PRINCIPIO DEI LAVORI VIRTUALI

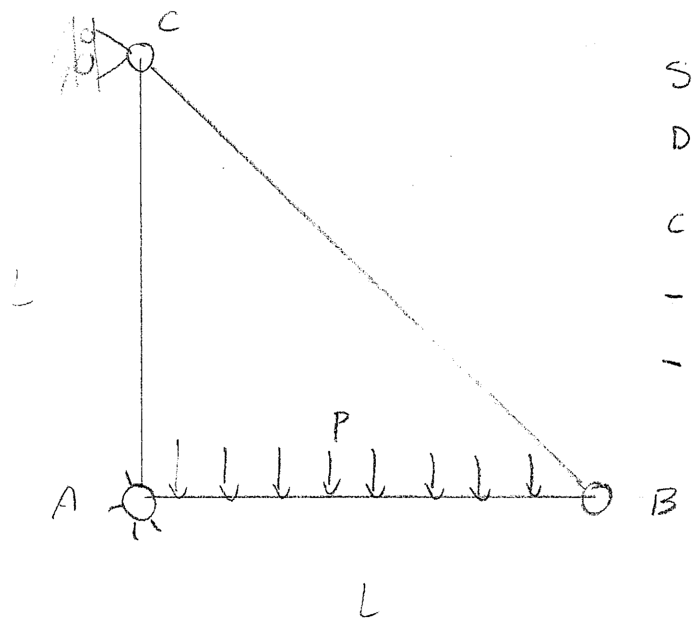
"IN UN SISTEMA MECCANICO CON VINCOLI FISSI E LISCI (ASSENZA DI ATTRITO), CONDIZIONE NECESSARIA E SUFFICIENTE PER L'EQUILIBRIO È CHE SIA NULLO IL LAVORO VIRTUALE DELLE FORZE E DELLE COPPIE ATTIVE PER QUALSIASI SPOSTAMENTO VIRTUALE DEL SISTEMA"

$$\delta^* L = \sum_j F_j \cdot \delta P_j + \sum_k C_k \cdot \delta \vartheta_k$$

SPOSTAMENTO VIRTUALE

$$\delta P_j = \sum_i \frac{\partial P_j}{\partial x_i} \delta x_i$$

$$\frac{\partial v_j}{\partial \dot{x}_i} = \frac{\partial P_j}{\partial x_i}$$



STRUTTURA SOGGETTA AL CARICO DISTRIBUITO $p \; [N/m]$

CALCOLARE

- REAZIONI VINCOLARI
- DIAGRAMMI AZIONI INTERNE IN AB

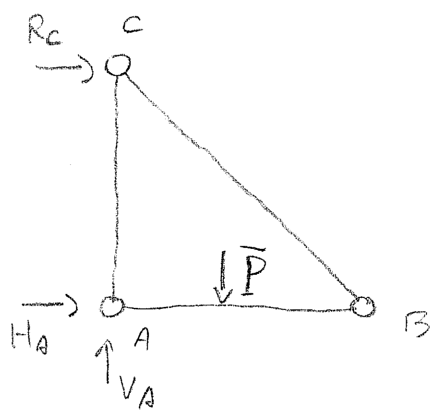
CALCOLO GDL:

/ $3 \times 3 = 9$ gdl N

O $4 \times 2 = 8$ gdv !

$1 \times 1 = 1$ gdv

0 ISOSTATICA



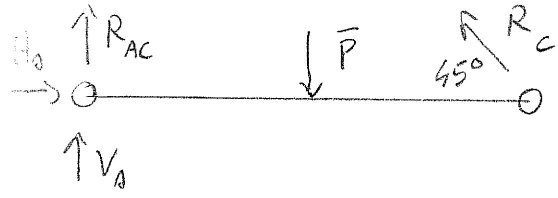
3 INCOGNITE $\quad \bar{P} = pL$

$$+\circlearrowleft \sum M_A = -\bar{P}\frac{L}{2} - R_C L = 0 \quad \Rightarrow \quad R_C = -\frac{\bar{P}}{2}$$

$$\sum F_x = R_C + H_A = 0 \quad \Rightarrow \quad H_A = \frac{\bar{P}}{2}$$

$$\sum F_y = -\bar{P} + V_A = 0 \quad \Rightarrow \quad V_A = \bar{P}$$

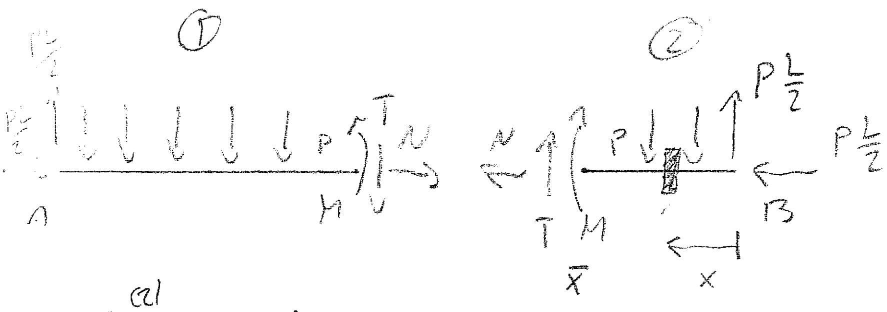
ISOLO ASTA AB



$$+\circlearrowleft \sum M_A^{(1)} = -\bar{P}\frac{L}{2} + R_{CB} L \frac{\sqrt{2}}{2} = 0 \qquad R_{CB} = \bar{P}\frac{\sqrt{2}}{2}$$

$$\sum F_y^{(1)} = -\bar{P} + \overset{\bar{P}}{V_A} + R_{AC} + \overset{\bar{P}/2}{R_{CB}\frac{\sqrt{2}}{2}} = 0$$

$$\Rightarrow R_{AC} = -\frac{\bar{P}}{2}$$



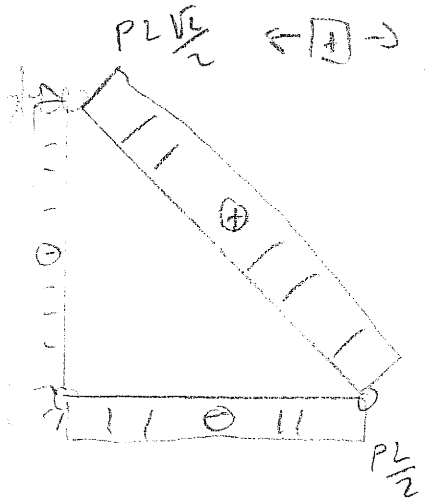
$$\Sigma F_x^{(2)} = -\frac{PL}{2} - N = 0 \qquad N = -P\frac{L}{2} \qquad \text{(ASTA COMPRESSA)}$$

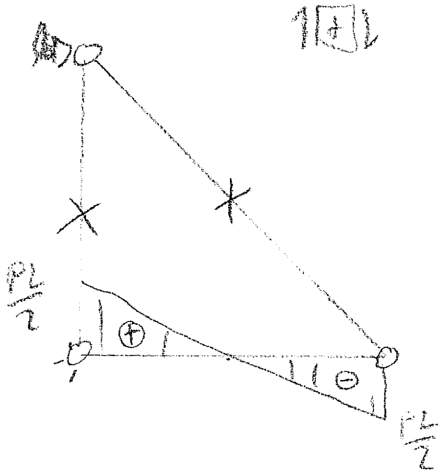
$$\Sigma F_y^{(2)} = -\int_0^{\bar{x}} p\,dx + \frac{pL}{2} + T = 0 \qquad T = p\bar{x} - p\frac{L}{2} = p\left(\bar{x} - \frac{L}{2}\right)$$

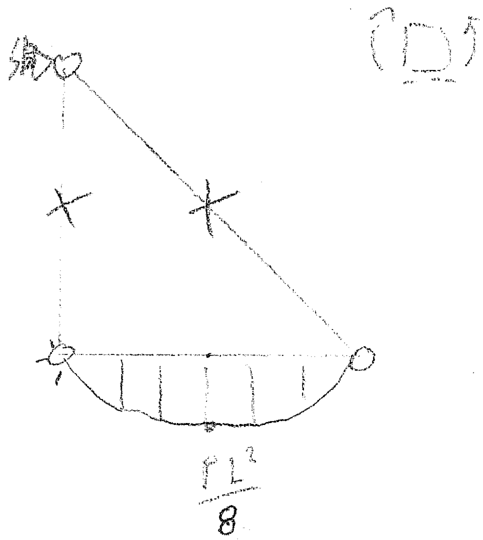
$$\begin{cases} T(0) = -p\frac{L}{2} \\ T(L) = p\frac{L}{2} \end{cases}$$

$$\Sigma M_p^{(2)} = p\frac{L}{2}\bar{x} - \int_0^{\bar{x}} p(\bar{x}-x)\,dx - M = 0 \qquad M = p\frac{L}{2}\bar{x} + \left[p\frac{(\bar{x}-x)^2}{2}\right]_0^{\bar{x}} =$$

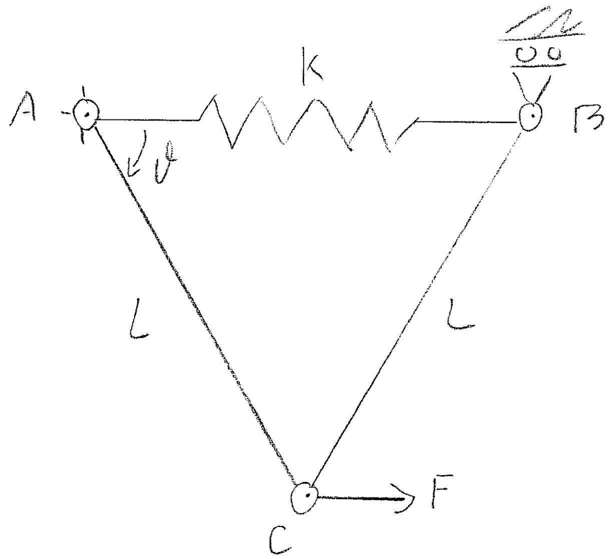
$$= p\frac{L}{\cancel{2}}\bar{x} - p\frac{\bar{x}^2}{2} \qquad \begin{cases} M(0) = 0 \\ M(L) = 0 \end{cases} \qquad M\left(\frac{L}{2}\right) = \frac{pL^2}{8}$$







STATICA - PLV



TROVARE LA POSIZIONE DI EQUILIBRIO ϑ

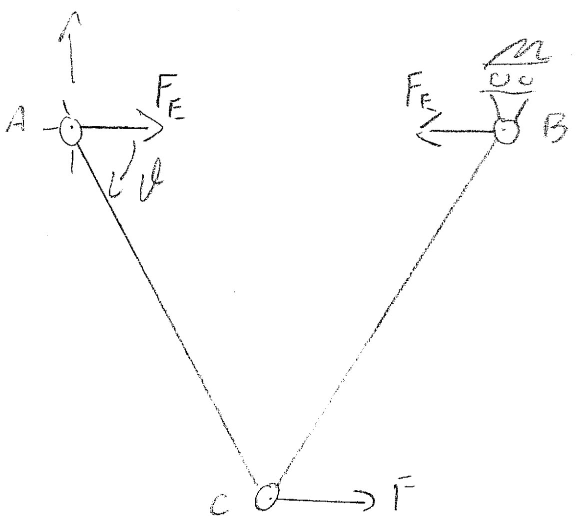
DATI

$L = 0.2\ m$

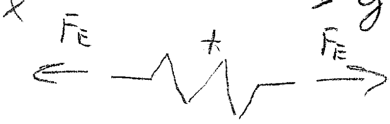
$F = 50\ N$

$k = 0.5\ N/mm$

$l_0 = 50\ mm$ (LUNGH. MOLLA SCARICA)



$\rightarrow x$ SISTEMA 1 gdl c.l. ϑ



$F_E = k\,\Delta l$

Δl POS TRAZIONE

$$\delta L = \cancel{\vec{F_E} \times \delta\vec{A}} + \vec{F_E} \times \delta\vec{B} + \vec{F} \times \delta\vec{C} = -F_E\,\delta x_B + F\,\delta x_C$$

$$x_B = 2L\cos\vartheta \qquad \delta x_B = \frac{\partial x_B}{\partial\vartheta}\,\delta\vartheta = -2L\sin\vartheta\,\delta\vartheta$$

$$x_C = L\cos\vartheta \qquad \delta x_C = \frac{\partial x_C}{\partial\vartheta}\,\delta\vartheta = -L\sin\vartheta\,\delta\vartheta$$

$$F_E = k\,\Delta l = k\,(l - l_0) = k\,(x_B - l_0)$$

$$\delta L = -k\,(2L\cos\vartheta - l_0)\cdot(-2L\sin\vartheta\,\delta\vartheta) + F\,(-L\sin\vartheta\,\delta\vartheta) = 0$$

$$\delta L = \delta\vartheta\left[2k\cancel{L}\,\cancel{\sin\vartheta}\,(2L\cos\vartheta - l_0) - F\cancel{L}\,\cancel{\sin\vartheta}\right] = 0$$

$$\cos\vartheta = \frac{2k\,l_0 + F}{4kL} = 0.5 \qquad \vartheta = 60°$$