Trabalho 13

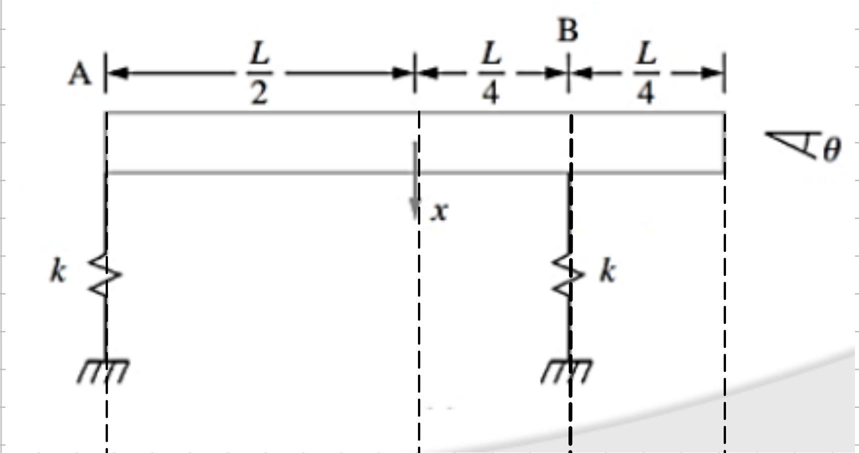
Dados:

m_1 ; $J_0 = \frac{1}{12} mL^2$; K_1 ;

Considerações:

- θ pequeno, portanto $tg\,\theta \simeq \theta$

Esquema:



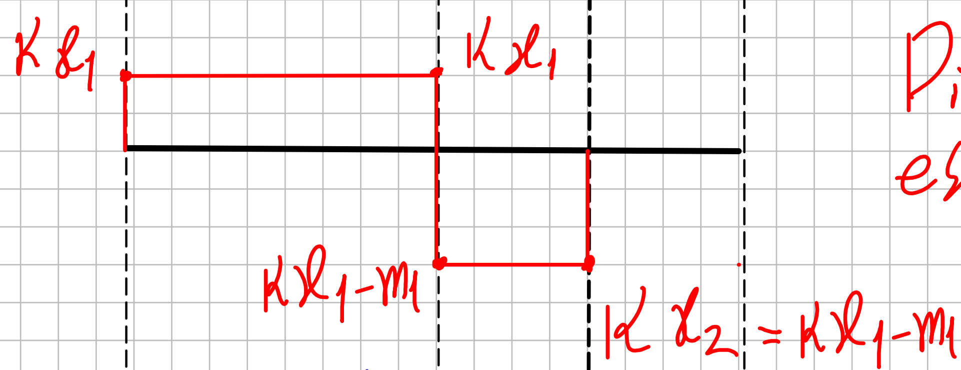


Diagrama de esforços cortantes

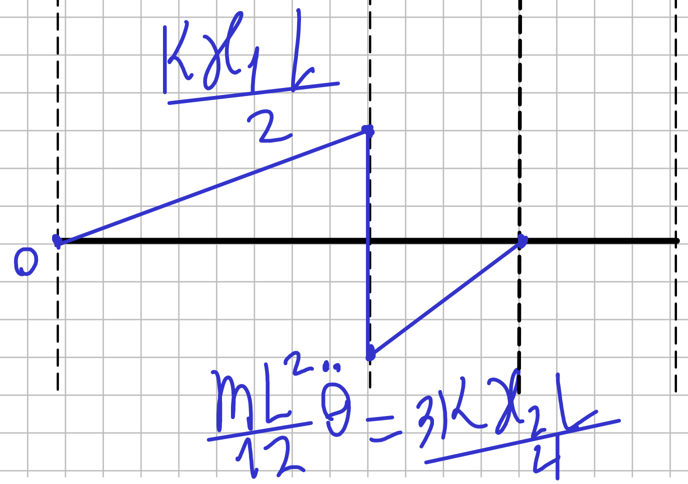


Diagrama de momento fletor

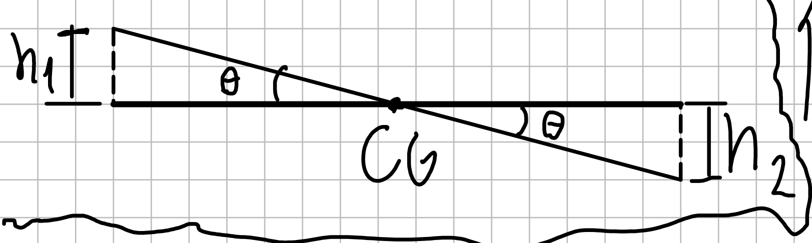
Desses dois diagramas temos que:

$$F(t) = K x_1 + K x_2 - m\ddot{x} = 0$$

e

$$M(t) = \frac{K x_1 L}{2} + \frac{m L^2 \ddot{\theta}}{12} - \frac{3K x_2 L}{4} = 0$$

Para encontrar os deslocamento x_1 e x_2 temos:



$$\begin{cases} x_1 = x - h_1 \\ x_2 = x + h_2 \end{cases}$$

$$tg\,\theta \simeq \theta \simeq \frac{2h_1}{L} = \frac{h_2}{L} \therefore$$

$$\begin{cases} h_1 = \frac{\theta L}{2} \\ h_2 = 3\frac{\theta L}{4} \end{cases}$$

Substituindo h_1 e h_2 nas equações de força e momento temos:

$$F(t) = K\left(x - \frac{\theta L}{2} + x + \frac{3\theta L}{4}\right) - m\ddot{x} = K\left(2x + 5\frac{\theta L}{4}\right) - m\ddot{x}$$

$$F(t) = 2Kx + \frac{5K\theta L}{4} - m\ddot{x}$$

e

$$M(t) = \frac{K\left(x - \frac{\theta L}{2}\right)L}{2} - \frac{3K\left(x + \frac{3\theta L}{4}\right)L}{4} + \frac{mL^2\theta}{12} =$$

$$\frac{Kx l}{2} - \frac{K\theta L^2}{4} - \frac{3Kx L}{4} - \frac{3K\theta L^2}{16} + \frac{mL^2\ddot{\theta}}{12} \therefore$$

$$M(t) = -\frac{KxL}{4} - \frac{5K\theta L^2}{16} + \frac{mL^2\ddot{\theta}}{12}$$

Portanto, as matrizes serão dadas por:

$$\begin{vmatrix} m & 0 \\ 0 & \frac{mL^2}{12} \end{vmatrix} \begin{vmatrix} \ddot{x} \\ \ddot{\theta} \end{vmatrix} + \begin{vmatrix} 2K & -\frac{KL}{4} \\ \frac{5L}{4} & -\frac{5K\theta L^2}{16} \end{vmatrix} = \begin{vmatrix} F(t) \\ M(t) \end{vmatrix}$$