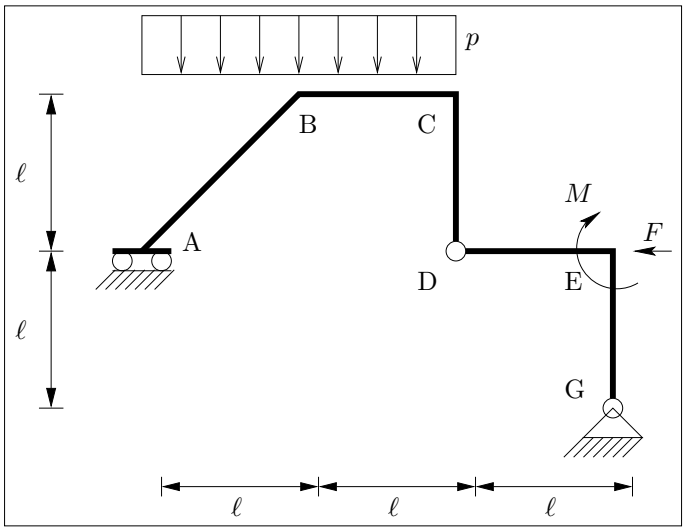
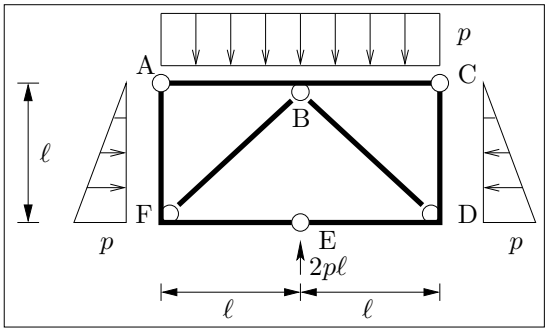
Statica - Ingegneria Civile - Prof. Daniele Zulli

Appello del 12/1/2026 - Durata 3 ore

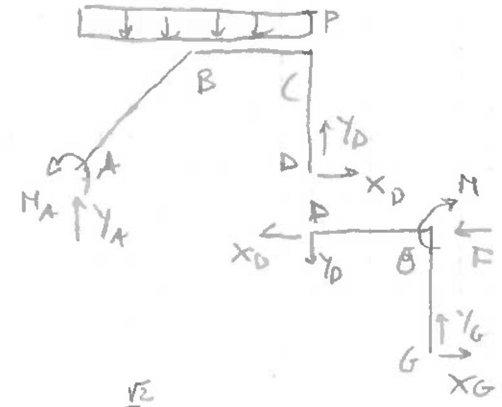
Esercizio 1: Scrivere e diagrammare le leggi di variazione delle caratteristiche di sollecitazione per la struttura in figura, nel caso in cui sia $F = p\ell$ e $M = p\ell^2$. Calcolare la rotazione della sezione in C, noto EI e per $EA \to +\infty$.



Esercizio 2: Diagrammare le caratteristiche di sollecitazione per la struttura in figura nel caso in cui sia $EA = \frac{EJ}{\ell^2}$ nei tratti BF e BD, mentre $EA \to +\infty$ altrove.



BS1 12/1/2026



$X_D = 0$

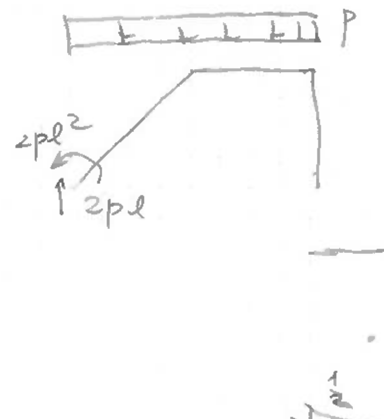
$X_G = F = pl$

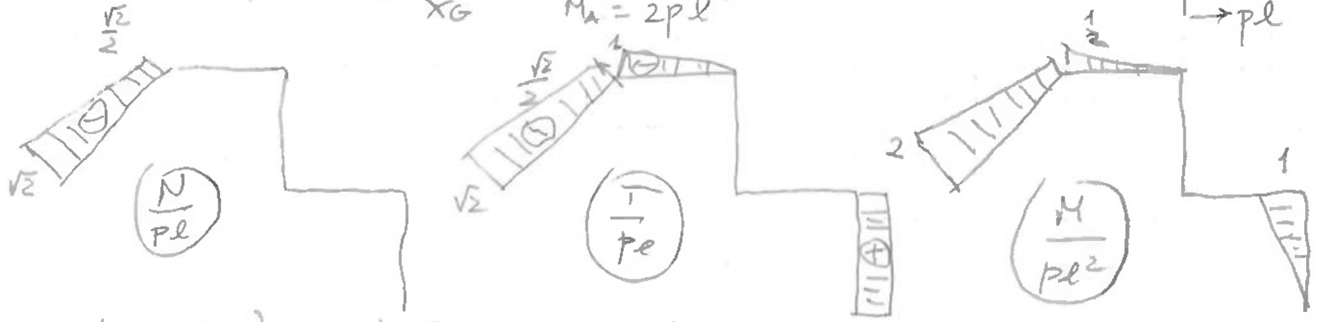
$Y_G = 0$

$Y_D = 0$

$Y_A = 2pl$

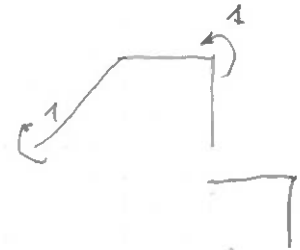
$M_A = 2pl^2$





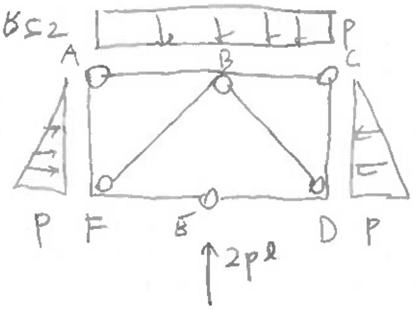
TRAVE	LUNG	N	T	M	M^*
AB	$l\sqrt{2}$	$-\sqrt{2}pl + p\frac{x}{2}$	$-\sqrt{2}pl + p\frac{x}{2}$	$-2pl^2 + \sqrt{2}plx - \frac{px^2}{4}$	1
BC	l	0	$-pl + px$	$-\frac{pl^2}{2} + plx - \frac{px^2}{2}$	1
CD	l	0	0	0	0
DB	l	0	0	0	0
BG	l	0	pl	$pl^2 - plx$	0

P.V.



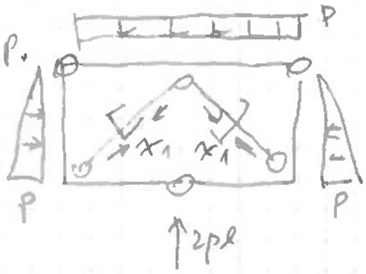
$$\varphi_C = \frac{1}{EI}\left[\int_D M M^* dx\right] = \frac{1}{EI}\left[\int_0^{l\sqrt{2}}\left(-2pl^2 + \sqrt{2}plx - \frac{px^2}{4}\right)dx + \int_0^l\left(-\frac{pl^2}{2} + plx - \frac{px^2}{2}\right)dx\right] = -\frac{(1+7\sqrt{2})}{6}\frac{pl^3}{EI}$$

BS2



Anello a tre cerniere con labilità esterne risolte da carichi esterni autoequilibrati, a cui si aggiungono due bielle: struttura due volte iperstatica per vincoli interni. Per simmetria l'iperstaticità diventa uno.

S.P.



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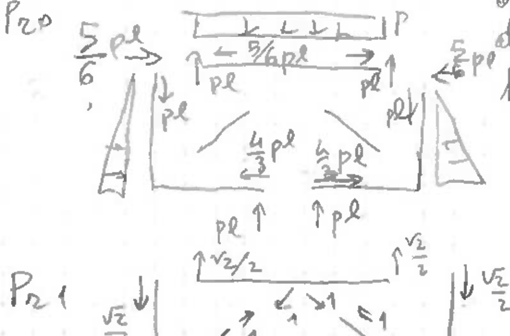

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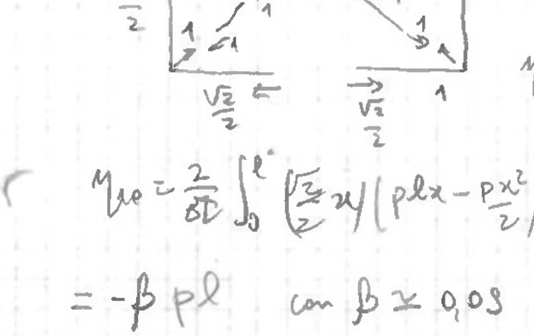
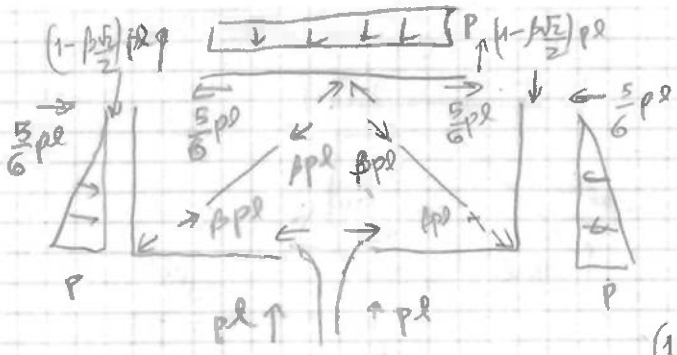


TRAVE	LUNG	N_0	M_0	N_1	M_1
AF	l	–	$\frac{5}{6}plx + \frac{p}{l}\frac{x^3}{6}$	–	0
EF	l	–	plx	–	0
AB	l	–	$plx - \frac{px^2}{2}$	–	$\frac{\sqrt{2}}{2}x$
FB	$l\sqrt{2}$	0	0	1	0

$$\eta_{11} = \frac{2}{EA}\int_0^{l\sqrt{2}} dx + \frac{2}{EI}\int_0^l \left(\frac{\sqrt{2}}{2}x\right)^2 dx = \frac{2l\sqrt{2}}{EA} + \frac{2}{EI}\frac{l^3}{6} = \frac{2}{EI}l^3\left(\sqrt{2} + \frac{1}{6}\right)$$

$$\eta_{10} = \frac{2}{EI}\int_0^l \left(\frac{\sqrt{2}}{2}x\right)\left(plx - \frac{px^2}{2}\right)dx = \frac{2}{EI}\frac{5\sqrt{2}}{48}pl^4, \quad \overline{\eta}_1 = 0, \quad X_1 = -\frac{\eta_{10} + \overline{\eta}_1}{\eta_{11}} = -\frac{5}{568}(12 - \sqrt{2})pl =$$

$$= -\beta pl \quad \text{con } \beta \simeq 0{,}09$$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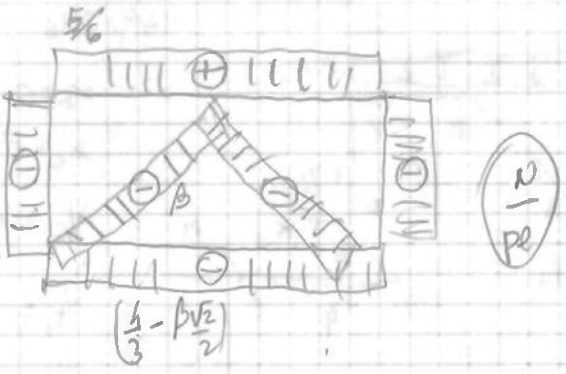
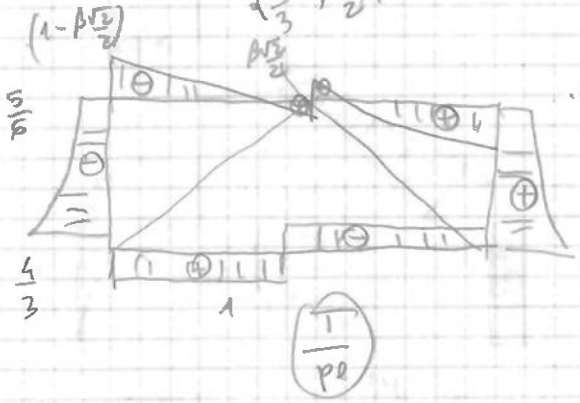

5/6
N/pℓ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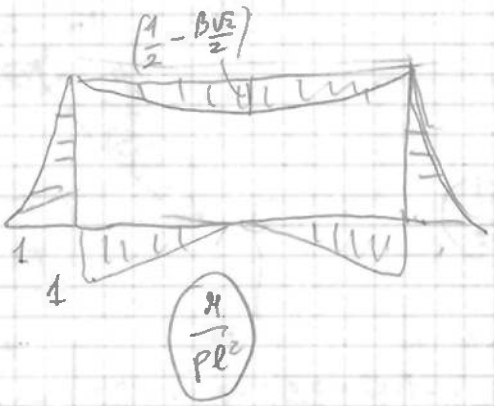
1/pℓ


1
1
M/pℓ²