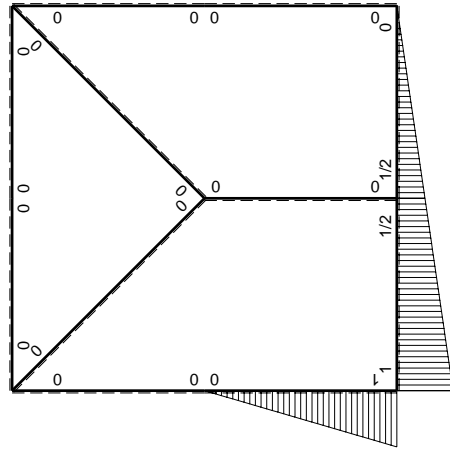


Schema di calcolo iperstatico

M_0 , flessione da carichi assegnati



M_x , flessione da iperstatica $X=1$

Quadro contributi PLV per iperstatica $X=H_H$

→	$M_x(x)$	$M_o(x)$	θ	$M_x M_o$	$M_x \theta$	$M_x M_x$	$\int M_x(M_o/EJ+\theta)dx$	$\int X M_x M_x / EJ dx$
AB b	$b-1/2x$	$-9/2Fb+9/4Fx$	0	$-9/2Fb^2+9/2Fbx-9/8Fx^2$	0	$b^2-bx+1/4x^2$	$(-21/8+0)Fb^3/EJ$	$7/12Xb^3/EJ$
BA b	$-1/2b-1/2x$	$9/4Fb+9/4Fx$	0	$-9/8Fb^2-9/4Fbx-9/8Fx^2$	0	$1/4b^2+1/2bx+1/4x^2$		
BC b	$1/2b-1/2x$	$-9/4Fb+9/4Fx$	$-Fb/EJ$	$-9/8Fb^2+9/4Fbx-9/8Fx^2$	$-1/2Fb^2/EJ+1/2Fxb/EJ$	$1/4b^2-1/2bx+1/4x^2$	$(-3/8-1/4)Fb^3/EJ$	$1/12Xb^3/EJ$
CB b	$-1/2x$	$9/4Fx$	Fb/EJ	$-9/8Fx^2$	$-1/2Fxb/EJ$	$1/4x^2$		
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	$-7/4Fb-9/4Fx-1/2qx^2$	0	$-7/4Fbx-9/4Fx^2-1/2qx^3$	0	x^2	$(-7/4+0)Fb^3/EJ$	$1/3Xb^3/EJ$
AH b	$-b+x$	$9/2Fb-13/4Fx+1/2qx^2$	0	$-9/2Fb^2+31/4Fbx-15/4Fx^2+1/2qx^3$	0	$b^2-2bx+x^2$		
H	cedimento nodo $-H_{1H}u_H$						Fb^3/EJ	
	totali						$-4Fb^3/EJ$	Xb^3/EJ
	iperstatica $X=H_H$						4F	

Sviluppi di calcolo iperstatica

$$L_{AB}^{xx} = \int_0^b (1 - x/b + 1/4 x^2/b^2) b^2 1/EJ dx = [x - 1/2 x^2/b + 1/12 x^3/b^2]_0^b b^2 1/EJ$$

$$= (b - 1/2 b + 1/12 b) b^2 1/EJ = 7/12 b^3/EJ$$

$$L_{BA}^{xx} = \int_0^b (1/4 + 1/2 x/b + 1/4 x^2/b^2) b^2 1/EJ dx = [1/4 x + 1/4 x^2/b + 1/12 x^3/b^2]_0^b b^2 1/EJ$$

$$= (1/4 b + 1/4 b + 1/12 b) b^2 1/EJ = 7/12 b^3/EJ$$

$$L_{BC}^{xx} = \int_0^b (1/4 - 1/2 x/b + 1/4 x^2/b^2) b^2 1/EJ dx = [1/4 x - 1/4 x^2/b + 1/12 x^3/b^2]_0^b b^2 1/EJ$$

$$= (1/4 b - 1/4 b + 1/12 b) b^2 1/EJ = 1/12 b^3/EJ$$

$$L_{CB}^{xx} = \int_0^b (1/4 x^2/b^2) b^2 1/EJ dx = [1/12 x^3/b^2]_0^b b^2 1/EJ$$

$$= (1/12 b) b^2 1/EJ = 1/12 b^3/EJ$$

$$L_{HA}^{xx} = \int_0^b (x^2/b^2) b^2 1/EJ dx = [1/3 x^3/b^2]_0^b b^2 1/EJ$$

$$= (1/3 b) b^2 1/EJ = 1/3 b^3/EJ$$

$$L_{AH}^{xx} = \int_0^b (1 - 2x/b + x^2/b^2) b^2 1/EJ dx = [x - x^2/b + 1/3 x^3/b^2]_0^b b^2 1/EJ$$

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

$$L_{AB}^{x_0} = \int_0^b (-9/2 + 9/2 x/b - 9/8 x^2/b^2) Fb^2 1/EJ dx = [-9/2 x + 9/4 x^2/b - 3/8 x^3/b^2]_0^b Fb^2 1/EJ$$

$$= (-9/2 b + 9/4 b - 3/8 b) Fb^2 1/EJ = -21/8 Fb^3/EJ$$

$$L_{BA}^{x_0} = \int_0^b (-9/8 - 9/4 x/b - 9/8 x^2/b^2) Fb^2 1/EJ dx = [-9/8 x - 9/8 x^2/b - 3/8 x^3/b^2]_0^b Fb^2 1/EJ$$

$$= (-9/8 b - 9/8 b - 3/8 b) Fb^2 1/EJ = -21/8 Fb^3/EJ$$

$$L_{BC}^{x_0} = \int_0^b (-9/8 + 9/4 x/b - 9/8 x^2/b^2) Fb^2 1/EJ dx + \int_0^b (-1/2 + 1/2 x/b) \theta dx$$

$$= [-9/8 x + 9/8 x^2/b - 3/8 x^3/b^2]_0^b Fb^2 1/EJ + [-1/2 x + 1/4 x^2/b]_0^b \theta$$

$$= (-9/8 b + 9/8 b - 3/8 b) Fb^2 1/EJ + (-1/2 b + 1/4 b) \theta = -5/8 Fb^3/EJ$$

$$L_{CB}^{x_0} = \int_0^b (-9/8 x^2/b^2) Fb^2 1/EJ dx + \int_0^b (1/2 x/b) \theta dx = [-3/8 x^3/b^2]_0^b Fb^2 1/EJ + [1/4 x^2/b]_0^b \theta$$

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

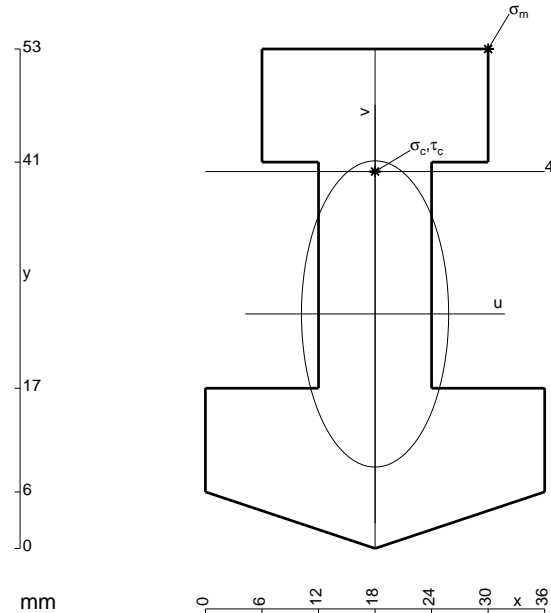
$$L_{HA}^{x_0} = \int_0^b (-7/4 x/b - 9/4 x^2/b^2 - 1/2 x^3/b^3) Fb^2 1/EJ dx = [-7/8 x^2/b - 3/4 x^3/b^2 - 1/8 x^4/b^3]_0^b Fb^2 1/EJ$$

$$= (-7/8 b - 3/4 b - 1/8 b) Fb^2 1/EJ = -7/4 Fb^3/EJ$$

$$L_{AH}^{x_0} = \int_0^b (-9/2 + 31/4 x/b - 15/4 x^2/b^2 + 1/2 x^3/b^3) Fb^2 1/EJ dx$$

$$= [-9/2 x + 31/8 x^2/b - 5/4 x^3/b^2 + 1/8 x^4/b^3]_0^b Fb^2 1/EJ$$

$$= (-9/2 b + 31/8 b - 5/4 b + 1/8 b) Fb^2 1/EJ = -7/4 Fb^3/EJ$$



- A = 1080. mm²
- J_u = 285273. mm⁴
- J_v = 65880. mm⁴
- 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
- σ_m = N/A-Mv/J_u = 209.2 N/mm²
- x_c = 18. mm
- y_c = 40. mm
- v_c = 15.12 mm
- σ_c = N/A-Mv/J_u = 112.1 N/mm²
- τ_c = 6.723 N/mm²
- σ_o = √σ²+3τ² = 112.7 N/mm²
- S = 6557. mm³