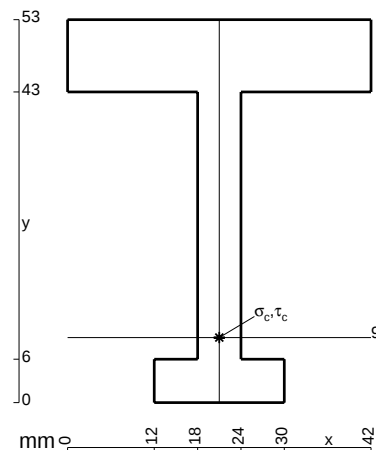
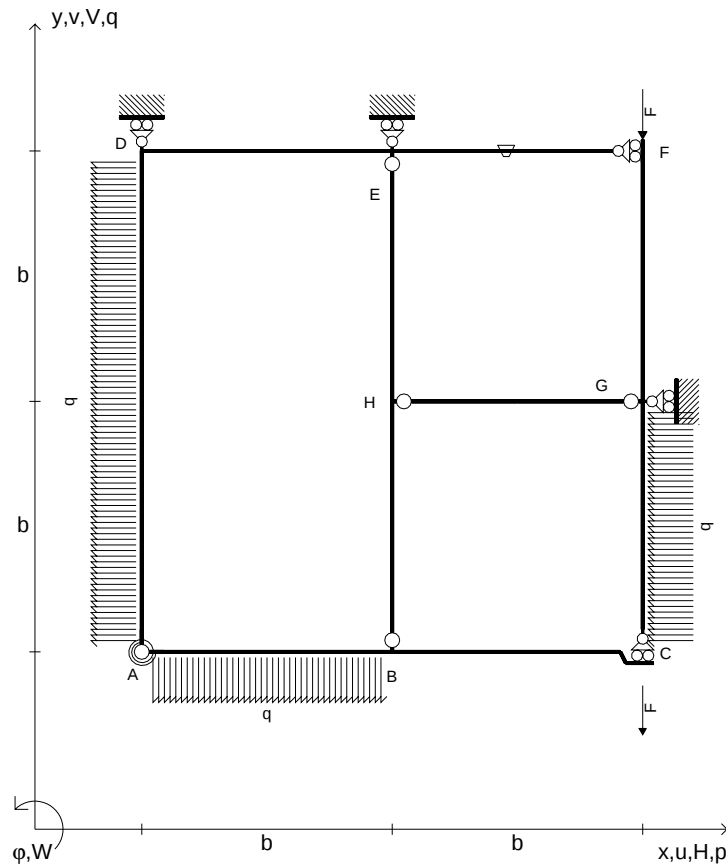


$$\begin{aligned} V_{FG} &= -F \\ V_{CB} &= -F \\ q_{AB} &= -q = -F/b \\ p_{AD} &= -q = -F/b \\ p_{GC} &= -q = -F/b \\ \theta_{EF} &= -\theta = -\alpha T/b = -bF/EJ \\ k_{AB} &= 4EJ/b \\ EJ_{AB} &= EJ \\ EJ_{BC} &= EJ \\ EJ_{AD} &= EJ \\ EJ_{DE} &= EJ \\ EJ_{EF} &= EJ \\ EJ_{FG} &= EJ \\ EJ_{GC} &= EJ \\ EJ_{HG} &= EJ \\ EJ_{HB} &= EJ \\ EJ_{HF} &= EJ \end{aligned}$$


Reazioni iperstatiche in soluzione: $X=W_{AD}$

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 BC ha la sezione riportata e dimensioni in mm, con:

$b = 670 \text{ mm}, F = 1210 \text{ N}$

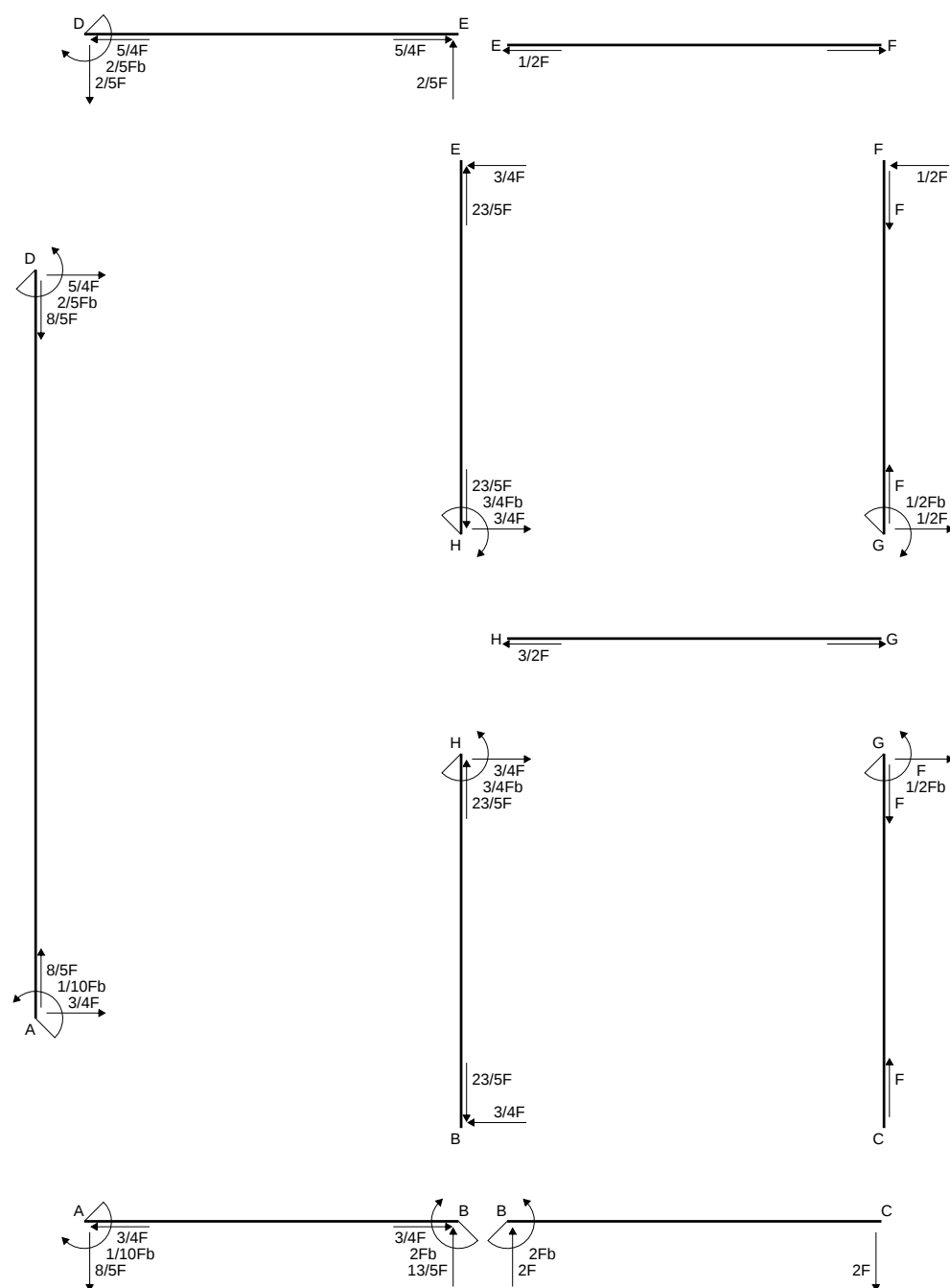
Calcolare sulla sezione B la massima tensione normale σ_m .

Calcolare in * le tensioni σ_c, τ_c e la tensione di von Mises.

Lembo inferiore sezione su tratteggio trave, a destra da B a C
Curvatura θ asta EF positiva se convessa a destra con inizio E.

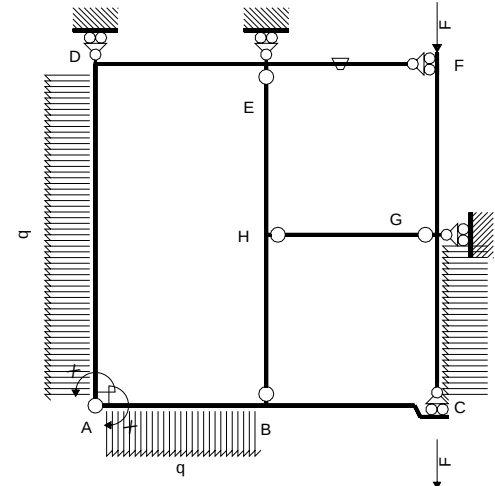
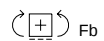
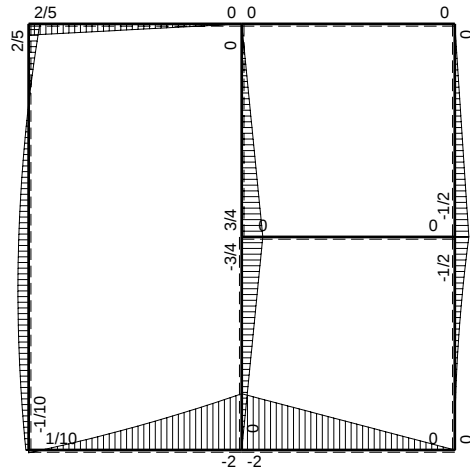
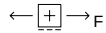
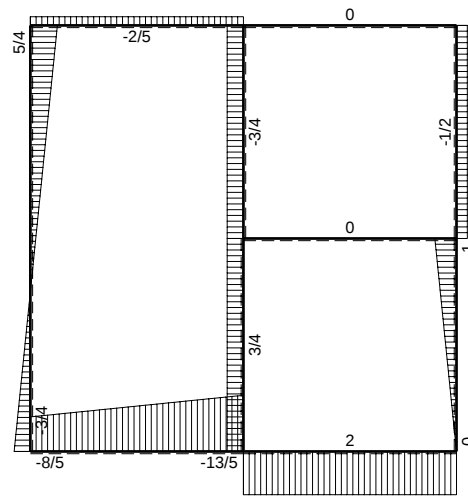
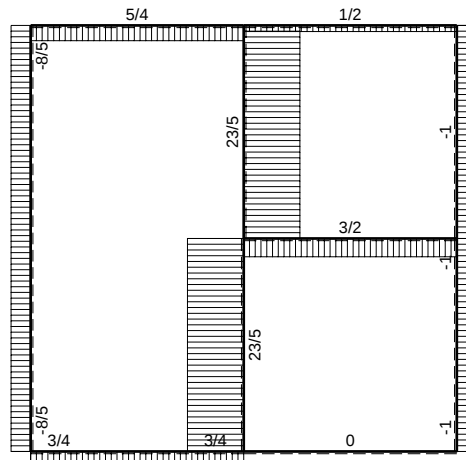
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23.04.25

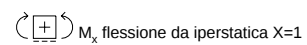
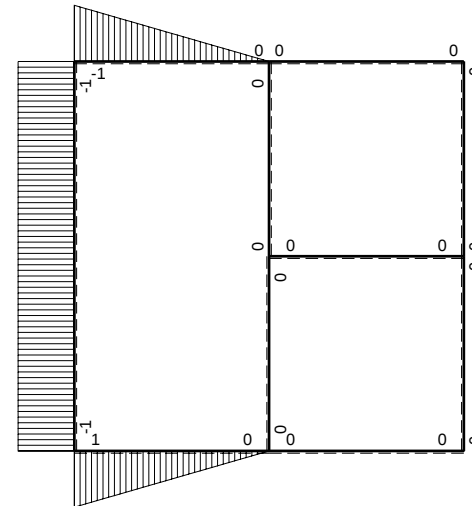
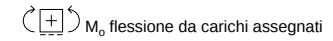
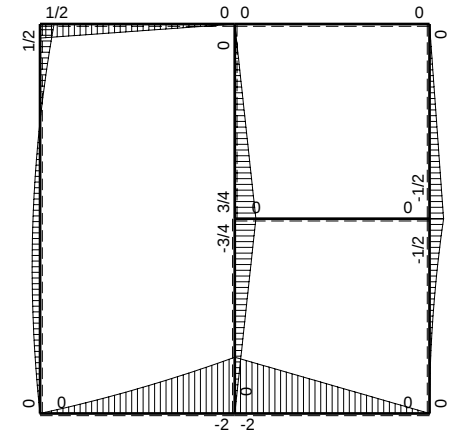


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23.04.25



Schema di calcolo iperstatico

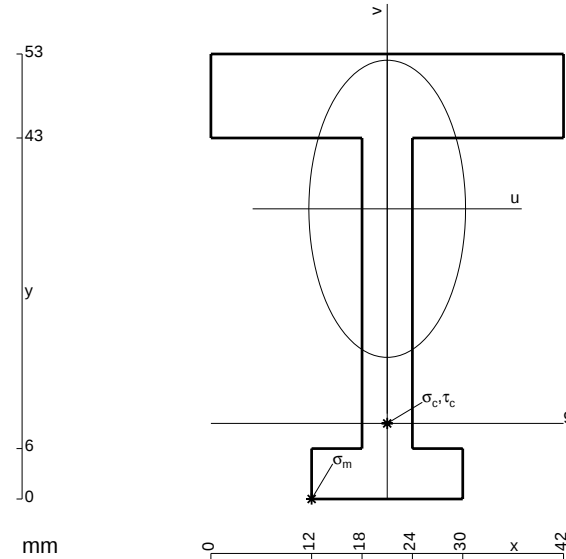


Quadro contributi PLV per iperstatica $X=W_{AD}$

→	$M_x(x)$	$M_0(x)$	θ	$M_x M_0$	$M_x \theta$	$M_x M_x$	$\int M_x(M_0/EJ+\theta)dx$	$\int X M_x M_x/EJ dx$
AB b	$1-x/b$	$-3/2Fx-1/2qx^2$	0	$-3/2Fx+Fx^2/b+1/2qx^3/b$	0	$1-2x/b+x^2/b^2$	$(-7/24+0)Fb^2/EJ$	$1/3Xb/EJ$
BA b	$-x/b$	$2Fb-5/2Fx+1/2qx^2$	0	$-2Fx+5/2Fx^2/b-1/2qx^3/b$	0	x^2/b^2		
BC b	0	$-2Fb+2Fx$	0	0	0	0	0+0	0
CB b	0	$2Fx$	0	0	0	0		
AD 2b	-1	$-3/4Fx+1/2qx^2$	0	$3/4Fx-1/2Fx^2/b$	0	1	$(1/6+0)Fb^2/EJ$	$2Xb/EJ$
DA 2b	1	$-1/2Fb+5/4Fx-1/2qx^2$	0	$-1/2Fb+5/4Fx-1/2Fx^2/b$	0	1		
DE b	$-1+x/b$	$1/2Fb-1/2Fx$	0	$-1/2Fb+Fx-1/2Fx^2/b$	0	$1-2x/b+x^2/b^2$	$(-1/6+0)Fb^2/EJ$	$1/3Xb/EJ$
ED b	x/b	$-1/2Fx$	0	$-1/2Fx^2/b$	0	x^2/b^2		
EF b	0	0	$-Fb/EJ$	0	0	0	0+0	0
FE b	0	0	Fb/EJ	0	0	0		
FG b	0	$-1/2Fx$	0	0	0	0	0+0	0
GF b	0	$1/2Fb-1/2Fx$	0	0	0	0		
GC b	0	$-1/2Fb+Fx-1/2qx^2$	0	0	0	0	0+0	0
CG b	0	$1/2qx^2$	0	0	0	0		
HG b	0	0	0	0	0	0	0+0	0
GH b	0	0	0	0	0	0		
HB b	0	$-3/4Fb+3/4Fx$	0	0	0	0	0+0	0
BH b	0	$3/4Fx$	0	0	0	0		
HE b	0	$3/4Fb-3/4Fx$	0	0	0	0	0+0	0
EH b	0	$-3/4Fx$	0	0	0	0		
AB	molla asta $-W_{1AB}(W_{0AB}+XW_{1AB})/k_{AB}$							$1/4Xb/EJ$
	totali						$-7/24Fb^2/EJ$	$35/12Xb/EJ$
	iperstatica $X=W_{AD}$						$1/10Fb$	

Sviluppi di calcolo iperstatica

$$\begin{aligned}
L_{AB}^{xx} &= \int_0^b (1 - 2x/b + x^2/b^2) \frac{1}{EJ} dx - 1 \cdot (-1) \frac{1}{4} \frac{b}{EJ} = \left[x - x^2/b + 1/3 x^3/b^2 \right]_0^b \frac{1}{EJ} - 1 \cdot (-1) \frac{1}{4} \frac{b}{EJ} \\
&= (b - b + 1/3 b) \frac{1}{EJ} - 1 \cdot (-1) \frac{1}{4} \frac{b}{EJ} = 7/12 \frac{b}{EJ} \\
L_{BA}^{xx} &= \int_0^b (x^2/b^2) \frac{1}{EJ} dx - 1 \cdot (-1) \frac{1}{4} \frac{b}{EJ} = \left[1/3 x^3/b^2 \right]_0^b \frac{1}{EJ} - 1 \cdot (-1) \frac{1}{4} \frac{b}{EJ} \\
&= (1/3 b) \frac{1}{EJ} - 1 \cdot (-1) \frac{1}{4} \frac{b}{EJ} = 7/12 \frac{b}{EJ} \\
L_{AD}^{xx} &= \int_0^{2b} (1) \frac{1}{EJ} dx = \left[x \right]_0^{2b} \frac{1}{EJ} \\
&= (2b) \frac{1}{EJ} = 2 \frac{b}{EJ} \\
L_{DA}^{xx} &= \int_0^{2b} (1) \frac{1}{EJ} dx = \left[x \right]_0^{2b} \frac{1}{EJ} \\
&= (2b) \frac{1}{EJ} = 2 \frac{b}{EJ} \\
L_{DE}^{xx} &= \int_0^b (1 - 2x/b + x^2/b^2) \frac{1}{EJ} dx = \left[x - x^2/b + 1/3 x^3/b^2 \right]_0^b \frac{1}{EJ} \\
&= (b - b + 1/3 b) \frac{1}{EJ} = 1/3 \frac{b}{EJ} \\
L_{ED}^{xx} &= \int_0^b (x^2/b^2) \frac{1}{EJ} dx = \left[1/3 x^3/b^2 \right]_0^b \frac{1}{EJ} \\
&= (1/3 b) \frac{1}{EJ} = 1/3 \frac{b}{EJ} \\
L_{AB}^{x_0} &= \int_0^b (-3/2 x/b + x^2/b^2 + 1/2 x^3/b^3) Fb \frac{1}{EJ} dx - 1 \cdot 0 \frac{1}{4} \frac{Fb^2}{EJ} \\
&= \left[-3/4 x^2/b + 1/3 x^3/b^2 + 1/8 x^4/b^3 \right]_0^b Fb \frac{1}{EJ} - 1 \cdot 0 \frac{1}{4} \frac{Fb^2}{EJ} \\
&= (-3/4 b + 1/3 b + 1/8 b) Fb \frac{1}{EJ} - 1 \cdot 0 \frac{1}{4} \frac{Fb^2}{EJ} = -7/24 \frac{Fb^2}{EJ} \\
L_{BA}^{x_0} &= \int_0^b (-2 x/b + 5/2 x^2/b^2 - 1/2 x^3/b^3) Fb \frac{1}{EJ} dx - 1 \cdot 0 \frac{1}{4} \frac{Fb^2}{EJ} \\
&= \left[-x^2/b + 5/6 x^3/b^2 - 1/8 x^4/b^3 \right]_0^b Fb \frac{1}{EJ} - 1 \cdot 0 \frac{1}{4} \frac{Fb^2}{EJ} \\
&= (-b + 5/6 b - 1/8 b) Fb \frac{1}{EJ} - 1 \cdot 0 \frac{1}{4} \frac{Fb^2}{EJ} = -7/24 \frac{Fb^2}{EJ} \\
L_{AD}^{x_0} &= \int_0^{2b} (3/4 x/b - 1/2 x^2/b^2) Fb \frac{1}{EJ} dx = \left[3/8 x^2/b - 1/6 x^3/b^2 \right]_0^{2b} Fb \frac{1}{EJ} \\
&= (3/2 b - 4/3 b) Fb \frac{1}{EJ} = 1/6 \frac{Fb^2}{EJ} \\
L_{DA}^{x_0} &= \int_0^{2b} (-1/2 + 5/4 x/b - 1/2 x^2/b^2) Fb \frac{1}{EJ} dx = \left[-1/2 x + 5/8 x^2/b - 1/6 x^3/b^2 \right]_0^{2b} Fb \frac{1}{EJ} \\
&= (-b + 5/2 b - 4/3 b) Fb \frac{1}{EJ} = 1/6 \frac{Fb^2}{EJ} \\
L_{DE}^{x_0} &= \int_0^b (-1/2 + x/b - 1/2 x^2/b^2) Fb \frac{1}{EJ} dx = \left[-1/2 x + 1/2 x^2/b - 1/6 x^3/b^2 \right]_0^b Fb \frac{1}{EJ} \\
&= (-1/2 b + 1/2 b - 1/6 b) Fb \frac{1}{EJ} = -1/6 \frac{Fb^2}{EJ} \\
L_{ED}^{x_0} &= \int_0^b (-1/2 x^2/b^2) Fb \frac{1}{EJ} dx = \left[-1/6 x^3/b^2 \right]_0^b Fb \frac{1}{EJ} \\
&= (-1/6 b) Fb \frac{1}{EJ} = -1/6 \frac{Fb^2}{EJ}
\end{aligned}$$



$$\begin{aligned}
A &= 750. \text{ mm}^2 \\
J_u &= 235055. \text{ mm}^4 \\
J_v &= 65322. \text{ mm}^4 \\
y_g &= 34.56 \text{ mm} \\
T_y &= 2420. \text{ N} \\
M_x &= -1621400. \text{ Nmm} \\
x_m &= 12. \text{ mm} \\
u_m &= -9. \text{ mm} \\
v_m &= -34.56 \text{ mm} \\
\sigma_m &= -Mv/J_u = -238.4 \text{ N/mm}^2 \\
x_c &= 21. \text{ mm} \\
y_c &= 9. \text{ mm} \\
v_c &= -25.56 \text{ mm} \\
\sigma_c &= -Mv/J_u = -176.3 \text{ N/mm}^2 \\
\tau_c &= 6.685 \text{ N/mm}^2 \\
\sigma_0 &= \sqrt{\sigma^2 + 3\tau^2} = 176.7 \text{ N/mm}^2 \\
S &= 3896. \text{ mm}^3
\end{aligned}$$