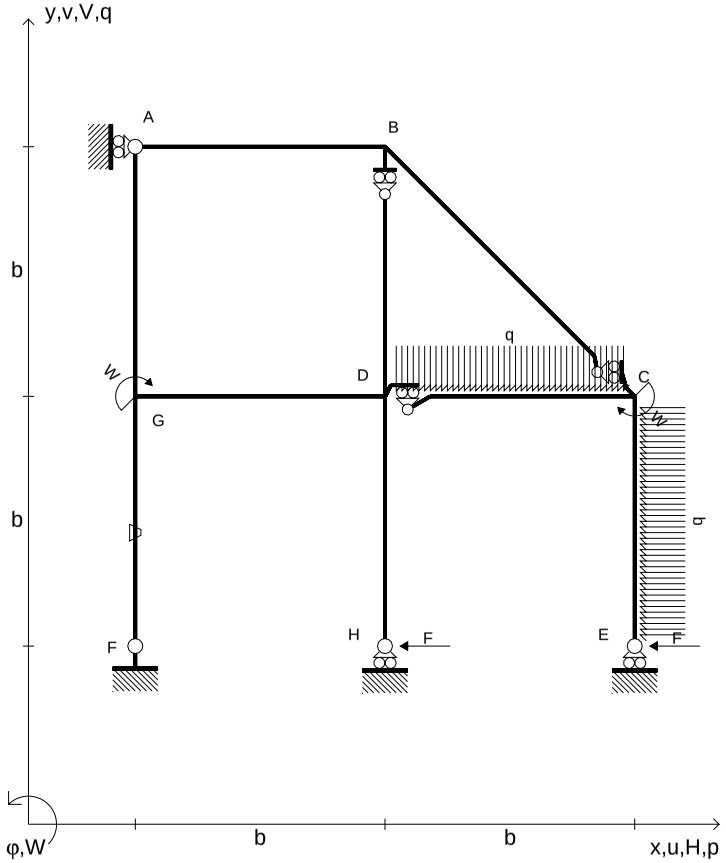
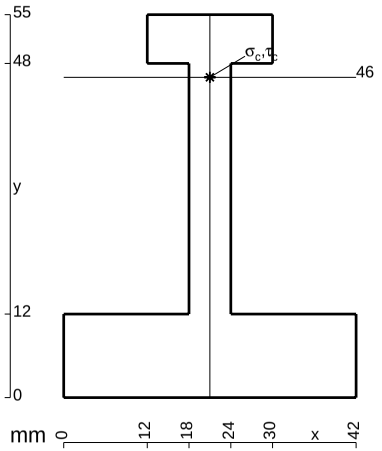
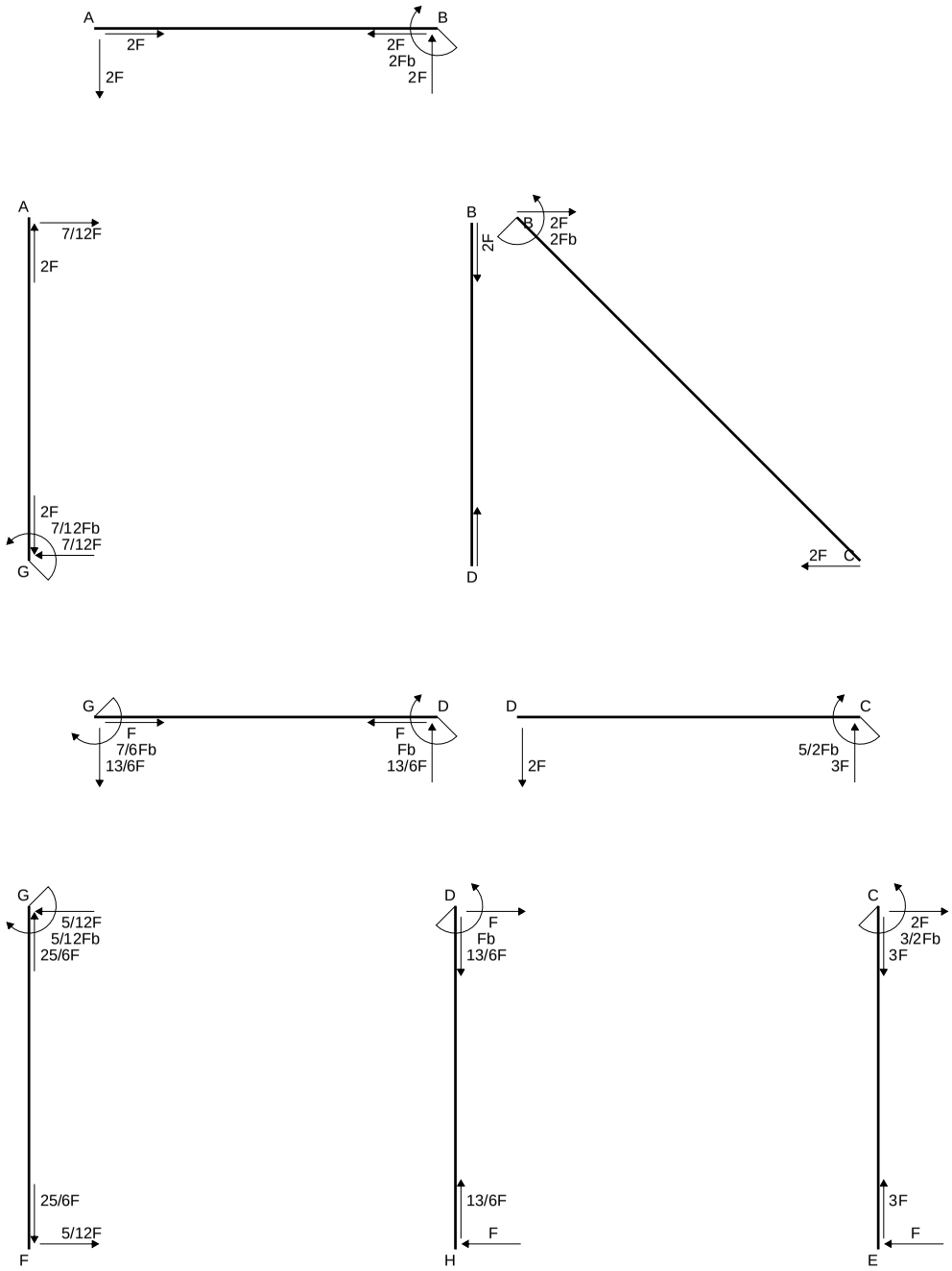
$H_E = -F$
$H_H = -F$
$W_C = -W = -Fb$
$W_G = -W = -Fb$
$q_{DC} = -q = -F/b$
$p_{CE} = -q = -F/b$
$\theta_{FG} = -\theta = -\alpha T/b = -bF/EJ$
$EJ_{AB} = EJ$
$EJ_{BC} = EJ$
$EJ_{BD} = EJ$
$EJ_{DC} = EJ$
$EJ_{CE} = EJ$
$EJ_{FG} = EJ$
$EJ_{GD} = EJ$
$EJ_{DH} = EJ$
$EJ_{GA} = EJ$



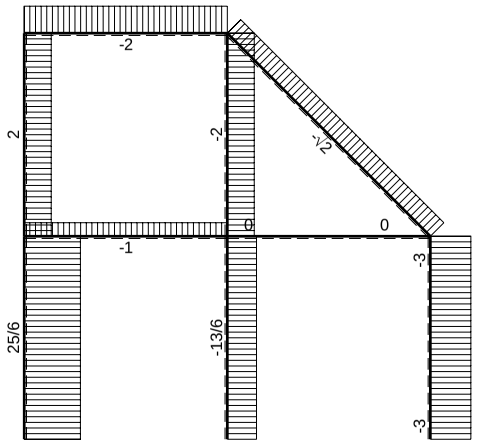


Reazioni iperstatiche in soluzione: $X=W_{GD}$
Carichi e deformazioni date hanno verso efficace in disegno.
Calcolare reazioni vincolari della struttura e delle aste.
Tracciare i diagrammi quotati delle azioni interne nelle aste.
J_{YZ} - x_{YZ} - θ_{YZ} riferimento locale asta YZ con origine in Y.
La trave DC ha la sezione riportata e dimensioni in mm, con:
b = 780 mm, F = 770 N
Calcolare sulla sezione C la massima tensione normale σ_m.
Calcolare in * le tensioni σ_c,τ_c e la tensione di von Mises.
Lembo inferiore sezione su tratteggio trave, a destra da D a C
Curvatura θ asta FG positiva se convessa a destra con inizio F.

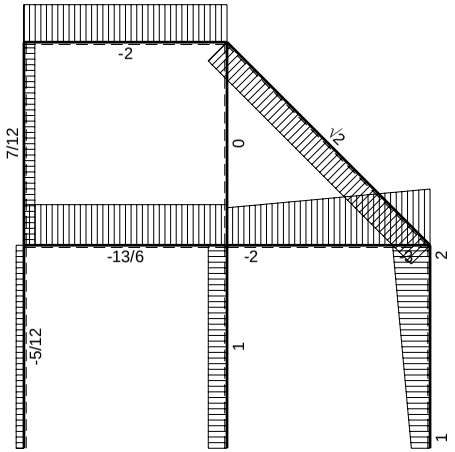
14.05.25



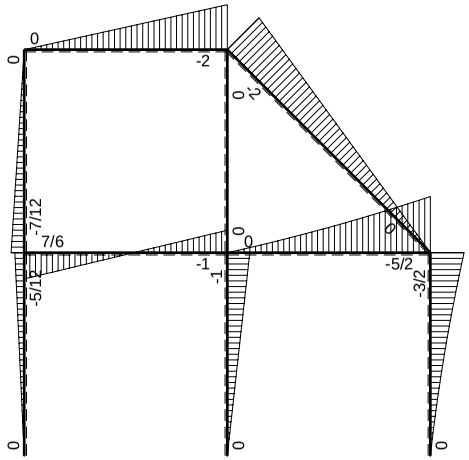
14.05.25



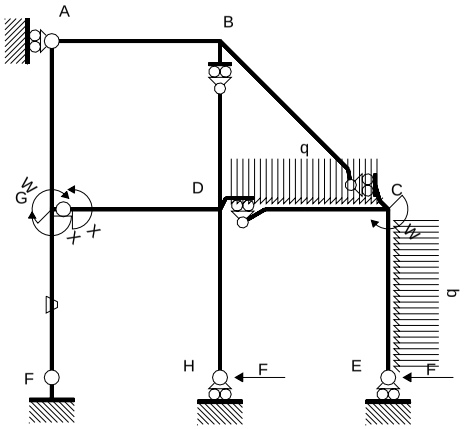
←□→ F



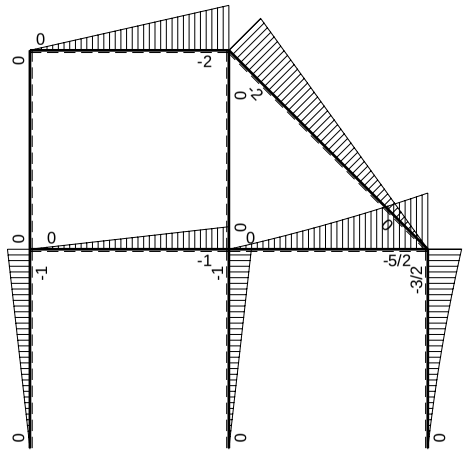
↑□↓ F



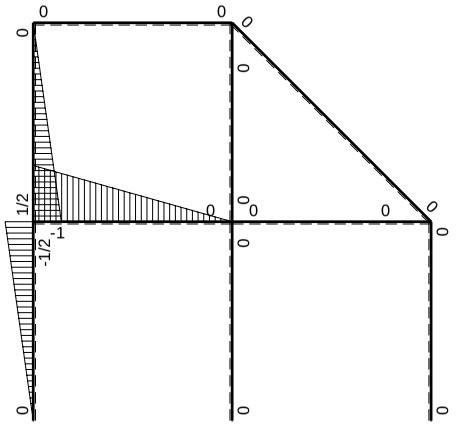
↻□↺ Fb



Schema di calcolo iperstatico



↻□↺ M_0 flessione da carichi assegnati



↻□↺ M_x flessione da iperstatica X=1

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

→	$M_x(x)$	$M_o(x)$	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	0	-2Fx	0	0	0	0	0+0	0
BA b	0	2Fb-2Fx	0	0	0	0		
BC $\sqrt{2}$b	0	-2Fb+$\sqrt{2}$Fx	0	0	0	0	0	0
BD b	0	0	0	0	0	0	0+0	0
DB b	0	0	0	0	0	0		
DC b	0	-2Fx-1/2qx^2	0	0	0	0	0+0	0
CD b	0	5/2Fb-3Fx+1/2qx^2	0	0	0	0		
CE b	0	-3/2Fb+2Fx-1/2qx^2	0	0	0	0	0+0	0
EC b	0	Fx+1/2qx^2	0	0	0	0		
FG b	-1/2x/b	-Fx	-Fb/EJ	1/2Fx^2/b	1/2Fx/EJ	1/4x^2/b^2	(1/6+1/4)Fb^2/EJ	1/12Xb/EJ
GF b	1/2-1/2x/b	Fb-Fx	Fb/EJ	1/2Fb-Fx+1/2Fx^2/b	1/2Fb/EJ-1/2Fx/EJ	1/4-1/2x/b+1/4x^2/b^2		
GD b	-1+x/b	-Fx	0	Fx-Fx^2/b	0	1-2x/b+x^2/b^2	(1/6+0)Fb^2/EJ	1/3Xb/EJ
DG b	x/b	Fb-Fx	0	Fx-Fx^2/b	0	x^2/b^2		
DH b	0	-Fb+Fx	0	0	0	0	0+0	0
HD b	0	Fx	0	0	0	0		
GA 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
AG b	-1/2x/b	0	0	0	0	1/4x^2/b^2		
	totali						7/12Fb^2/EJ	1/2Xb/EJ
	iperstatica $X=W_{GD}$						-7/6Fb	

Sviluppi di calcolo iperstatica

@ Adolfo Zavelani Rossi, Politecnico di Milano, vers.27.03.13 14.05.25

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

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

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

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

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

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

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

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

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

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

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

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

$L^{Xo}_{FG} = \int_o^b (1/2\ x^2/b^2)\ Fb\ 1/EJ\ dx + \int_o^b (1/2\ x/b)\ \theta\ dx = [1/6\ x^3/b^2]_o^b\ Fb\ 1/EJ + [1/4\ x^2/b]_o^b\ \theta$

$= (1/6\ b)\ Fb\ 1/EJ + (1/4\ b)\ \theta = 5/12\ Fb^2/EJ$

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

$= [1/2\ x - 1/2\ x^2/b + 1/6\ x^3/b^2]_o^b\ Fb\ 1/EJ + [-1/2\ x + 1/4\ x^2/b]_o^b\ \theta$

$= (1/2\ b - 1/2\ b + 1/6\ b)\ Fb\ 1/EJ + (-1/2\ b + 1/4\ b)\ \theta = 5/12\ Fb^2/EJ$

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

$= (1/2\ b - 1/3\ b)\ Fb\ 1/EJ = 1/6\ Fb^2/EJ$

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

$= (1/2\ b - 1/3\ b)\ Fb\ 1/EJ = 1/6\ Fb^2/EJ$

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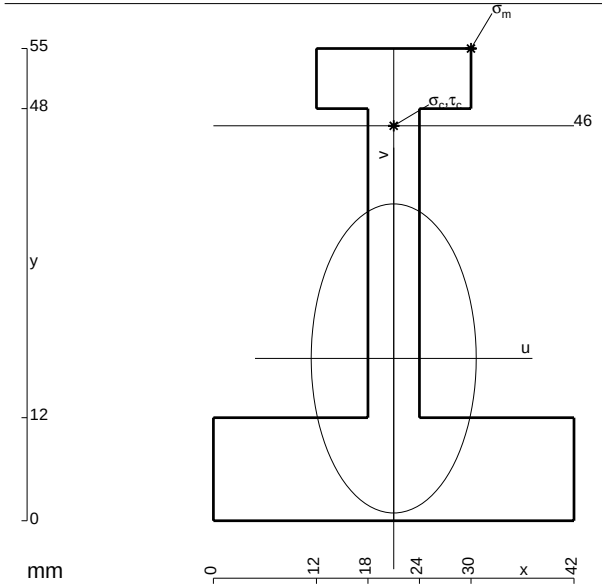

A = 846. mm^2
J_u = 274282. mm^4
J_v = 78138. mm^4
y_g = 18.9 mm
T_y = -2310. N
M_x = -1501500. Nmm
x_m = 30. mm
y_m = 55. mm
u_m = 9. mm
v_m = 36.1 mm
$\sigma_m = -Mv/J_u$ = 197.6 N/mm^2
x_c = 21. mm
y_c = 46. mm
v_c = 27.1 mm
$\sigma_c = -Mv/J_u$ = 148.3 N/mm^2
τ_c = 6.238 N/mm^2
$\sigma_o = \sqrt{\sigma^2 + 3\tau^2}$ = 148.7 N/mm^2
S^* = 4444. mm^3