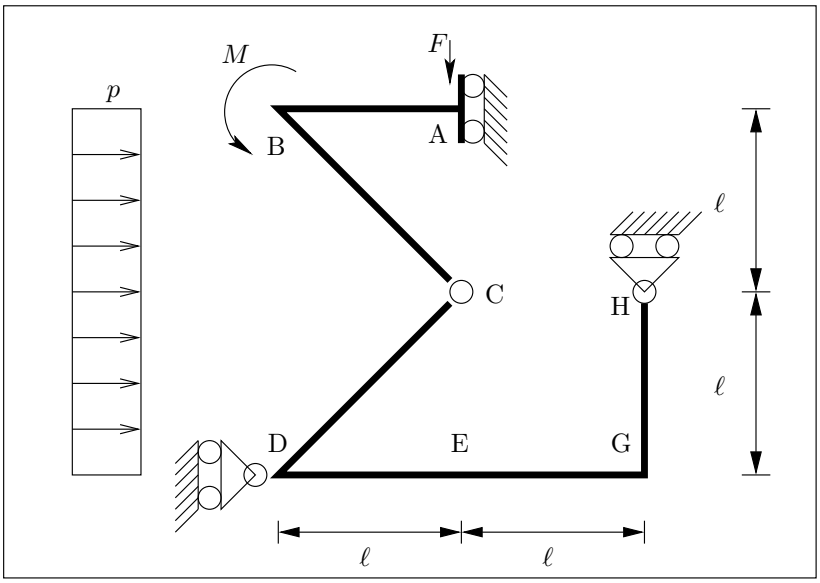
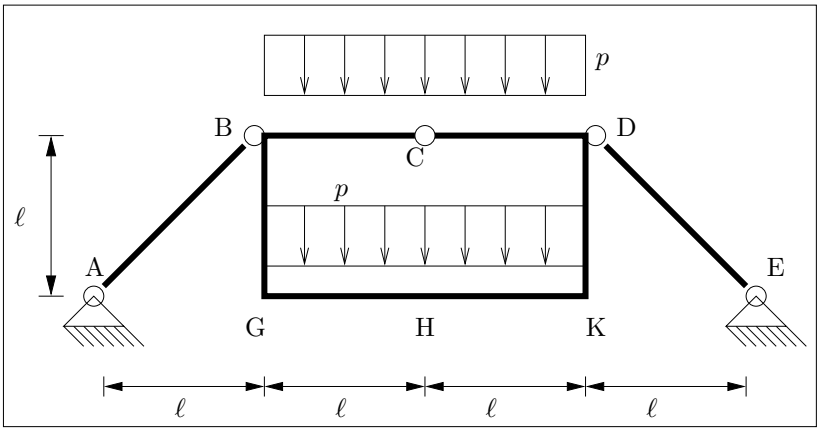
Statica - Ingegneria Civile e Ambientale - Prof. Daniele Zulli

Appello del 16/6/2025 - 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 B, noto EI e per $EA \to +\infty$.



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



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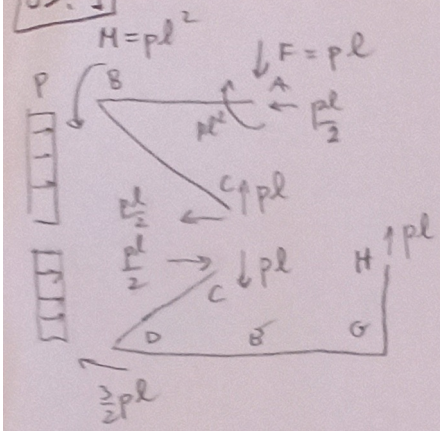
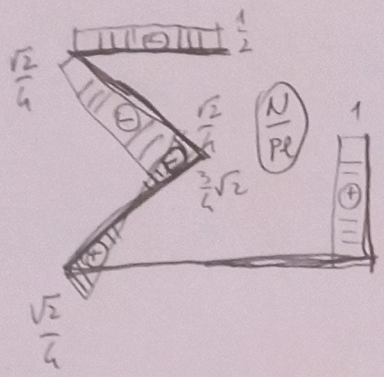
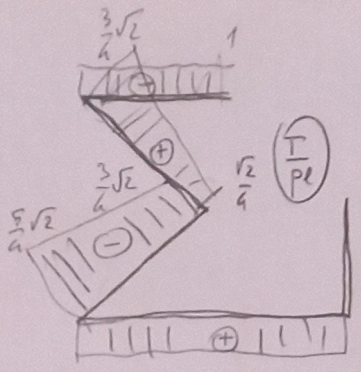
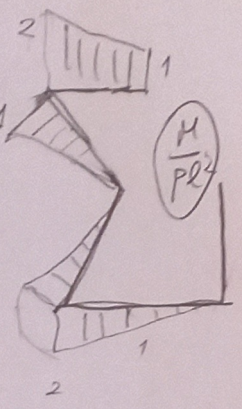
ES. 1



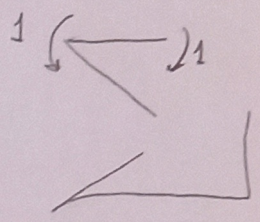






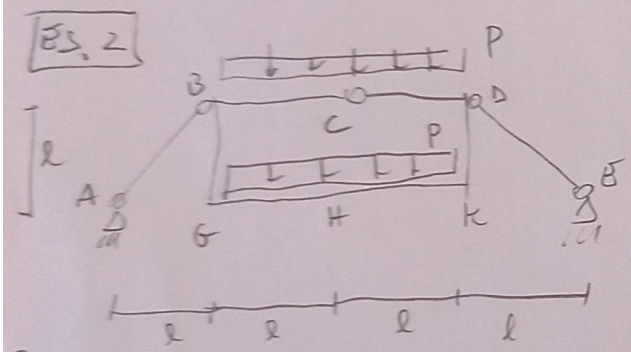
TRAVE	LUNG	N	T	M	M^V
AB	l	$-\frac{pl}{2}$	$-pl$	$pl^2 + plx$	1
CB	$l\sqrt{2}$	$-\frac{3}{4}\sqrt{2}pl + \frac{p}{2}x$	$\frac{\sqrt{2}}{4}pl + \frac{p}{2}x$	$-\frac{\sqrt{2}}{4}plx - \frac{px^2}{4}$	0
CD	$l\sqrt{2}$	$-\frac{\sqrt{2}}{4} + \frac{px}{2}$	$\frac{3\sqrt{2}}{4}pl + \frac{p}{2}x$	$\frac{3\sqrt{2}}{4}plx + \frac{px^2}{4}$	0
HG	l	pl	0	0	0
GD	$2l$	0	pl	$-plx$	0

Sist virtuale



$$v_B = \frac{1}{EJ}\int_0^l \left(pl^2 + plx\right)dx = \frac{3}{2}\frac{pl^3}{EJ}$$

ES. 2



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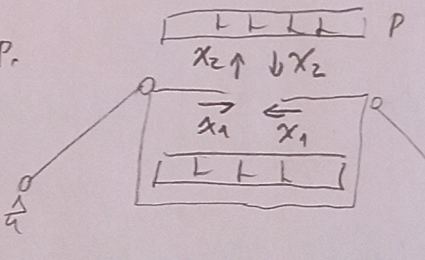
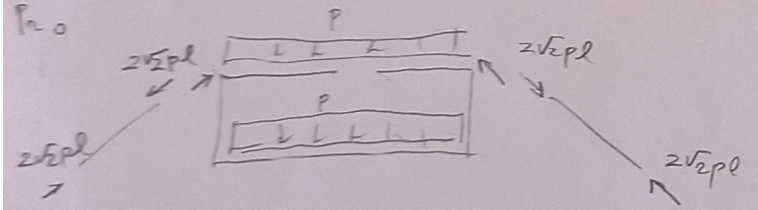
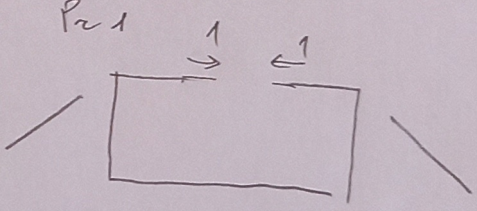


Struttura 2 volte iperstatica per vincoli interni, ma $X_2 = 0$ per simmetria di geometria e carichi ⇒ 1 volta iperstatica

$P_2 = 0$



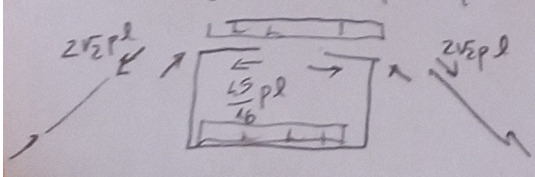
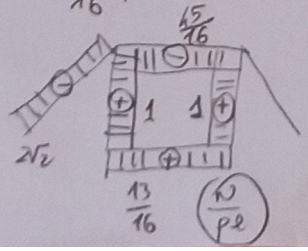
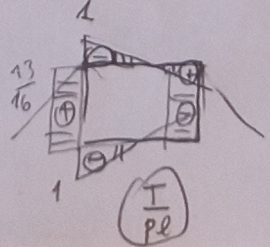
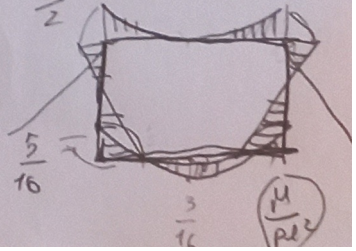
$P_2 = 1$



TRAVE	LUNG	N_0	M_0	M_1
AB	$l\sqrt{2}$	$-2\sqrt{2}pl$	0	0
CB	l	—	$\frac{px^2}{2}$	0
BG	l	—	$p\frac{l^2}{2} + 2plx$	x
GH	l	—	$\frac{5}{2}pl^2 + plx - p\frac{x^2}{2}$	l

$$\eta_{10} = \frac{2}{EJ}\left[\int_0^l \left(p\frac{l^2}{2} + 2plx\right)x\,dx + \int_0^l \left(\frac{5}{2}pl^2 + plx - p\frac{x^2}{2}\right)l\,dx\right]$$

$$= \frac{2}{EJ}\left[\frac{15}{4}pl^4\right]$$

$$\eta_{11} = \frac{2}{EJ}\left[\int_0^l x^2\,dx + \int_0^l l^2\,dx\right]dx = \frac{2}{EJ}\left[\frac{4}{3}l^3\right]; \quad \eta_1 = 0$$

$$X_1 = -\frac{\eta_{10}}{\eta_{11}} = -\frac{15}{4}\cdot\frac{3}{4}pl = -\frac{45}{16}pl$$