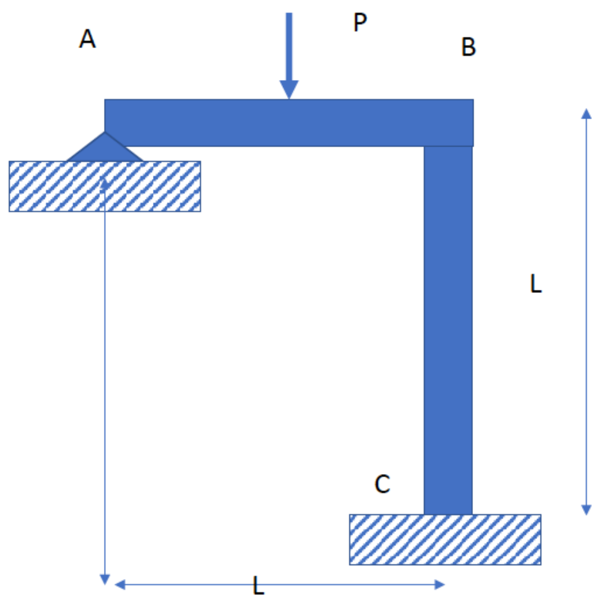
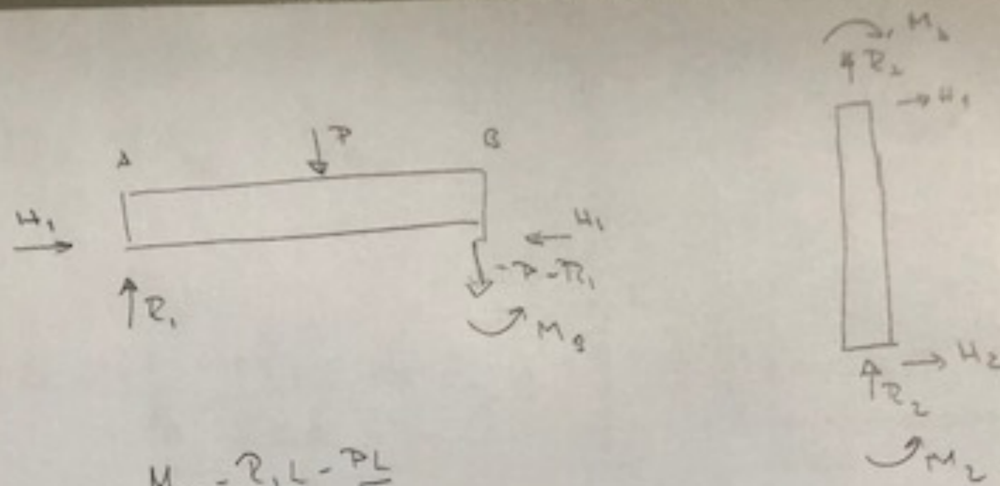
Calcular as reações em A e C





$$M_B = R_1 L - \frac{PL}{2}$$

* EQUILÍBRIO (GLOBAL)

$$\boxed{\begin{aligned} H_1 + H_2 &= 0 \\ R_1 + R_2 - P &= 0 \\ -R_1 L + H_1 L + \frac{PL}{2} &= 0 \end{aligned}}$$

SISTEMA ESTATICAMENTE NÃO DETERMINADO

$$R_1 = \frac{1}{L}\left[H_1 L + \frac{PL}{2}\right] = H_1 + \frac{P}{2}$$

\# CONDIÇÃO CINEMÁTICA

$$\boxed{\delta_H^A = \frac{\partial U}{\partial H_1} = 0}$$

$$U = U_{AB} + U_{BC}$$

$$U_{AB} = \underbrace{\int_0^L \frac{H_1^2}{2EA}\, dx}_{\text{COMPRESSÃO}} + \underbrace{\int_0^L \frac{\left(\frac{P}{2}\langle x - \frac{L}{2}\rangle - R_1 x\right)^2}{2EI}\, dx}_{\text{FLEXÃO}}$$

$$U_{BC} = \int_0^L \frac{(R_1 - P)^2}{2EA}\, dy + \int \frac{(-M_3 - H_1 y)^2}{2EI}\, dy$$

$$\frac{\partial U}{\partial H_1} = \frac{H_1 L}{EA} + \frac{1}{EI}\frac{\partial R}{\partial H_1}\left[\frac{5PL^3}{48} - \frac{R_1 L^3}{3}\right]$$

$$+ \frac{(R_1 - P)}{EA}\frac{\partial R_1}{\partial H_1} L + \frac{1}{EI}\left[- M_3 \frac{\partial M_3}{\partial H_1} L - H_1 \frac{\partial M_3}{\partial H_1}\frac{L^2}{2} + \frac{M_3 L^2}{2}\right.$$

$$\left. + \frac{H_1 L^3}{3}\right] = 0$$

SENDO QUE:

$$\boxed{\frac{\partial R_1}{\partial H_1} = 1} \qquad e \qquad \frac{\partial M_3}{\partial H_1} = \frac{\partial R_1}{\partial H_1} L = L$$

$$\frac{H_1 L}{EA} + \frac{1}{EI}\left[\frac{5PL^3}{48} - \left(H_1 + \frac{P}{2}\right)\frac{L^3}{3}\right] + \left(H_1 - \frac{P}{2}\right)\frac{1}{EA}L +$$

$$+ \frac{1}{EI}\left[-\left(R_1 L - P\frac{L}{2}\right)L^2 - \cancel{H_1\frac{L^3}{3}} + \left(R_1 L - P\frac{L}{2}\right)\frac{L^2}{2} + \cancel{H_1\frac{L^3}{3}}\right] = 0$$

$$\frac{H_1 L}{EA} - \frac{1}{EI}\left[-\frac{PL^3}{16} - \frac{H_1 L^3}{3}\right] + \left(H_1 - \frac{P}{2}\right)\frac{L}{EA} = 0$$

$$H_1 = P\,\frac{\left[\frac{L^3}{16 I} - \frac{L}{2A}\right]}{\left[\frac{2L+1}{A} + \frac{L^3}{3EI}\right]}$$

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