
5/24F
19/24Fb
19/48F
5/24F
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C
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19/48Fb
19/48F
5/24F
19/48F
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3/2Fb
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-5/24

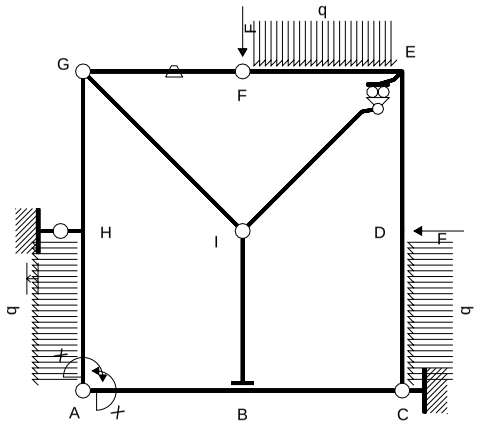

-1
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0
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29/24
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0
5/24
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19/48
19/48

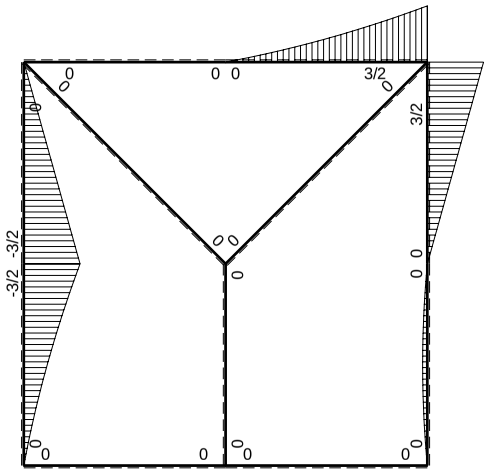
F

F

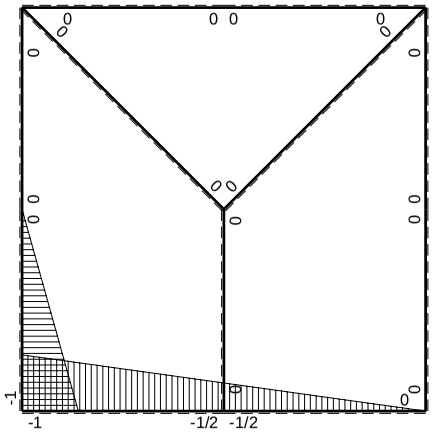

0
0 0
3/2
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-3/2
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0
0 0
-3/2
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-19/24
0
0
-19/24
-19/48
-19/48

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 986254 CI04.xxxx.156

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PROCEDIMENTO E RISULTATI 986254 CI04.xxxx.156

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
DE b	0	3/2Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+3/2Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	-Fb/EJ	0	0	0	0+0	0
GF b	0	0	Fb/EJ	0	0	0		
GH b	0	-3/2Fx	0	0	0	0	0+0	0
HG b	0	3/2Fb-3/2Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3/2Fb+2Fx-1/2qx^2$	0	$3/2Fx-2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(5/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$Fx+1/2qx^2$	0	$Fx-1/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-19/24Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						19/24Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

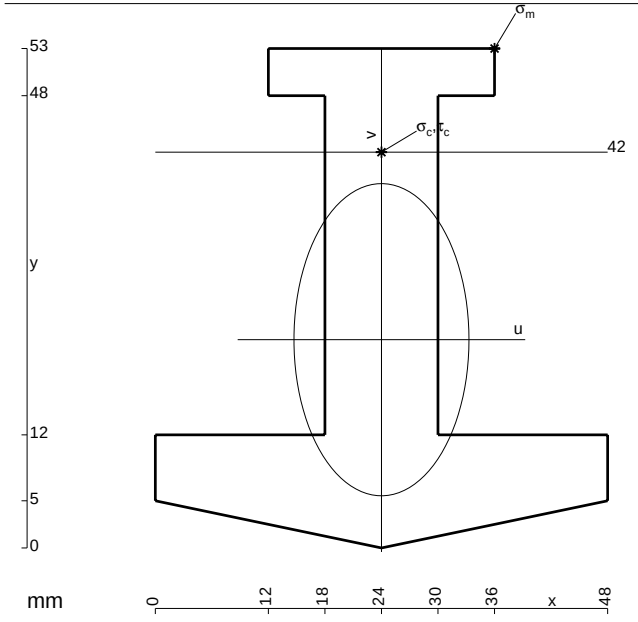
$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(3/2\ x/b - 2\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[3/4\ x^2/b - 2/3\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

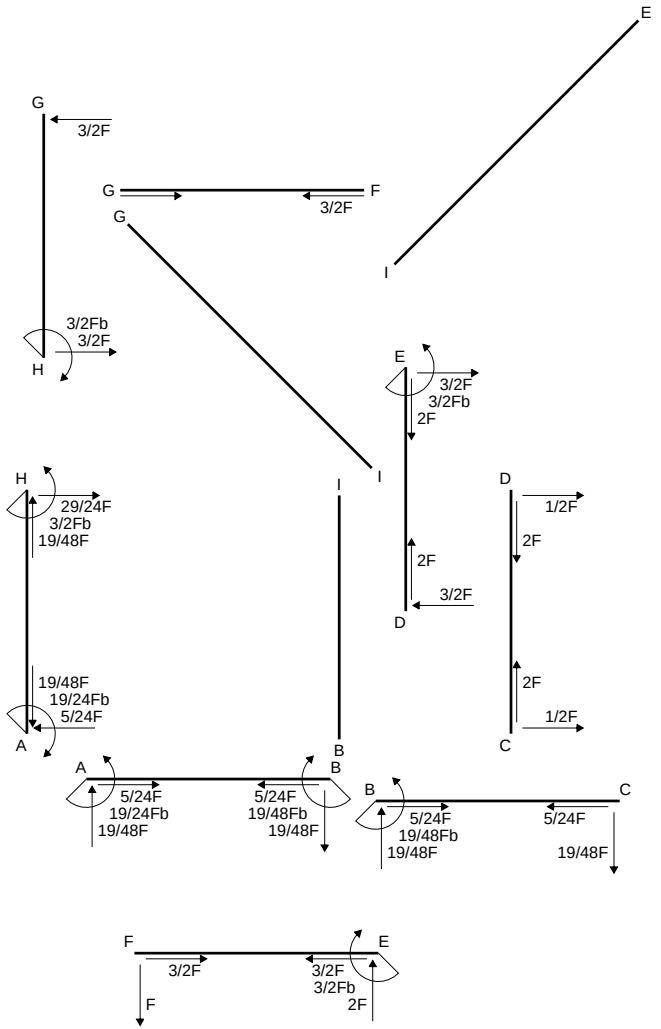
$= \left(3/4\ b - 2/3\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ Fb^2/EJ$

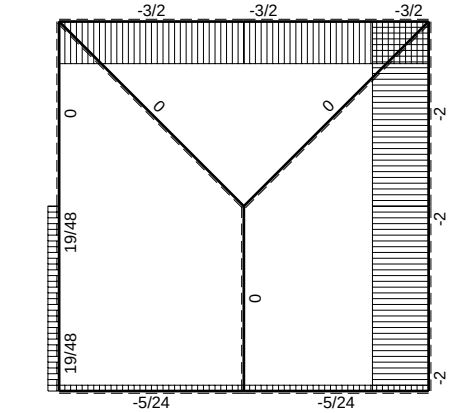
$L^{Xo}_{AH} = \int_o^b \left(\ x/b - 1/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[1/2\ x^2/b - 1/6\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

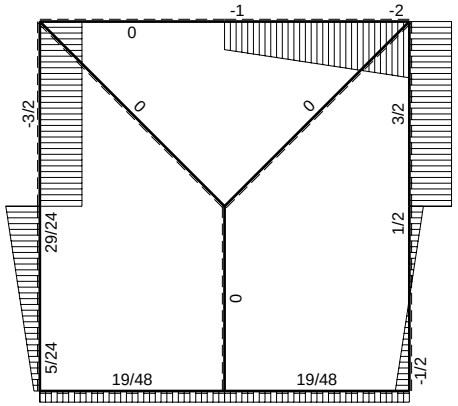
$= \left(1/2\ b - 1/6\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ Fb^2/EJ$

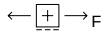


A = 1008. mm^2
J_u = 276602. mm^4
J_v = 86976. mm^4
y_g = 22.1 mm
N = -2370. N
T_y = -3160. N
M_x = 1848600. Nmm
x_m = 36. mm
y_m = 53. mm
u_m = 12. mm
v_m = 30.9 mm
$\sigma_m = N/A - Mv/J_u$ = -208.9 N/mm^2
x_c = 24. mm
y_c = 42. mm
v_c = 19.9 mm
$\sigma_c = N/A - Mv/J_u$ = -135.4 N/mm^2
τ_c = 4.814 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 135.6 N/mm^2
S^* = 5057. mm^3

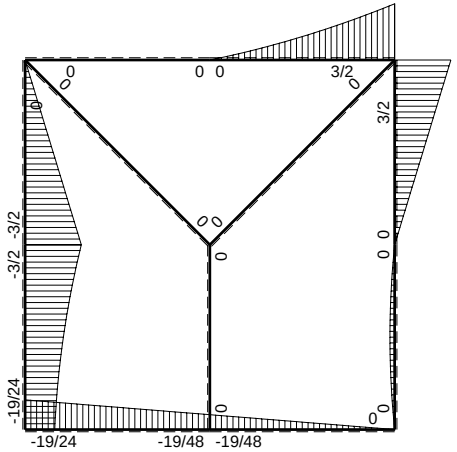






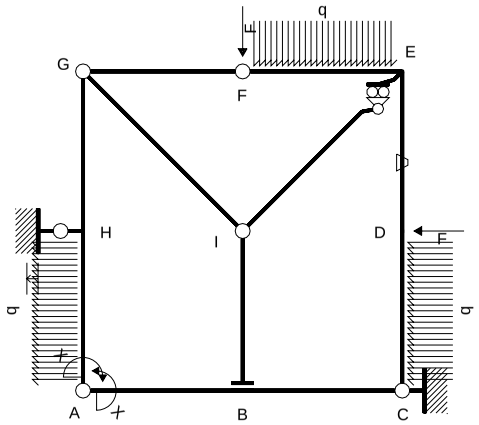


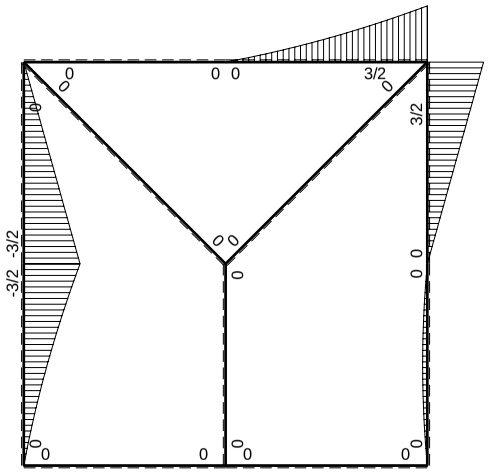




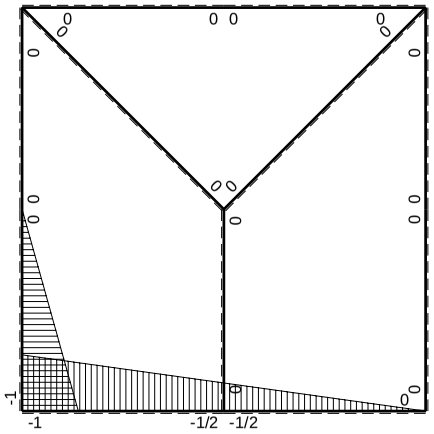


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
DE b	0	3/2Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-3/2Fb+3/2Fx	Fb/EJ	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3/2Fx	0	0	0	0	0+0	0
HG b	0	3/2Fb-3/2Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3/2Fb+2Fx-1/2qx^2$	0	$3/2Fx-2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(5/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$Fx+1/2qx^2$	0	$Fx-1/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-19/24Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						19/24Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

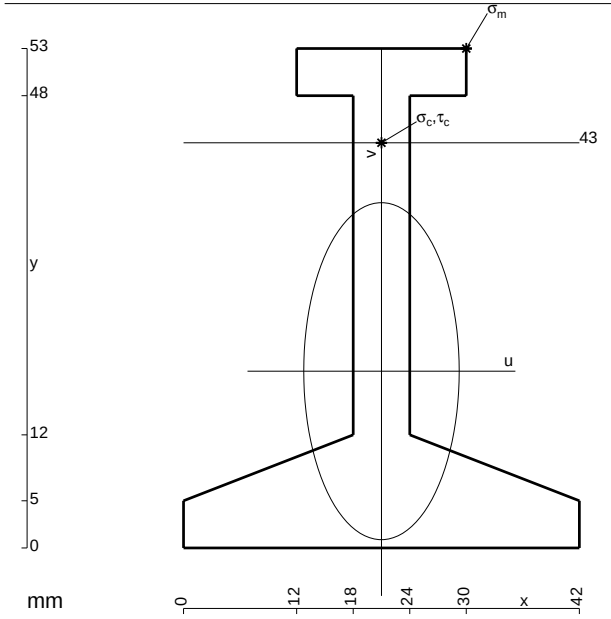
$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{HA} = \int_o^b \left(3/2\ x/b - 2\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[3/4\ x^2/b - 2/3\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$$

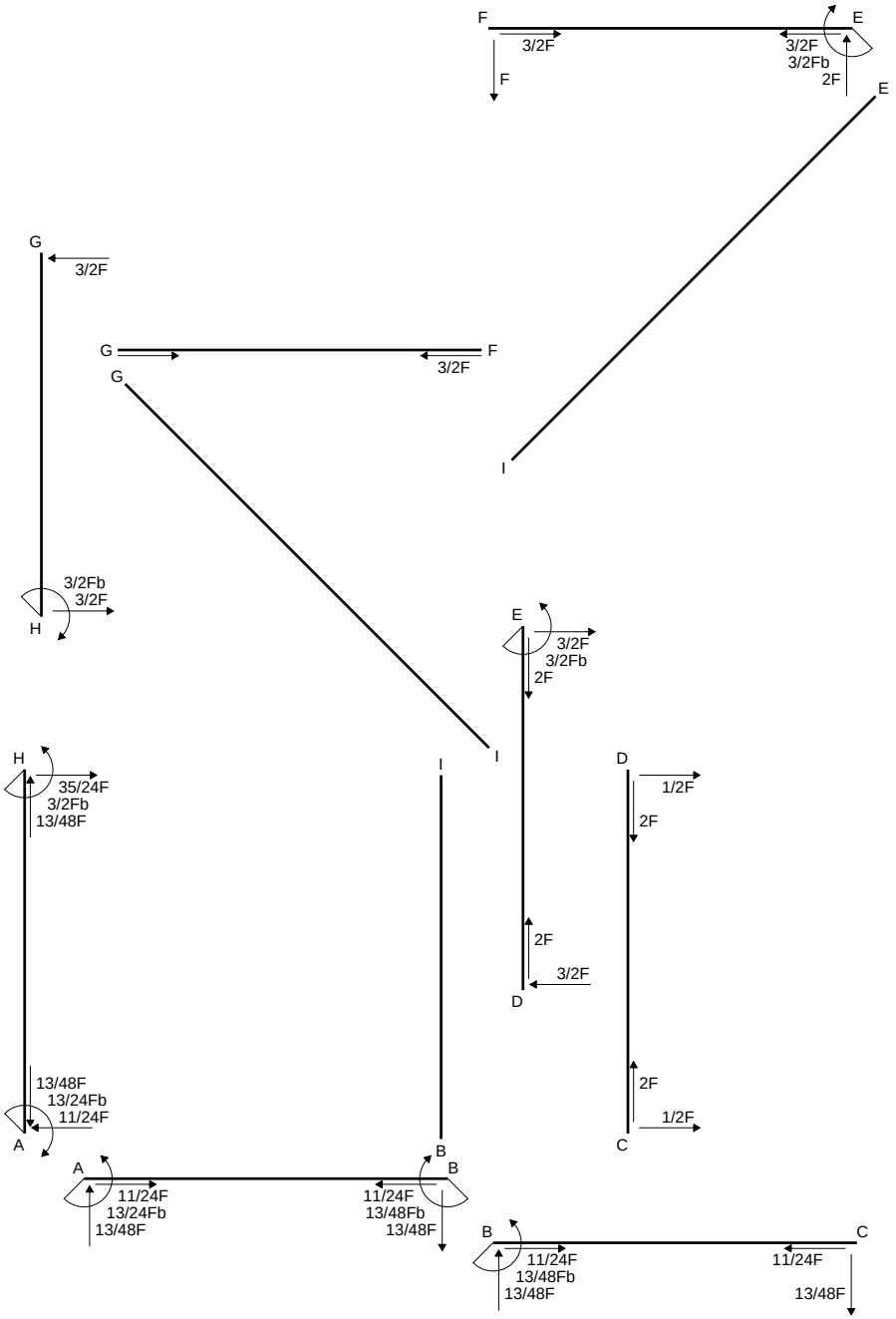
$$= \left(3/4\ b - 2/3\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ \ Fb^2/EJ$$

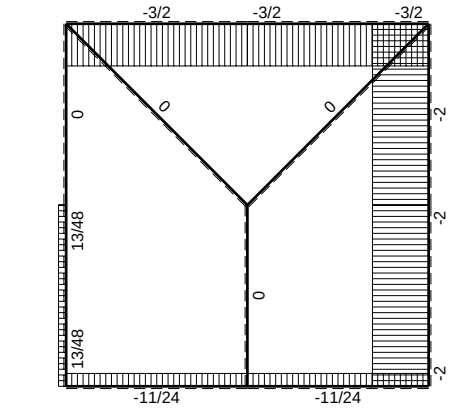
$$L^{Xo}_{AH} = \int_o^b \left(\ x/b - 1/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[1/2\ x^2/b - 1/6\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$$

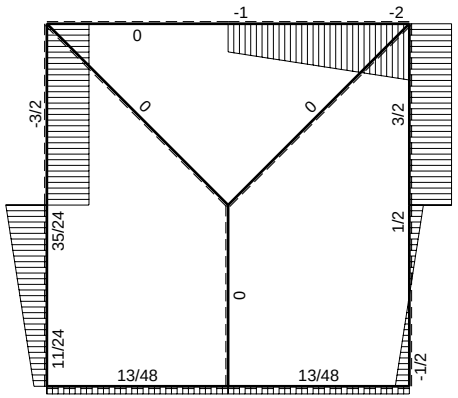
$$= \left(1/2\ b - 1/6\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ \ Fb^2/EJ$$



A = 684. mm^2
J_u = 218819. mm^4
J_v = 46548. mm^4
y_g = 18.76 mm
N = -1665. N
T_y = -2220. N
M_x = 1381950. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 9. mm
v_m = 34.24 mm
$\sigma_m = N/A - Mv/J_u$ = -218.7 N/mm^2
x_c = 21. mm
y_c = 43. mm
v_c = 24.24 mm
$\sigma_c = N/A - Mv/J_u$ = -155.5 N/mm^2
τ_c = 6.187 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 155.9 N/mm^2
S^* = 3659. mm^3

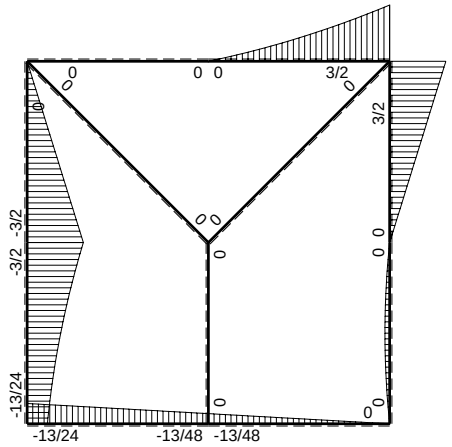

F
E
3/2F
3/2F
3/2Fb
2F
F
E
G
3/2F
G
F
3/2F
G
I
3/2Fb
3/2F
H
E
3/2F
3/2Fb
2F
I
I
H
35/24F
3/2Fb
13/48F
D
1/2F
2F
2F
3/2F
D
13/48F
13/24Fb
11/24F
A
2F
1/2F
C
B
A
B
11/24F
13/24Fb
13/48F
11/24F
13/48Fb
13/48F
B
C
11/24F
13/48Fb
13/48F
11/24F
13/48F


-3/2
-3/2
-3/2
0
0
0
-2
-2
-2
13/48
0
13/48
-11/24
-11/24

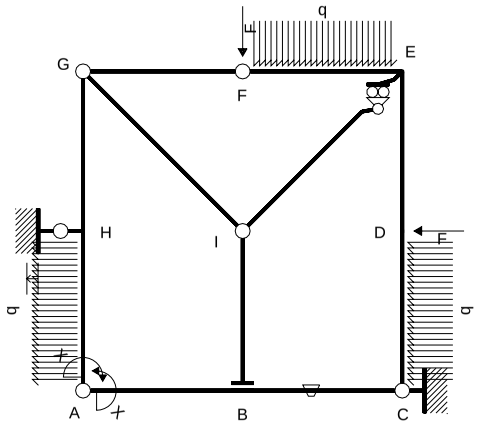

0
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-2
-3/2
0
0
3/2
35/24
0
1/2
11/24
-1/2
13/48
13/48

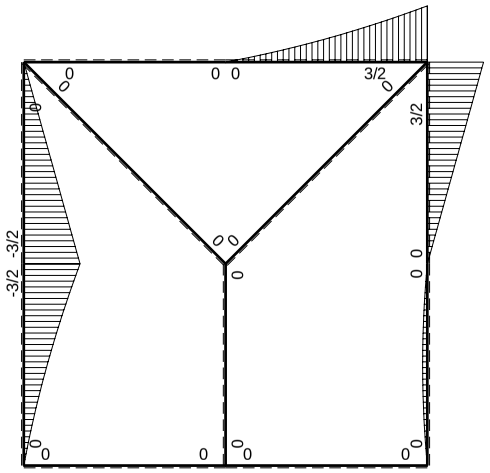
F

F

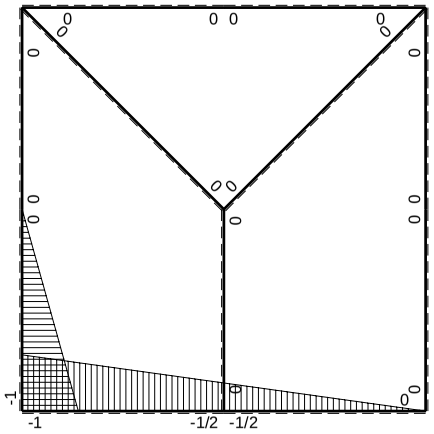

0
0 0
3/2
0
0
0
3/2
0
0
-3/2
-3/2
0
0 0
0
0
-13/24
-13/24
-13/48
-13/48

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	-Fb/EJ	0	1/2Fb/EJ-1/2Fx/EJ	$1/4-1/2x/b+1/4x^2/b^2$	$(0+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	0	Fb/EJ	0	1/2Fx/EJ	$1/4x^2/b^2$		
CD b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
DE b	0	3/2Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+3/2Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3/2Fx	0	0	0	0	0+0	0
HG b	0	3/2Fb-3/2Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3/2Fb+2Fx-1/2qx^2$	0	$3/2Fx-2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(5/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$Fx+1/2qx^2$	0	$Fx-1/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-13/24Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						13/24Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{BC} = \int_o^b \left(1/2 - 1/2\ x/b\ \right)\theta\ \ dx = \left[1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(1/2\ b - 1/4\ b\ \right)\theta\ \ = 1/4\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/2\ x/b\ \right)\theta\ \ dx = \left[-1/4\ x^2/b\ \right]_o^b\ \theta$

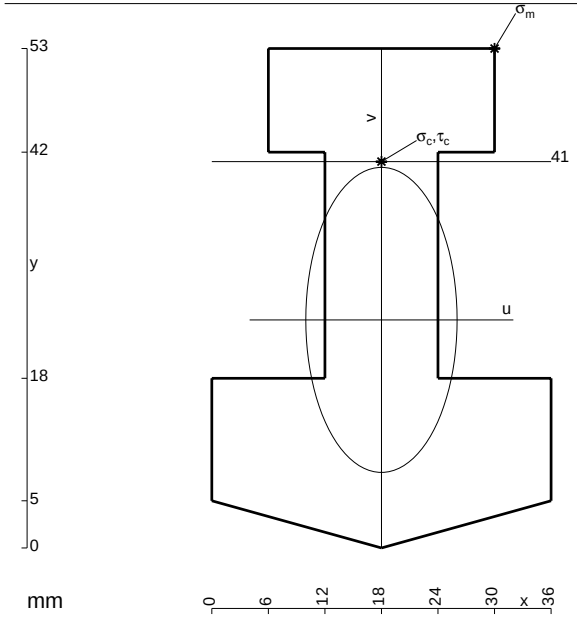
$= \left(-1/4\ b\ \right)\theta\ \ = 1/4\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(3/2\ x/b - 2\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[3/4\ x^2/b - 2/3\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

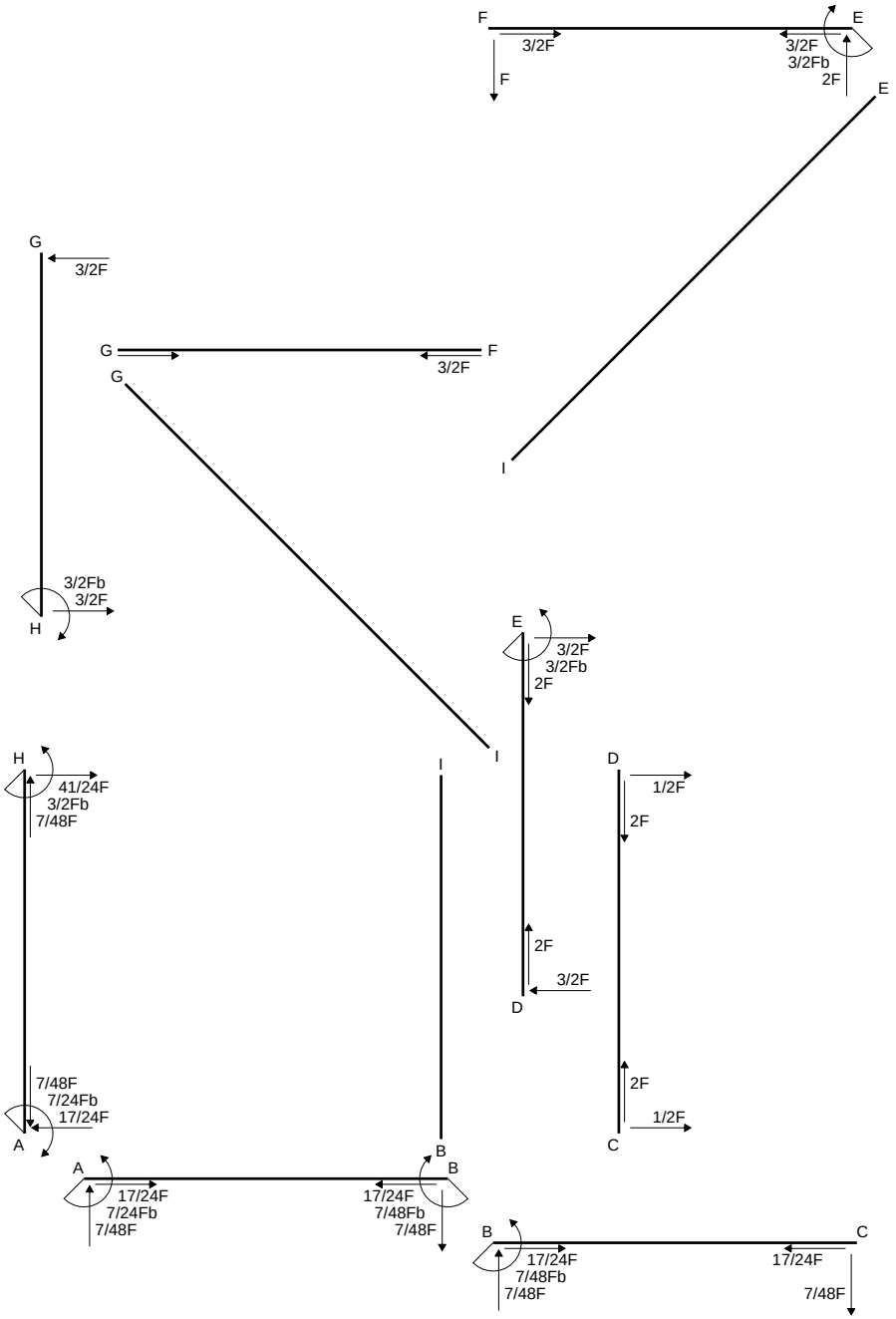
$= \left(3/4\ b - 2/3\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ \ Fb^2/EJ$

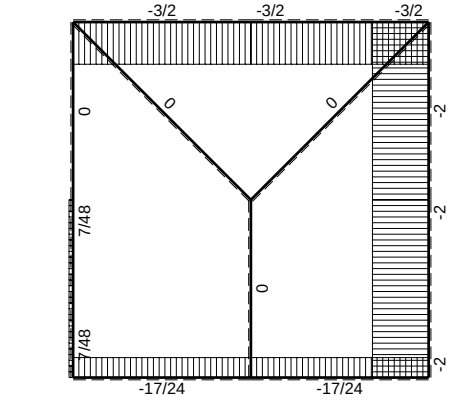
$L^{Xo}_{AH} = \int_o^b \left(\ x/b - 1/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[1/2\ x^2/b - 1/6\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

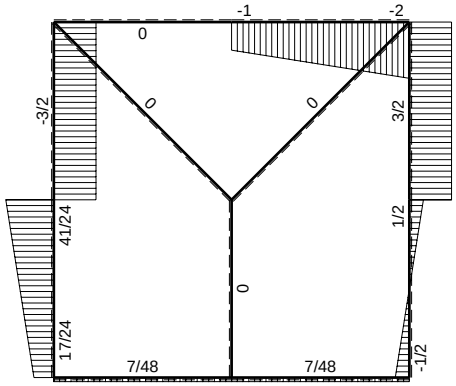
$= \left(1/2\ b - 1/6\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ \ Fb^2/EJ$



A = 1110. mm^2
J_u = 290885. mm^4
J_v = 71532. mm^4
y_g = 24.2 mm
N = -2610. N
T_y = -3480. N
M_x = 2296800. Nmm
x_m = 30. mm
y_m = 53. mm
u_m = 12. mm
v_m = 28.8 mm
$\sigma_m = N/A - Mv/J_u$ = -229.8 N/mm^2
x_c = 18. mm
y_c = 41. mm
v_c = 16.8 mm
$\sigma_c = N/A - Mv/J_u$ = -135. N/mm^2
τ_c = 6.339 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 135.4 N/mm^2
S^* = 6359. mm^3

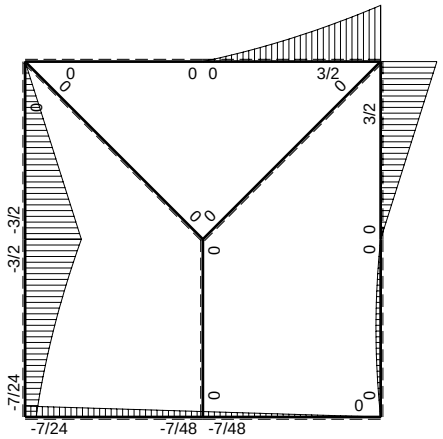

F
E
3/2F
3/2F
3/2Fb
2F
F
E
G
3/2F
G
F
3/2F
G
I
3/2Fb
3/2F
H
E
3/2F
3/2Fb
2F
H
I
I
D
41/24F
3/2Fb
7/48F
1/2F
2F
2F
3/2F
D
7/48F
7/24Fb
17/24F
2F
1/2F
A
B
C
A
B
17/24F
7/24Fb
7/48F
17/24F
7/48Fb
7/48F
B
C
17/24F
7/48Fb
7/48F
17/24F
7/48F


-3/2
-3/2
-3/2
0
0
0
-2
-2
-2
7/48
0
7/48
-17/24
-17/24

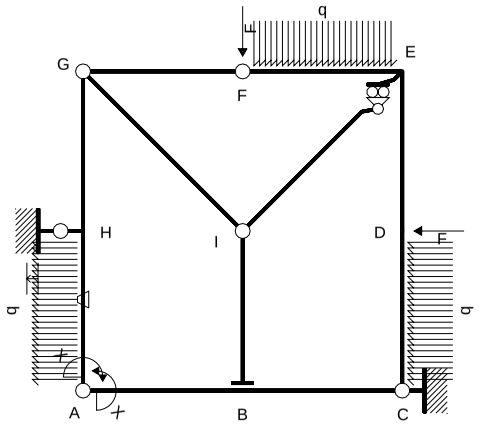

-1
-2
0
-3/2
3/2
0
0
0
41/24
1/2
0
17/24
-1/2
7/48
7/48

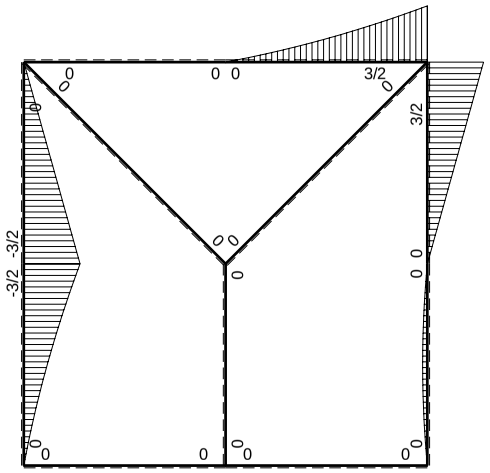
F

F

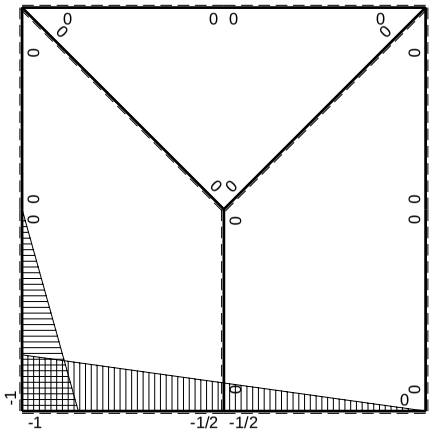

0
0 0
3/2
0
0
0
3/2
0 0
-3/2
-3/2
0
0 0
-7/24
0
0
-7/24
-7/48
-7/48

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
DE b	0	3/2Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+3/2Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3/2Fx	0	0	0	0	0+0	0
HG b	0	3/2Fb-3/2Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3/2Fb+2Fx-1/2qx^2$	-Fb/EJ	$3/2Fx-2Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(5/24+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$Fx+1/2qx^2$	Fb/EJ	$Fx-1/2Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-7/24Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						7/24Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{HA} = \int_o^b \left(3/2\ x/b - 2\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\theta\ \ dx$$

$$= \left[3/4\ x^2/b - 2/3\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b \theta$$

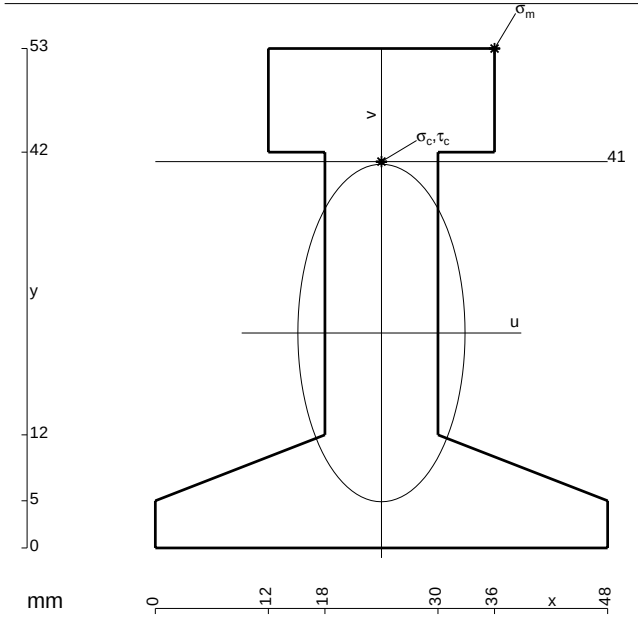
$$= \left(3/4\ b - 2/3\ b + 1/8\ b\ \right) Fb\ 1/EJ\ + \left(1/2\ b\ \right)\theta\ \ = 17/24\ \ Fb^2/EJ$$

$$L^{Xo}_{AH} = \int_o^b \left(\ x/b - 1/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\theta\ \ dx$$

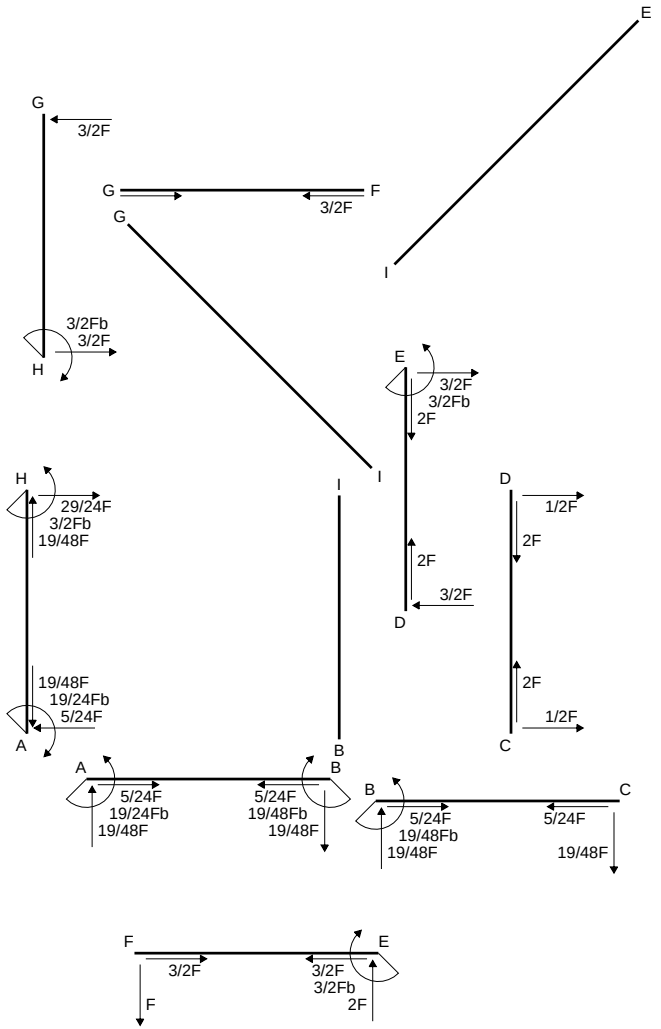
$$= \left[1/2\ x^2/b - 1/6\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b \theta$$

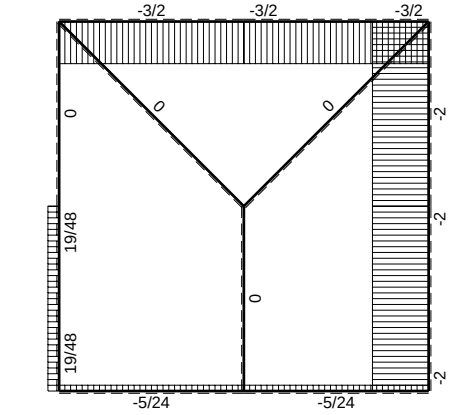
$$= \left(1/2\ b - 1/6\ b - 1/8\ b\ \right) Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\theta\ \ = 17/24\ \ Fb^2/EJ$$

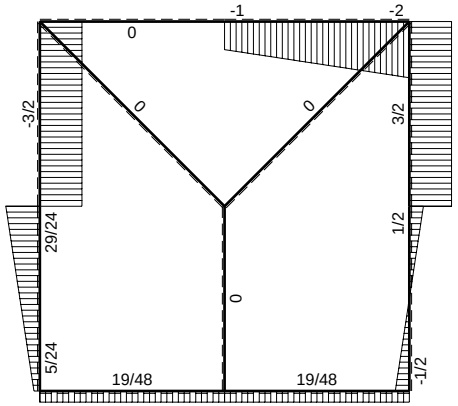
PROCEDIMENTO E RISULTATI 269143 CI04.xxxx.159

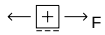


A = 1074. mm^2
J_u = 344482. mm^4
J_v = 84492. mm^4
y_g = 22.81 mm
N = -2910. N
T_y = -3880. N
M_x = 2706300. Nmm
x_m = 36. mm
y_m = 53. mm
u_m = 12. mm
v_m = 30.19 mm
$\sigma_m = N/A - Mv/J_u$ = -239.9 N/mm^2
x_c = 24. mm
y_c = 41. mm
v_c = 18.19 mm
$\sigma_c = N/A - Mv/J_u$ = -145.6 N/mm^2
τ_c = 6.328 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 146. N/mm^2
S^* = 6742. mm^3

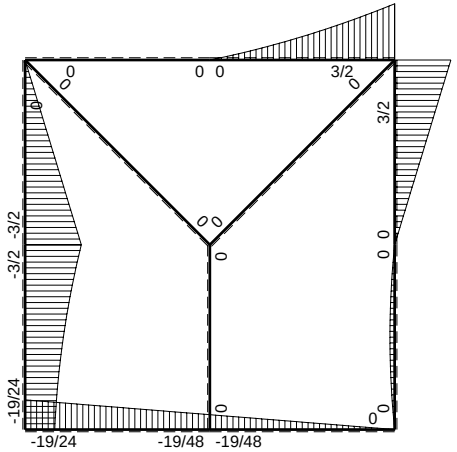






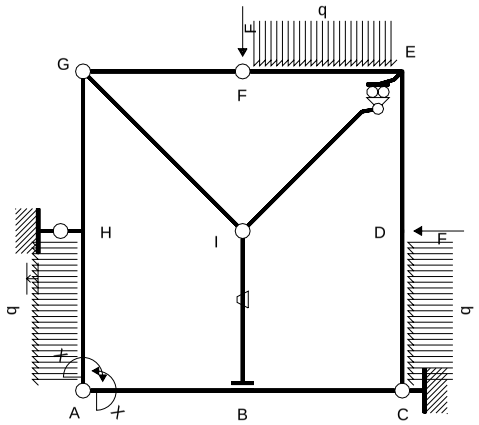


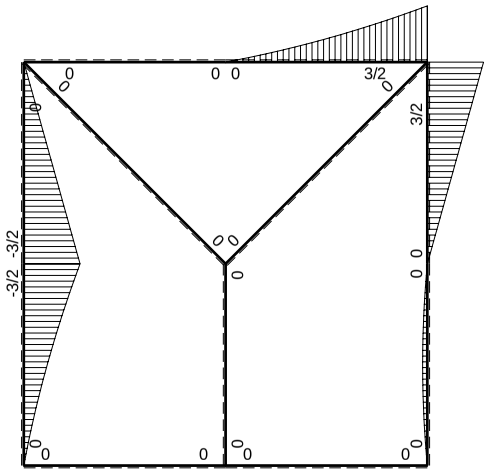




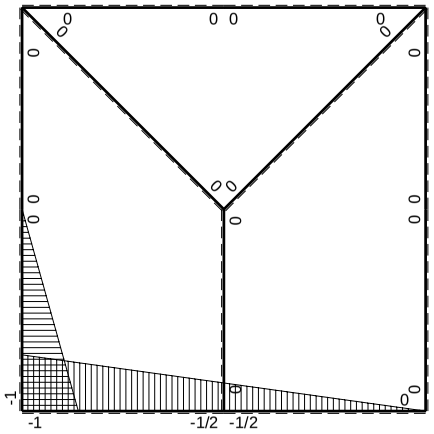


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
DE b	0	3/2Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+3/2Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3/2Fx	0	0	0	0	0+0	0
HG b	0	3/2Fb-3/2Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	-Fb/EJ	0	0	0	0+0	0
BI b	0	0	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3/2Fb+2Fx-1/2qx^2$	0	$3/2Fx-2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(5/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$Fx+1/2qx^2$	0	$Fx-1/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-19/24Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						19/24Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

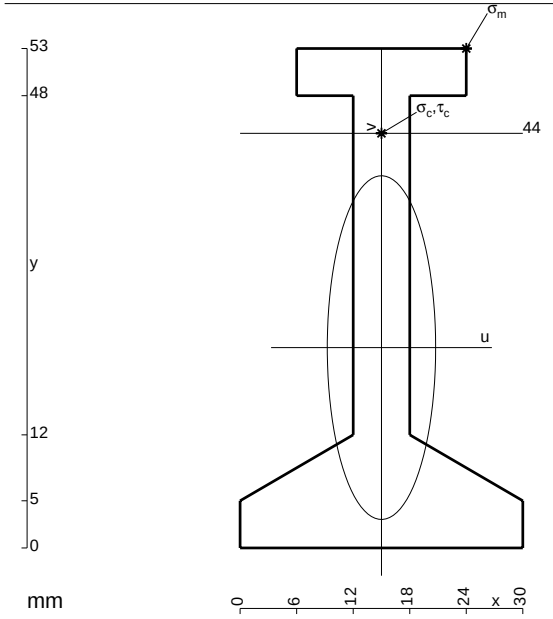
$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{HA} = \int_o^b \left(3/2\ x/b - 2\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[3/4\ x^2/b - 2/3\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

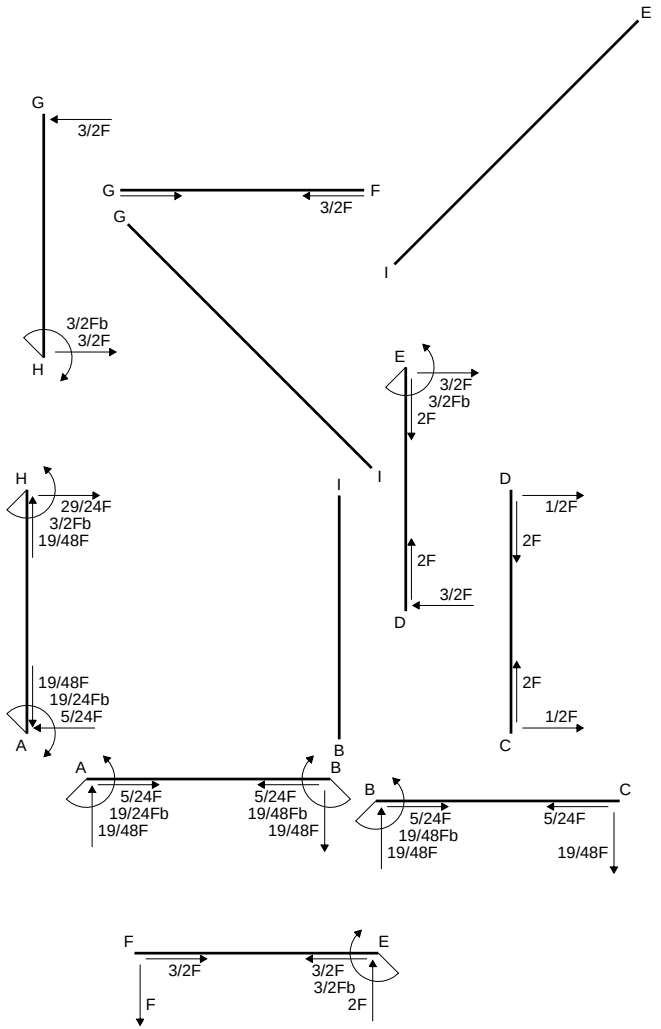
$= \left(3/4\ b - 2/3\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ Fb^2/EJ$

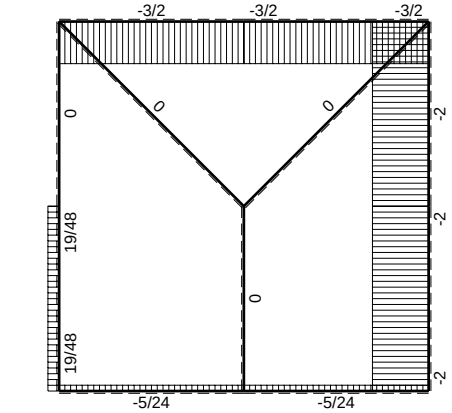
$L^{Xo}_{AH} = \int_o^b \left(\ x/b - 1/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[1/2\ x^2/b - 1/6\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

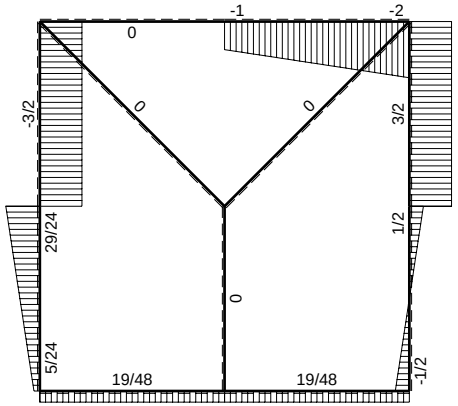
$= \left(1/2\ b - 1/6\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ Fb^2/EJ$

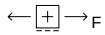


A = 582. mm^2
J_u = 193597. mm^4
J_v = 19242. mm^4
y_g = 21.26 mm
N = -2430. N
T_y = -3240. N
M_x = 1190700. Nmm
x_m = 24. mm
y_m = 53. mm
u_m = 9. mm
v_m = 31.74 mm
$\sigma_m = N/A - Mv/J_u$ = -199.4 N/mm^2
x_c = 15. mm
y_c = 44. mm
v_c = 22.74 mm
$\sigma_c = N/A - Mv/J_u$ = -144. N/mm^2
τ_c = 8.997 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 144.9 N/mm^2
S^* = 3225. mm^3

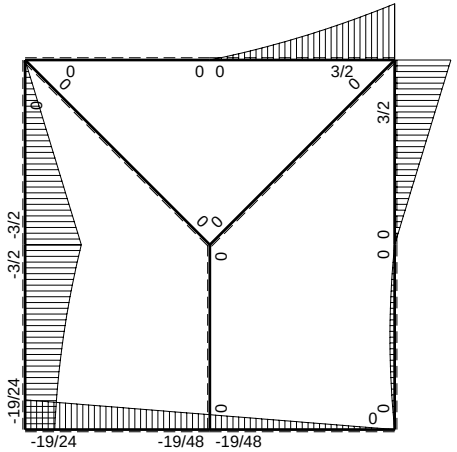






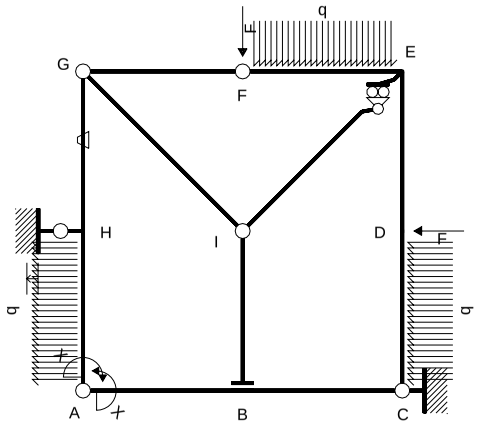


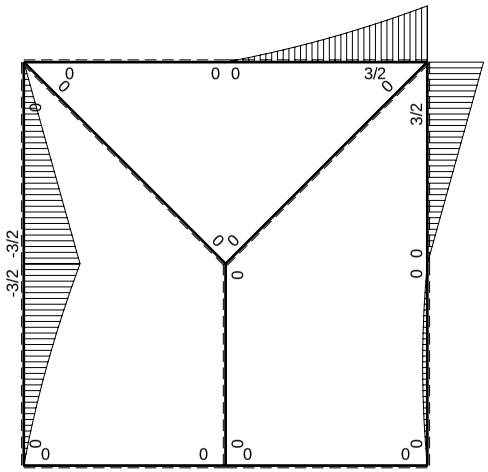




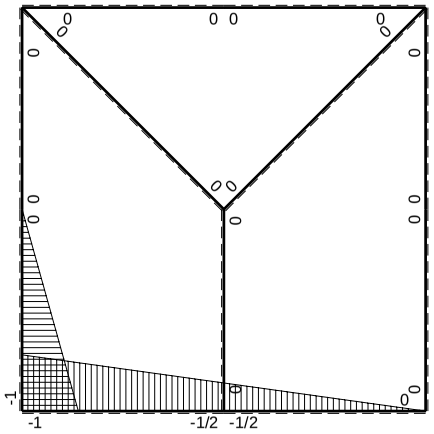


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 265627 CI04.xxxx.161

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PROCEDIMENTO E RISULTATI 265627 CI04.xxxx.161

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
DE b	0	3/2Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+3/2Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3/2Fx	-Fb/EJ	0	0	0	0+0	0
HG b	0	3/2Fb-3/2Fx	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3/2Fb+2Fx-1/2qx^2$	0	$3/2Fx-2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(5/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$Fx+1/2qx^2$	0	$Fx-1/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-19/24Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						19/24Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

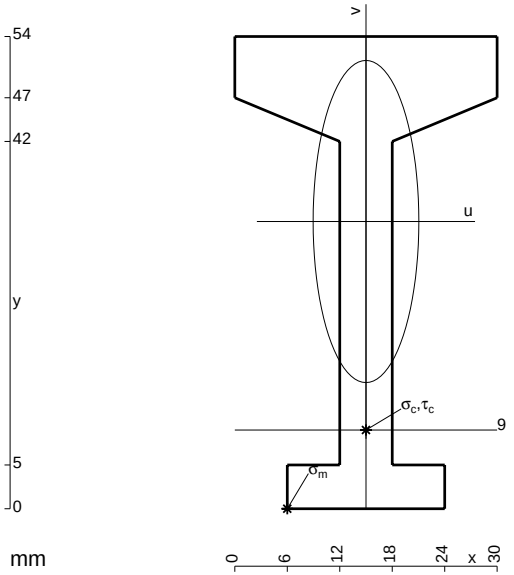
$L^{Xo}_{HA} = \int_o^b \left(3/2\ x/b - 2\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[3/4\ x^2/b - 2/3\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/4\ b - 2/3\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(\ x/b - 1/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[1/2\ x^2/b - 1/6\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

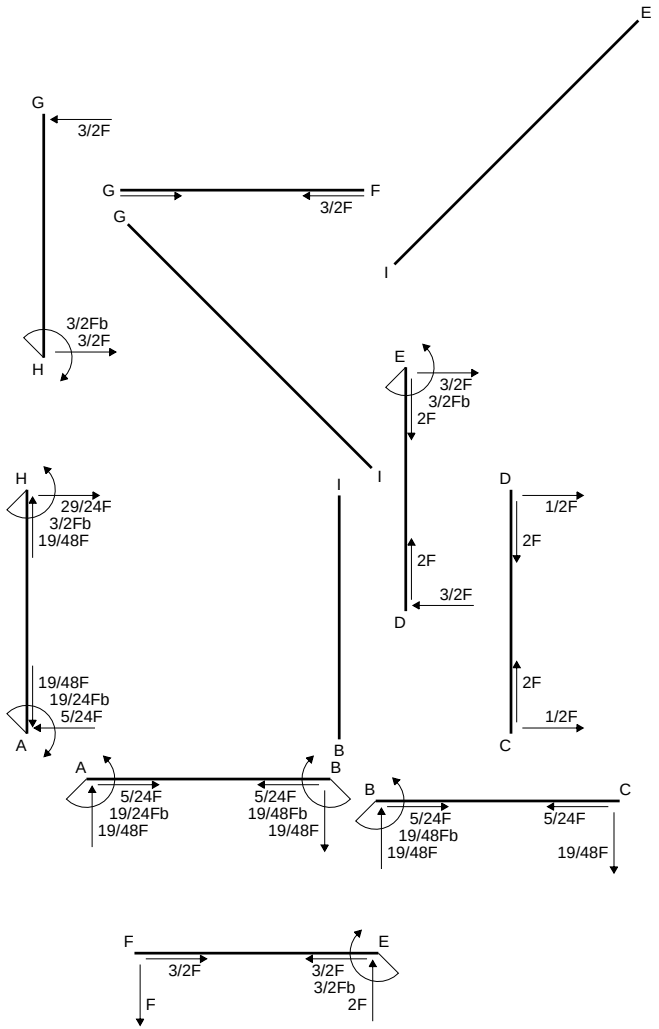
$= \left(1/2\ b - 1/6\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ \ Fb^2/EJ$

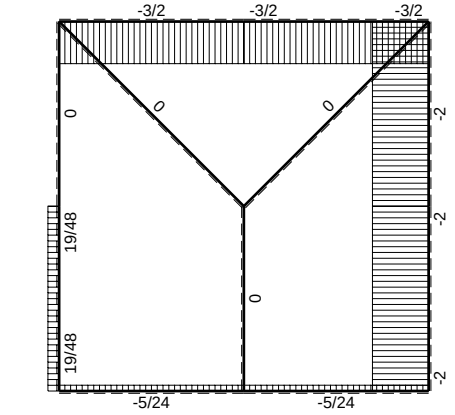
PROCEDIMENTO E RISULTATI 265627 CI04.xxxx.161

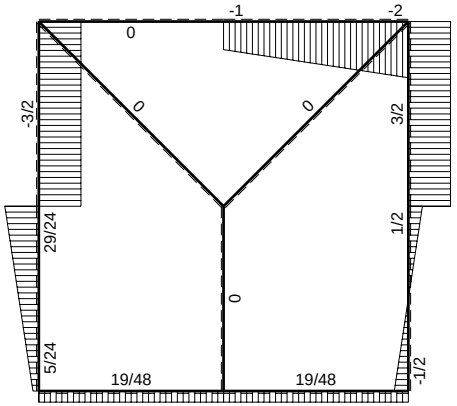


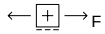
A = 612. mm^2
J_u = 207668. mm^4
J_v = 22356. mm^4
y_g = 32.85 mm
N = -2460. N
T_y = -3280. N
M_x = 1353000. Nmm
x_m = 6. mm
u_m = -9. mm
v_m = -32.85 mm
$\sigma_m = N/A - Mv/J_u$ = 210. N/mm^2
x_c = 15. mm
y_c = 9. mm
v_c = -23.85 mm
$\sigma_c = N/A - Mv/J_u$ = 151.3 N/mm^2
τ_c = 8.823 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 152.1 N/mm^2
S^* = 3351. mm^3

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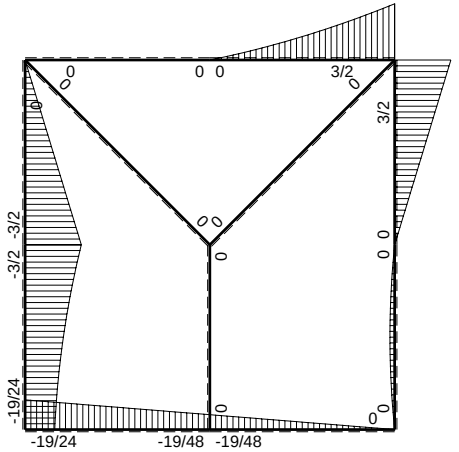






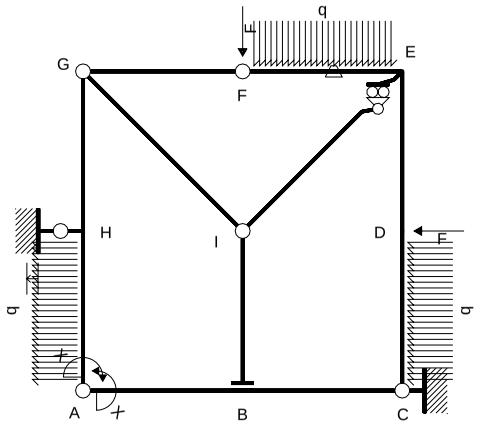


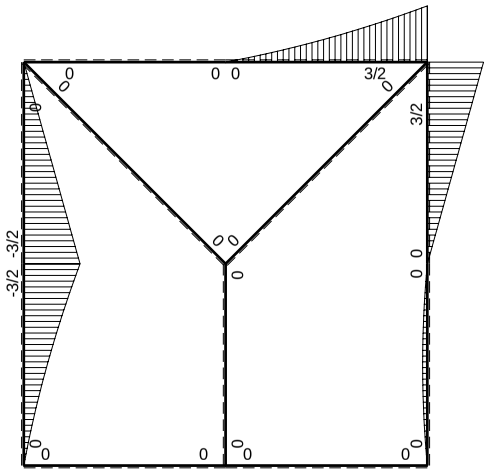




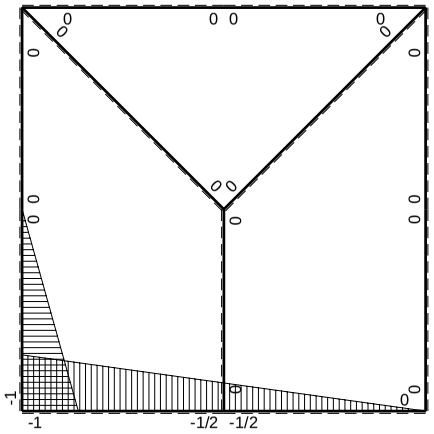


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 212930 CI04.xxxx.162

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PROCEDIMENTO E RISULTATI 212930 CI04.xxxx.162

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-1/2Fx+1/2qx^2$	0	0	0	0	0+0	0
DC b	0	$1/2Fx-1/2qx^2$	0	0	0	0		
DE b	0	3/2Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+3/2Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	Fb/EJ	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3/2Fx	0	0	0	0	0+0	0
HG b	0	3/2Fb-3/2Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3/2Fb+2Fx-1/2qx^2$	0	$3/2Fx-2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(5/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$Fx+1/2qx^2$	0	$Fx-1/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-19/24Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						19/24Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

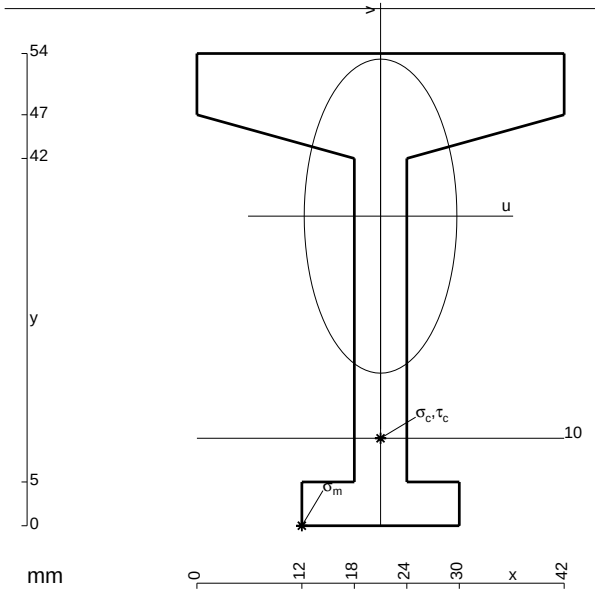
$L^{Xo}_{HA} = \int_o^b \left(3/2\ x/b - 2\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[3/4\ x^2/b - 2/3\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(3/4\ b - 2/3\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ Fb^2/EJ$

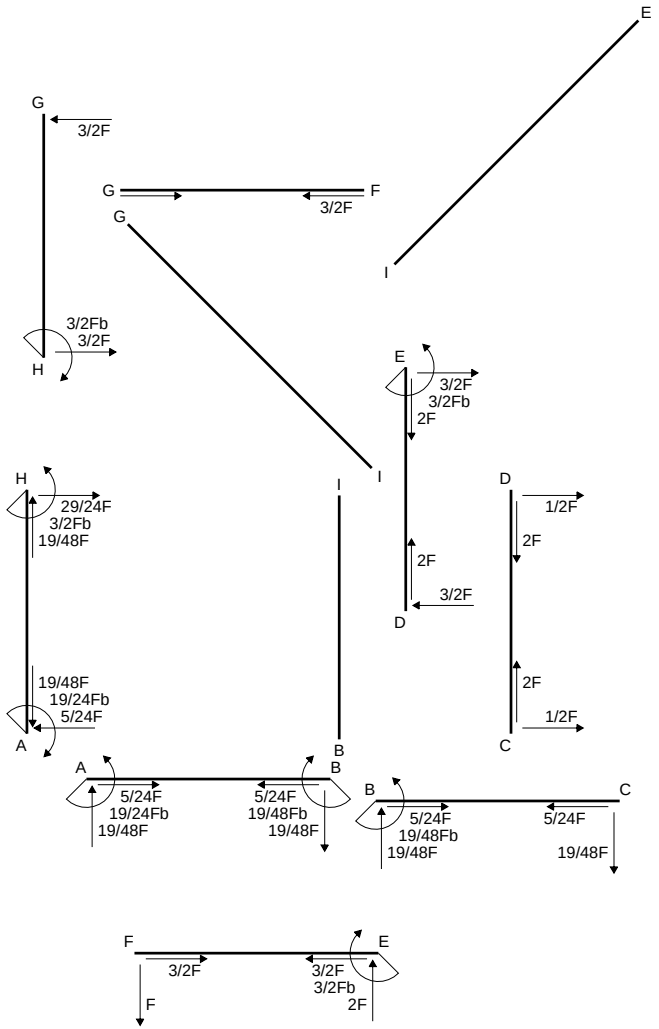
$L^{Xo}_{AH} = \int_o^b \left(\ x/b - 1/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[1/2\ x^2/b - 1/6\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

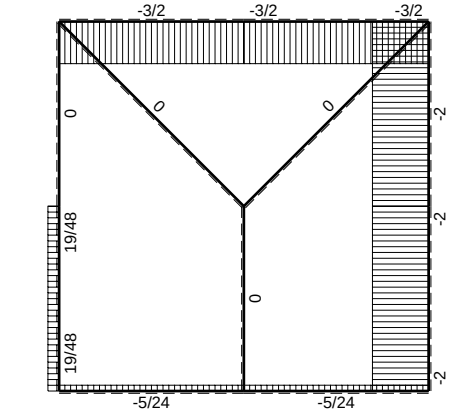
$= \left(1/2\ b - 1/6\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ Fb^2/EJ$

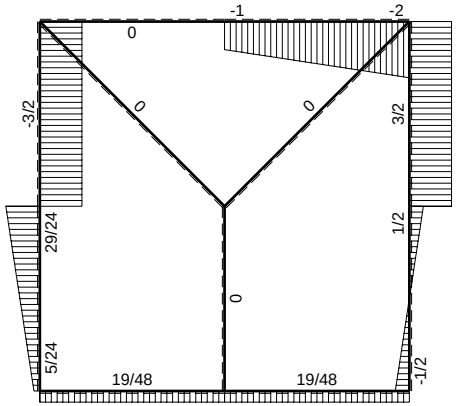
PROCEDIMENTO E RISULTATI 212930 CI04.xxxx.162



A = 726. mm^2
J_u = 234156. mm^4
J_v = 55314. mm^4
y_g = 35.4 mm
N = -2460. N
T_y = -3280. N
M_x = 1476000. Nmm
x_m = 12. mm
u_m = -9. mm
v_m = -35.4 mm
$\sigma_m = N/A - Mv/J_u$ = 219.8 N/mm^2
x_c = 21. mm
y_c = 10. mm
v_c = -25.41 mm
$\sigma_c = N/A - Mv/J_u$ = 156.8 N/mm^2
τ_c = 8.868 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 157.5 N/mm^2
S^* = 3799. mm^3

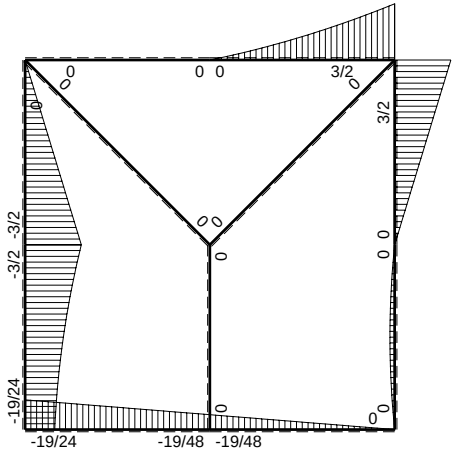

G
3/2F
G
F
3/2F
G
I
E
3/2Fb
3/2F
H
E
3/2F
3/2Fb
2F
I
I
H
29/24F
3/2Fb
19/48F
D
1/2F
2F
2F
3/2F
D
19/48F
19/24Fb
5/24F
2F
1/2F
A
B
C
A
B
5/24F
19/24Fb
19/48F
5/24F
19/48Fb
19/48F
B
C
5/24F
19/48Fb
19/48F
5/24F
19/48F
F
E
3/2F
3/2F
3/2Fb
2F
F


-3/2
-3/2
-3/2
0
0
0
-2
19/48
-2
0
19/48
-2
-5/24
-5/24

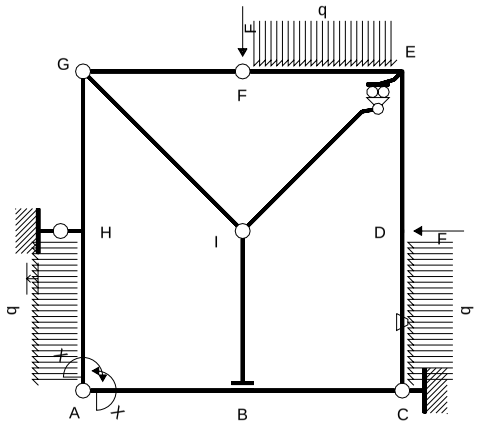

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-2
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0
0
3/2
29/24
1/2
0
5/24
19/48
19/48
-1/2

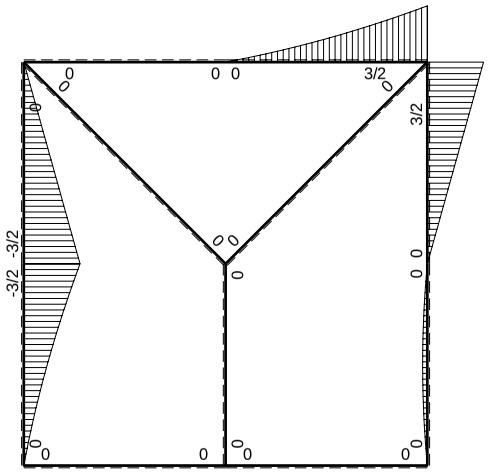
F

F

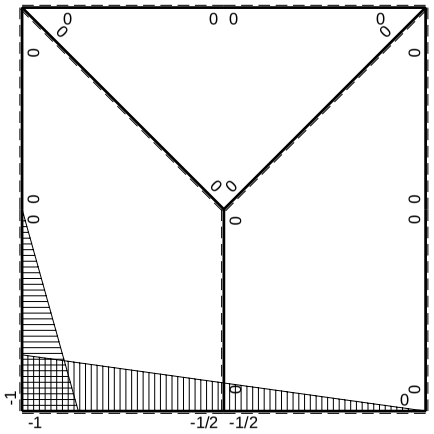

0
0 0
3/2
0
0
3/2
0
0
-3/2
0
0
0 0
-3/2
0
-19/24
0
0
-19/24
-19/48
-19/48

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264603 CI04.xxxx.163

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PROCEDIMENTO E RISULTATI 264603 CI04.xxxx.163

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	0	0	0	0	$1-x/b+1/4x^2/b^2$	0+0	7/12Xb/EJ
BA b	1/2+1/2x/b	0	0	0	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	0	0	0	0	$1/4-1/2x/b+1/4x^2/b^2$	0+0	1/12Xb/EJ
CB b	1/2x/b	0	0	0	0	$1/4x^2/b^2$		
CD b	0	$-1/2Fx+1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
DC b	0	$1/2Fx-1/2qx^2$	Fb/EJ	0	0	0		
DE b	0	3/2Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+3/2Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-3/2Fx	0	0	0	0	0+0	0
HG b	0	3/2Fb-3/2Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-3/2Fb+2Fx-1/2qx^2$	0	$3/2Fx-2Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(5/24+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$Fx+1/2qx^2$	0	$Fx-1/2Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-19/24Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						19/24Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

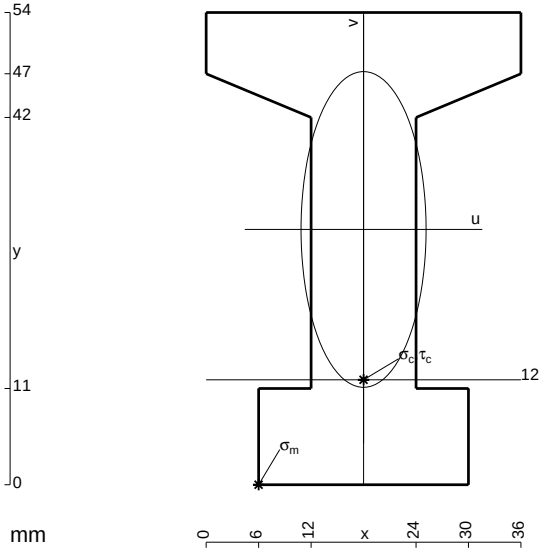
$L^{Xo}_{HA} = \int_o^b \left(3/2\ x/b - 2\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[3/4\ x^2/b - 2/3\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

$= \left(3/4\ b - 2/3\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ Fb^2/EJ$

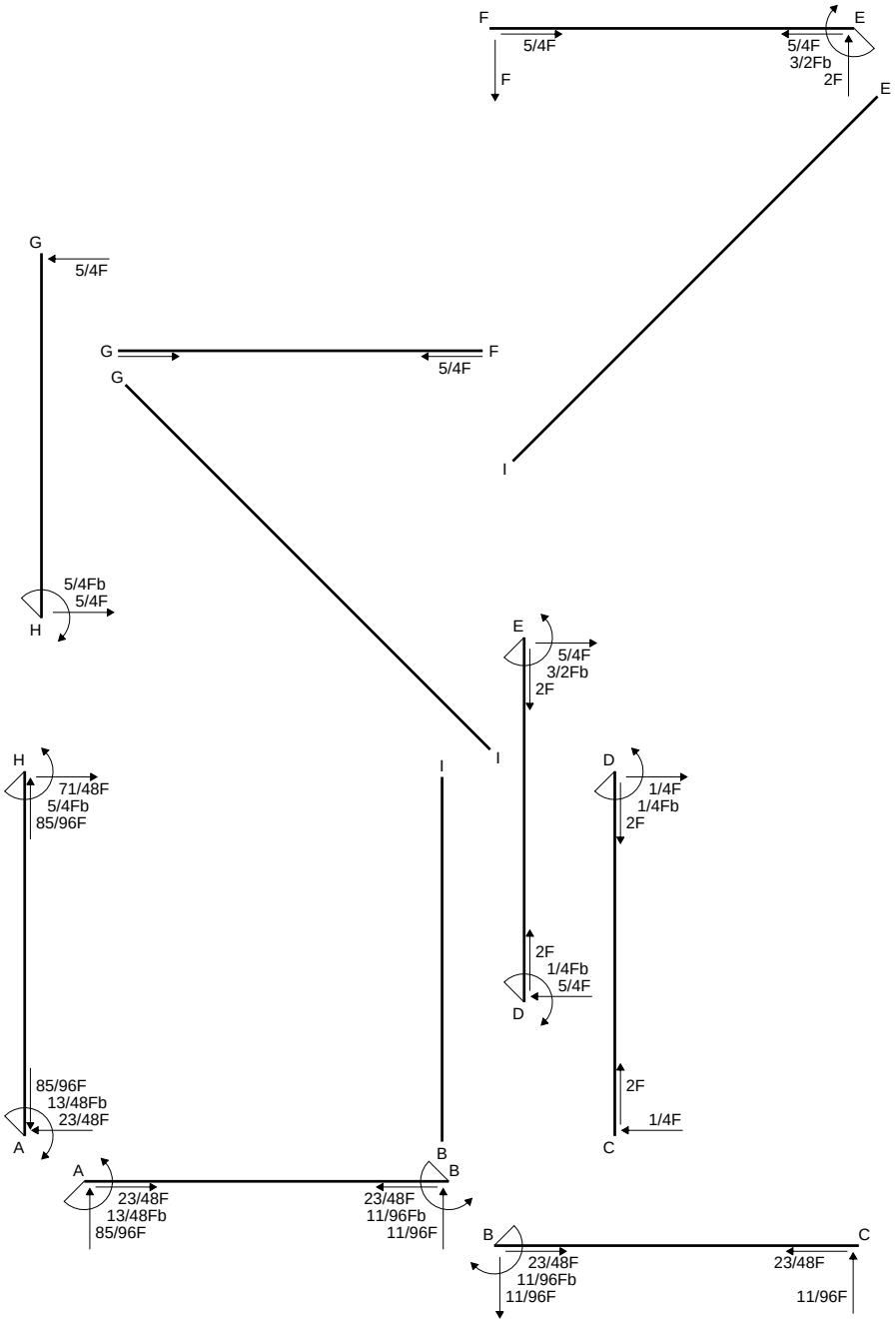
$L^{Xo}_{AH} = \int_o^b \left(\ x/b - 1/2\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[1/2\ x^2/b - 1/6\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

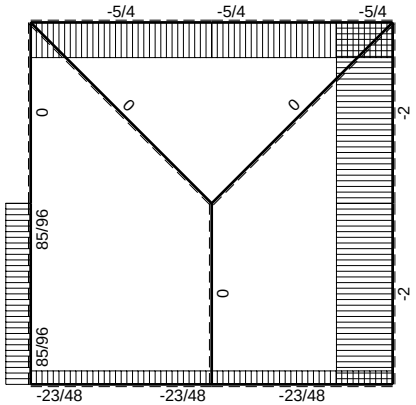
$= \left(1/2\ b - 1/6\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 5/24\ Fb^2/EJ$

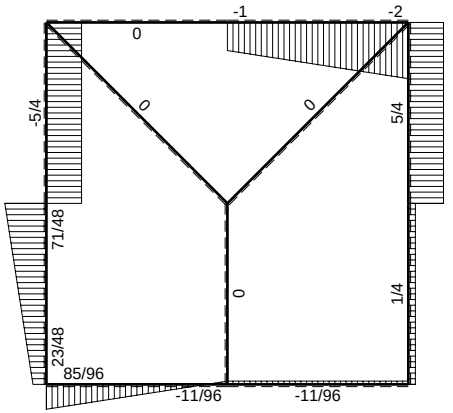
PROCEDIMENTO E RISULTATI 264603 CI04.xxxx.163



A = 1008. mm^2
J_u = 328681. mm^4
J_v = 51552. mm^4
y_g = 29.19 mm
N = -4050. N
T_y = -5400. N
M_x = 2632500. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -29.19 mm
$\sigma_m = N/A - Mv/J_u$ = 229.8 N/mm^2
x_c = 18. mm
y_c = 12. mm
v_c = -17.19 mm
$\sigma_c = N/A - Mv/J_u$ = 133.7 N/mm^2
τ_c = 8.854 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 134.6 N/mm^2
S^* = 6467. mm^3

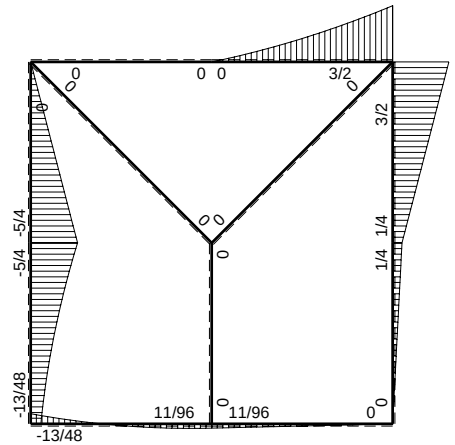

F
5/4F
F
E
5/4F
3/2Fb
2F
E
G
5/4F
G
F
5/4F
G
I
5/4Fb
5/4F
H
E
5/4F
3/2Fb
2F
H
71/48F
5/4Fb
85/96F
I
I
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
85/96F
13/48Fb
23/48F
A
2F
1/4F
C
B
A
B
23/48F
13/48Fb
85/96F
23/48F
11/96Fb
11/96F
B
C
23/48F
11/96Fb
11/96F
23/48F
11/96F


-5/4
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85/96
0
-2
85/96
-23/48
-23/48
-23/48

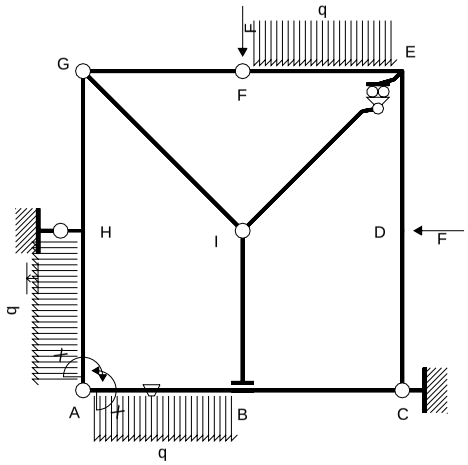

-1
-2
0
-5/4
0
0
5/4
71/48
0
1/4
23/48
85/96
-11/96
-11/96

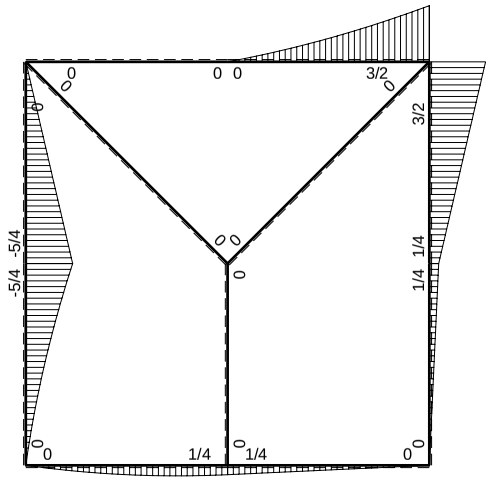
F

F

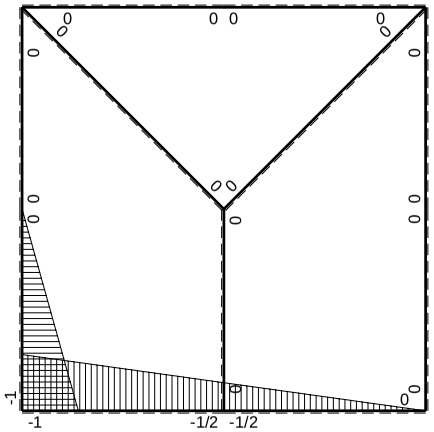

0
0 0
3/2
0
0
3/2
-5/4
-5/4
0
1/4
1/4
-13/48
11/96
11/96
0
-13/48

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264698 CI04.xxxx.164

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PROCEDIMENTO E RISULTATI 264698 CI04.xxxx.164

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx-1/2qx^2	-Fb/EJ	-3/4Fx+7/8Fx^2/b-1/4qx^3/b	Fb/EJ-1/2Fx/EJ	1-x/b+1/4x^2/b^2	(-7/48+3/4)Fb^2/EJ	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb-1/4Fx+1/2qx^2	Fb/EJ	-1/8Fb-1/4Fx+1/8Fx^2/b+1/4qx^3/b	1/2Fb/EJ+1/2Fx/EJ	1/4+1/2x/b+1/4x^2/b^2		
BC b	-1/2+1/2x/b	1/4Fb-1/4Fx	0	-1/8Fb+1/4Fx-1/8Fx^2/b	0	1/4-1/2x/b+1/4x^2/b^2	(-1/24+0)Fb^2/EJ	1/12Xb/EJ
CB b	1/2x/b	-1/4Fx	0	-1/8Fx^2/b	0	1/4x^2/b^2		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-2Fx+1/2qx^2	0	0	0	0	0+0	0
FE b	0	-Fx-1/2qx^2	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-5/4Fx	0	0	0	0	0+0	0
HG b	0	5/4Fb-5/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	-5/4Fb+7/4Fx-1/2qx^2	0	5/4Fx-7/4Fx^2/b+1/2qx^3/b	0	x^2/b^2	(1/6+0)Fb^2/EJ	1/3Xb/EJ
AH b	1-x/b	3/4Fx+1/2qx^2	0	3/4Fx-1/4Fx^2/b-1/2qx^3/b	0	1-2x/b+x^2/b^2		
H	cedimento nodo $-H_{1H}u_H$						-Fb^2/EJ	
	totali						-13/48Fb^2/EJ	Xb/EJ
	iperstatica $X=W_{AB}$						13/48Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 7/8\ x^2/b^2 - 1/4\ x^3/b^3\ \right) Fb\ 1/EJ\ dx + \int_o^b \left(1 - 1/2\ x/b\ \right)\theta\ \ dx$

$= \left[-3/8\ x^2/b + 7/24\ x^3/b^2 - 1/16\ x^4/b^3\ \right]_o^b Fb\ 1/EJ\ + \left[\ x - 1/4\ x^2/b\ \right]_o^b \theta$

$= \left(-3/8\ b + 7/24\ b - 1/16\ b\ \right) Fb\ 1/EJ\ + \left(\ b - 1/4\ b\ \right)\theta\ \ = 29/48\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 - 1/4\ x/b + 1/8\ x^2/b^2 + 1/4\ x^3/b^3\ \right) Fb\ 1/EJ\ dx + \int_o^b \left(-1/2 - 1/2\ x/b\ \right)\theta\ \ dx$

$= \left[-1/8\ x - 1/8\ x^2/b + 1/24\ x^3/b^2 + 1/16\ x^4/b^3\ \right]_o^b Fb\ 1/EJ\ + \left[-1/2\ x - 1/4\ x^2/b\ \right]_o^b \theta$

$= \left(-1/8\ b - 1/8\ b + 1/24\ b + 1/16\ b\ \right) Fb\ 1/EJ\ + \left(-1/2\ b - 1/4\ b\ \right)\theta\ \ = 29/48\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/8 + 1/4\ x/b - 1/8\ x^2/b^2\ \right) Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/8\ x^2/b - 1/24\ x^3/b^2\ \right]_o^b Fb\ 1/EJ$

$= \left(-1/8\ b + 1/8\ b - 1/24\ b\ \right) Fb\ 1/EJ\ = -1/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/8\ x^2/b^2\ \right) Fb\ 1/EJ\ dx = \left[-1/24\ x^3/b^2\ \right]_o^b Fb\ 1/EJ$

$= \left(-1/24\ b\ \right) Fb\ 1/EJ\ = -1/24\ \ Fb^2/EJ$

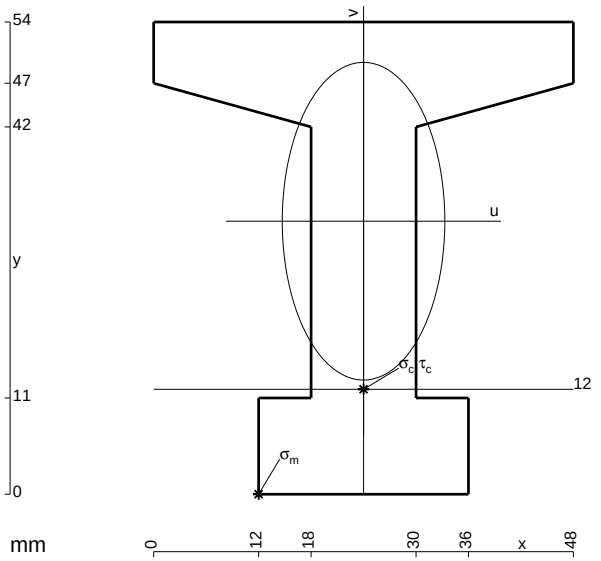
$L^{Xo}_{HA} = \int_o^b \left(5/4\ x/b - 7/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[5/8\ x^2/b - 7/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

$= \left(5/8\ b - 7/12\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/6\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(3/4\ x/b - 1/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right) Fb\ 1/EJ\ dx = \left[3/8\ x^2/b - 1/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

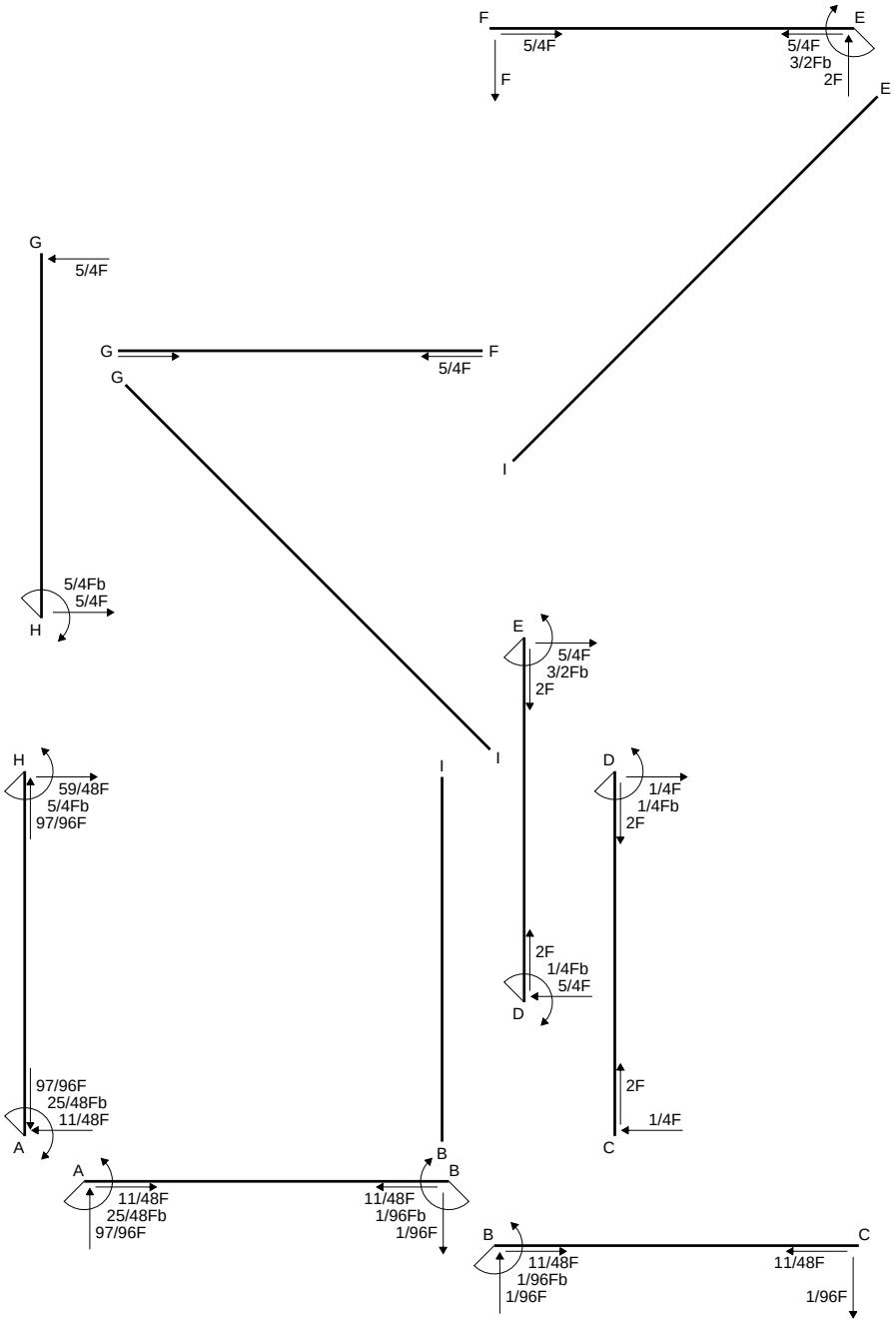
$= \left(3/8\ b - 1/12\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/6\ \ Fb^2/EJ$

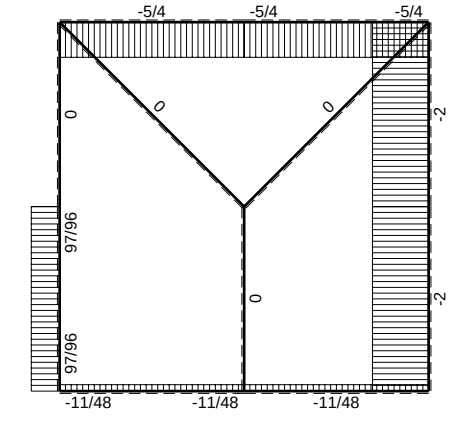
PROCEDIMENTO E RISULTATI 264698 CI04.xxxx.164

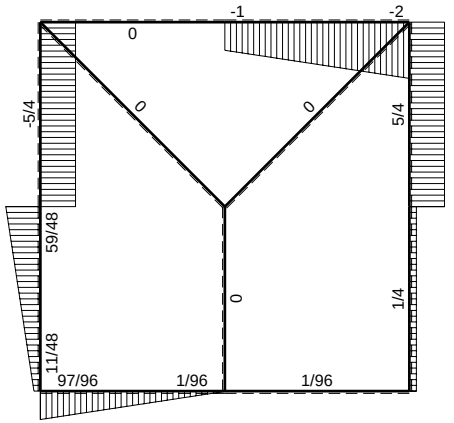


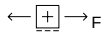
A = 1122. mm^2
J_u = 370409. mm^4
J_v = 96948. mm^4
y_g = 31.22 mm
N = -3425. N
T_y = -5480. N
M_x = 2877000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -31.22 mm
$\sigma_m = N/A - Mv/J_u$ = 239.4 N/mm^2
x_c = 24. mm
y_c = 12. mm
v_c = -19.22 mm
$\sigma_c = N/A - Mv/J_u$ = 146.2 N/mm^2
τ_c = 8.663 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 147. N/mm^2
S^* = 7027. mm^3

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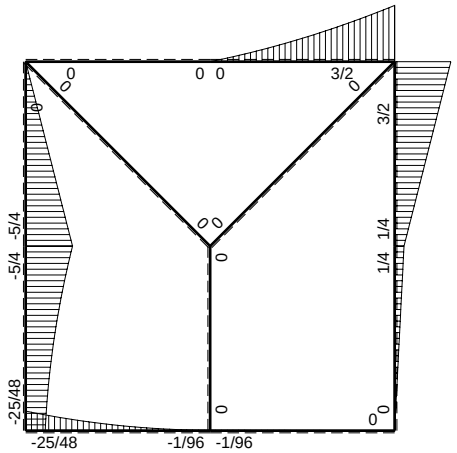

F
E
5/4F
5/4F
3/2Fb
2F
F
E
G
5/4F
G
F
5/4F
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I
5/4Fb
5/4F
H
E
5/4F
3/2Fb
2F
H
I
I
D
59/48F
5/4Fb
97/96F
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
97/96F
25/48Fb
11/48F
A
2F
1/4F
C
B
A
B
11/48F
25/48Fb
97/96F
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1/96Fb
1/96F
B
C
11/48F
1/96Fb
1/96F
11/48F
1/96F


-5/4
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97/96
-11/48
-11/48
-11/48

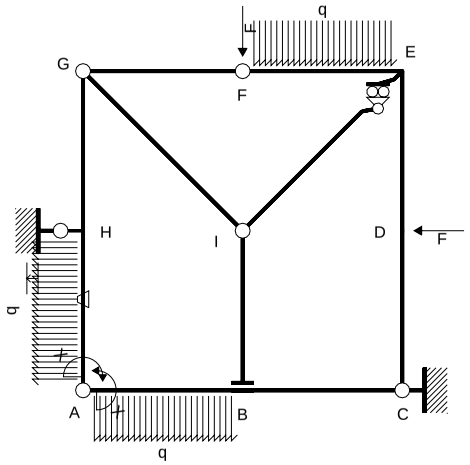

-1
-2
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-5/4
0
0
5/4
59/48
0
1/4
11/48
97/96
1/96
1/96

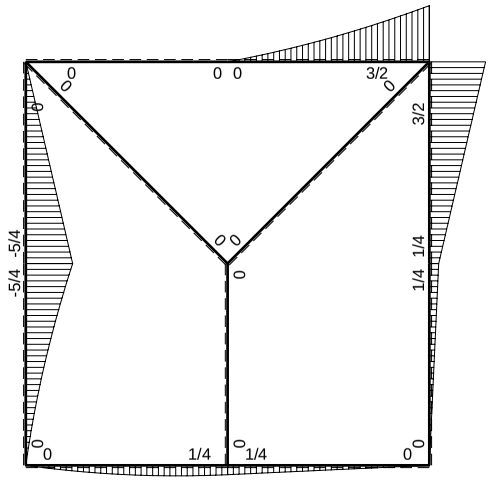

F


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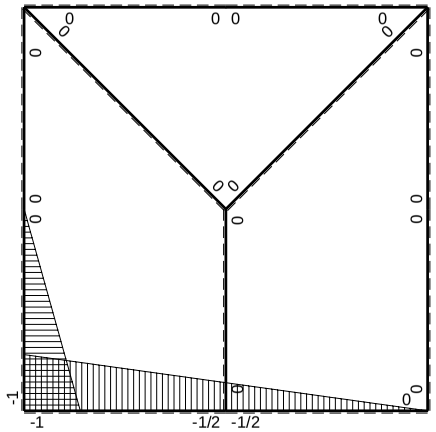

0
0 0
3/2
0
0
0
3/2
0
0
-5/4
-5/4
1/4
1/4
0
0
0
-25/48
-25/48
-1/96
-1/96


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	3/4Fx-1/2qx^2	0	-3/4Fx+7/8Fx^2/b-1/4qx^3/b	0	1-x/b+1/4x^2/b^2	(-7/48+0)Fb^2/EJ	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/4Fb-1/4Fx+1/2qx^2	0	-1/8Fb-1/4Fx+1/8Fx^2/b+1/4qx^3/b	0	1/4+1/2x/b+1/4x^2/b^2		
BC b	-1/2+1/2x/b	1/4Fb-1/4Fx	0	-1/8Fb+1/4Fx-1/8Fx^2/b	0	1/4-1/2x/b+1/4x^2/b^2	(-1/24+0)Fb^2/EJ	1/12Xb/EJ
CB b	1/2x/b	-1/4Fx	0	-1/8Fx^2/b	0	1/4x^2/b^2		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	3/2Fb-2Fx+1/2qx^2	0	0	0	0	0+0	0
FE b	0	-Fx-1/2qx^2	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-5/4Fx	0	0	0	0	0+0	0
HG b	0	5/4Fb-5/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	-5/4Fb+7/4Fx-1/2qx^2	-Fb/EJ	5/4Fx-7/4Fx^2/b+1/2qx^3/b	Fx/EJ	x^2/b^2	(1/6+1/2)Fb^2/EJ	1/3Xb/EJ
AH b	1-x/b	3/4Fx+1/2qx^2	Fb/EJ	3/4Fx-1/4Fx^2/b-1/2qx^3/b	Fb/EJ-Fx/EJ	1-2x/b+x^2/b^2		
H	cedimento nodo $-H_{1H}u_H$						-Fb^2/EJ	
	totali						-25/48Fb^2/EJ	Xb/EJ
	iperstatica $X=W_{AB}$						25/48Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-3/4\ x/b + 7/8\ x^2/b^2 - 1/4\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[-3/8\ x^2/b + 7/24\ x^3/b^2 - 1/16\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-3/8\ b + 7/24\ b - 1/16\ b\ \right)\ Fb\ 1/EJ\ = -7/48\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/8 - 1/4\ x/b + 1/8\ x^2/b^2 + 1/4\ x^3/b^3\right)\ Fb\ 1/EJ\ dx$

$= \left[-1/8\ x - 1/8\ x^2/b + 1/24\ x^3/b^2 + 1/16\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b - 1/8\ b + 1/24\ b + 1/16\ b\ \right)\ Fb\ 1/EJ\ = -7/48\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/8 + 1/4\ x/b - 1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/8\ x + 1/8\ x^2/b - 1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/8\ b + 1/8\ b - 1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/24\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/8\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/24\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/24\ b\ \right)\ Fb\ 1/EJ\ = -1/24\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(5/4\ x/b - 7/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\ \theta\ dx$

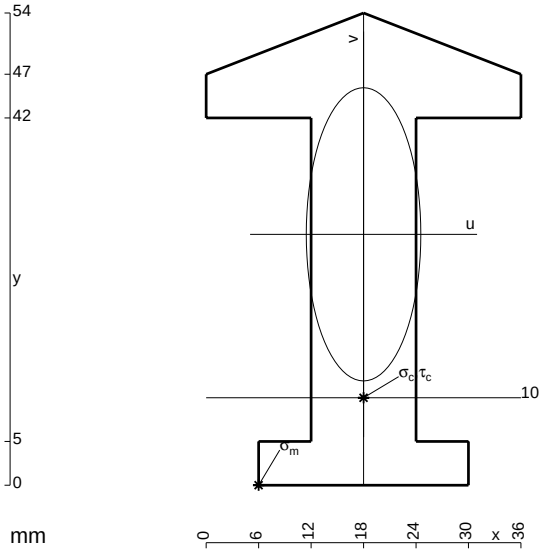
$= \left[5/8\ x^2/b - 7/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b\ \theta$

$= \left(5/8\ b - 7/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b\ \right)\ \theta\ \ = 2/3\ \ Fb^2/EJ$

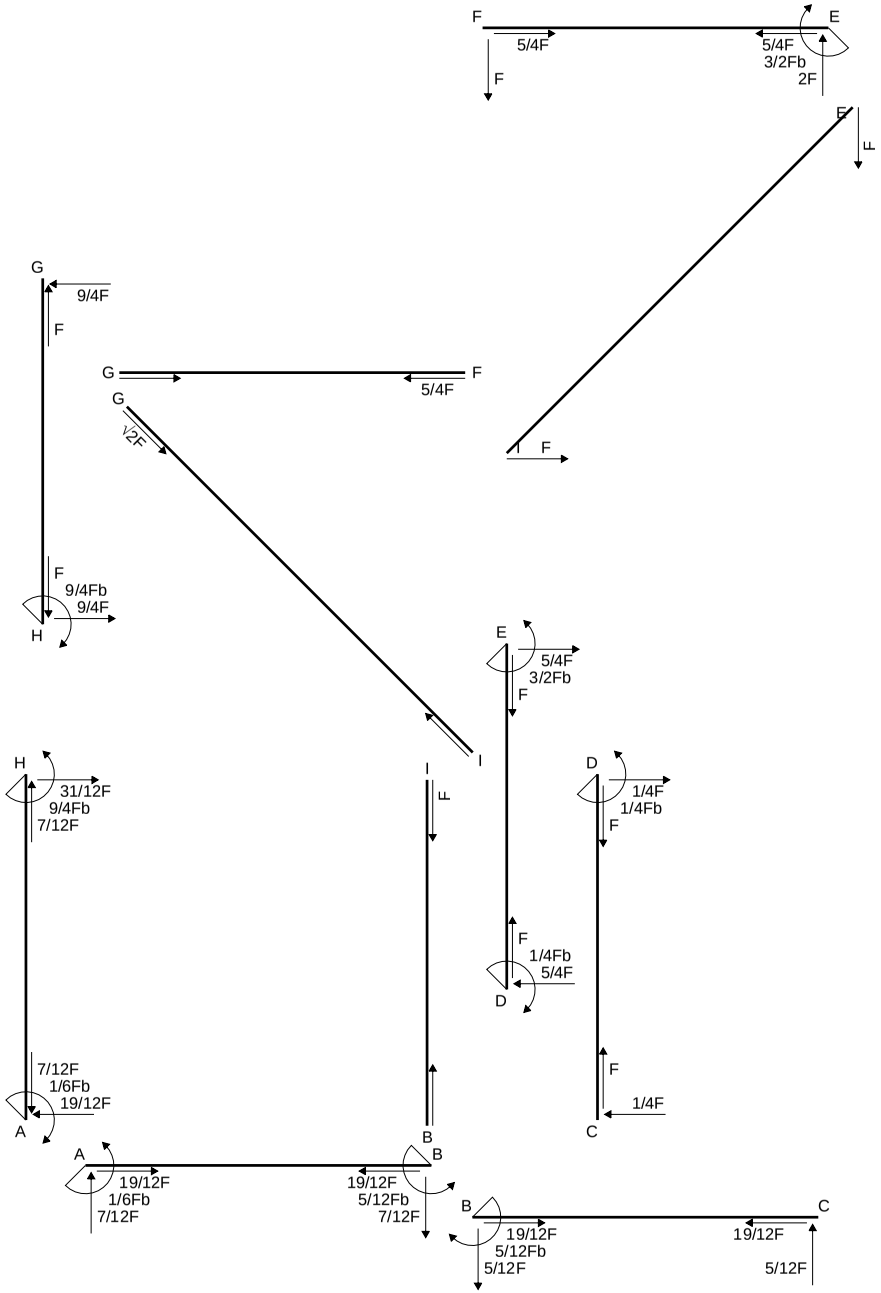
$L^{Xo}_{AH} = \int_o^b \left(3/4\ x/b - 1/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\ \theta\ dx$

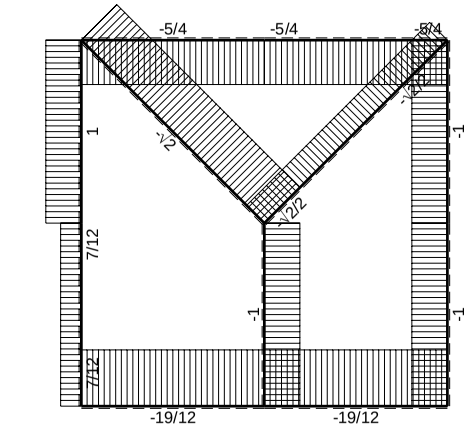
$= \left[3/8\ x^2/b - 1/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b\ \theta$

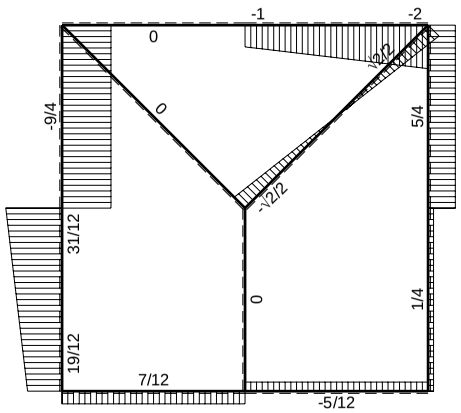
$= \left(3/8\ b - 1/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\ \theta\ \ = 2/3\ \ Fb^2/EJ$

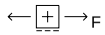


A = 870. mm^2
J_u = 244577. mm^4
J_v = 37332. mm^4
y_g = 28.69 mm
N = -1913. N
T_y = -3060. N
M_x = 1721250. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.69 mm
$\sigma_m = N/A - Mv/J_u$ = 199.7 N/mm^2
x_c = 18. mm
y_c = 10. mm
v_c = -18.69 mm
$\sigma_c = N/A - Mv/J_u$ = 129.3 N/mm^2
τ_c = 4.602 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 129.6 N/mm^2
S^* = 4414. mm^3

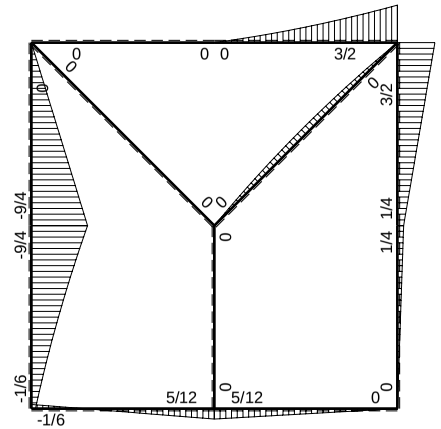

F
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3/2Fb
2F
F
F
G
9/4F
F
G
F
5/4F
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F
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
F
I
H
31/12F
9/4Fb
7/12F
I
F
D
1/4F
1/4Fb
F
F
1/4Fb
5/4F
D
7/12F
1/6Fb
19/12F
A
F
1/4F
C
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B
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B
C
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5/12F
19/12F
5/12F


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7/12
-19/12
-19/12

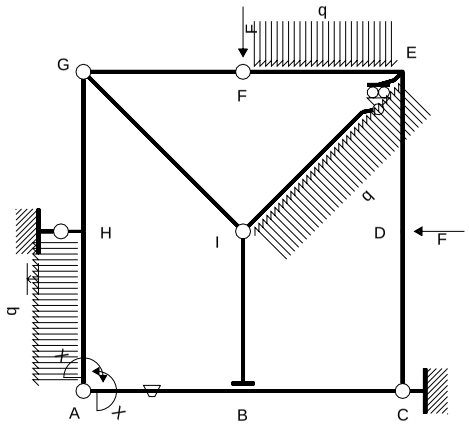

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31/12
0
1/4
19/12
7/12
-5/12

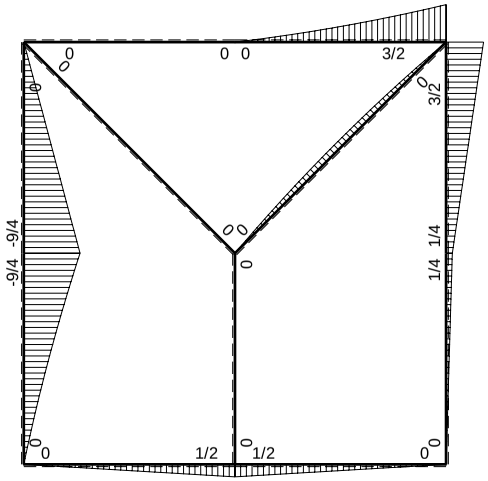

F


F

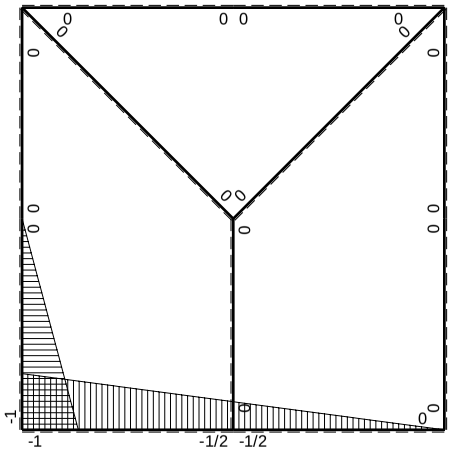

0
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3/2
0
0
3/2
0 0
0
-9/4
-9/4
-9/4
1/4
1/4
0
-1/6
5/12
0
5/12
0 0
-1/6


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 265852 CI04.xxxx.166

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	-Fb/EJ	$-1/2Fx+1/4Fx^2/b$	Fb/EJ-1/2Fx/EJ	$1-x/b+1/4x^2/b^2$	$(-1/6+3/4)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/2Fb+1/2Fx	Fb/EJ	$-1/4Fb+1/4Fx^2/b$	1/2Fb/EJ+1/2Fx/EJ	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/6Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1 - 1/2\ x/b\right)\ \theta\ dx$

$= \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ + \left(\ b - 1/4\ b\ \right)\ \theta\ = 7/12\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2 - 1/2\ x/b\right)\ \theta\ dx$

$= \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/2\ b - 1/4\ b\ \right)\ \theta\ = 7/12\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

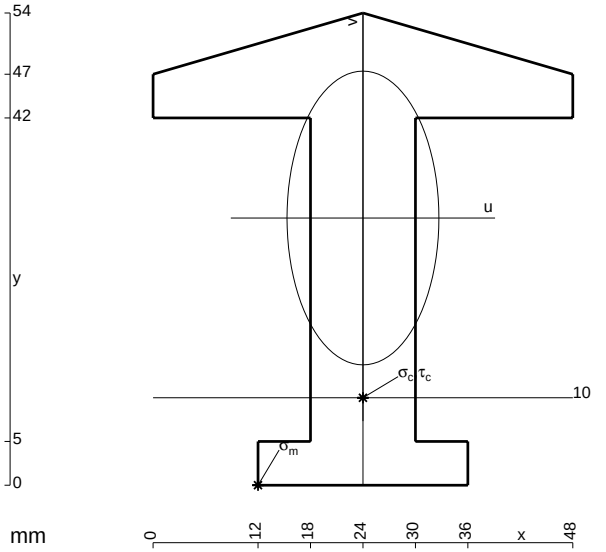
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

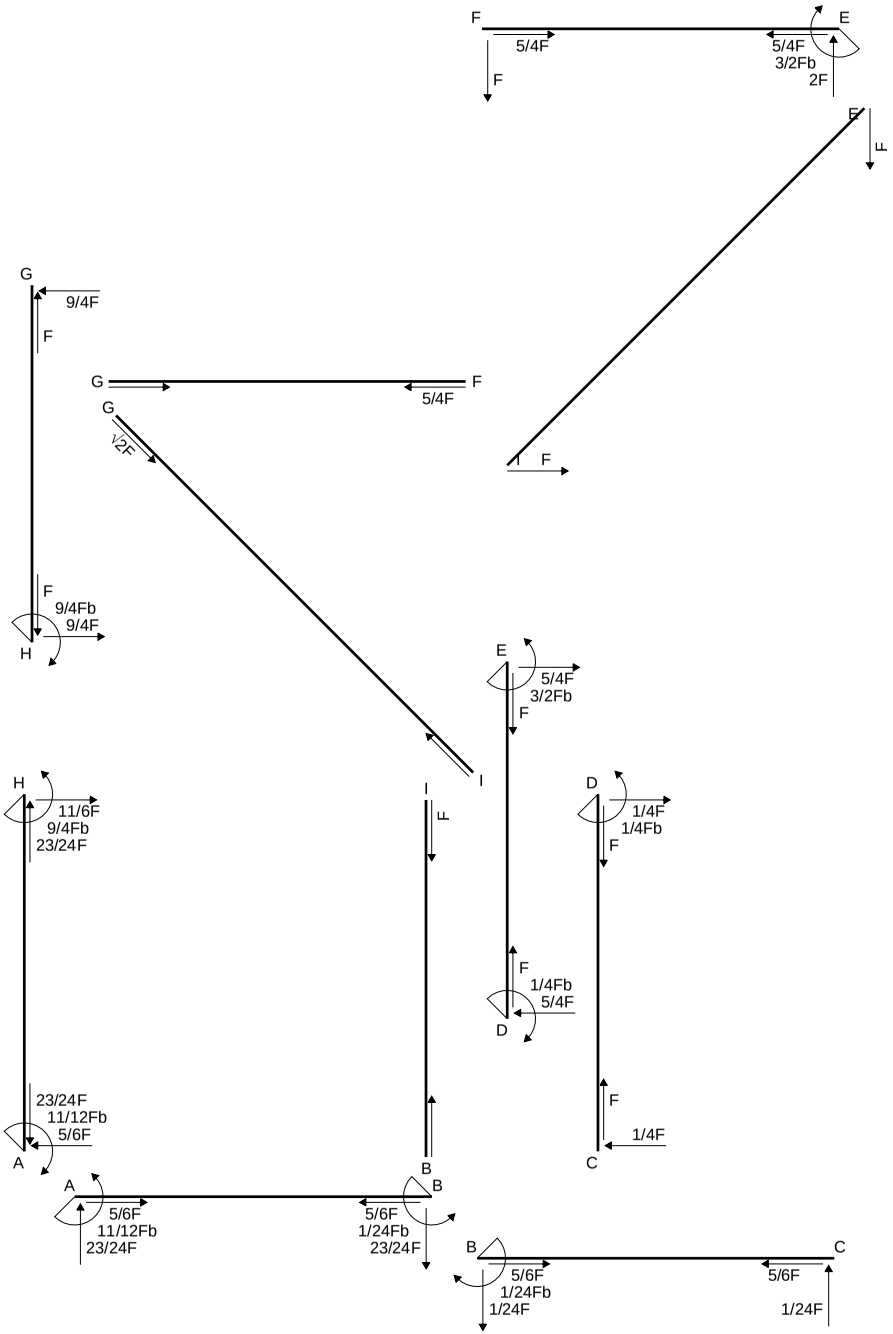
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

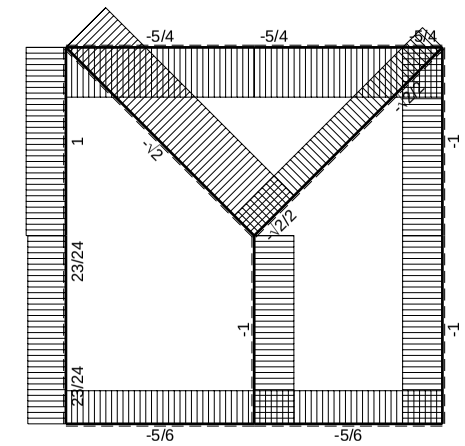
PROCEDIMENTO E RISULTATI 265852 CI04.xxxx.166

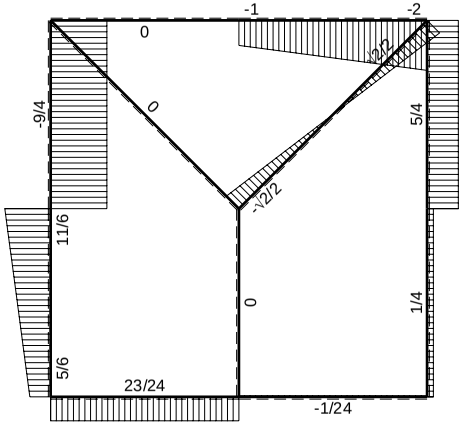


A = 972. mm^2
J_u = 274322. mm^4
J_v = 73296. mm^4
y_g = 30.56 mm
N = 1050. N
T_y = -2363. N
M_x = -1890000. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.56 mm
$\sigma_m = N/A - Mv/J_u$ = -209.5 N/mm^2
x_c = 24. mm
y_c = 10. mm
v_c = -20.56 mm
$\sigma_c = N/A - Mv/J_u$ = -140.6 N/mm^2
τ_c = 3.409 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 140.7 N/mm^2
S^* = 4750. mm^3

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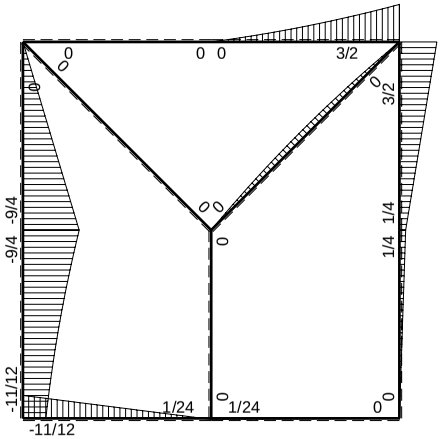

F
5/4F
E
5/4F
3/2Fb
2F
F
F
G
9/4F
F
G
5/4F
F
G
½F
F
I
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
F
H
11/6F
9/4Fb
23/24F
I
F
D
1/4F
1/4Fb
F
F
1/4Fb
5/4F
D
23/24F
11/12Fb
5/6F
A
F
1/4F
C
B
A
B
5/6F
11/12Fb
23/24F
5/6F
1/24Fb
23/24F
B
C
5/6F
1/24Fb
1/24F
5/6F
1/24F


-5/4
-5/4
-5/4
1
-1
-½
-√2/2
-1
23/24
-1
-1
23/24
-5/6
-5/6

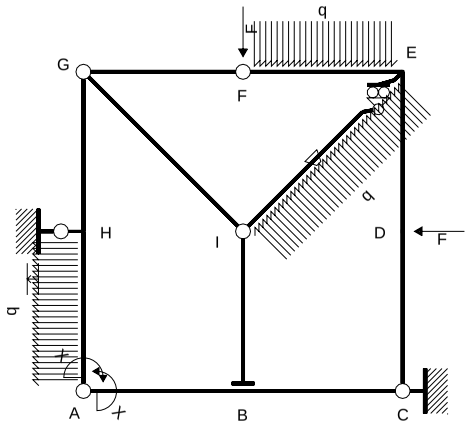

-1
-2
0
-½
-9/4
0
5/4
-√2/2
11/6
0
1/4
5/6
23/24
-1/24

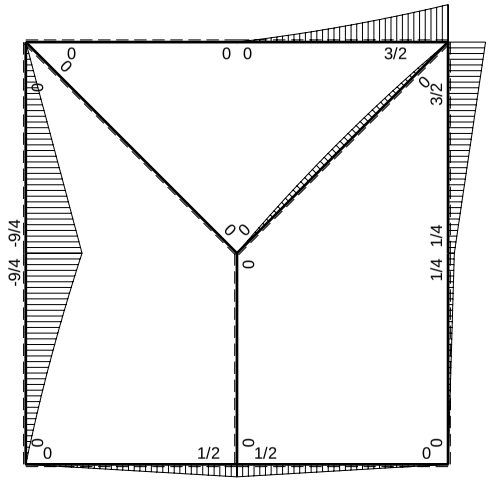
←□→ F

↑□↓ F

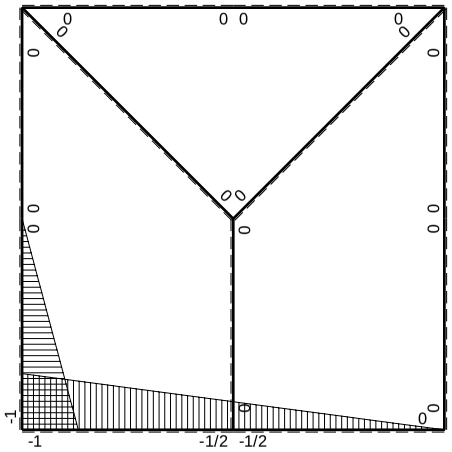

0
0 0
3/2
0
0
3/2
0 0
-9/4
-9/4
0
1/4
1/4
-11/12
1/24
0
1/24
0 0
-11/12

□ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-11/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						11/12Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b (1 - x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - 1/2\ b + 1/12\ b\ )\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b (1/4 + 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b + 1/4\ b + 1/12\ b)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b (1/4 - 1/2\ x/b + 1/4\ x^2/b^2)\ 1/EJ\ dx = [1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/4\ b - 1/4\ b + 1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b (1/4\ x^2/b^2)\ 1/EJ\ dx = [1/12\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/12\ b)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b (\ x^2/b^2)\ 1/EJ\ dx = [1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (1/3\ b)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b (1 - 2\ x/b + x^2/b^2)\ 1/EJ\ dx = [\ x - x^2/b + 1/3\ x^3/b^2\ ]_o^b\ 1/EJ$

$= (\ b - b + 1/3\ b\ )\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b (-1/2\ x/b + 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x^2/b + 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/12\ b)\ Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b (-1/4 + 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x + 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/12\ b)\ Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b (-1/4 + 1/2\ x/b - 1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/4\ b + 1/4\ b - 1/12\ b)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b (-1/4\ x^2/b^2)\ Fb\ 1/EJ\ dx = [-1/12\ x^3/b^2\ ]_o^b\ Fb\ 1/EJ$

$= (-1/12\ b)\ Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

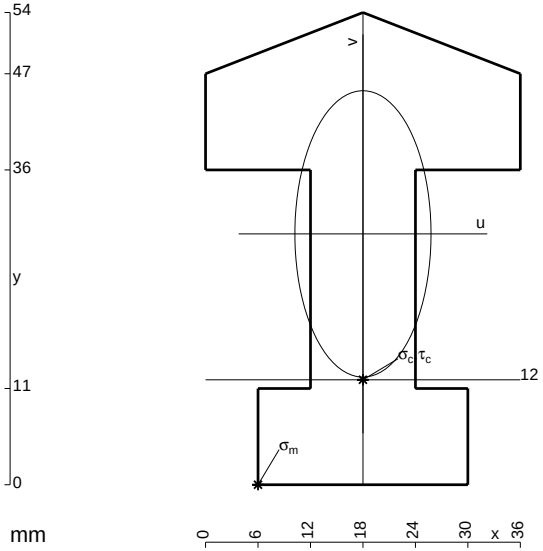
$L^{Xo}_{HA} = \int_o^b (9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

$= (9/8\ b - 11/12\ b + 1/8\ b)\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

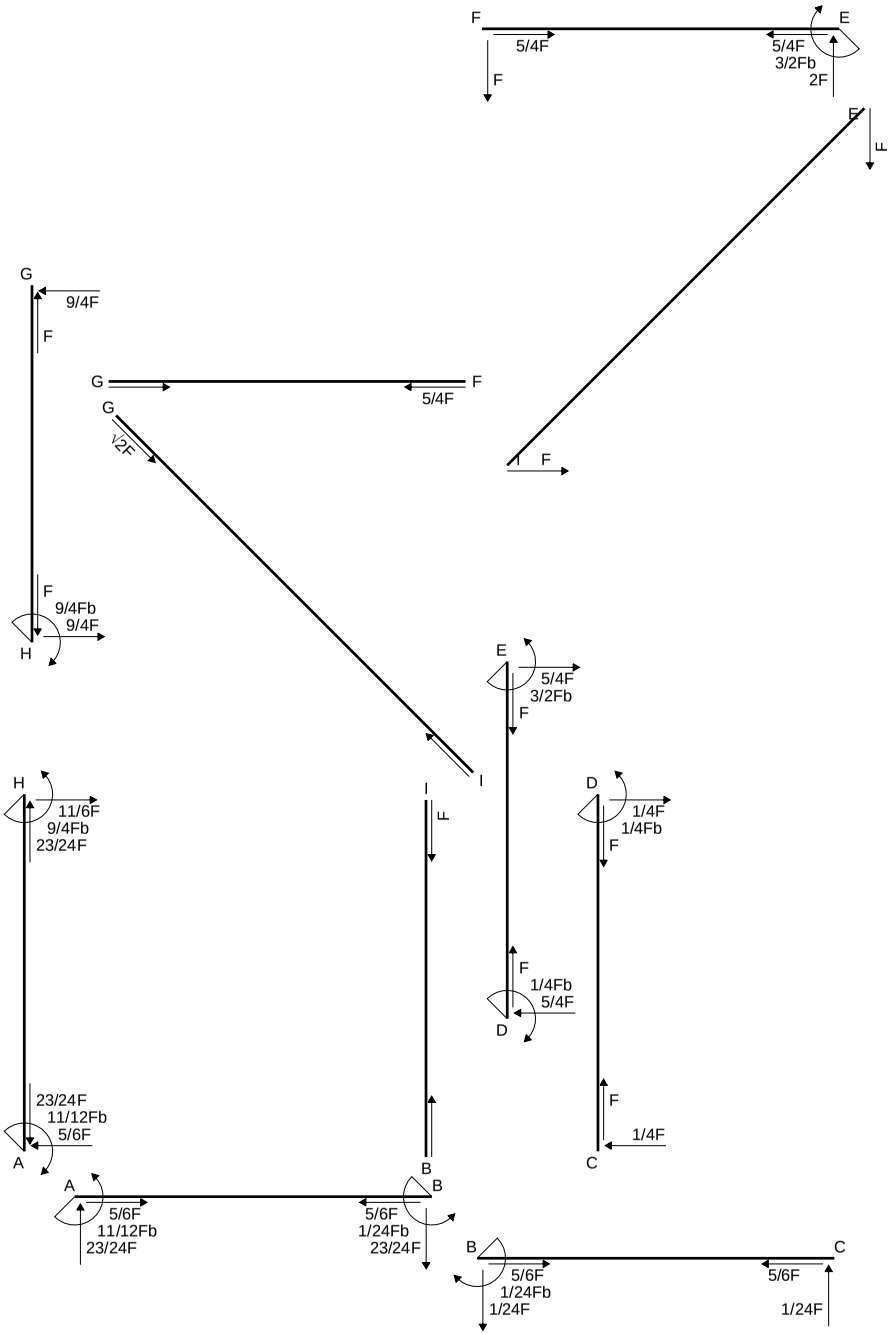
$L^{Xo}_{AH} = \int_o^b (7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3)\ Fb\ 1/EJ\ dx = [7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ ]_o^b\ Fb\ 1/EJ$

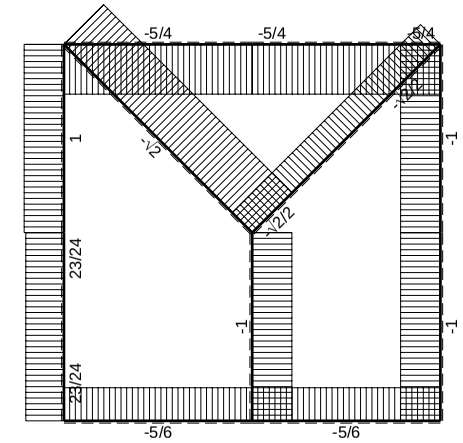
$= (7/8\ b - 5/12\ b - 1/8\ b)\ Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

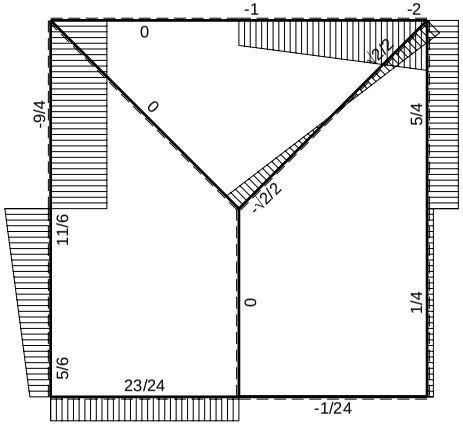
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A = 1086. mm^2
J_u = 291353. mm^4
J_v = 65844. mm^4
y_g = 28.69 mm
N = 1170. N
T_y = -2633. N
M_x = -2237630. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.69 mm
$\sigma_m = N/A - Mv/J_u$ = -219.2 N/mm^2
x_c = 18. mm
y_c = 12. mm
v_c = -16.69 mm
$\sigma_c = N/A - Mv/J_u$ = -127.1 N/mm^2
τ_c = 4.764 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 127.3 N/mm^2
S^* = 6327. mm^3

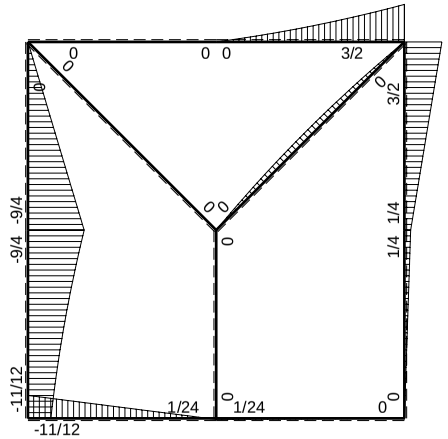

F
5/4F
E
5/4F
3/2Fb
2F
F
F
G
9/4F
F
G
5/4F
F
G
½F
F
F
9/4Fb
9/4F
H
I
E
5/4F
3/2Fb
F
H
11/6F
9/4Fb
23/24F
I
F
D
1/4F
1/4Fb
F
F
1/4Fb
5/4F
D
F
1/4F
C
23/24F
11/12Fb
5/6F
A
B
A
B
5/6F
11/12Fb
23/24F
5/6F
1/24Fb
23/24F
B
C
5/6F
1/24Fb
1/24F
5/6F
1/24F


-5/4
-5/4
-5/4
1
-1
-½
-√2/2
-√2/2
23/24
-1
-1
-1
23/24
-5/6
-5/6

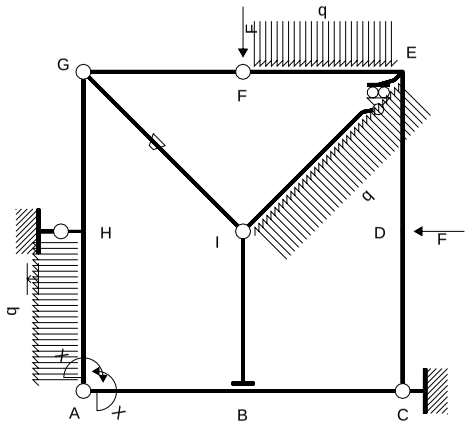

-1
-2
0
-√2/2
-9/4
0
5/4
11/6
-√2/2
0
1/4
5/6
23/24
-1/24

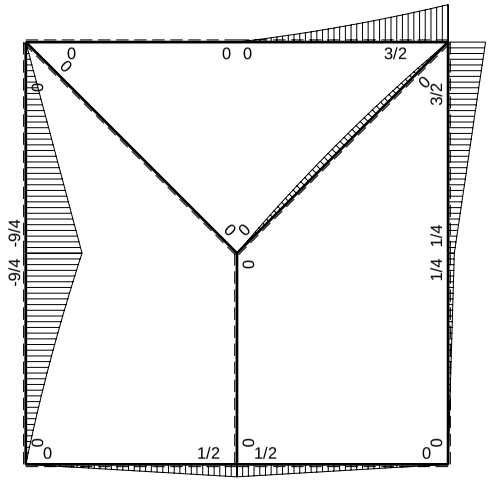
←□→ F

↑□↓ F

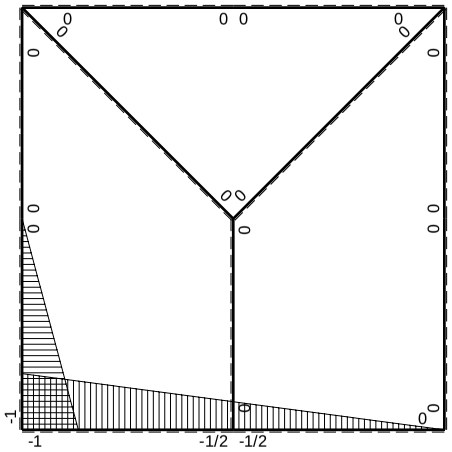

0
0 0
3/2
0
0
3/2
0
0
-9/4
-9/4
0
1/4
1/4
-11/12
1/24
0
1/24
0
0
-11/12

□ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-11/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						11/12Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

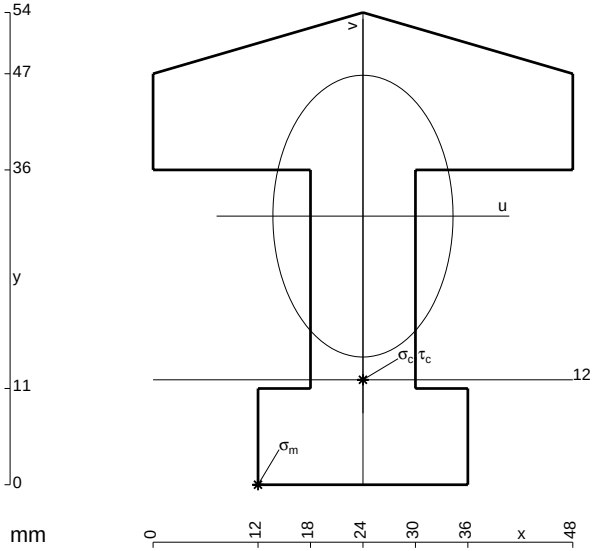
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

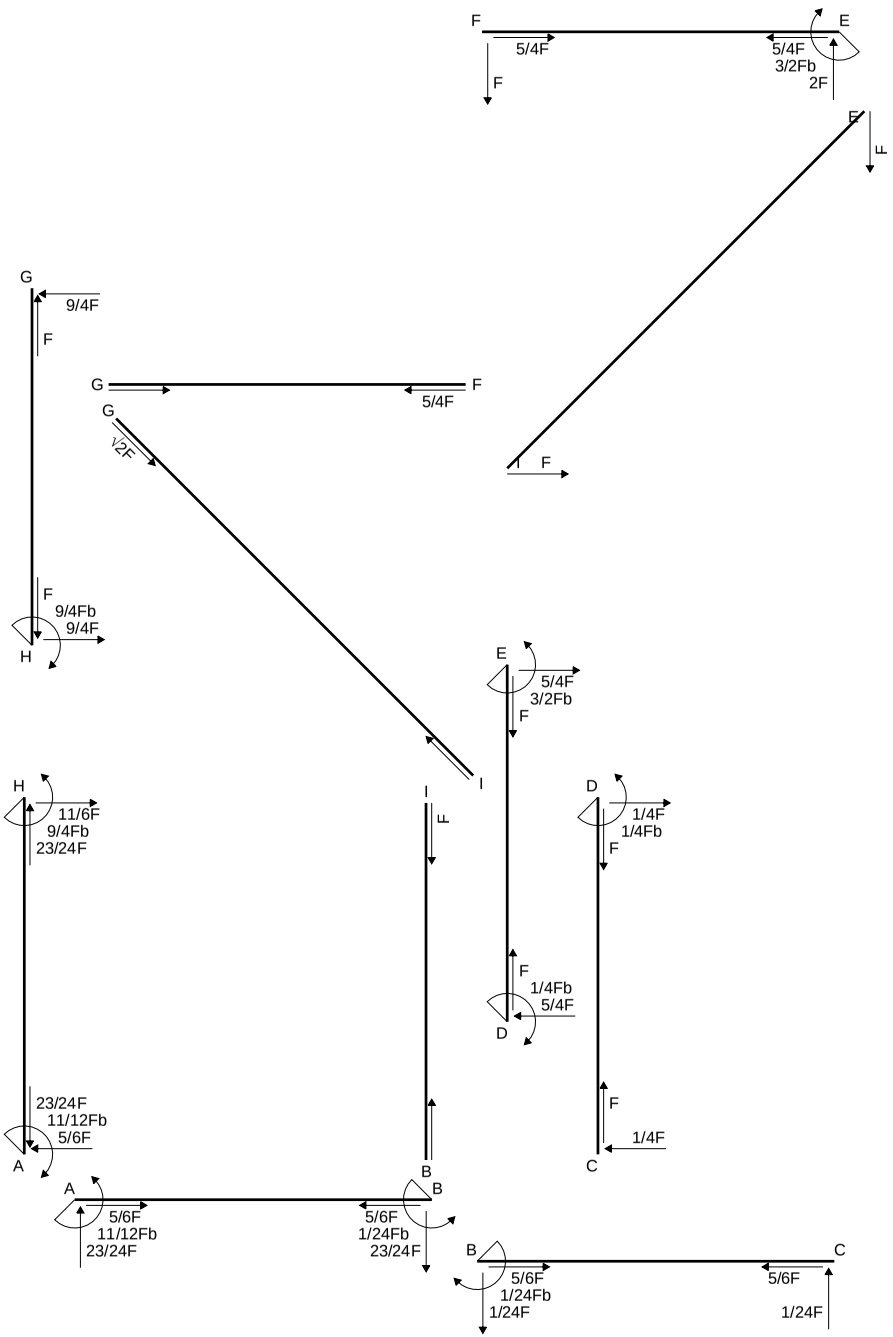
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

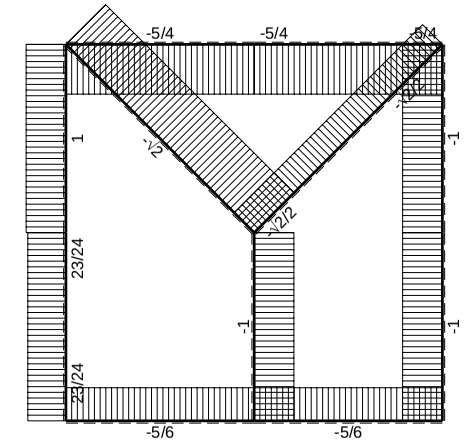
PROCEDIMENTO E RISULTATI 264626 CI04.xxxx.168

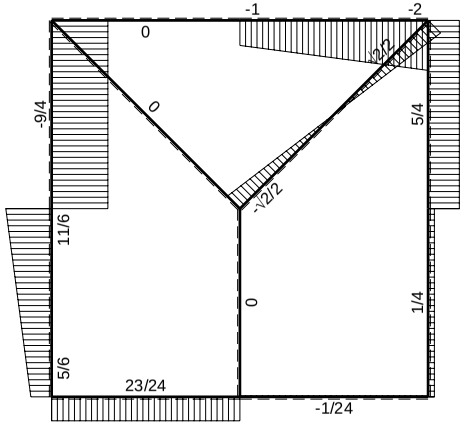


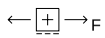
A = 1260. mm^2
J_u = 327186. mm^4
J_v = 133776. mm^4
y_g = 30.72 mm
N = 1210. N
T_y = -2723. N
M_x = -2450250. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.72 mm
$\sigma_m = N/A - Mv/J_u$ = -229.1 N/mm^2
x_c = 24. mm
y_c = 12. mm
v_c = -18.72 mm
$\sigma_c = N/A - Mv/J_u$ = -139.2 N/mm^2
τ_c = 4.776 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 139.4 N/mm^2
S^* = 6888. mm^3

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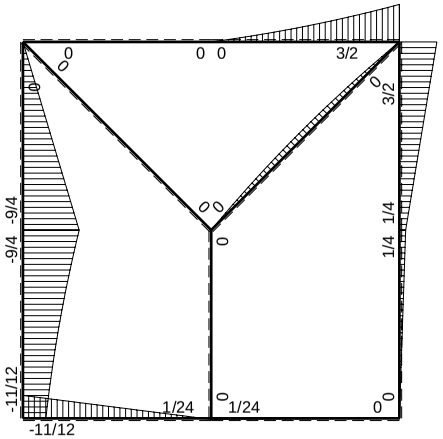






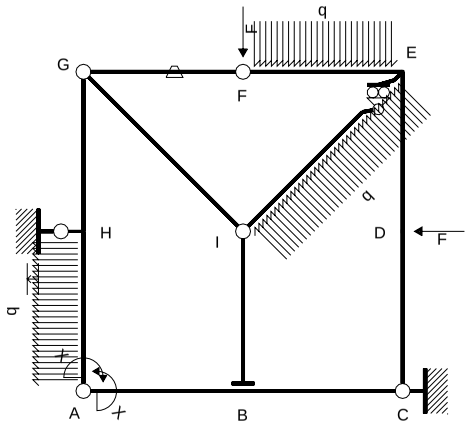


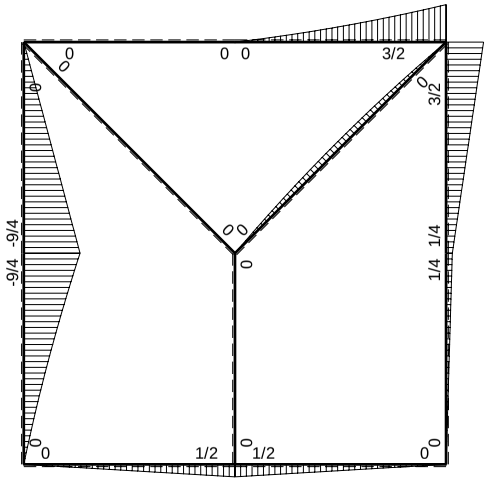




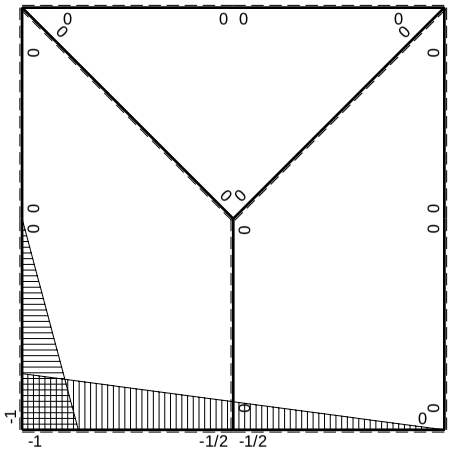


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 268284 CI04.xxxx.169

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PROCEDIMENTO E RISULTATI 268284 CI04.xxxx.169

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	-Fb/EJ	0	0	0	0+0	0
GF b	0	0	Fb/EJ	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-11/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						11/12Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

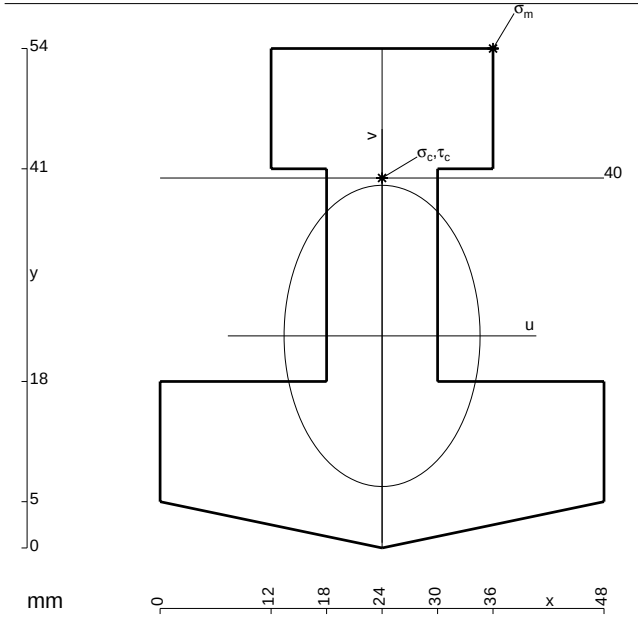
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

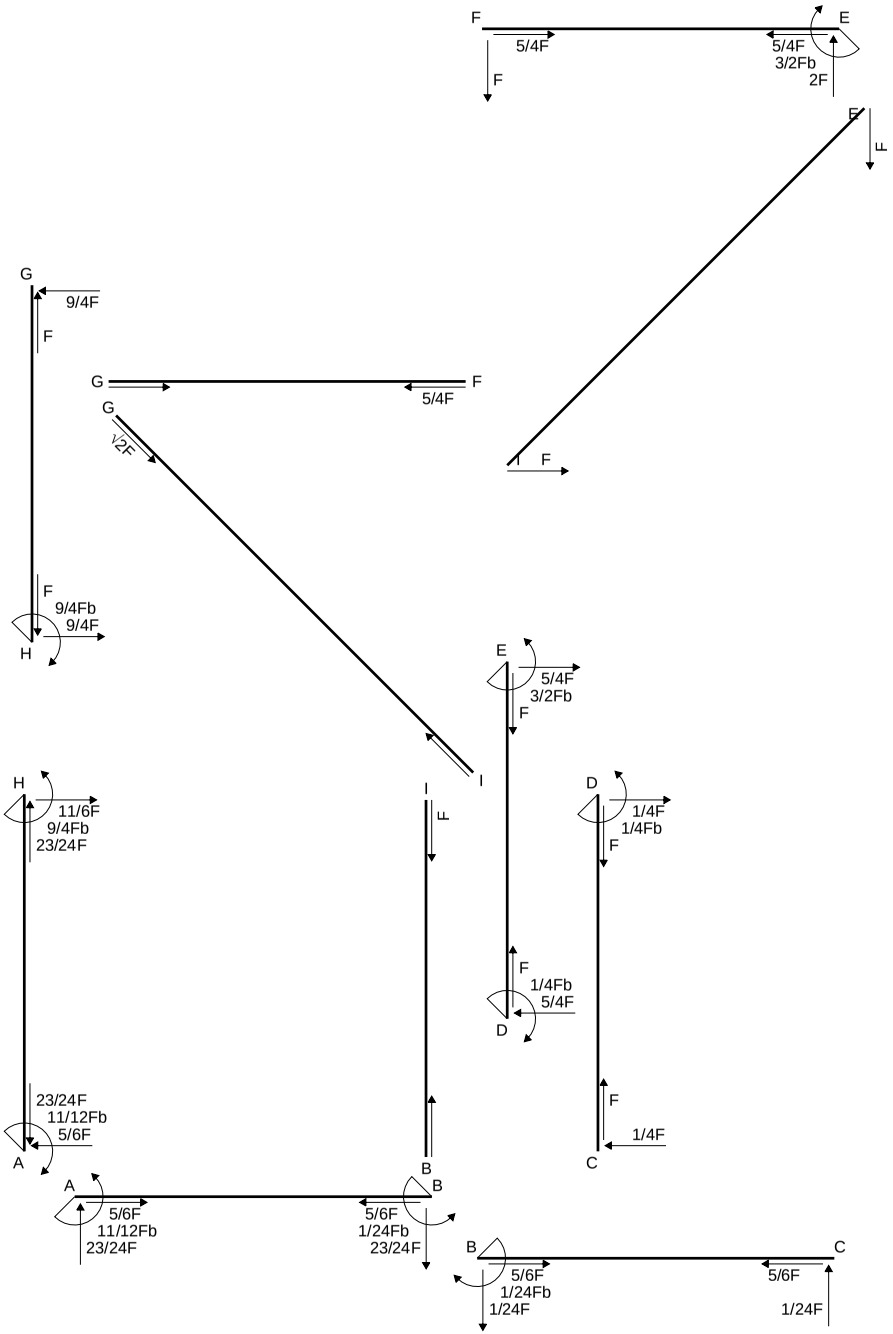
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

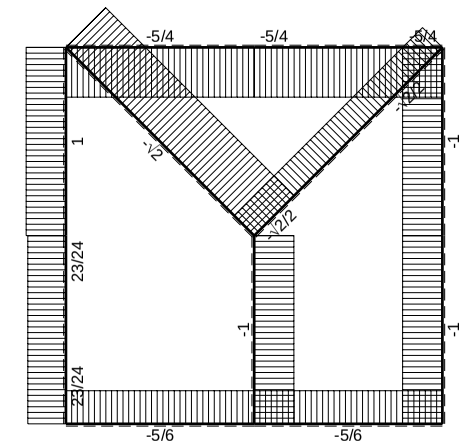
PROCEDIMENTO E RISULTATI 268284 CI04.xxxx.169

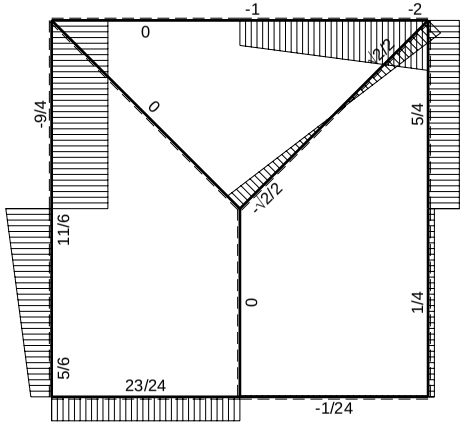


A = 1332. mm^2
J_u = 353385. mm^4
J_v = 149616. mm^4
y_g = 22.93 mm
N = 1270. N
T_y = -2858. N
M_x = -2714630. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 31.07 mm
$\sigma_m = N/A - Mv/J_u$ = 239.7 N/mm^2
x_c = 24. mm
y_c = 40. mm
v_c = 17.07 mm
$\sigma_c = N/A - Mv/J_u$ = 132.1 N/mm^2
τ_c = 5.308 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 132.4 N/mm^2
S^* = 7878. mm^3

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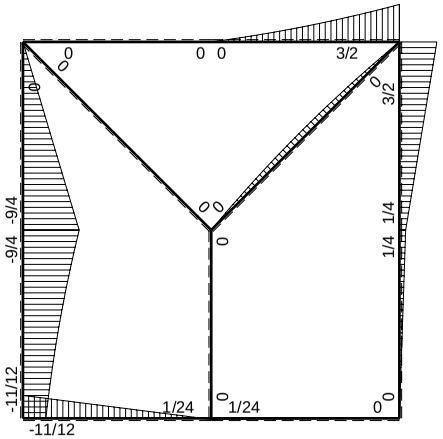






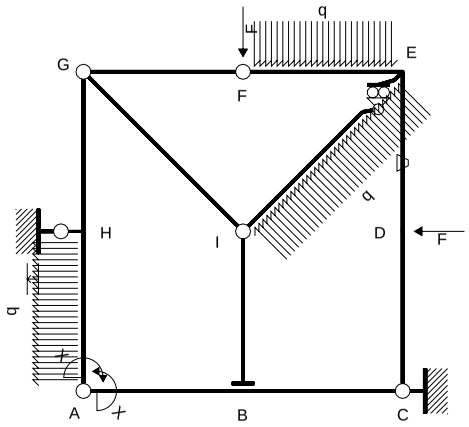
←□→ F

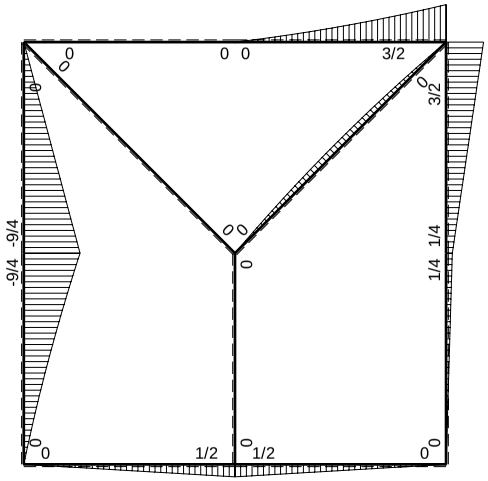
↑□↓ F



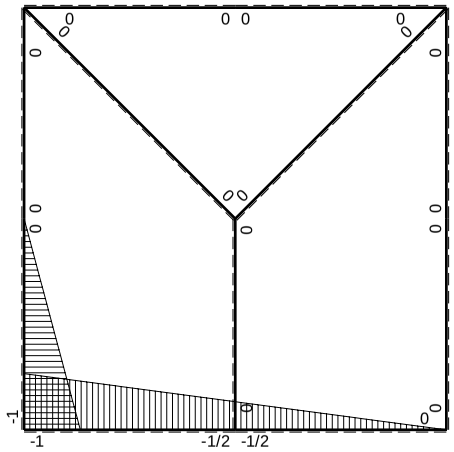
□ Fb

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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 266409 CI04.xxxx.170

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	Fb/EJ	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-11/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						11/12Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

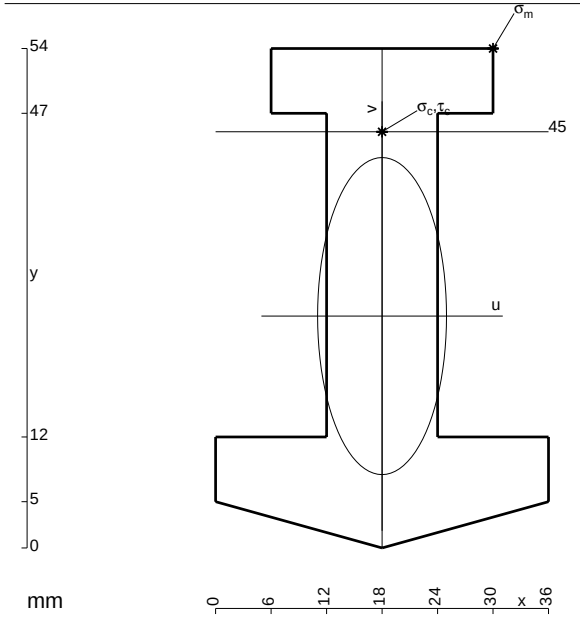
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

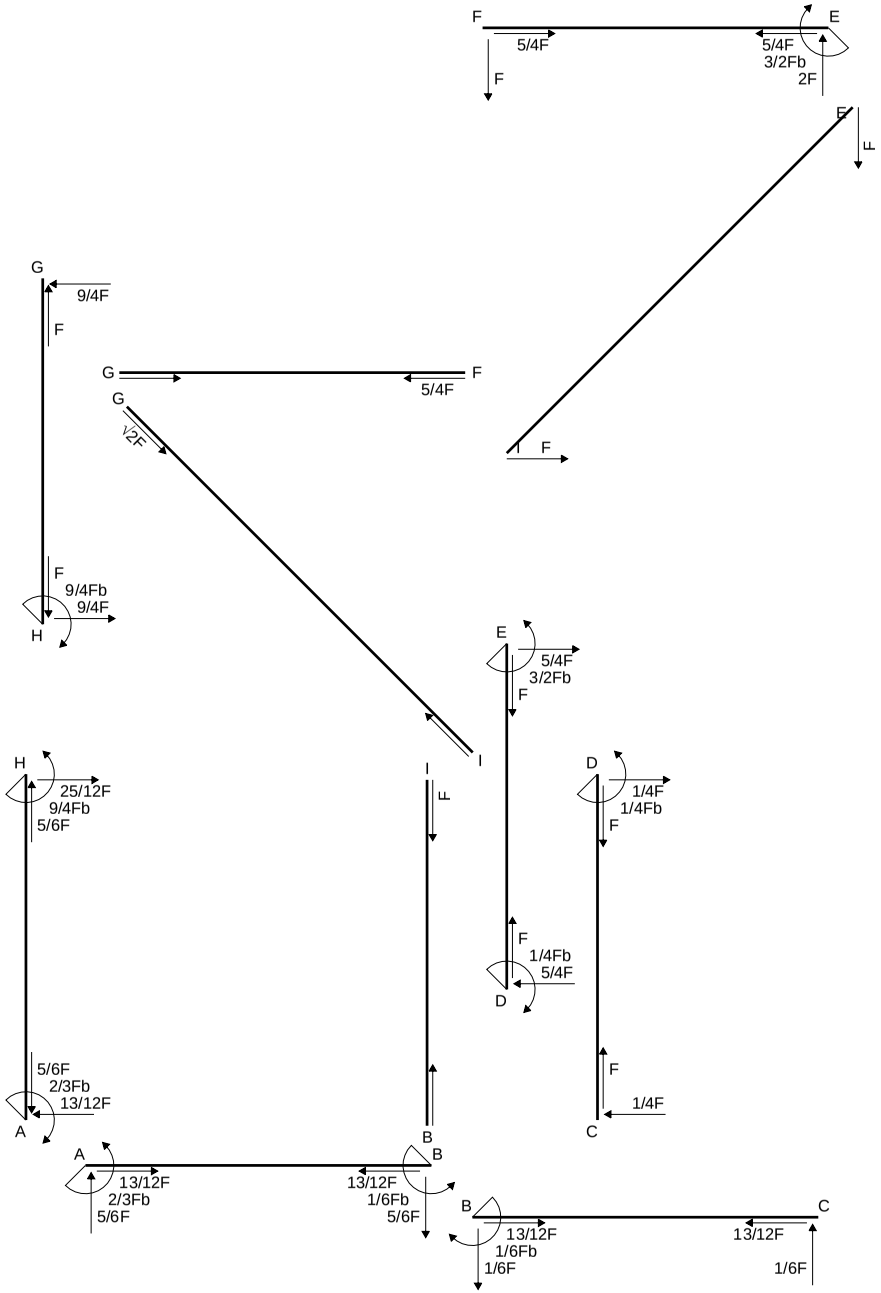
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

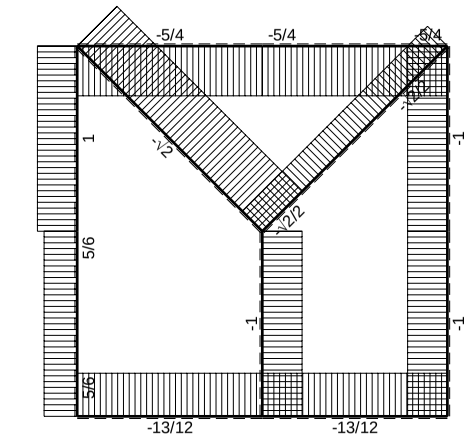
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

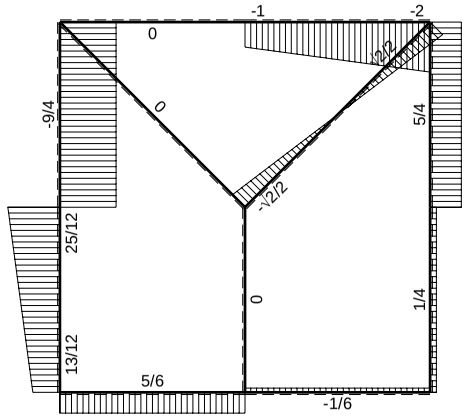
PROCEDIMENTO E RISULTATI 266409 CI04.xxxx.170



A = 930. mm^2
J_u = 273314. mm^4
J_v = 45180. mm^4
y_g = 25.07 mm
N = 1660. N
T_y = -3735. N
M_x = -1867500. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 28.93 mm
$\sigma_m = N/A - Mv/J_u$ = 199.5 N/mm^2
x_c = 18. mm
y_c = 45. mm
v_c = 19.93 mm
$\sigma_c = N/A - Mv/J_u$ = 138. N/mm^2
τ_c = 5.437 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 138.3 N/mm^2
S^* = 4774. mm^3

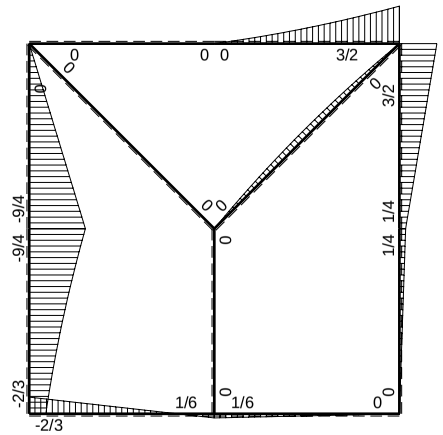

F
5/4F
E
5/4F
3/2Fb
2F
F
F
G
9/4F
F
G
F
5/4F
G
√2F
F
F
9/4Fb
9/4F
H
E
5/4F
3/2Fb
F
I
H
25/12F
9/4Fb
5/6F
I
F
D
1/4F
1/4Fb
F
F
1/4Fb
5/4F
D
5/6F
2/3Fb
13/12F
A
F
1/4F
C
A
B
13/12F
2/3Fb
5/6F
13/12F
1/6Fb
5/6F
B
C
13/12F
1/6Fb
1/6F
13/12F
1/6F


-5/4
-5/4
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-1
5/6
-13/12
-13/12

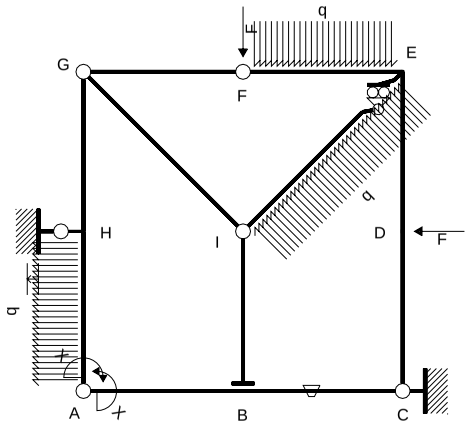

-1
-2
0
-√2/2
0
-9/4
5/4
-√2/2
25/12
0
1/4
13/12
5/6
-1/6

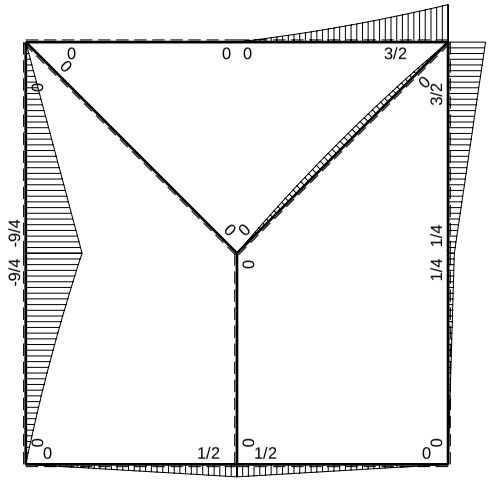
←□→ F

↑□↓ F

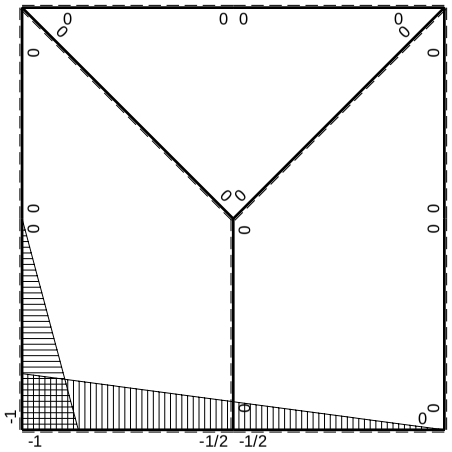

0
0 0
3/2
0
0
0
3/2
0
0
-9/4
-9/4
0
1/4
1/4
-2/3
1/6
0
1/6
0
0
-2/3

↻□↺ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 213022 CI04.xxxx.171

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PROCEDIMENTO E RISULTATI 213022 CI04.xxxx.171

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	-Fb/EJ	$-1/4Fb+1/2Fx-1/4Fx^2/b$	1/2Fb/EJ-1/2Fx/EJ	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	Fb/EJ	$-1/4Fx^2/b$	1/2Fx/EJ	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-2/3Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						2/3Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1/2 - 1/2\ x/b\ \right)\ \theta\ \ dx$$

$$= \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$$

$$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2\ x/b\ \right)\ \theta\ \ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/4\ x^2/b\ \right]_o^b\ \theta$$

$$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/4\ b\ \right)\ \theta\ \ = 1/6\ \ Fb^2/EJ$$

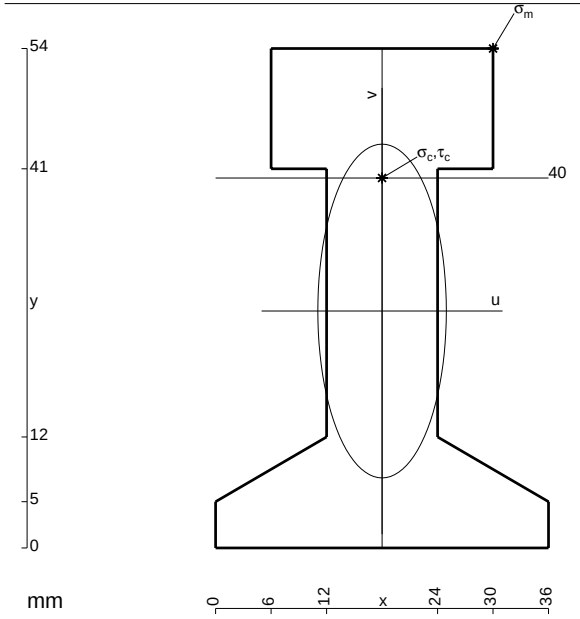
$$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

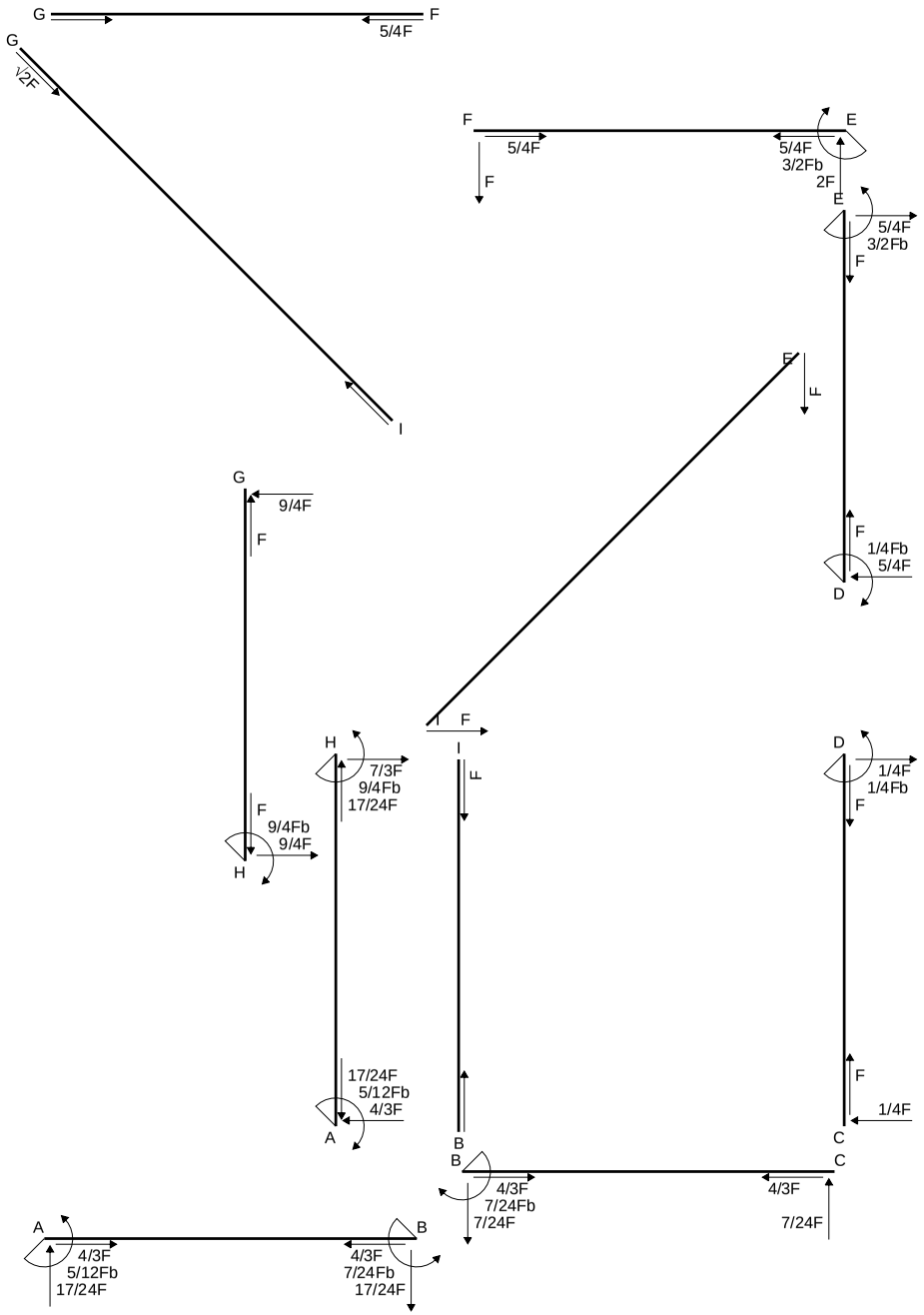
$$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

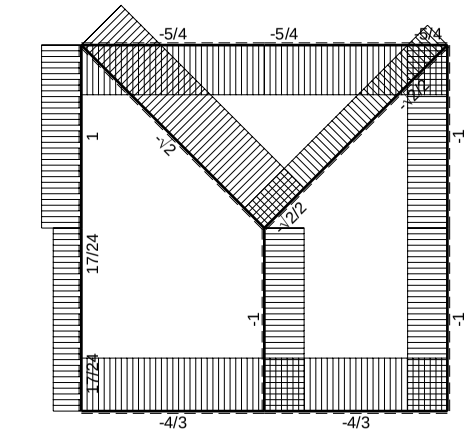
$$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

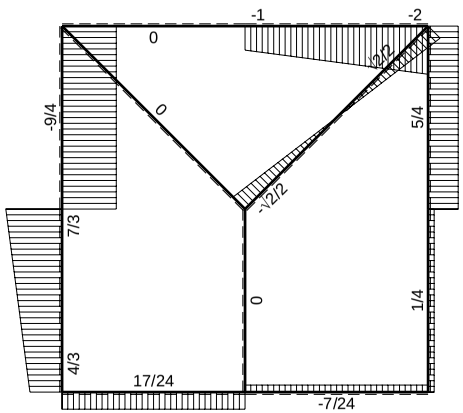
PROCEDIMENTO E RISULTATI 213022 CI04.xxxx.171

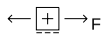


A = 1008. mm^2
J_u = 328290. mm^4
J_v = 48672. mm^4
y_g = 25.62 mm
N = 1940. N
T_y = -4365. N
M_x = -2400750. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 28.38 mm
$\sigma_m = N/A - Mv/J_u$ = 209.5 N/mm^2
x_c = 18. mm
y_c = 40. mm
v_c = 14.38 mm
$\sigma_c = N/A - Mv/J_u$ = 107.1 N/mm^2
τ_c = 7.763 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 107.9 N/mm^2
S^* = 7006. mm^3

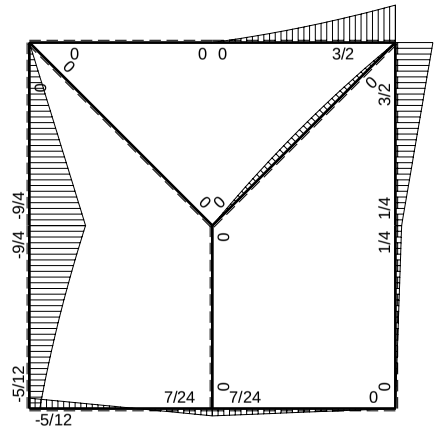

G
F
5/4F
G
√2F
I
F
5/4F
E
5/4F
3/2Fb
2F
E
5/4F
3/2Fb
F
F
F
F
1/4Fb
5/4F
D
G
9/4F
F
F
9/4Fb
9/4F
H
H
7/3F
9/4Fb
17/24F
F
I
F
D
1/4F
1/4Fb
F
17/24F
5/12Fb
4/3F
A
F
1/4F
B
B
C
C
4/3F
7/24Fb
7/24F
4/3F
7/24F
A
B
4/3F
5/12Fb
17/24F
4/3F
7/24Fb
17/24F


-5/4
-5/4
-5/4
1
-1
-√2
-√2
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17/24
-4/3
-4/3

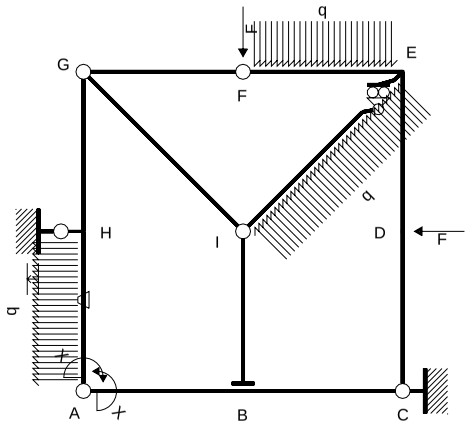

0
-1
-2
-9/4
0
-√2/2
-√2/2
5/4
7/3
0
1/4
4/3
17/24
-7/24

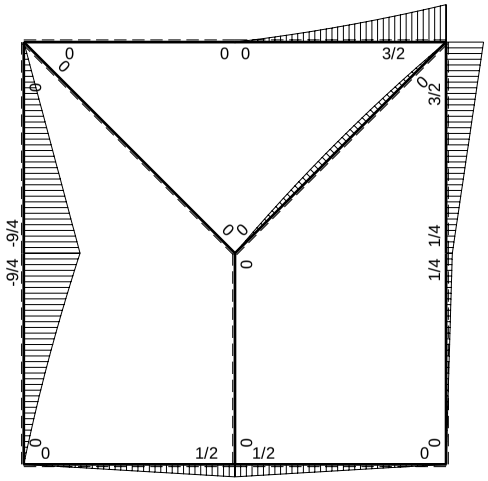

F


F

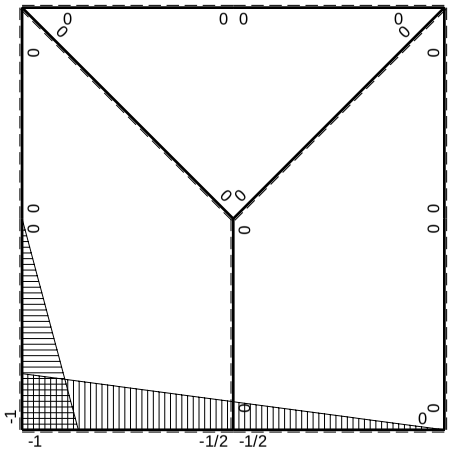

0
0 0
3/2
0
0
3/2
0 0
0
-9/4
-9/4
-9/4
1/4
1/4
1/4
0
-5/12
7/24
0
7/24
0
0
-5/12


Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	-Fb/EJ	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(1/3+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	Fb/EJ	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/12Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\ \right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\ \theta\ \ dx$

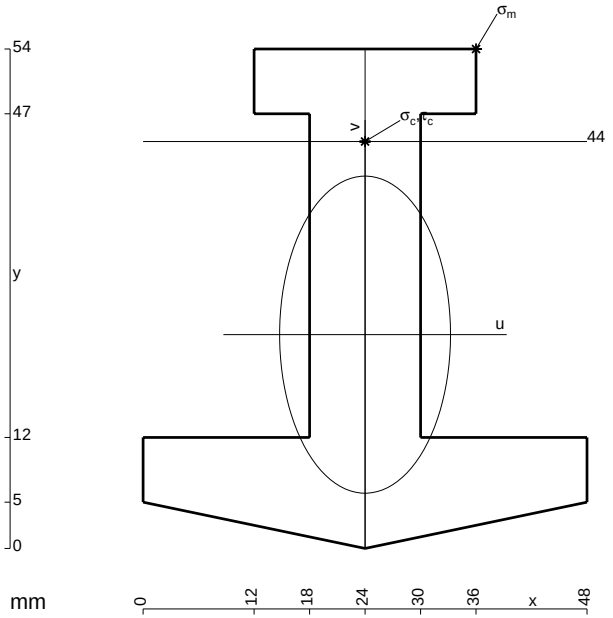
$= \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b\ \theta$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b\ \right)\ \theta\ \ = 5/6\ \ Fb^2/EJ$

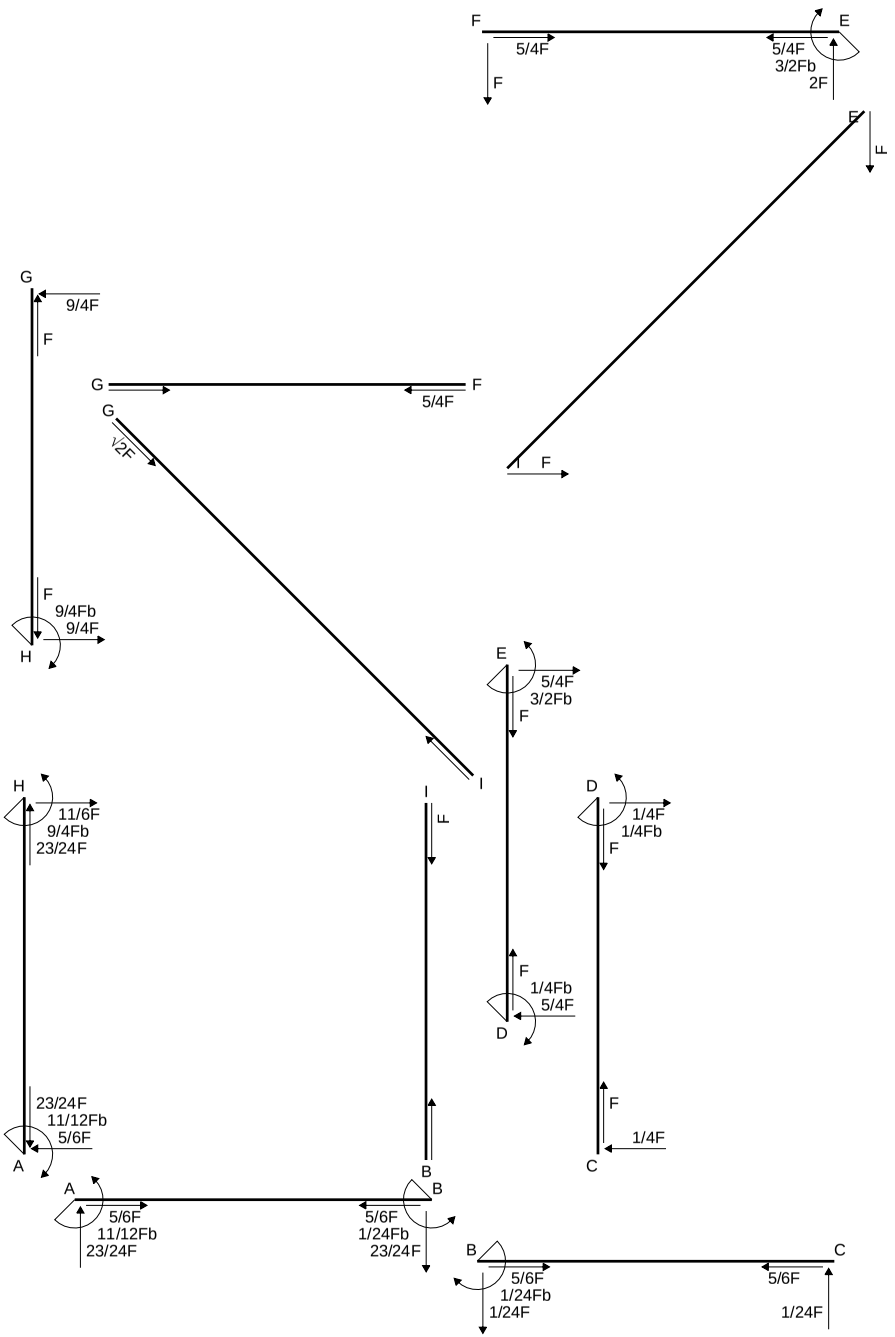
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\ \theta\ \ dx$

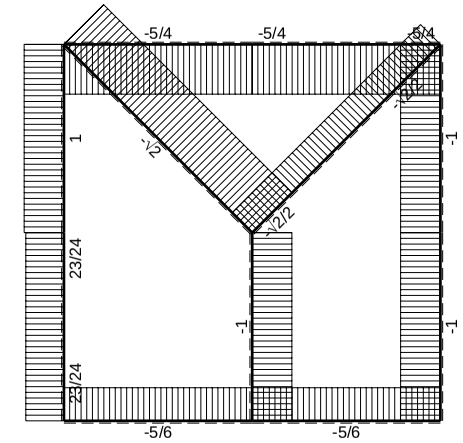
$= \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b\ \theta$

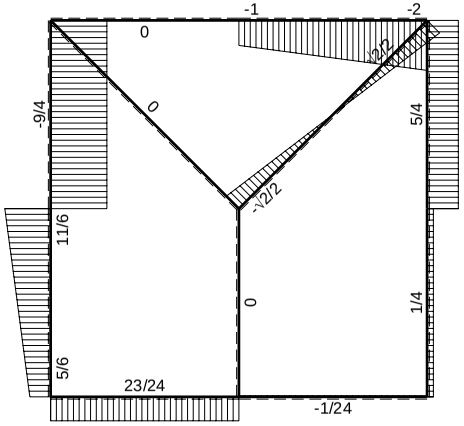
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\ \theta\ \ = 5/6\ \ Fb^2/EJ$

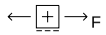


A = 1044. mm^2
J_u = 306939. mm^4
J_v = 89136. mm^4
y_g = 23.11 mm
N = 1600. N
T_y = -3600. N
M_x = -2160000. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 30.89 mm
$\sigma_m = N/A - Mv/J_u$ = 218.9 N/mm^2
x_c = 24. mm
y_c = 44. mm
v_c = 20.89 mm
$\sigma_c = N/A - Mv/J_u$ = 148.5 N/mm^2
τ_c = 5.285 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 148.8 N/mm^2
S^* = 5407. mm^3

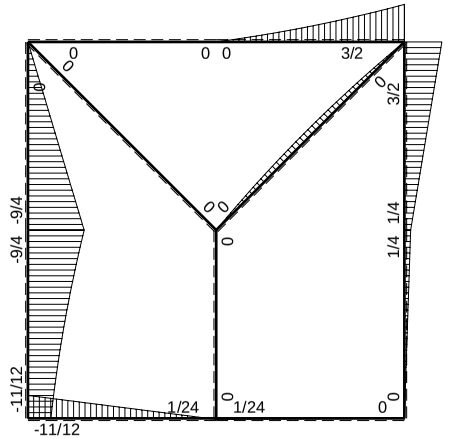






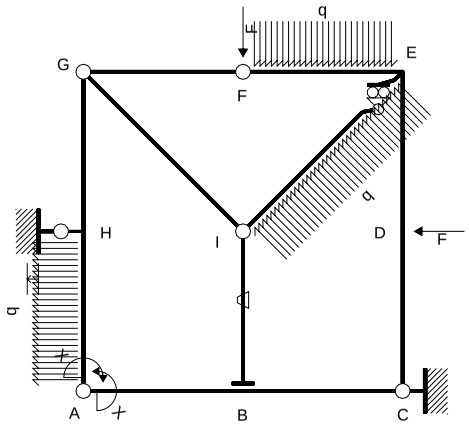


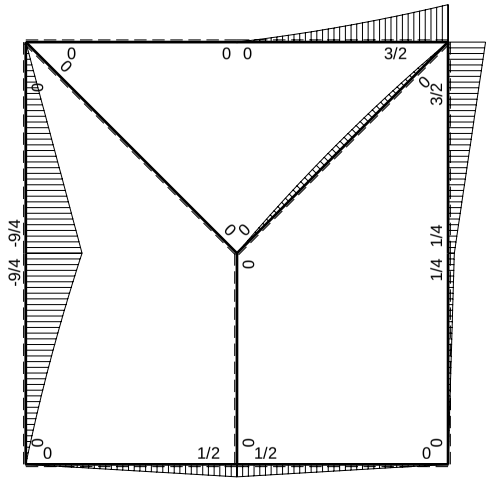




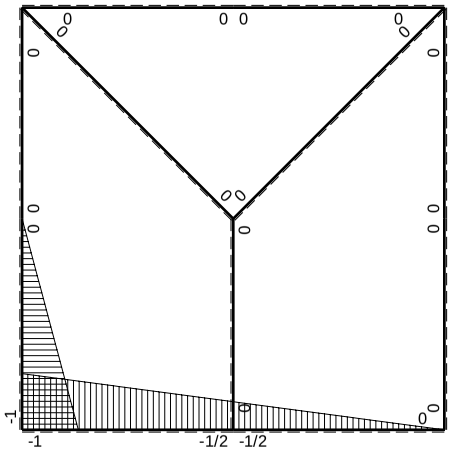


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	-Fb/EJ	0	0	0	0+0	0
BI b	0	0	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-11/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						11/12Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

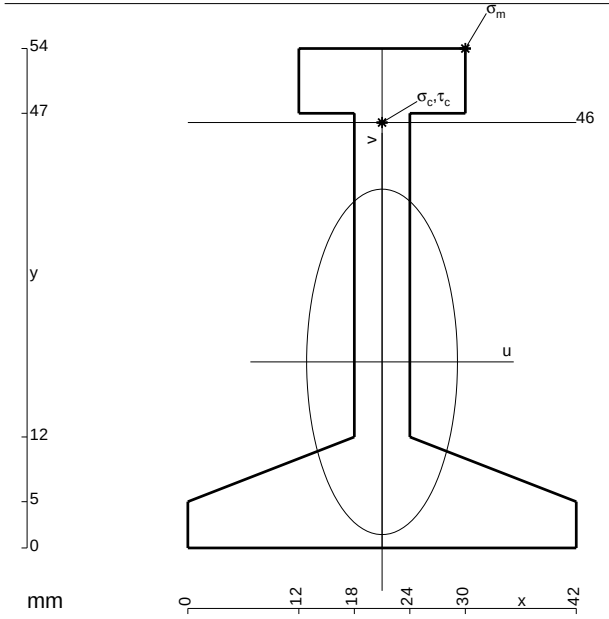
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

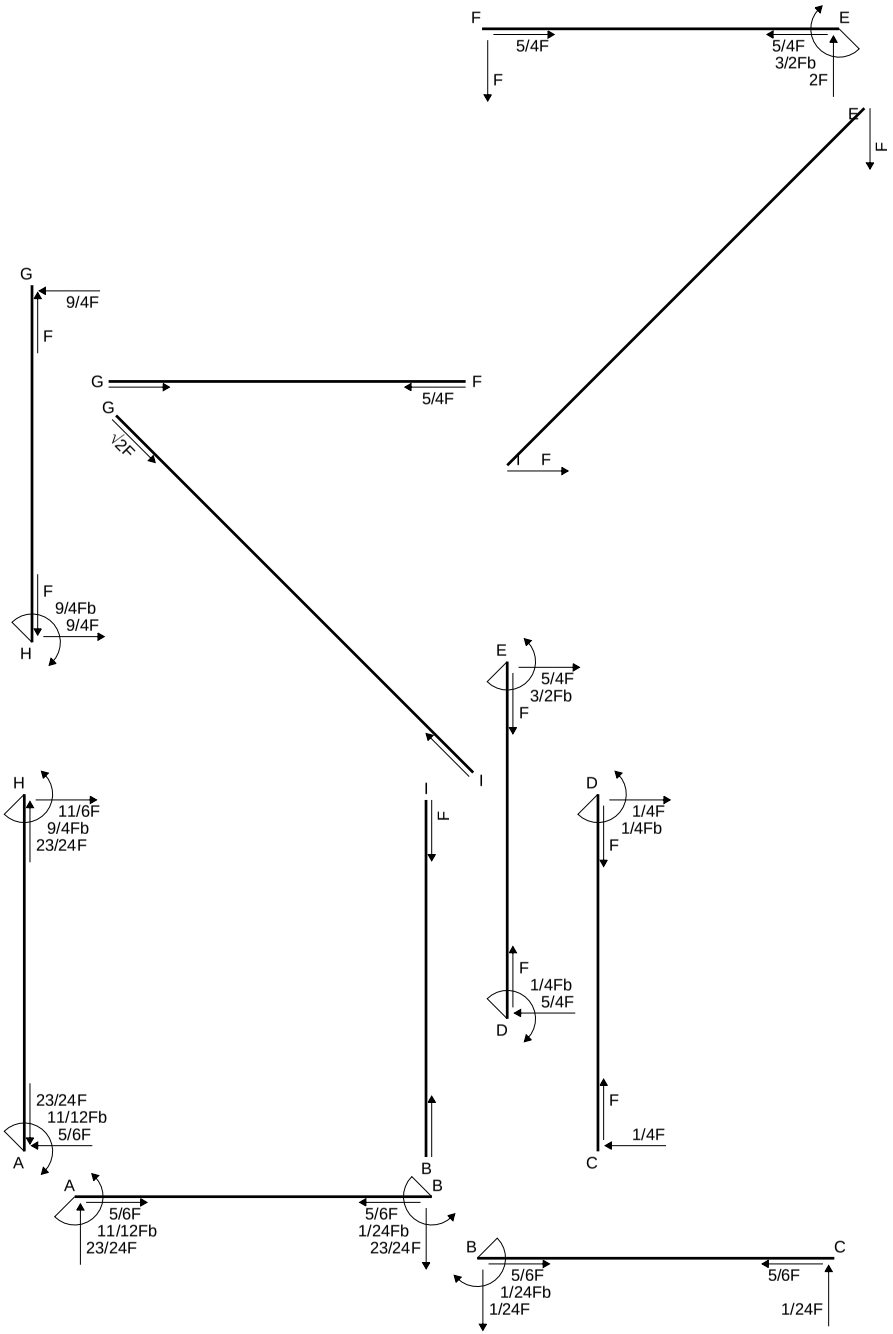
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

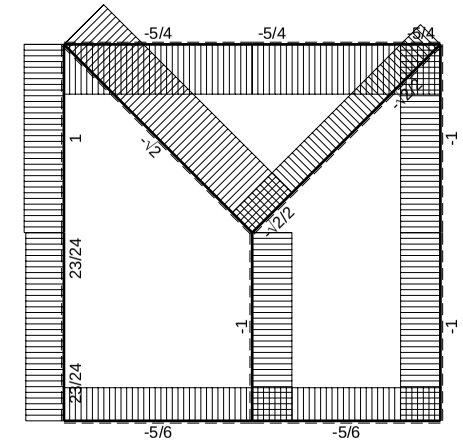
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

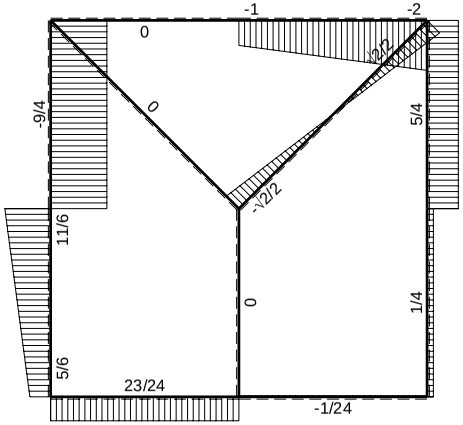
PROCEDIMENTO E RISULTATI 275579 CI04.xxxx.173



A = 714. mm^2
J_u = 249141. mm^4
J_v = 47502. mm^4
y_g = 20.12 mm
N = 1140. N
T_y = -2565. N
M_x = -1667250. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 9. mm
v_m = 33.88 mm
$\sigma_m = N/A - Mv/J_u$ = 228.3 N/mm^2
x_c = 21. mm
y_c = 46. mm
v_c = 25.88 mm
$\sigma_c = N/A - Mv/J_u$ = 174.8 N/mm^2
τ_c = 6.84 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 175.2 N/mm^2
S^* = 3986. mm^3

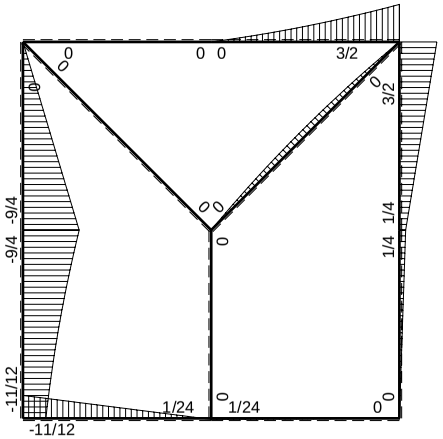

F
5/4F
E
5/4F
3/2Fb
2F
F
F
G
9/4F
F
G
F
5/4F
G
½F
F
F
9/4Fb
9/4F
H
I
E
5/4F
3/2Fb
F
H
11/6F
9/4Fb
23/24F
I
F
D
1/4F
1/4Fb
F
F
1/4Fb
5/4F
D
F
1/4F
C
23/24F
11/12Fb
5/6F
A
B
A
B
5/6F
11/12Fb
23/24F
5/6F
1/24Fb
23/24F
B
C
5/6F
1/24Fb
1/24F
5/6F
1/24F


-5/4
-5/4
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23/24
-5/6
-5/6

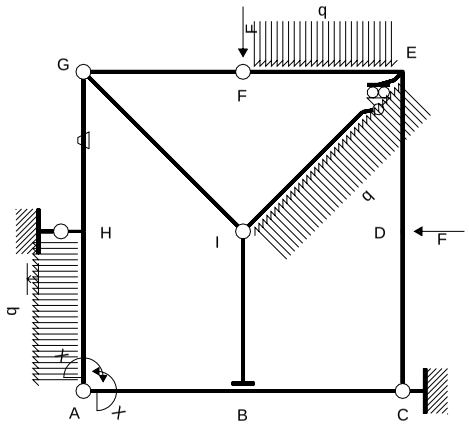

-1
-2
0
-1/2
-9/4
0
5/4
-1/2
11/6
0
1/4
5/6
23/24
-1/24

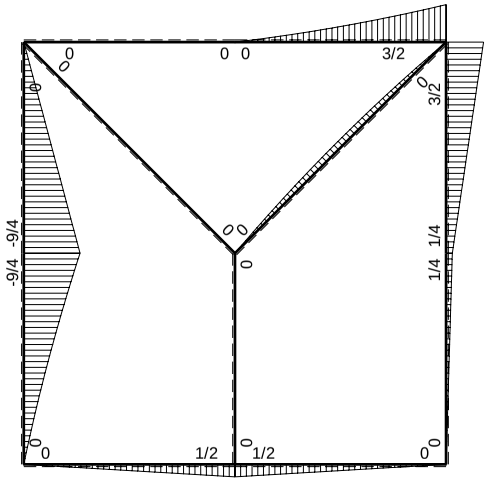
←□→ F

↑□↓ F

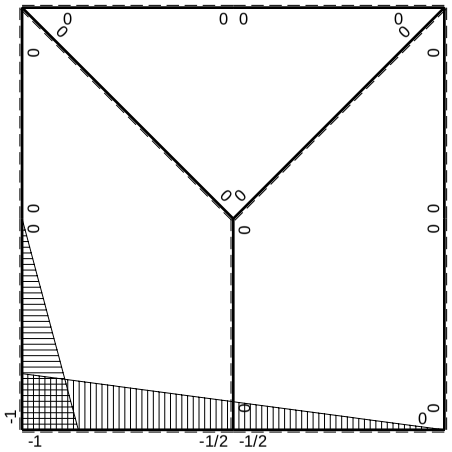

0
0 0
3/2
0
0
3/2
0 0
-9/4
-9/4
0
1/4 1/4
-11/12
1/24
0
1/24
0 0
-11/12

□ Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	-Fb/EJ	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	Fb/EJ	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-11/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						11/12Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

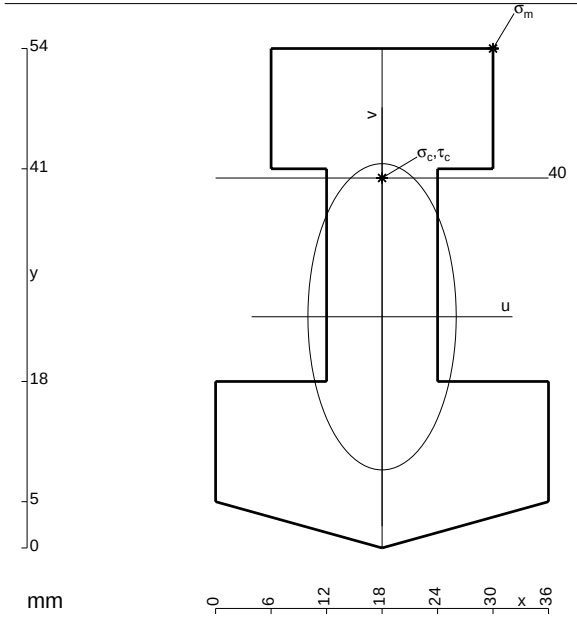
$$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

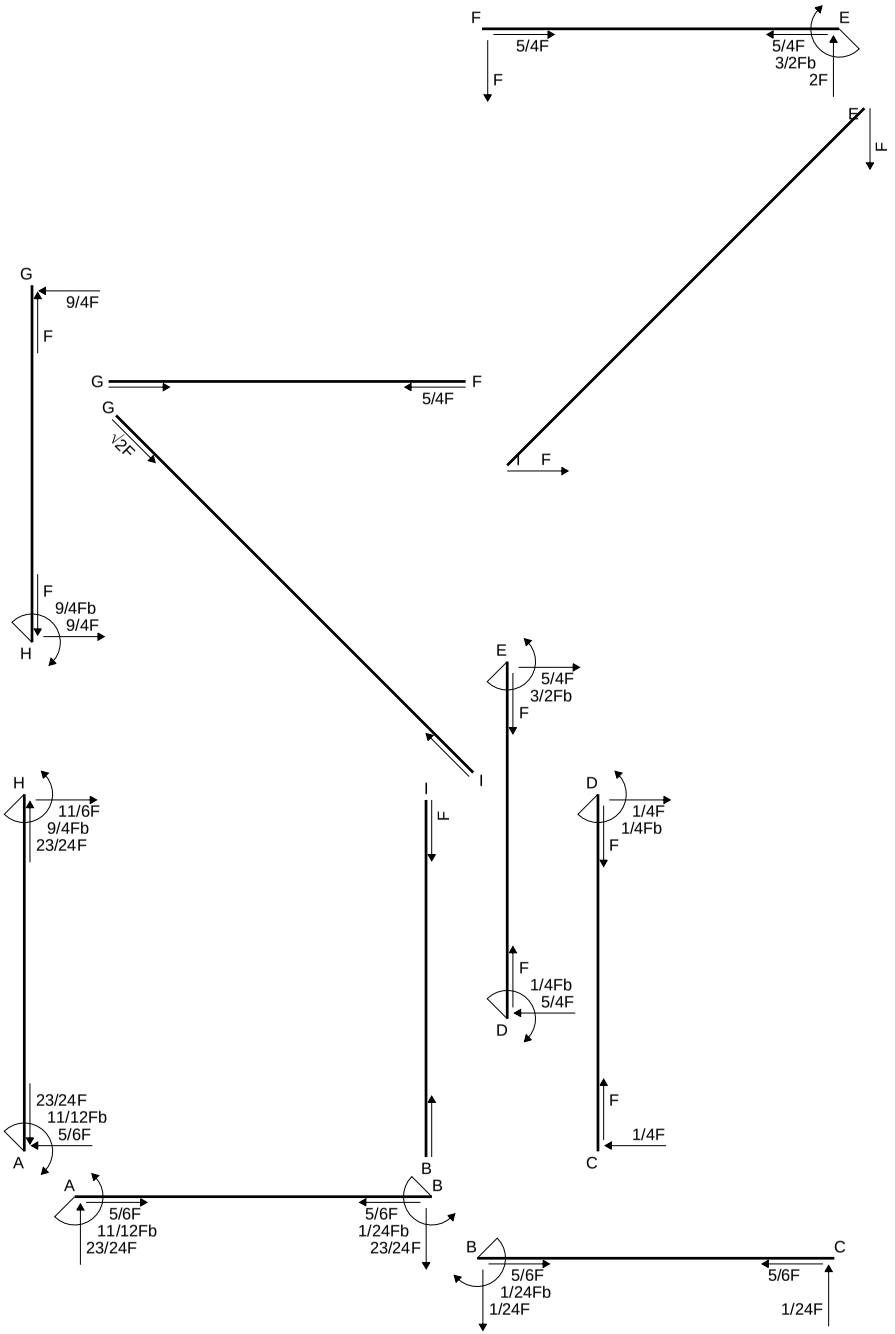
$$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

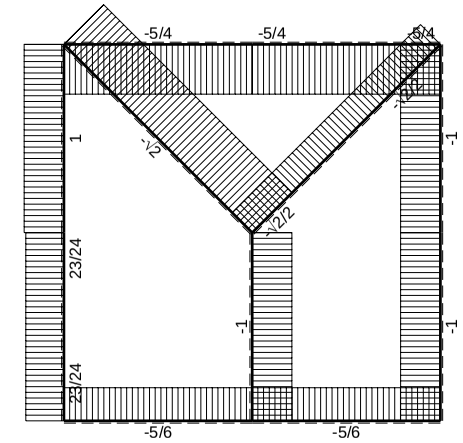
$$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

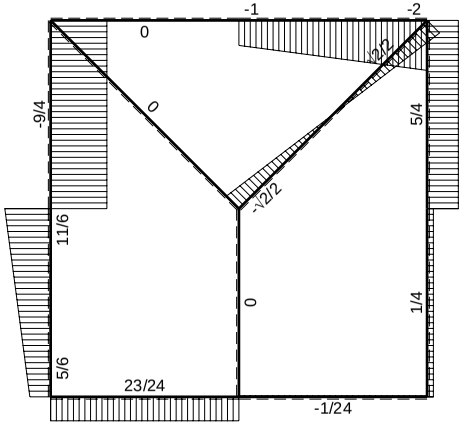
PROCEDIMENTO E RISULTATI 215204 CI04.xxxx.174



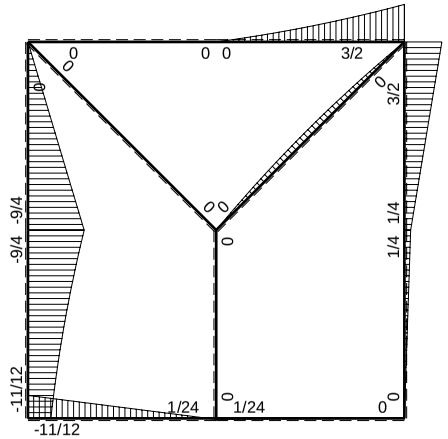
A = 1146. mm^2
J_u = 314359. mm^4
J_v = 73692. mm^4
y_g = 24.99 mm
N = 1640. N
T_y = -3690. N
M_x = -2583000. Nmm
x_m = 30. mm
y_m = 54. mm
u_m = 12. mm
v_m = 29.01 mm
$\sigma_m = N/A - Mv/J_u$ = 239.8 N/mm^2
x_c = 18. mm
y_c = 40. mm
v_c = 15.01 mm
$\sigma_c = N/A - Mv/J_u$ = 124.7 N/mm^2
τ_c = 7.05 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 125.3 N/mm^2
S^* = 7208. mm^3


F
5/4F
E
5/4F
3/2Fb
2F
F
F
G
9/4F
F
G
5/4F
F
G
½F
F
F
9/4Fb
9/4F
H
I
E
5/4F
3/2Fb
F
H
11/6F
9/4Fb
23/24F
I
F
D
1/4F
1/4Fb
F
F
1/4Fb
5/4F
D
23/24F
11/12Fb
5/6F
A
F
1/4F
C
B
A
B
5/6F
11/12Fb
23/24F
5/6F
1/24Fb
23/24F
B
C
5/6F
1/24Fb
1/24F
5/6F
1/24F

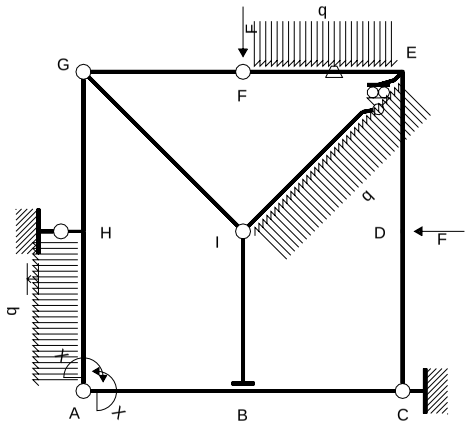

-5/4
-5/4
-5/4
1
-1
-½
-½√2
-1
-1
23/24
23/24
-1
-5/6
-5/6

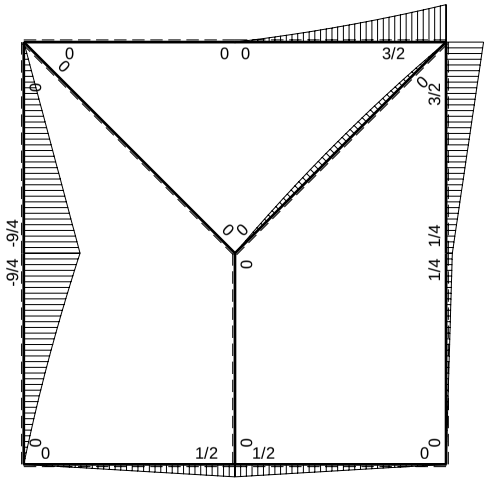

-1
-2
0
-½
-9/4
0
5/4
-½√2
11/6
0
1/4
5/6
23/24
-1/24

F F

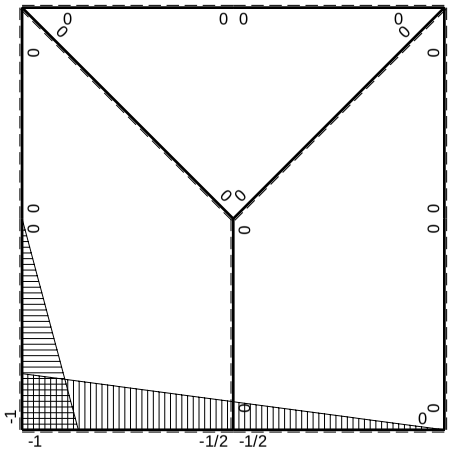

0
0 0
3/2
0
0
3/2
0 0
-9/4
-9/4
0
1/4
1/4
1/24
0
1/24
0 0
-11/12
-11/12

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	-Fb/EJ	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	Fb/EJ	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-11/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						11/12Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

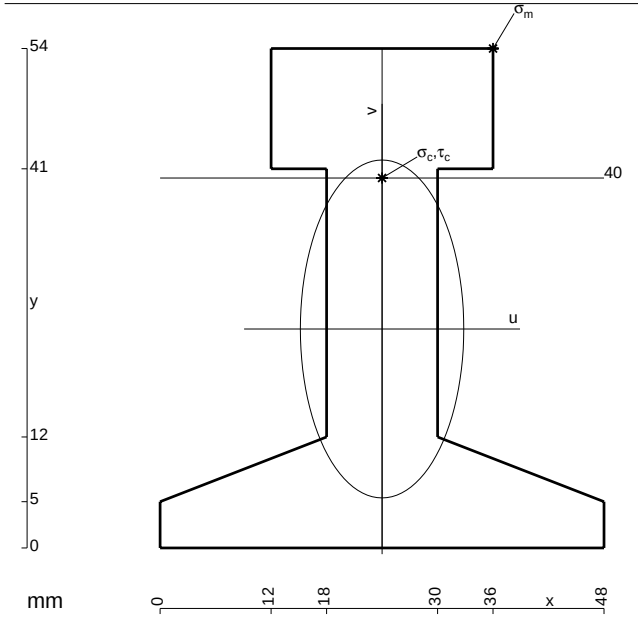
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

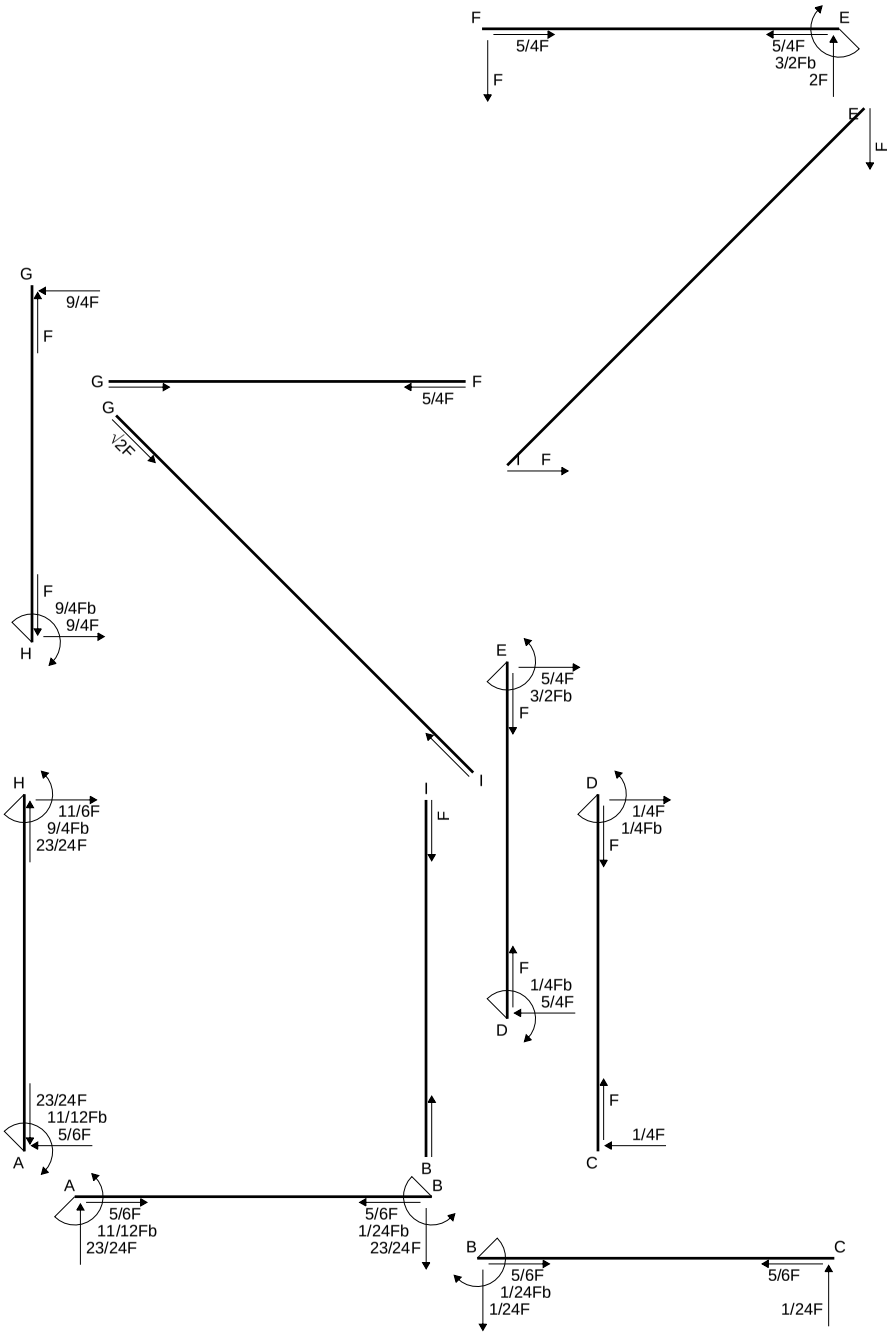
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

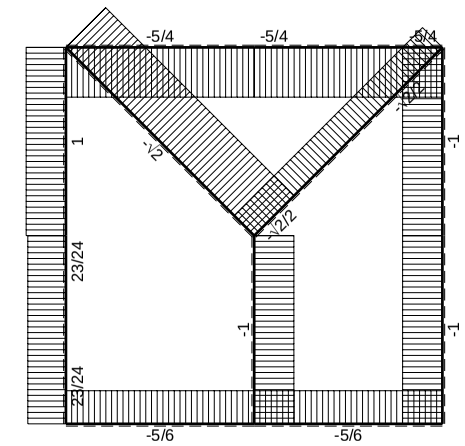
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

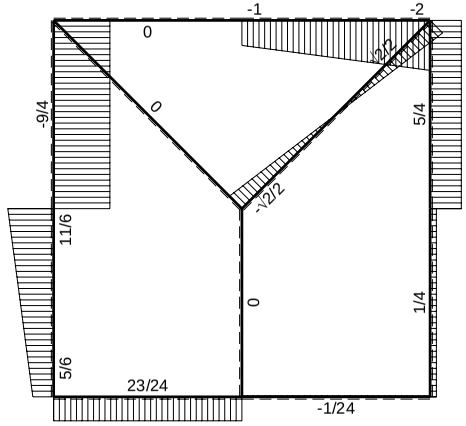
PROCEDIMENTO E RISULTATI 265726 CI04.xxxx.175

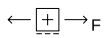


A = 1110. mm^2
J_u = 370450. mm^4
J_v = 86652. mm^4
y_g = 23.68 mm
N = 1430. N
T_y = -3218. N
M_x = -2413130. Nmm
x_m = 36. mm
y_m = 54. mm
u_m = 12. mm
v_m = 30.32 mm
$\sigma_m = N/A - Mv/J_u$ = 198.8 N/mm^2
x_c = 24. mm
y_c = 40. mm
v_c = 16.32 mm
$\sigma_c = N/A - Mv/J_u$ = 107.6 N/mm^2
τ_c = 5.526 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 108.1 N/mm^2
S^* = 7635. mm^3

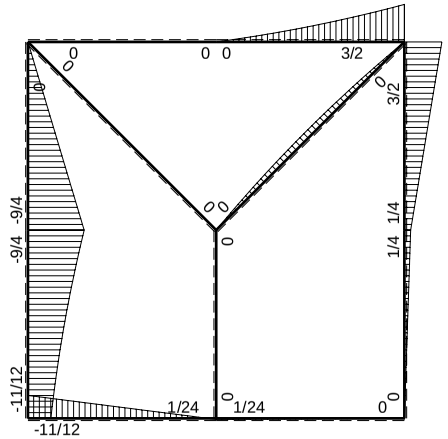






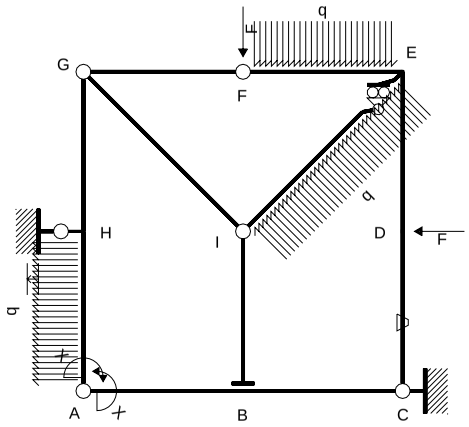


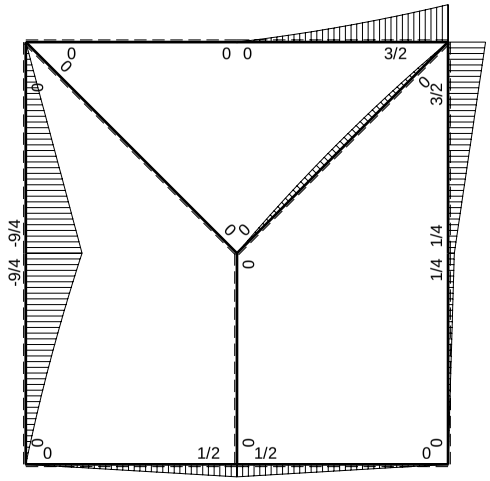




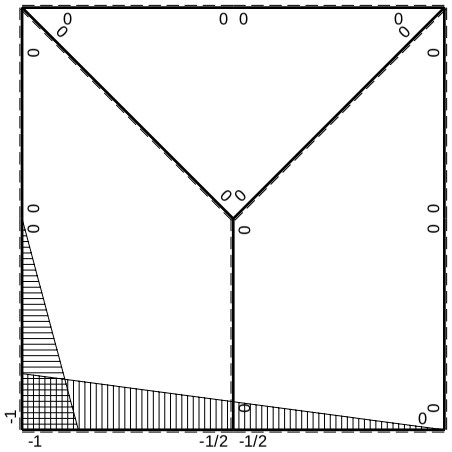


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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 270371 CI04.xxxx.176

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	-Fb/EJ	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	Fb/EJ	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	0	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	$-\sqrt{2}/2Fx+1/2qx^2$	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-11/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						11/12Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

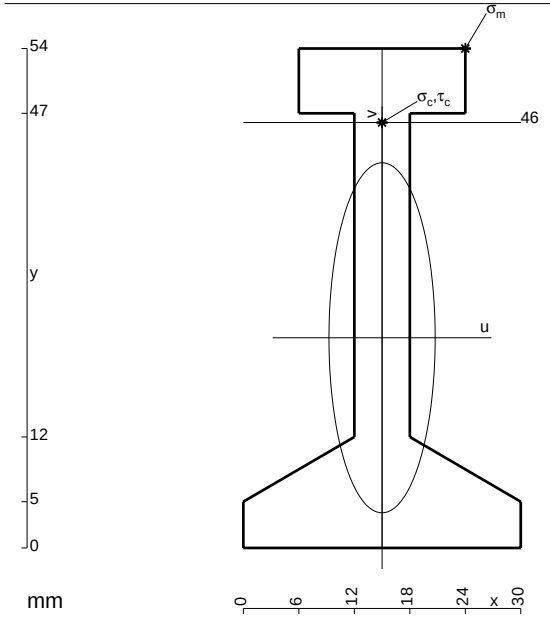
$$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

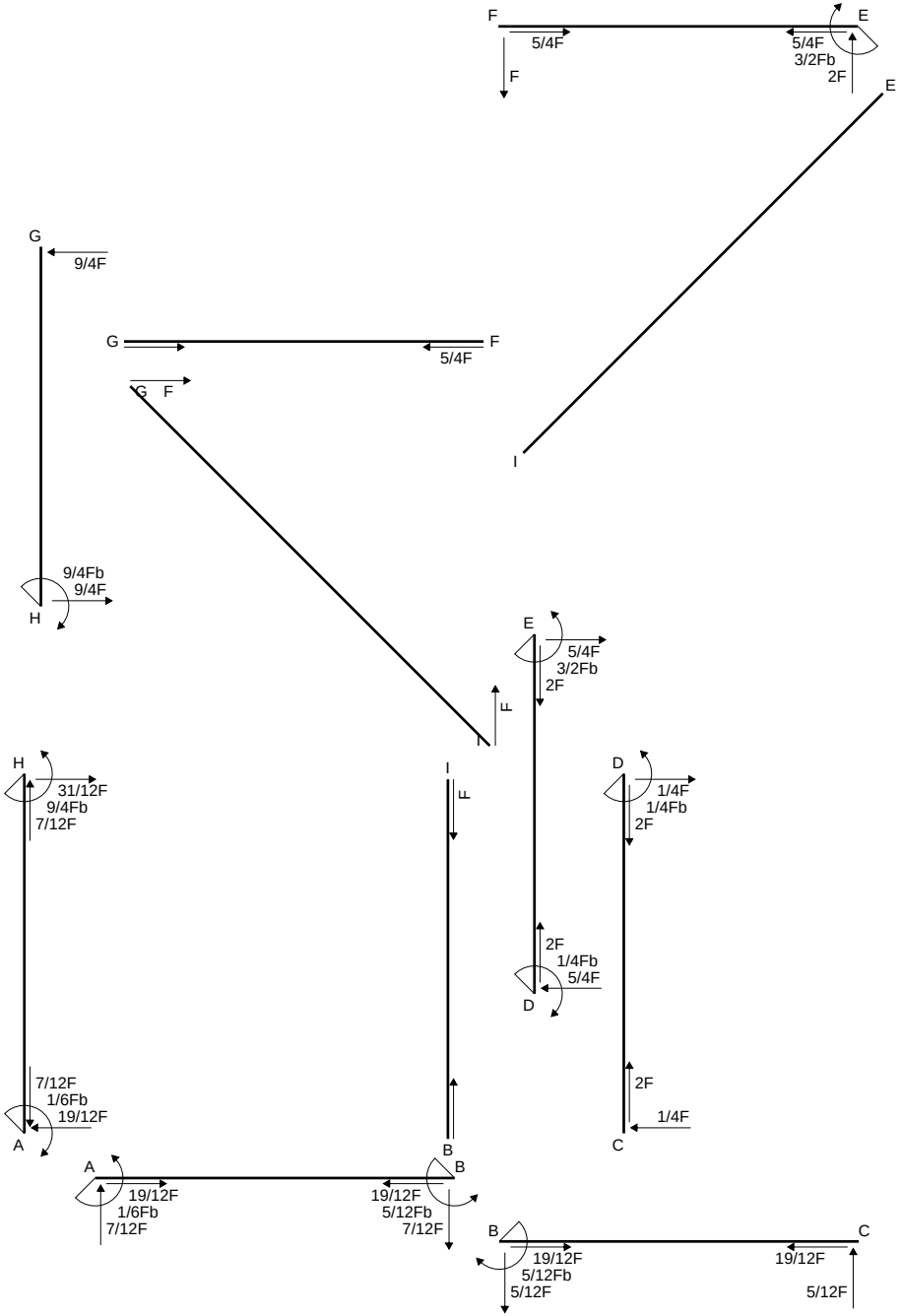
$$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

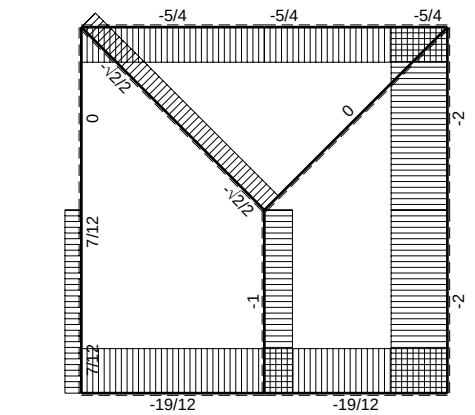
$$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

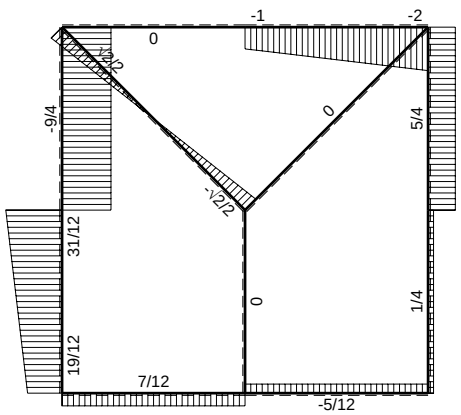
PROCEDIMENTO E RISULTATI 270371 CI04.xxxx.176



A = 612. mm^2
J_u = 219263. mm^4
J_v = 20196. mm^4
y_g = 22.72 mm
N = 810. N
T_y = -1823. N
M_x = -1458000. Nmm
x_m = 24. mm
y_m = 54. mm
u_m = 9. mm
v_m = 31.28 mm
$\sigma_m = N/A - Mv/J_u$ = 209.3 N/mm^2
x_c = 15. mm
y_c = 46. mm
v_c = 23.28 mm
$\sigma_c = N/A - Mv/J_u$ = 156.1 N/mm^2
τ_c = 5.046 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 156.4 N/mm^2
S^* = 3643. mm^3

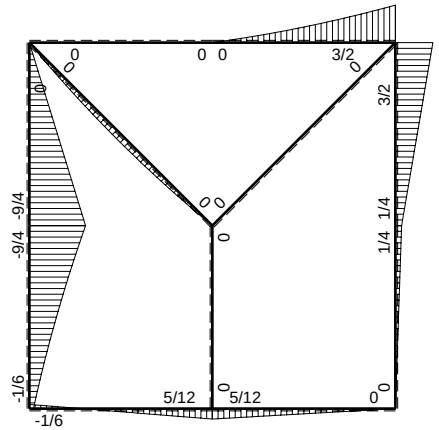

F
5/4F
E
5/4F
3/2Fb
2F
F
E
G
9/4F
G
F
5/4F
G
F
I
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
F
H
31/12F
9/4Fb
7/12F
I
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
7/12F
1/6Fb
19/12F
A
2F
1/4F
C
B
A
B
19/12F
1/6Fb
7/12F
19/12F
5/12Fb
7/12F
B
C
19/12F
5/12Fb
5/12F
19/12F
5/12F


-5/4
-5/4
-5/4
-√2/2
0
0
-2
-√2/2
7/12
-1
-2
7/12
-19/12
-19/12

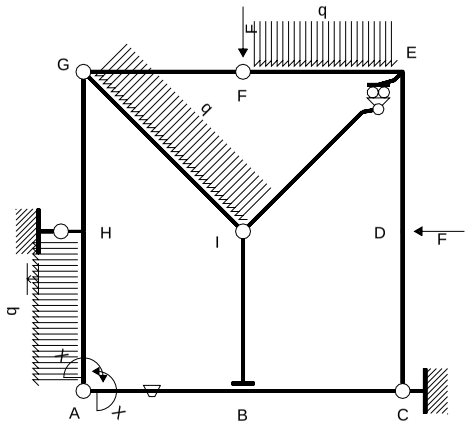

-1
-2
0
-√2/2
-9/4
0
5/4
-√2/2
31/12
0
1/4
19/12
7/12
-5/12

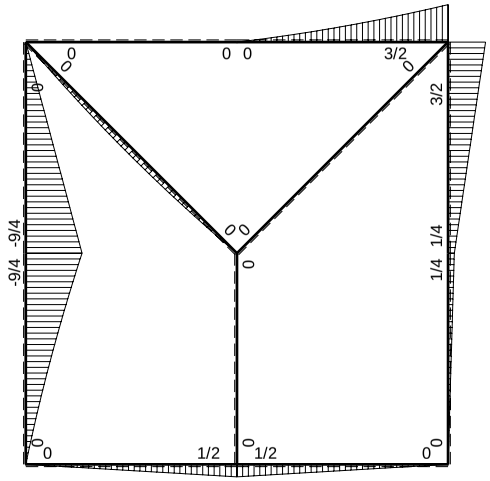
F

F

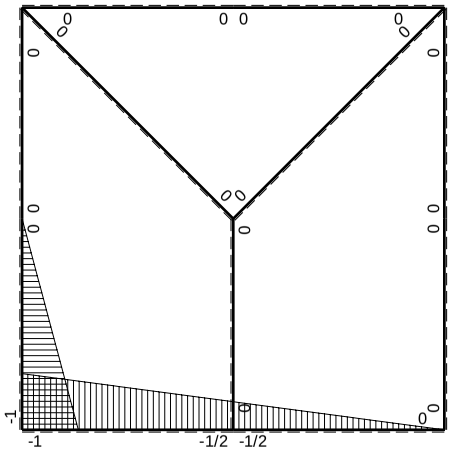

0
0 0
3/2
0
0
3/2
0
-9/4
-9/4
0
1/4
1/4
-9/4
0
-1/6
5/12
5/12
0
0
-1/6

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 306451 CI04.xxxx.177

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PROCEDIMENTO E RISULTATI 306451 CI04.xxxx.177

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	-Fb/EJ	$-1/2Fx+1/4Fx^2/b$	Fb/EJ-1/2Fx/EJ	$1-x/b+1/4x^2/b^2$	$(-1/6+3/4)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	-1/2Fb+1/2Fx	Fb/EJ	$-1/4Fb+1/4Fx^2/b$	1/2Fb/EJ+1/2Fx/EJ	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-1/6Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						1/6Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx + \int_o^b \left(1 - 1/2\ x/b\right)\theta\ dx$

$= \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ\ + \left[\ x - 1/4\ x^2/b\ \right]_o^b \theta$

$= \left(-1/4\ b + 1/12\ b\ \right) Fb\ 1/EJ\ + \left(\ b - 1/4\ b\ \right)\theta\ = 7/12\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx + \int_o^b \left(-1/2 - 1/2\ x/b\right)\theta\ dx$

$= \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ\ + \left[-1/2\ x - 1/4\ x^2/b\ \right]_o^b \theta$

$= \left(-1/4\ b + 1/12\ b\ \right) Fb\ 1/EJ\ + \left(-1/2\ b - 1/4\ b\ \right)\theta\ = 7/12\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right) Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ$

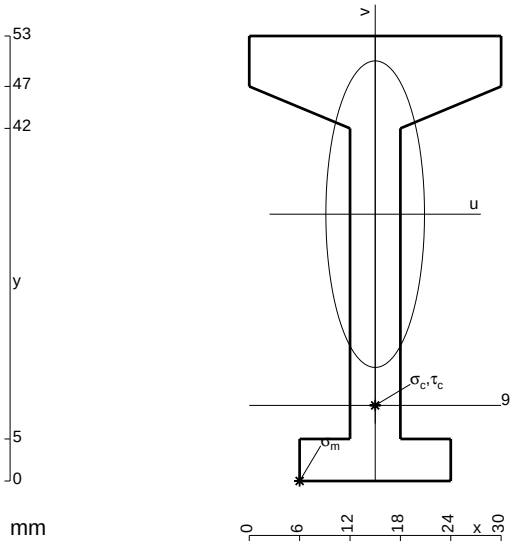
$= \left(-1/12\ b\ \right) Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

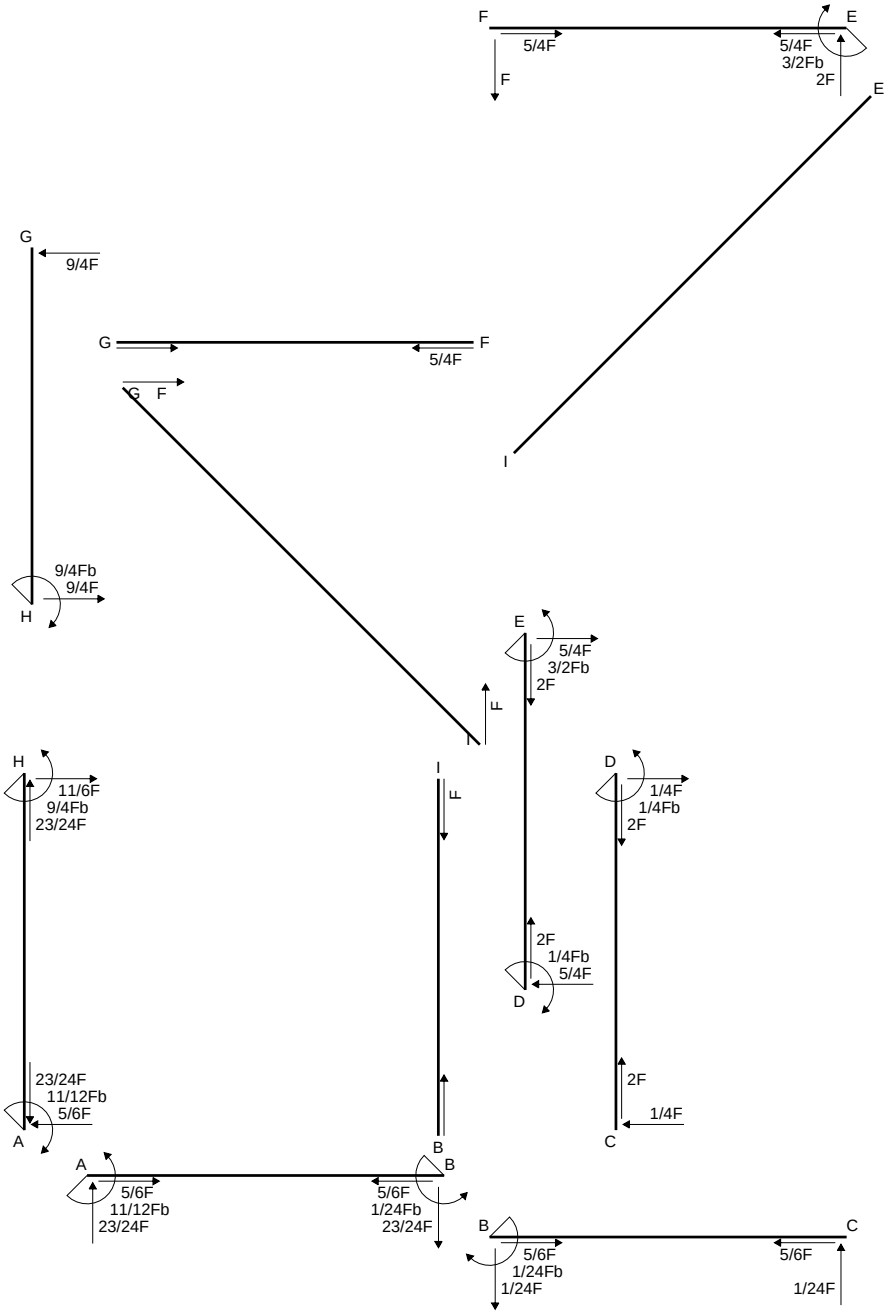
$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

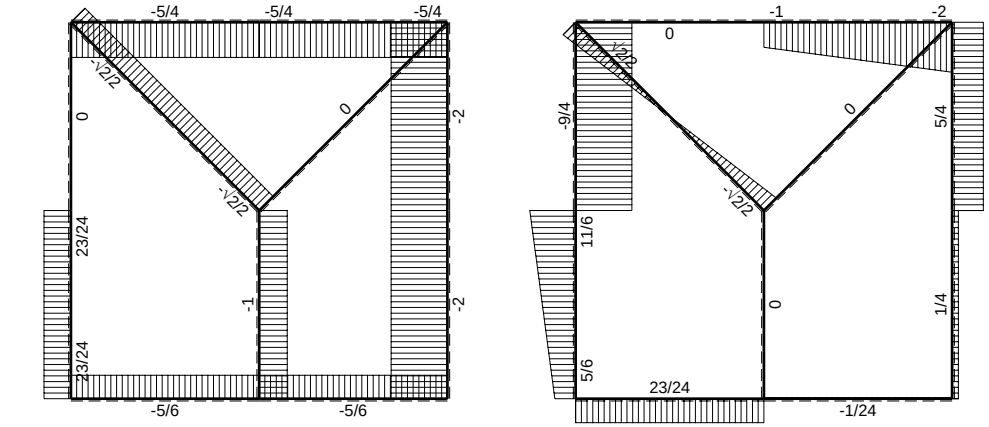
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

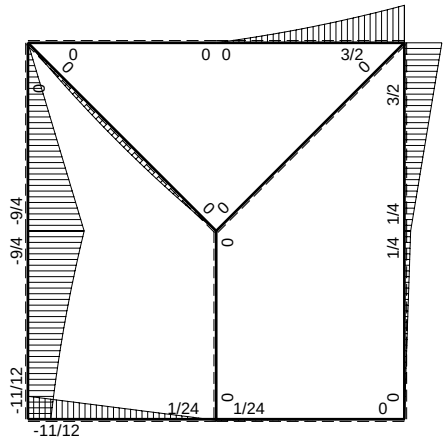


A = 582. mm^2
J_u = 194208. mm^4
J_v = 20106. mm^4
y_g = 31.78 mm
T_y = -1598. N
M_x = -1325930. Nmm
x_m = 6. mm
u_m = -9. mm
v_m = -31.78 mm
$\sigma_m = -Mv/J_u$ = -217. N/mm^2
x_c = 15. mm
y_c = 9. mm
v_c = -22.78 mm
$\sigma_c = -Mv/J_u$ = -155.5 N/mm^2
τ_c = 4.428 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 155.7 N/mm^2
S^* = 3230. mm^3

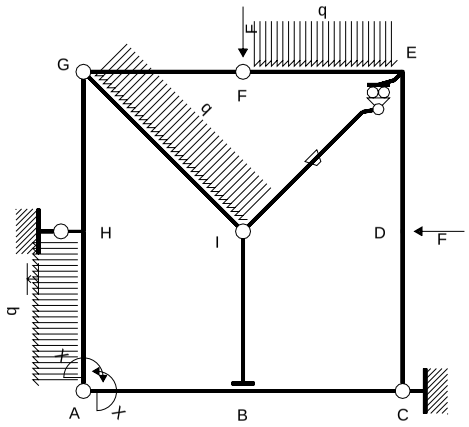

F
E
5/4F
5/4F
3/2Fb
2F
F
E
G
9/4F
G
F
5/4F
G
F
I
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
F
H
11/6F
9/4Fb
23/24F
I
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
2F
1/4F
C
23/24F
11/12Fb
5/6F
A
B
A
B
5/6F
11/12Fb
23/24F
5/6F
1/24Fb
23/24F
B
C
5/6F
1/24Fb
1/24F
5/6F
1/24F

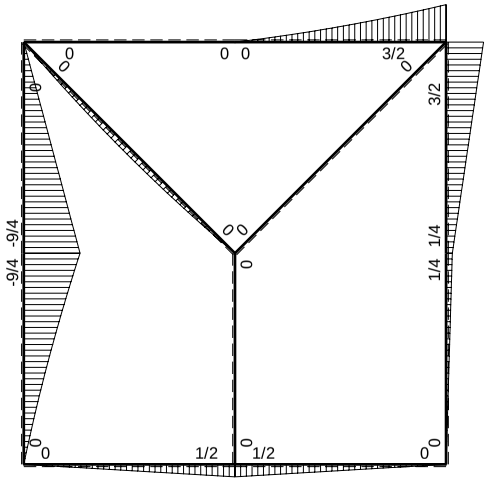

-5/4
-5/4
-5/4
-√2/2
0
0
-2
-√2/2
23/24
-1
-2
23/24
-5/6
-5/6
-1
-2
0
-√2/2
-9/4
0
5/4
-√2/2
11/6
0
1/4
5/6
23/24
-1/24

F F

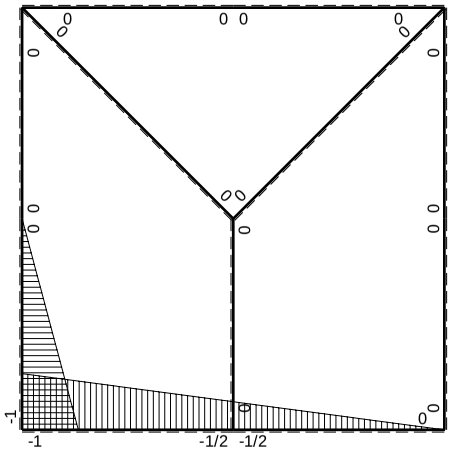

0
0 0
3/2
0
0
3/2
0
0
-9/4
-9/4
0
1/4
1/4
-11/12
1/24
1/24
0
0
-11/12

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 268272 CI04.xxxx.178

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PROCEDIMENTO E RISULTATI 268272 CI04.xxxx.178

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	-Fb/EJ	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-11/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						11/12Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right) Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right) Fb\ 1/EJ\ = -1/6\ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right) Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right) Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b Fb\ 1/EJ$

$= \left(-1/12\ b\ \right) Fb\ 1/EJ\ = -1/12\ Fb^2/EJ$

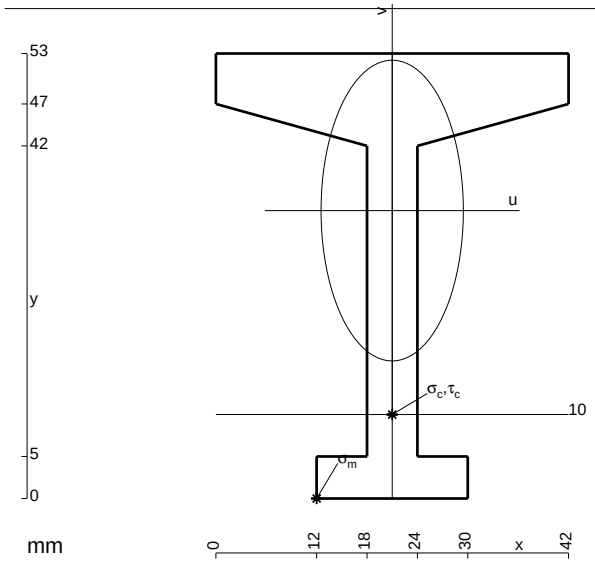
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right) Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right) Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b Fb\ 1/EJ$

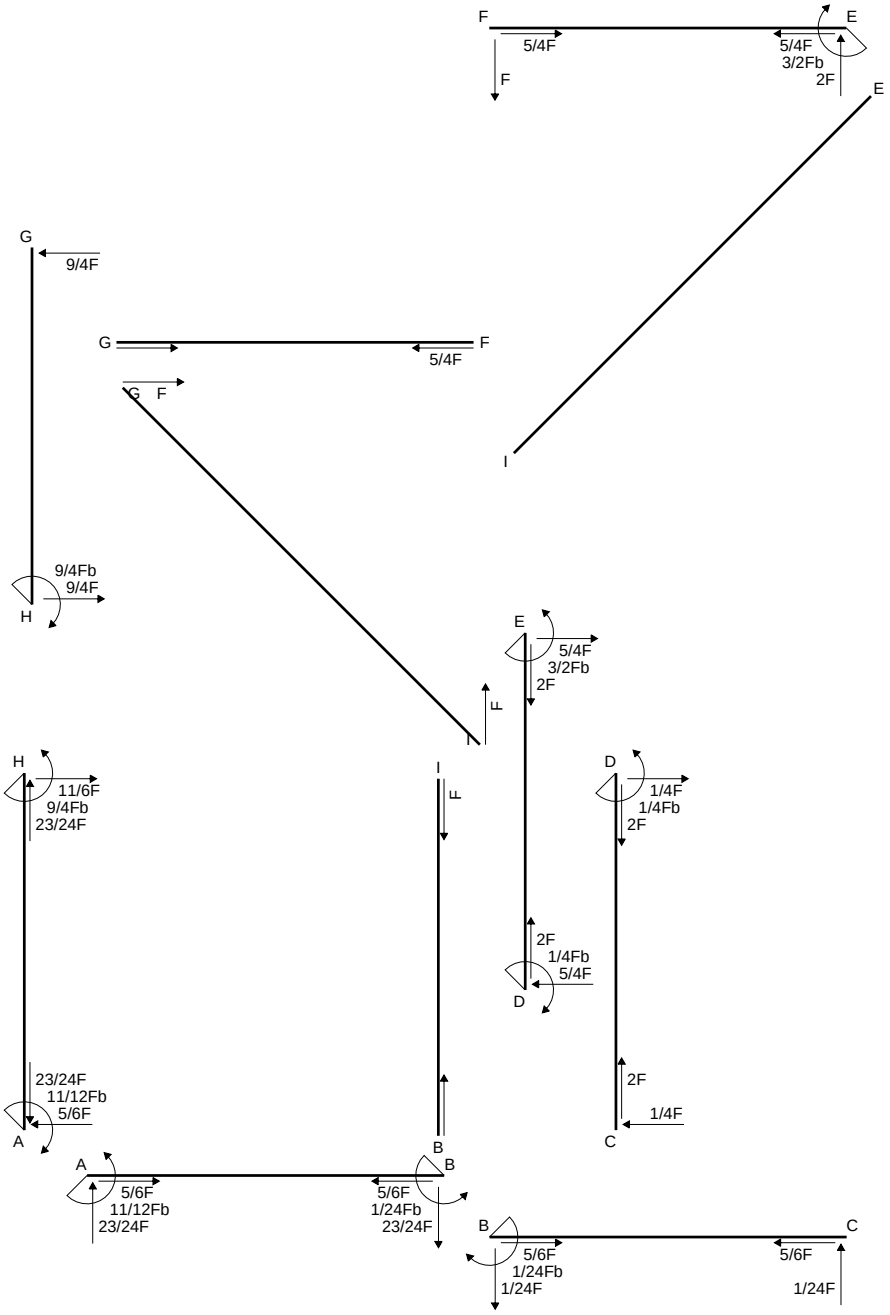
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right) Fb\ 1/EJ\ = 1/3\ Fb^2/EJ$

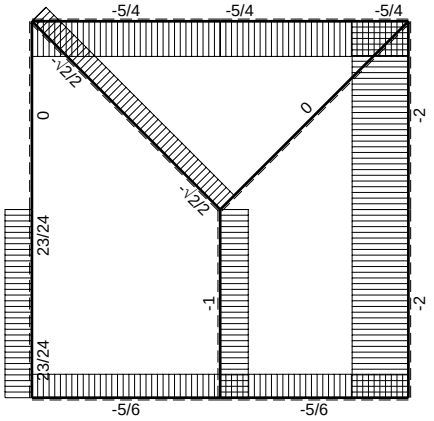
PROCEDIMENTO E RISULTATI 268272 CI04.xxxx.178

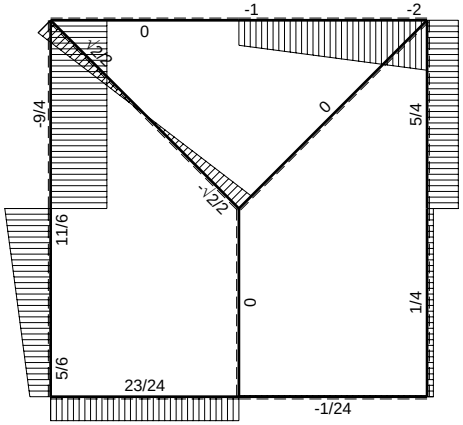


A = 684. mm^2
J_u = 219556. mm^4
J_v = 49140. mm^4
y_g = 34.29 mm
T_y = -1665. N
M_x = -1465200. Nmm
x_m = 12. mm
u_m = -9. mm
v_m = -34.29 mm
$\sigma_m = -Mv/J_u$ = -228.9 N/mm^2
x_c = 21. mm
y_c = 10. mm
v_c = -24.29 mm
$\sigma_c = -Mv/J_u$ = -162.1 N/mm^2
τ_c = 4.633 N/mm^2
$\sigma_0 = \sqrt{\sigma^2 + 3\tau^2}$ = 162.3 N/mm^2
S^* = 3665. mm^3

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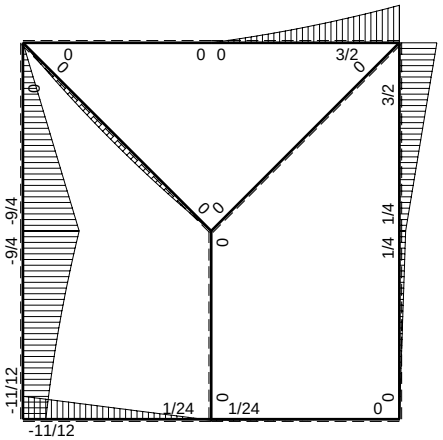






←□→ F

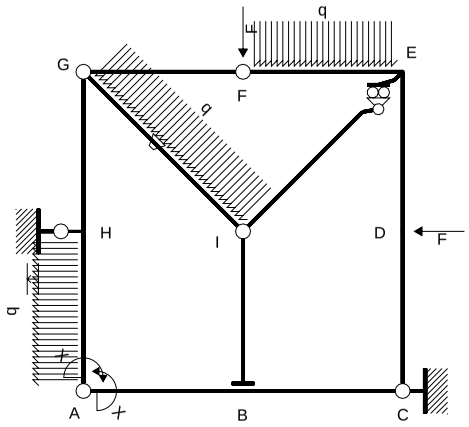
↑□↓ F

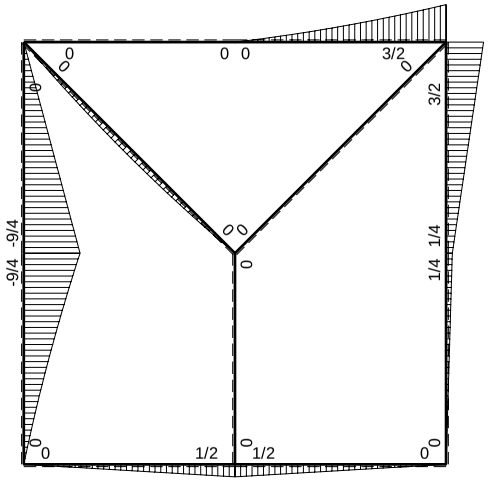


↻□↺ Fb

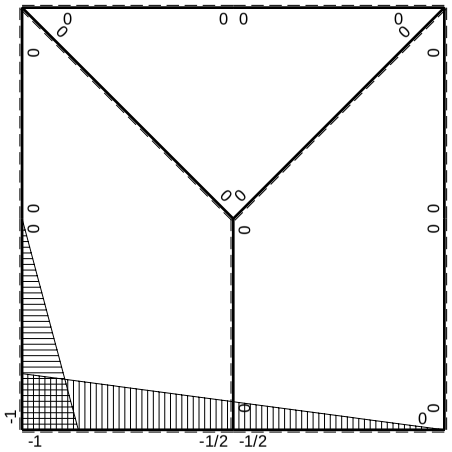
AZIONI INTERNE 267819 CI04.xxxx.179

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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	-Fb/EJ	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-11/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						11/12Fb	

Sviluppi di calcolo iperstatica

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$$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$$

$$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$$

$$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$$

$$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$$

$$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$$

$$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

$$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$$

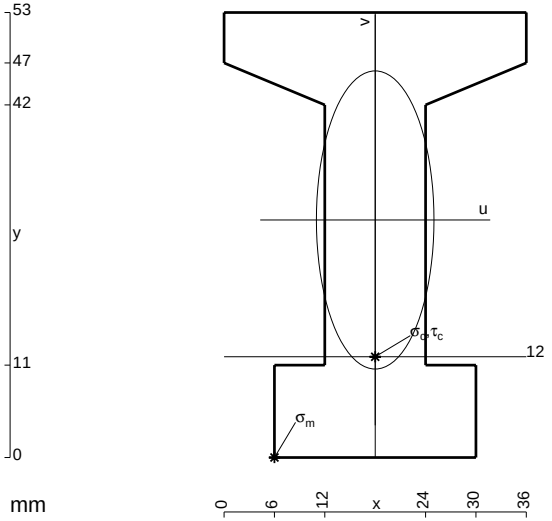
$$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

$$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

$$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$$

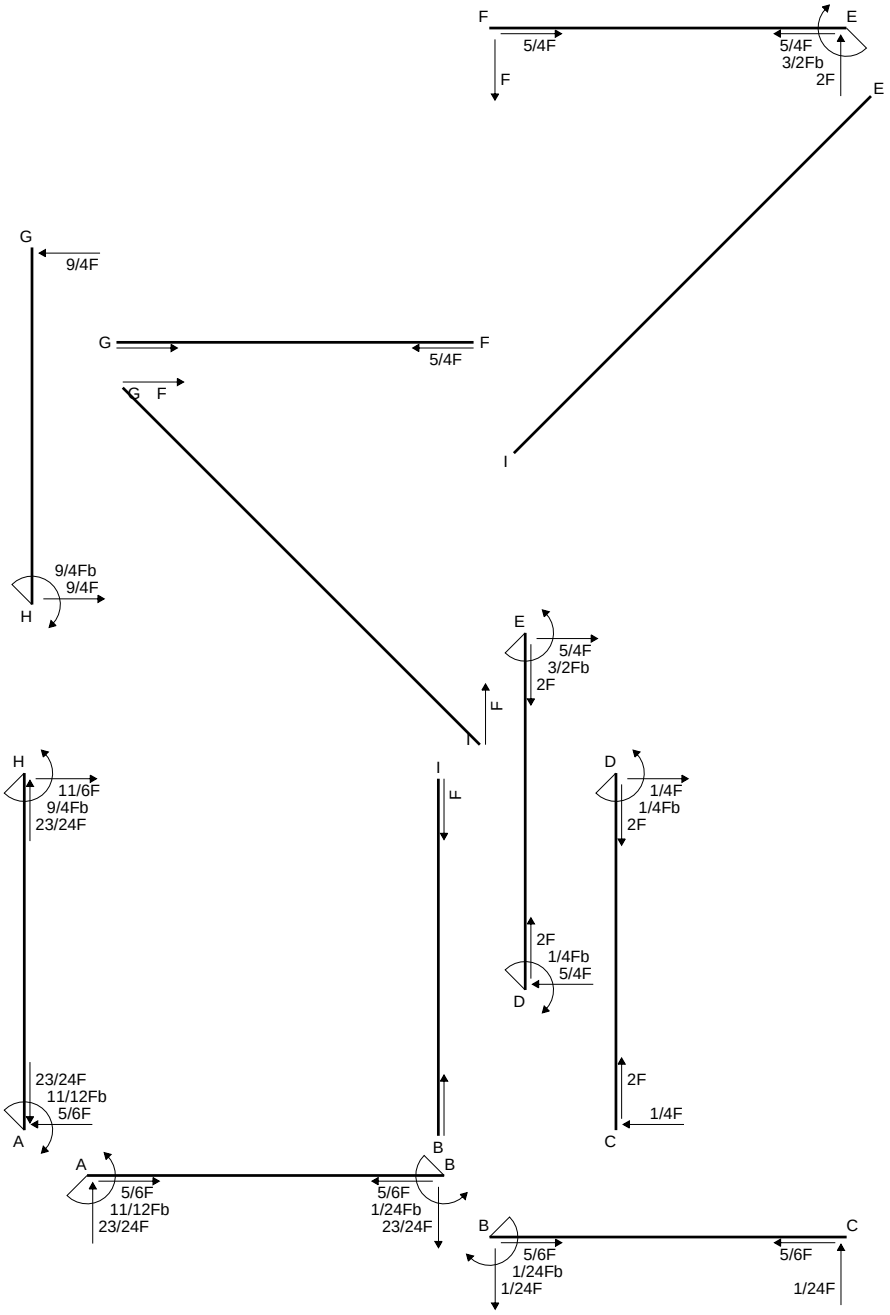
$$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$$

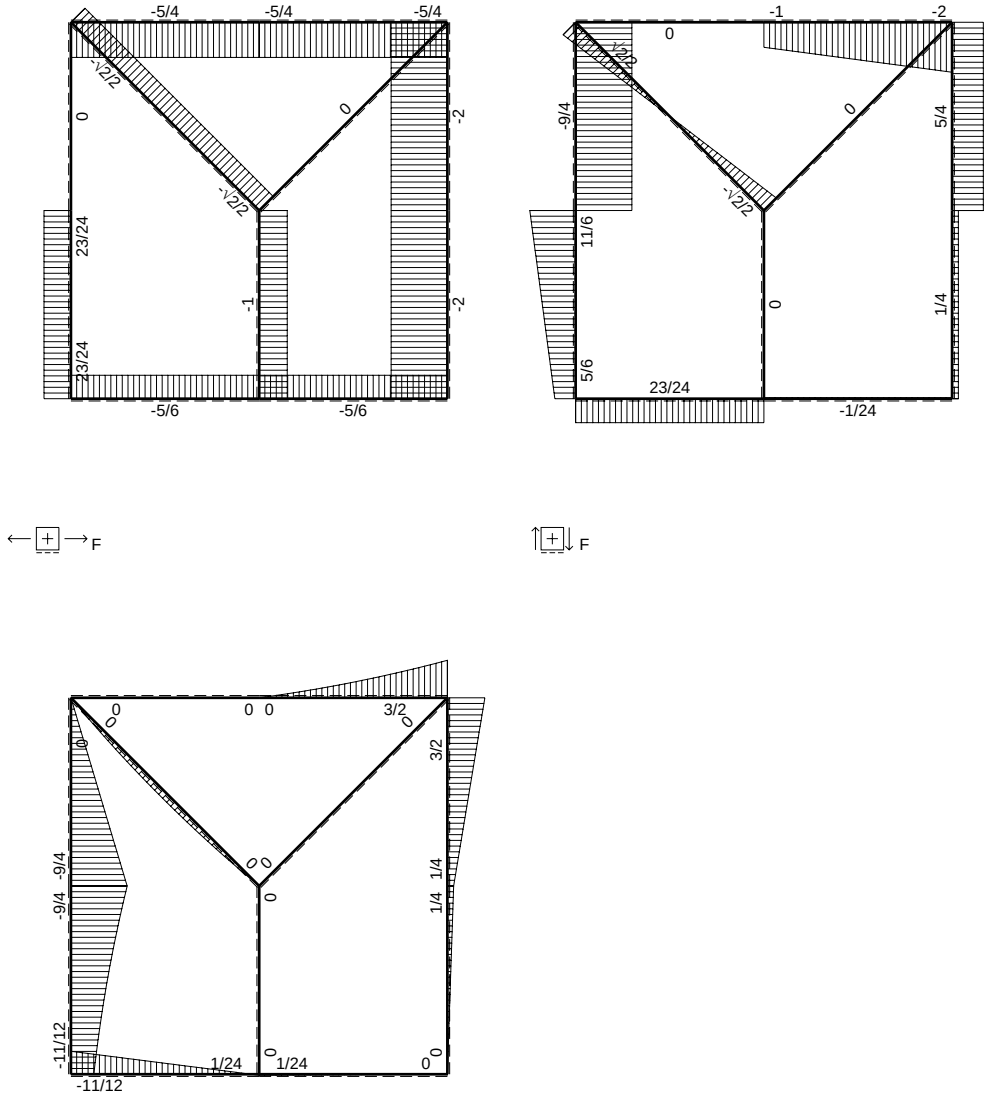
PROCEDIMENTO E RISULTATI 267819 CI04.xxxx.179

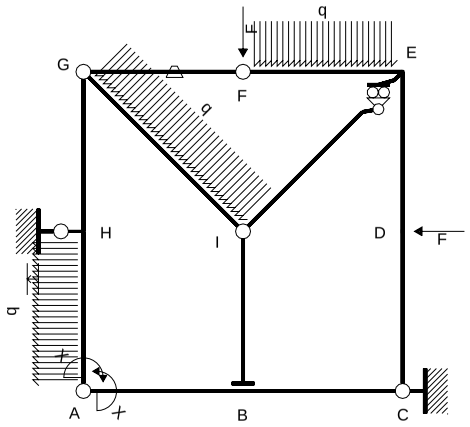


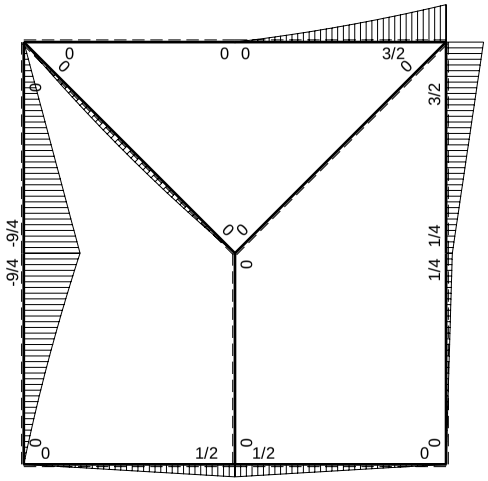
A = 972. mm^2
J_u = 306619. mm^4
J_v = 47664. mm^4
y_g = 28.29 mm
T_y = -2790. N
M_x = -2594700. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.29 mm
$\sigma_m = -Mv/J_u$ = -239.4 N/mm^2
x_c = 18. mm
y_c = 12. mm
v_c = -16.29 mm
$\sigma_c = -Mv/J_u$ = -137.9 N/mm^2
τ_c = 4.715 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 138.1 N/mm^2
S^* = 6219. mm^3

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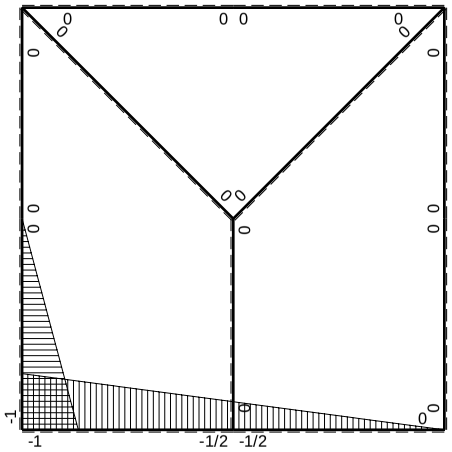

F
E
5/4F
5/4F
3/2Fb
2F
F
E
G
9/4F
G
F
5/4F
G
F
I
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
F
H
11/6F
9/4Fb
23/24F
I
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
2F
1/4F
C
23/24F
11/12Fb
5/6F
A
B
A
B
5/6F
11/12Fb
23/24F
5/6F
1/24Fb
23/24F
B
C
5/6F
1/24Fb
1/24F
5/6F
1/24F


-5/4
-5/4
-5/4
-√2/2
-√2/2
0
0
-2
23/24
-1
-2
23/24
-5/6
-5/6
-1
-2
0
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-√2/2
-9/4
5/4
11/6
0
1/4
5/6
23/24
-1/24
F
F
0 0
3/2
-9/4
-9/4
1/4
1/4
-11/12
1/24
1/24
-11/12
Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 264071 CI04.xxxx.180

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PROCEDIMENTO E RISULTATI 264071 CI04.xxxx.180

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	-Fb/EJ	0	0	0	0+0	0
GF b	0	0	Fb/EJ	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-11/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						11/12Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

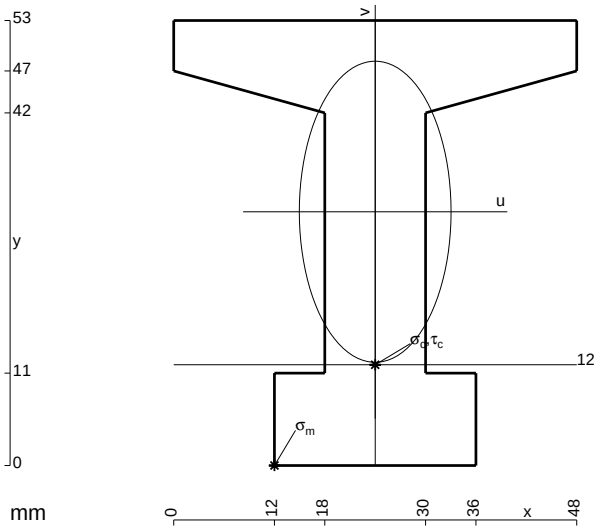
$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

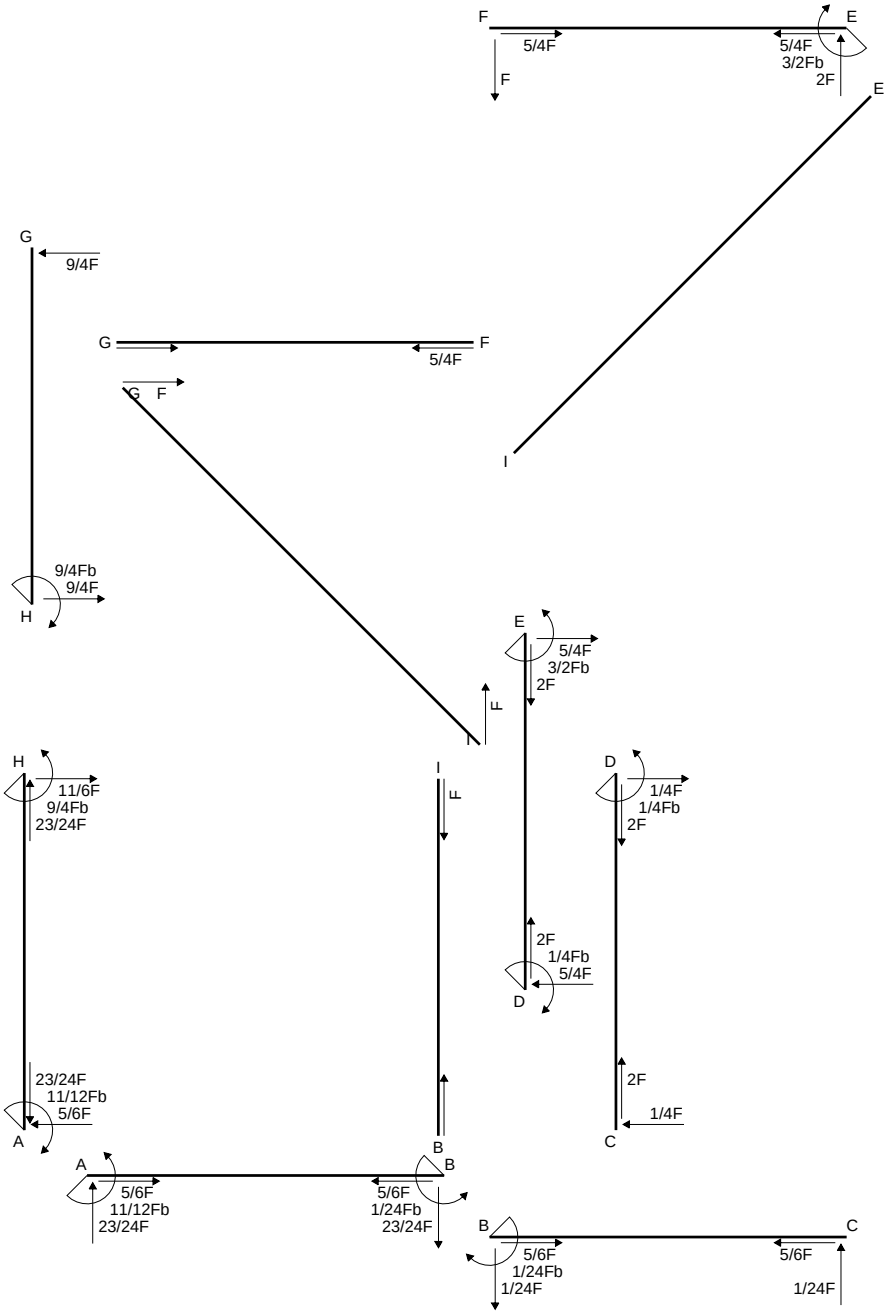
$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

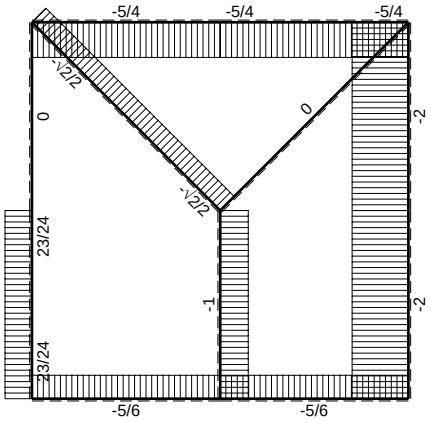
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

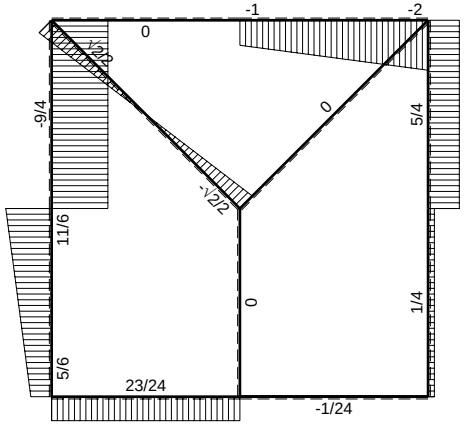
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$



A = 1074. mm^2
J_u = 345511. mm^4
J_v = 87732. mm^4
y_g = 30.22 mm
T_y = -4658. N
M_x = -2282180. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.22 mm
$\sigma_m = -Mv/J_u$ = -199.6 N/mm^2
x_c = 24. mm
y_c = 12. mm
v_c = -18.22 mm
$\sigma_c = -Mv/J_u$ = -120.4 N/mm^2
τ_c = 7.584 N/mm^2
$\sigma_0 = \sqrt{\sigma^2 + 3\tau^2}$ = 121.1 N/mm^2
S^* = 6752. mm^3

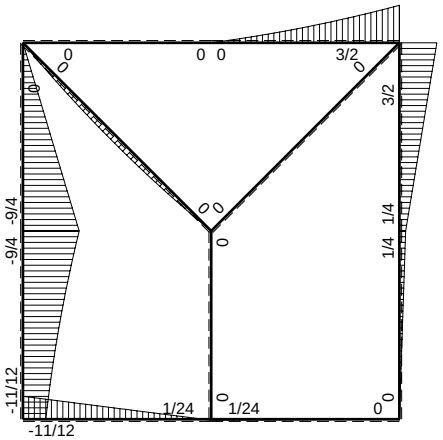






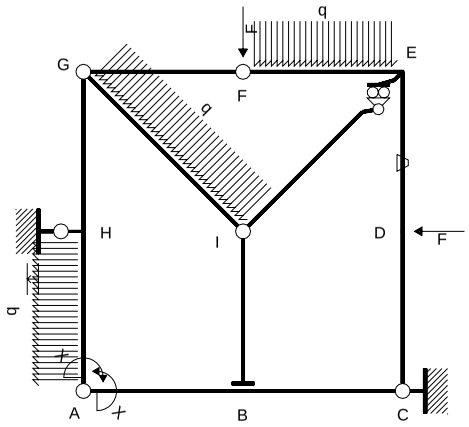
←□→ F

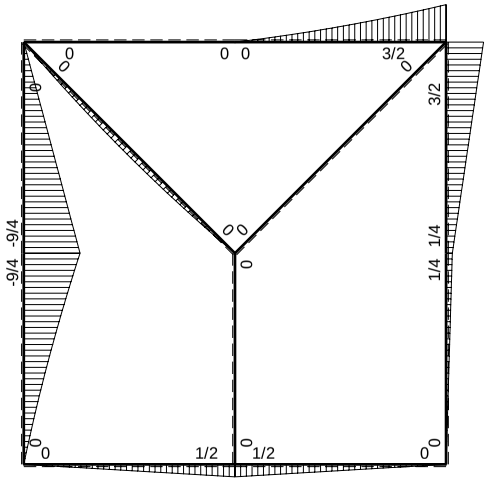
↑□↓ F



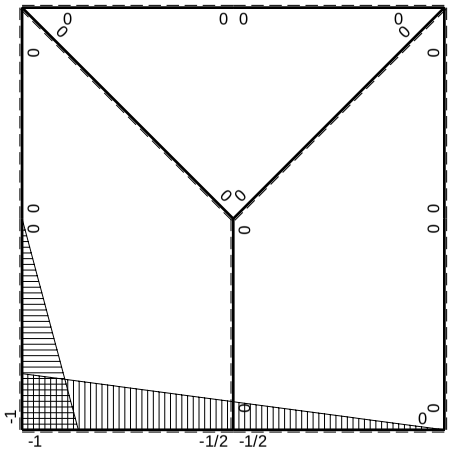
↻□↺ Fb

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M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 274715 CI04.xxxx.181

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	-Fb/EJ	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	Fb/EJ	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-11/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						11/12Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/12\ b\right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

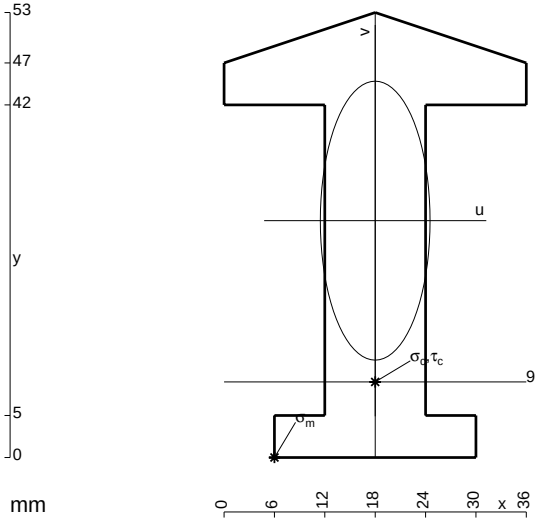
$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

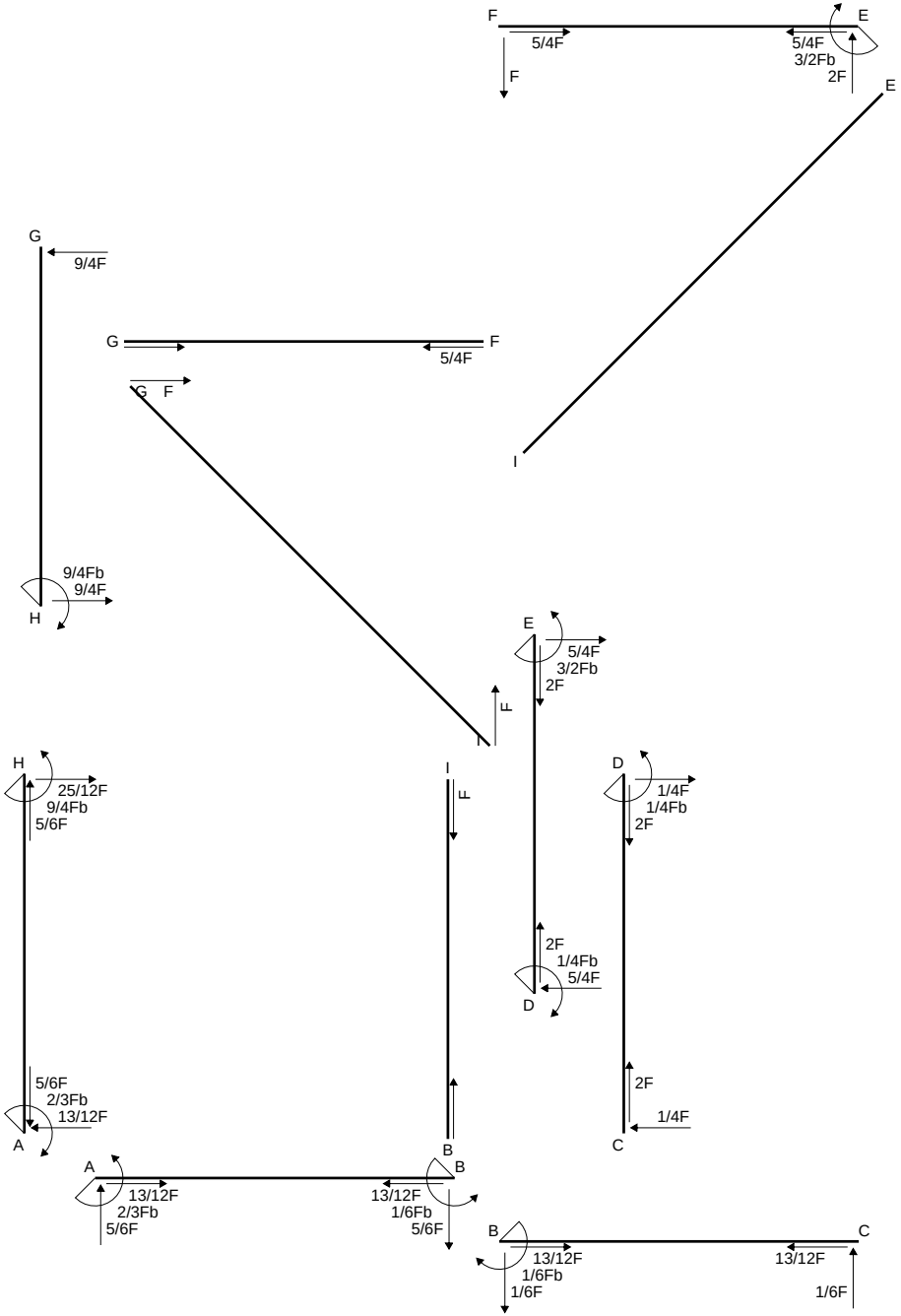
$= \left(7/8\ b - 5/12\ b - 1/8\ b\right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

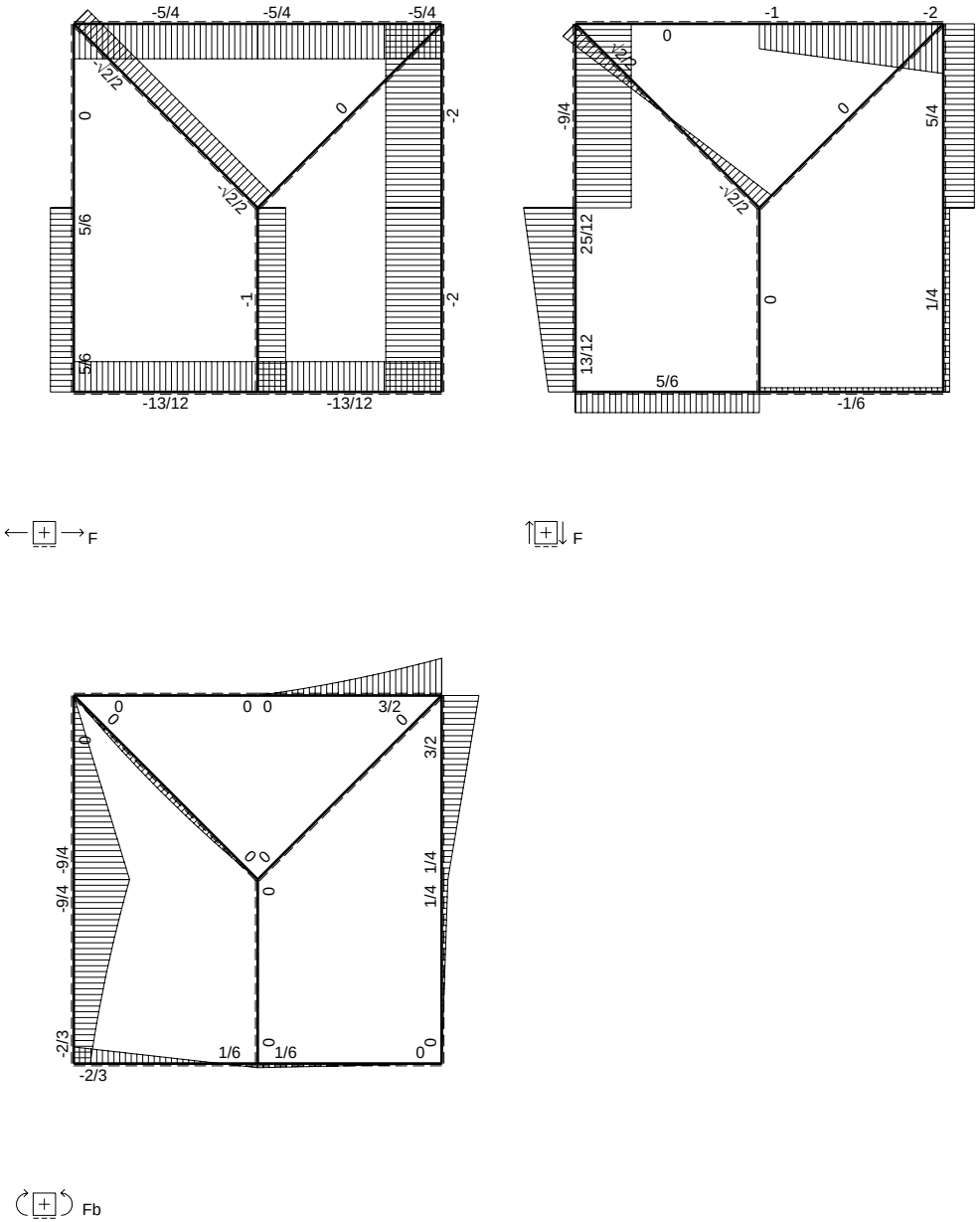
PROCEDIMENTO E RISULTATI 274715 CI04.xxxx.181

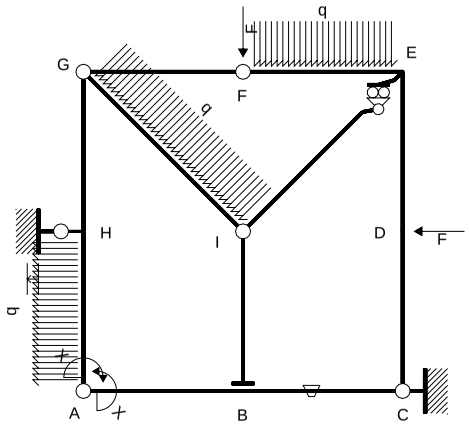


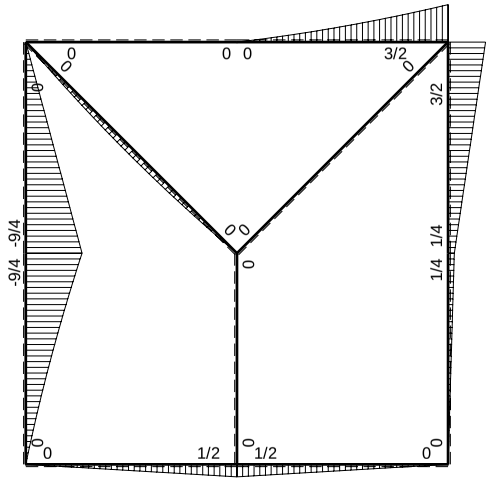
A = 852. mm^2
J_u = 235110. mm^4
J_v = 36360. mm^4
y_g = 28.21 mm
T_y = -3285. N
M_x = -1741050. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.21 mm
$\sigma_m = -Mv/J_u$ = -208.9 N/mm^2
x_c = 18. mm
y_c = 9. mm
v_c = -19.21 mm
$\sigma_c = -Mv/J_u$ = -142.3 N/mm^2
τ_c = 4.778 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 142.5 N/mm^2
S^* = 4103. mm^3

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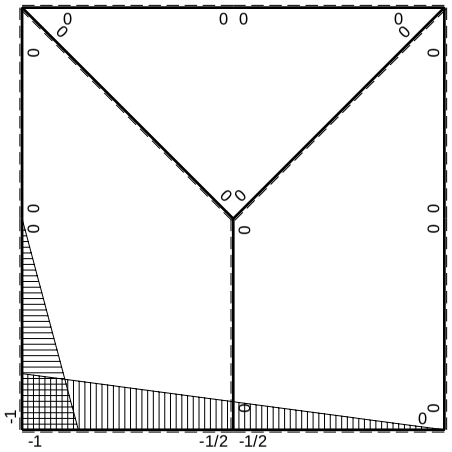

F
5/4F
E
5/4F
3/2Fb
2F
F
E
G
9/4F
G
F
5/4F
G
F
I
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
F
H
25/12F
9/4Fb
5/6F
I
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
5/6F
2/3Fb
13/12F
A
2F
1/4F
C
B
A
A
13/12F
2/3Fb
5/6F
B
13/12F
1/6Fb
5/6F
B
C
13/12F
1/6Fb
1/6F
13/12F
1/6F


-5/4
-5/4
-5/4
-√2/2
0
0
-2
5/6
-1
-2
5/6
-13/12
-13/12
F
-1
-2
0
-9/4
5/4
-√2/2
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3/2
0
0
0
3/2
-9/4
-9/4
0
1/4
1/4
-2/3
1/6
1/6
0
-2/3
Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 247954 CI04.xxxx.182

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PROCEDIMENTO E RISULTATI 247954 CI04.xxxx.182

Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	-Fb/EJ	$-1/4Fb+1/2Fx-1/4Fx^2/b$	1/2Fb/EJ-1/2Fx/EJ	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+1/4)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	Fb/EJ	$-1/4Fx^2/b$	1/2Fx/EJ	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-2/3Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						2/3Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(1/2 - 1/2\ x/b\ \right)\ \theta\ \ dx$

$= \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x - 1/4\ x^2/b\ \right]_o^b\ \theta$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b - 1/4\ b\ \right)\ \theta\ \ = 1/6\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\ \right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1/2\ x/b\ \right)\ \theta\ \ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ\ + \left[-1/4\ x^2/b\ \right]_o^b\ \theta$

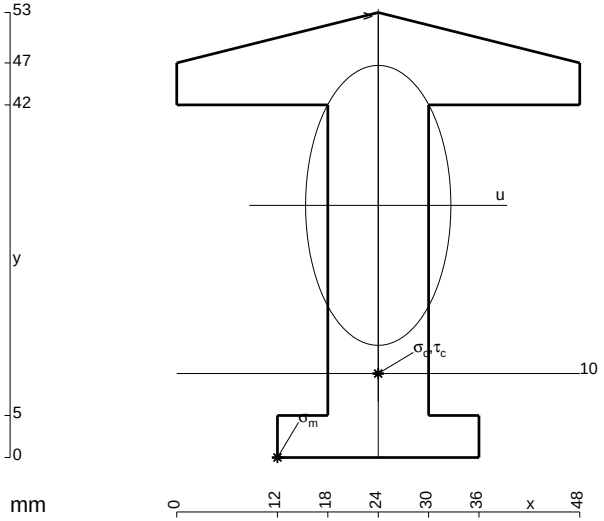
$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ + \left(-1/4\ b\ \right)\ \theta\ \ = 1/6\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

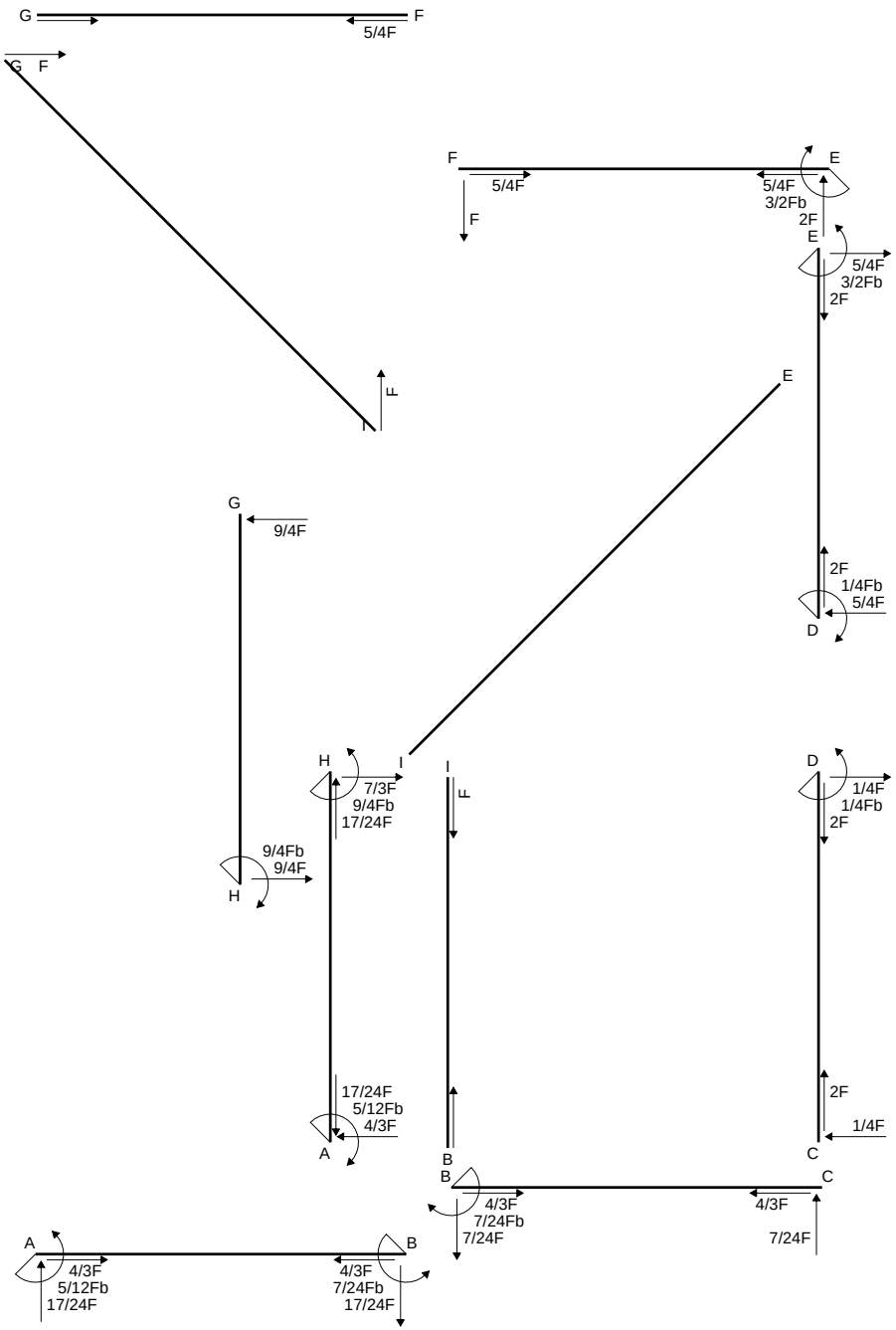
$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

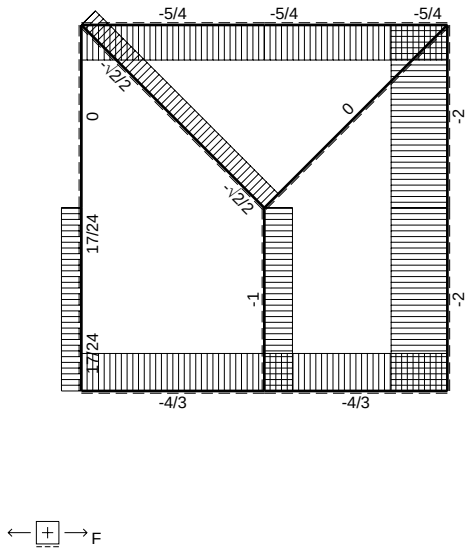
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\ \right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

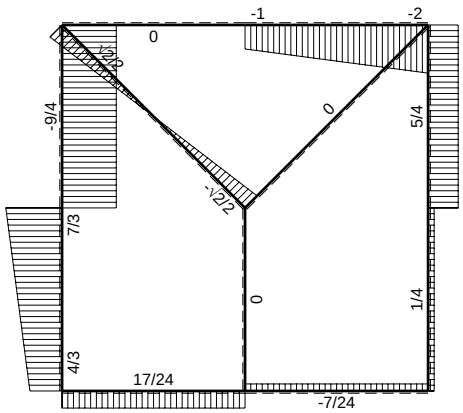


A = 948. mm^2
J_u = 263643. mm^4
J_v = 70992. mm^4
y_g = 30.03 mm
T_y = -3308. N
M_x = -1918350. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.03 mm
$\sigma_m = -Mv/J_u$ = -218.5 N/mm^2
x_c = 24. mm
y_c = 10. mm
v_c = -20.03 mm
$\sigma_c = -Mv/J_u$ = -145.8 N/mm^2
τ_c = 4.867 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 146. N/mm^2
S^* = 4656. mm^3

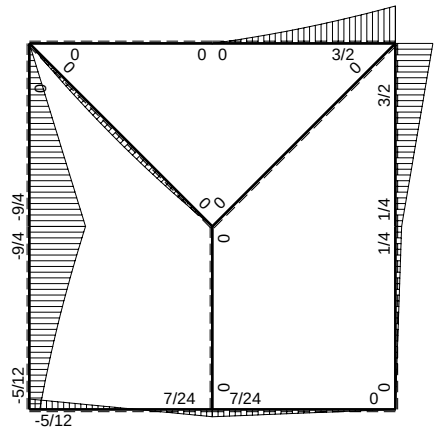

G
F
5/4F
G F
F
5/4F
F
E
5/4F
3/2Fb
2F
E
5/4F
3/2Fb
2F
F
E
G
9/4F
2F
1/4Fb
5/4F
D
9/4Fb
9/4F
H
H
I
7/3F
9/4Fb
17/24F
I
F
D
1/4F
1/4Fb
2F
17/24F
5/12Fb
4/3F
A
B
B
2F
1/4F
C
C
4/3F
7/24Fb
7/24F
4/3F
7/24F
A
B
4/3F
5/12Fb
17/24F
4/3F
7/24Fb
17/24F


-5/4
-5/4
-5/4
-√2/2
0
0
-2
-√2/2
17/24
-1
-2
17/24
-4/3
-4/3

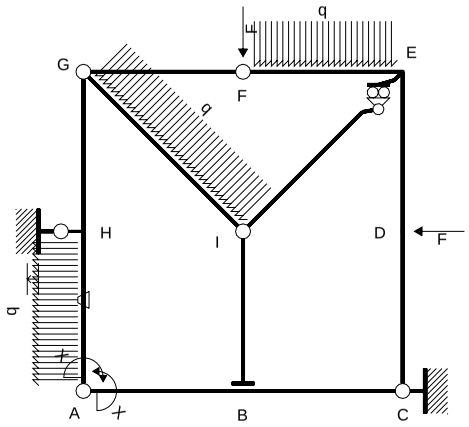
F

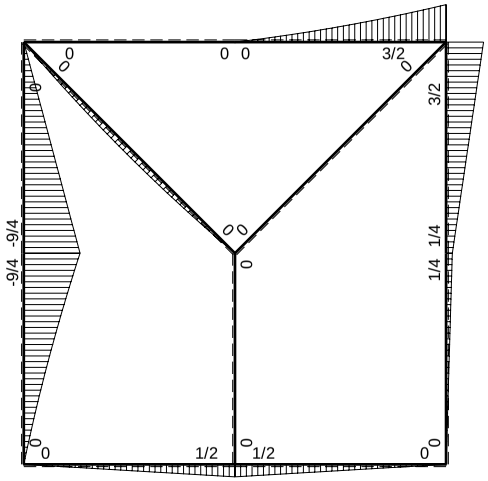

-1
-2
0
√2/2
-9/4
5/4
0
-√2/2
7/3
0
1/4
4/3
17/24
-7/24

F

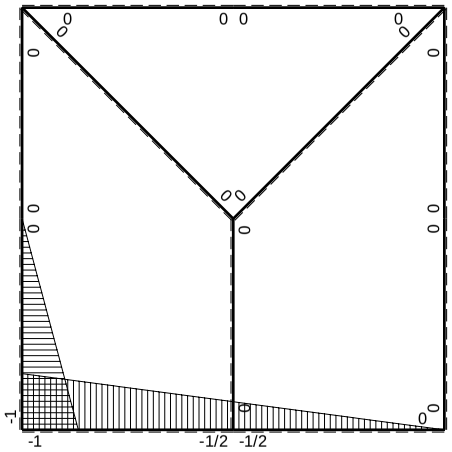

0
0 0
3/2
0
0
3/2
0 0
-9/4
-9/4
0
1/4
1/4
-5/12
7/24
7/24
0
0
-5/12

Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 248666 CI04.xxxx.183

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	0	0	0	0	0+0	0
BI b	0	0	0	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	-Fb/EJ	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	Fx/EJ	x^2/b^2	$(1/3+1/2)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	Fb/EJ	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	Fb/EJ-Fx/EJ	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-5/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						5/12Fb	

Sviluppi di calcolo iperstatica

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$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(\ x/b\ \right)\ \theta\ \ dx$

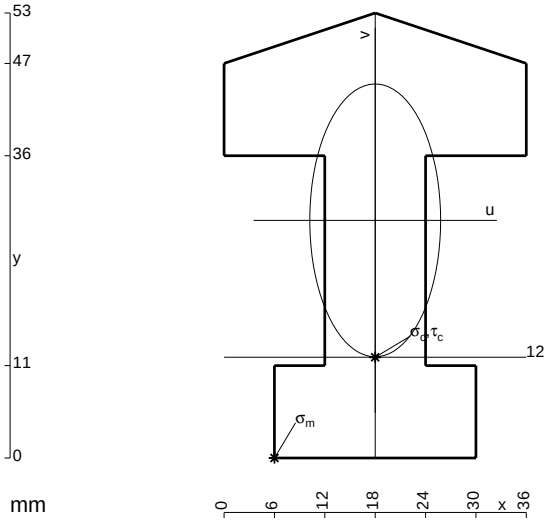
$= \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[1/2\ x^2/b\ \right]_o^b\ \theta$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(1/2\ b\ \right)\ \theta\ \ = 5/6\ \ Fb^2/EJ$

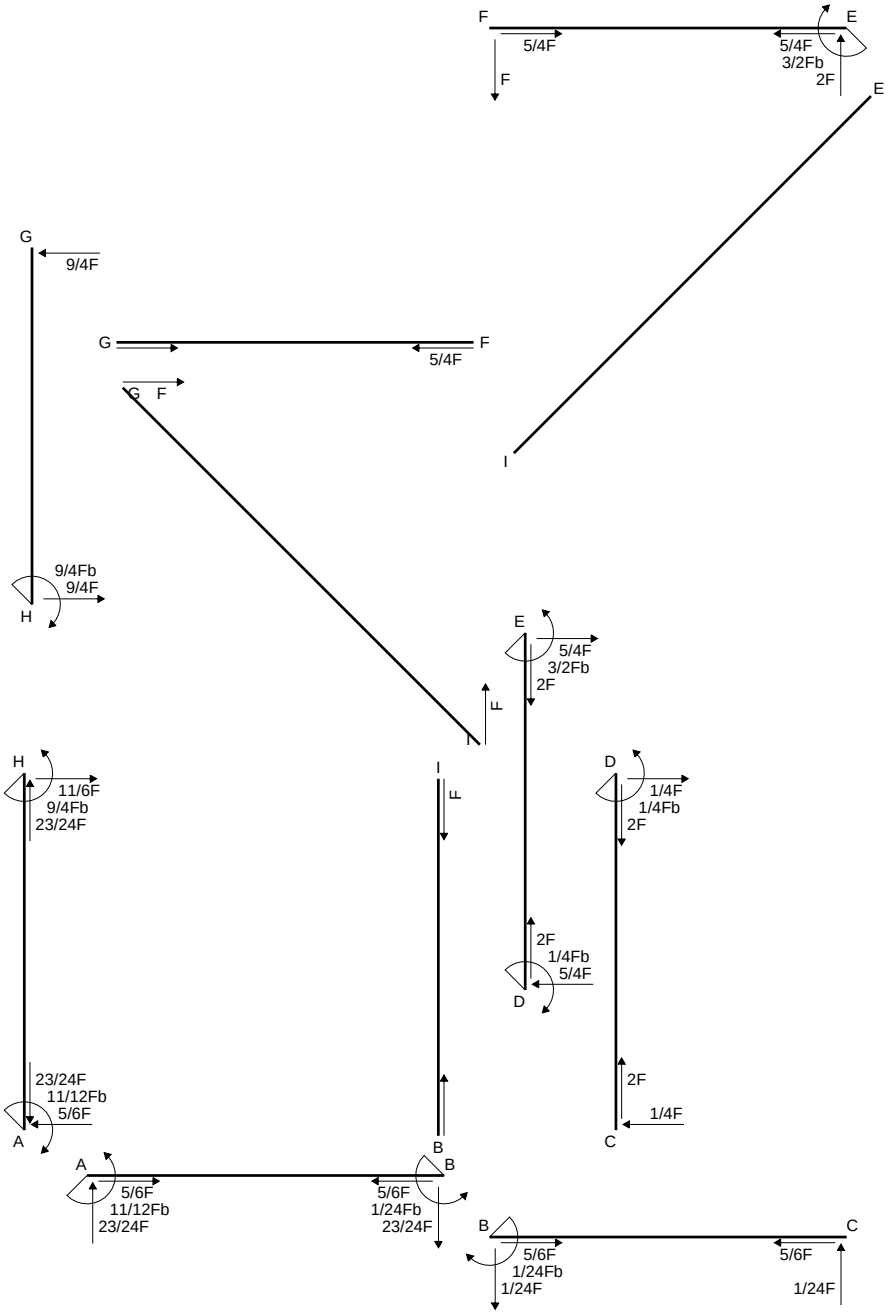
$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx + \int_o^b \left(-1 + x/b\ \right)\ \theta\ \ dx$

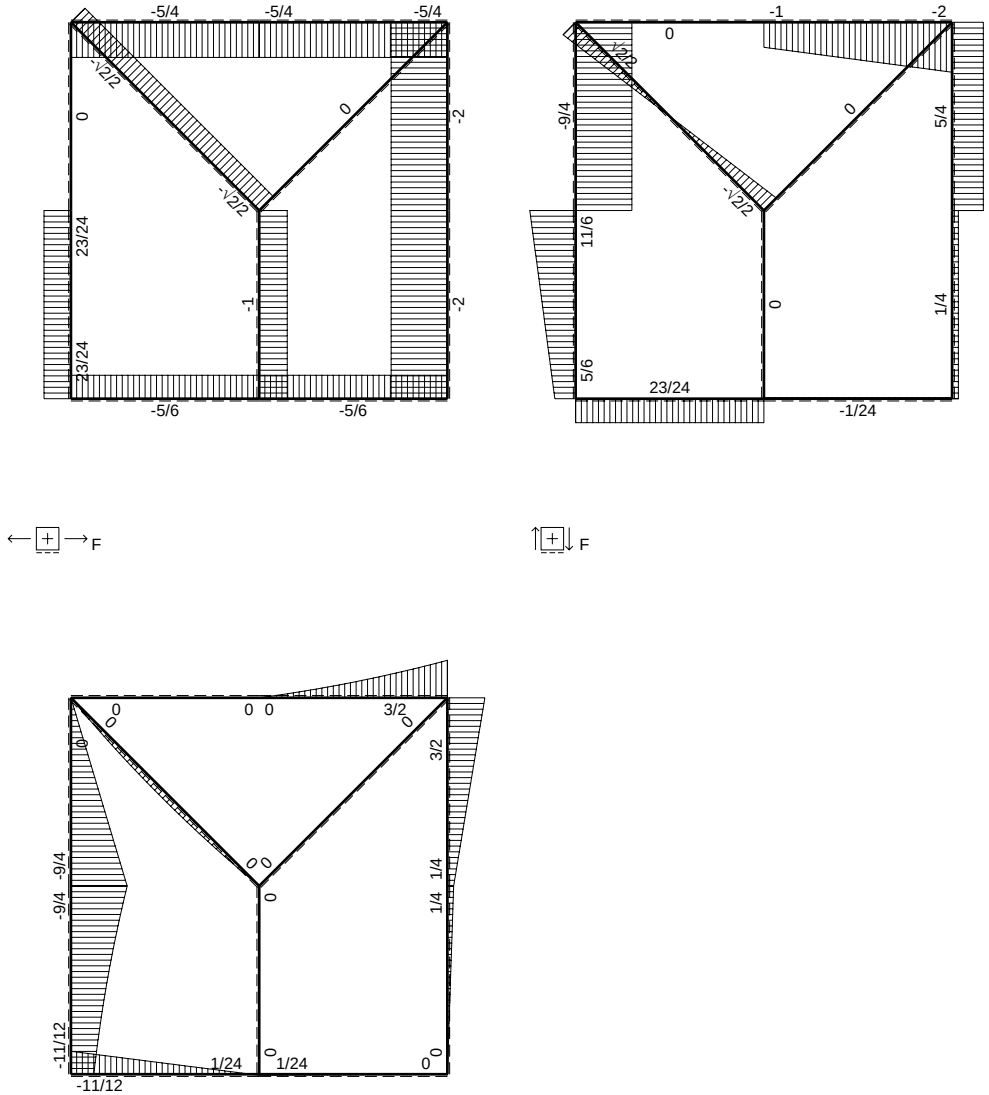
$= \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ\ + \left[-\ x + 1/2\ x^2/b\ \right]_o^b\ \theta$

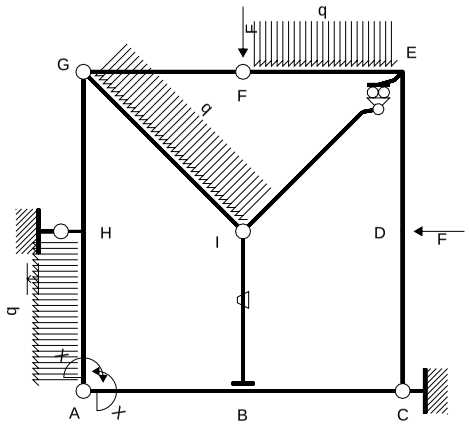
$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ + \left(-\ b + 1/2\ b\ \right)\ \theta\ \ = 5/6\ \ Fb^2/EJ$

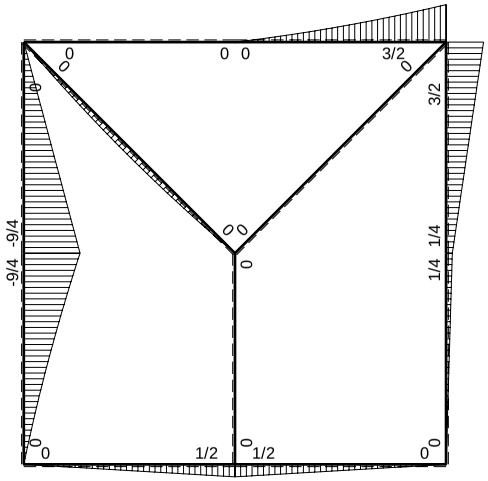


A = 1068. mm^2
J_u = 281922. mm^4
J_v = 64872. mm^4
y_g = 28.3 mm
T_y = -3623. N
M_x = -2282180. Nmm
x_m = 6. mm
u_m = -12. mm
v_m = -28.3 mm
$\sigma_m = -Mv/J_u$ = -229.1 N/mm^2
x_c = 18. mm
y_c = 12. mm
v_c = -16.3 mm
$\sigma_c = -Mv/J_u$ = -132. N/mm^2
τ_c = 6.662 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 132.5 N/mm^2
S^* = 6222. mm^3

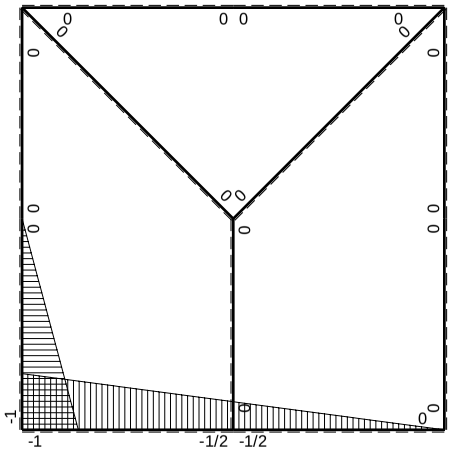

F
E
5/4F
5/4F
3/2Fb
2F
F
E
G
9/4F
G
F
5/4F
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F
I
9/4Fb
9/4F
H
E
5/4F
3/2Fb
2F
F
H
11/6F
9/4Fb
23/24F
I
F
D
1/4F
1/4Fb
2F
2F
1/4Fb
5/4F
D
2F
1/4F
C
23/24F
11/12Fb
5/6F
A
B
A
B
5/6F
11/12Fb
23/24F
5/6F
1/24Fb
23/24F
B
C
5/6F
1/24Fb
1/24F
5/6F
1/24F


-5/4
-5/4
-5/4
-√2/2
-√2/2
0
0
-2
23/24
-1
-2
23/24
-5/6
-5/6
F
-1
-2
0
-√2/2
-√2/2
-9/4
5/4
11/6
0
1/4
5/6
23/24
-1/24
F
0 0
3/2
-9/4
-9/4
1/4
1/4
-11/12
1/24
1/24
0
-11/12
Fb





M_0 flessione da carichi assegnati



M_x flessione da iperstatica X=1

PROCEDIMENTO E RISULTATI 248460 CI04.xxxx.184

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Quadro contributi PLV per iperstatica $X=W_{AB}$

→	$M_x(x)$	$M_o(x)$	θ	M_xM_o	$M_x\theta$	M_xM_x	$\int M_x(M_o/EJ+\theta)dx$	$\int XM_xM_x/EJdx$
AB b	-1+1/2x/b	1/2Fx	0	$-1/2Fx+1/4Fx^2/b$	0	$1-x/b+1/4x^2/b^2$	$(-1/6+0)Fb^2/EJ$	7/12Xb/EJ
BA b	1/2+1/2x/b	$-1/2Fb+1/2Fx$	0	$-1/4Fb+1/4Fx^2/b$	0	$1/4+1/2x/b+1/4x^2/b^2$		
BC b	-1/2+1/2x/b	1/2Fb-1/2Fx	0	$-1/4Fb+1/2Fx-1/4Fx^2/b$	0	$1/4-1/2x/b+1/4x^2/b^2$	$(-1/12+0)Fb^2/EJ$	1/12Xb/EJ
CB b	1/2x/b	-1/2Fx	0	$-1/4Fx^2/b$	0	$1/4x^2/b^2$		
CD b	0	1/4Fx	0	0	0	0	0+0	0
DC b	0	-1/4Fb+1/4Fx	0	0	0	0		
DE b	0	1/4Fb+5/4Fx	0	0	0	0	0+0	0
ED b	0	-3/2Fb+5/4Fx	0	0	0	0		
EF b	0	$3/2Fb-2Fx+1/2qx^2$	0	0	0	0	0+0	0
FE b	0	$-Fx-1/2qx^2$	0	0	0	0		
FG b	0	0	0	0	0	0	0+0	0
GF b	0	0	0	0	0	0		
GH b	0	-9/4Fx	0	0	0	0	0+0	0
HG b	0	9/4Fb-9/4Fx	0	0	0	0		
GI $\sqrt{2}$b	0	$\sqrt{2}/2Fx-1/2qx^2$	0	0	0	0	0	0
IB b	0	0	-Fb/EJ	0	0	0	0+0	0
BI b	0	0	Fb/EJ	0	0	0		
IE $\sqrt{2}$b	0	0	0	0	0	0	0	0
HA b	-x/b	$-9/4Fb+11/4Fx-1/2qx^2$	0	$9/4Fx-11/4Fx^2/b+1/2qx^3/b$	0	x^2/b^2	$(1/3+0)Fb^2/EJ$	1/3Xb/EJ
AH b	1-x/b	$7/4Fx+1/2qx^2$	0	$7/4Fx-5/4Fx^2/b-1/2qx^3/b$	0	$1-2x/b+x^2/b^2$		
H	cedimento nodo $-H_{1H}u_H$						$-Fb^2/EJ$	
	totali						$-11/12Fb^2/EJ$	Xb/EJ
	iperstatica $X=W_{AB}$						11/12Fb	

Sviluppi di calcolo iperstatica

@ Adolfo Zavelani Rossi, Politecnico di Milano, vers.27.03.13 16.04.26

$L^{XX}_{AB} = \int_o^b \left(1 - x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - 1/2\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - 1/2\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BA} = \int_o^b \left(1/4 + 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x + 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b + 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 7/12\ \ b/EJ$

$L^{XX}_{BC} = \int_o^b \left(1/4 - 1/2\ x/b + 1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/4\ x - 1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/4\ b - 1/4\ b + 1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{CB} = \int_o^b \left(1/4\ x^2/b^2\right)\ 1/EJ\ dx = \left[1/12\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/12\ b\ \right)\ 1/EJ\ = 1/12\ \ b/EJ$

$L^{XX}_{HA} = \int_o^b \left(\ x^2/b^2\ \right)\ 1/EJ\ dx = \left[1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{XX}_{AH} = \int_o^b \left(1 - 2\ x/b + x^2/b^2\right)\ 1/EJ\ dx = \left[\ x - x^2/b + 1/3\ x^3/b^2\ \right]_o^b\ 1/EJ$

$= \left(\ b - b + 1/3\ b\ \right)\ 1/EJ\ = 1/3\ \ b/EJ$

$L^{Xo}_{AB} = \int_o^b \left(-1/2\ x/b + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x^2/b + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BA} = \int_o^b \left(-1/4 + 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/6\ \ Fb^2/EJ$

$L^{Xo}_{BC} = \int_o^b \left(-1/4 + 1/2\ x/b - 1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/4\ x + 1/4\ x^2/b - 1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

$= \left(-1/4\ b + 1/4\ b - 1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{CB} = \int_o^b \left(-1/4\ x^2/b^2\right)\ Fb\ 1/EJ\ dx = \left[-1/12\ x^3/b^2\ \right]_o^b\ Fb\ 1/EJ$

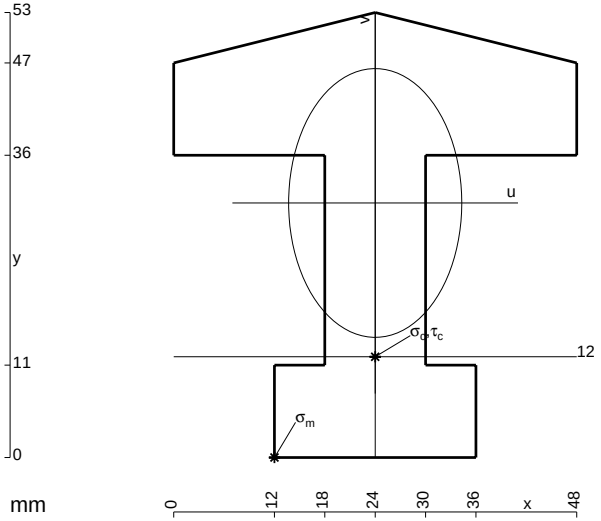
$= \left(-1/12\ b\ \right)\ Fb\ 1/EJ\ = -1/12\ \ Fb^2/EJ$

$L^{Xo}_{HA} = \int_o^b \left(9/4\ x/b - 11/4\ x^2/b^2 + 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[9/8\ x^2/b - 11/12\ x^3/b^2 + 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(9/8\ b - 11/12\ b + 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$

$L^{Xo}_{AH} = \int_o^b \left(7/4\ x/b - 5/4\ x^2/b^2 - 1/2\ x^3/b^3\right)\ Fb\ 1/EJ\ dx = \left[7/8\ x^2/b - 5/12\ x^3/b^2 - 1/8\ x^4/b^3\ \right]_o^b\ Fb\ 1/EJ$

$= \left(7/8\ b - 5/12\ b - 1/8\ b\ \right)\ Fb\ 1/EJ\ = 1/3\ \ Fb^2/EJ$



A = 1236. mm^2
J_u = 316729. mm^4
J_v = 131472. mm^4
y_g = 30.32 mm
T_y = -3668. N
M_x = -2493900. Nmm
x_m = 12. mm
u_m = -12. mm
v_m = -30.32 mm
$\sigma_m = -Mv/J_u$ = -238.7 N/mm^2
x_c = 24. mm
y_c = 12. mm
v_c = -18.32 mm
$\sigma_c = -Mv/J_u$ = -144.2 N/mm^2
τ_c = 6.539 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 144.7 N/mm^2
S^* = 6777. mm^3