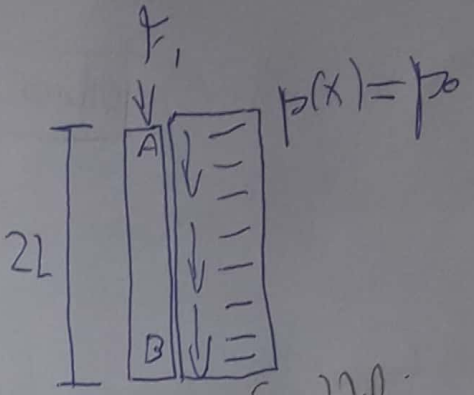
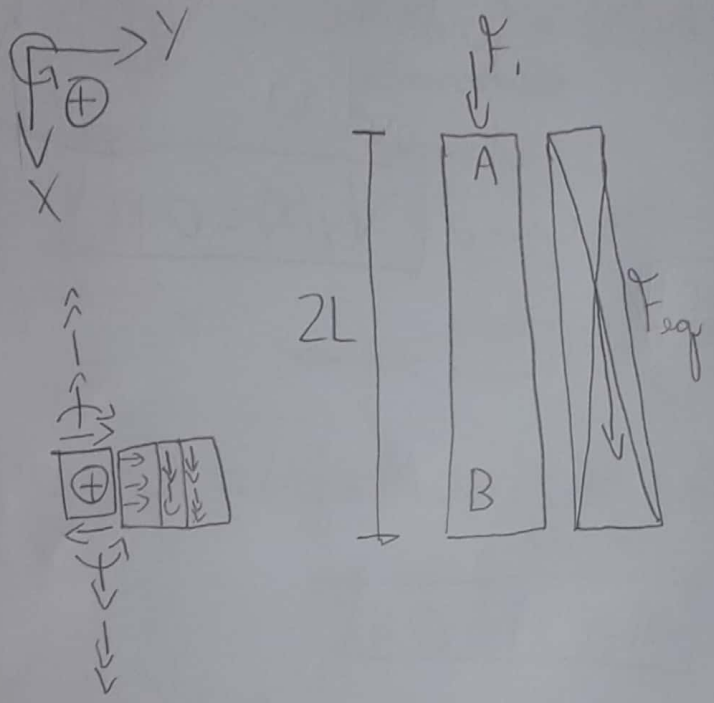
Ex - EqDifEquil - Cricial_01

Dados: $L = 2\,m$

$p_0 = 5000\,N/m$

$F_1 = 8000\,N$





Eq. Dif.:

$$\frac{dN_x(x)}{dx} = -p(x)$$

$$p(x) = p_0$$

$$N_x(X=0) = -F_1$$

Eq. Dif.:

$$\frac{dM_x(x)}{dx} = -t(x)$$

$$t(x) = 0$$

$$M_x(X=0) = 0$$

Eq. Dif.:

$$\frac{d^2M_z(x)}{dx^2} = q(x)$$

$$q(x) = 0$$

$$\left.\frac{dM_z(x)}{dx}\right|_{x=0} = 0$$

$$N_x(x) = -\int p(x)\,dx + C_p = -\int_0^X p_0\,dx + C_p$$

$$N_x(x) = -X \cdot p_0 + C_p \rightarrow N_x(X=0) = -F_1$$

~~$N_x(X=0) = -8000\,N$~~

$$-F_1 = -(0)\cdot p_0 + C_p \rightarrow C_p = -F_1$$

~~$C_p = -8000\,N$~~

$$N_x(X=4) = -(4)\cdot 5000 - 8000$$

$$N_x(X=4) = -28000\,N$$

~~$N_x(X) = -X \cdot 5000 - 8000$~~

$M_x(X) = -\int t(x).dX + Ct \rightarrow M_x(X) = -\int 0.dX + Ct$

$M_x(X) = Ct \rightarrow M_x(0) = \boxed{0 N.m = Ct}$ $\boxed{M_x(X) = 0 N}$

Eq. 2dif.: $\frac{dV_y(X)}{dX} = q(X) \rightarrow q(X) = 0 \rightarrow V_y(X) = 0 = \frac{dM_z(X)}{dX}$

$V_y(X) = \int q(x).dX + C_1 \rightarrow V_y(X) = \int 0.dX + C_1 \rightarrow V_y(X) = C_1$

$V_y(X=0) = 0 \rightarrow V_y(X=0) = 0 = C_1 \rightarrow \boxed{V_y(X) = 0 N}$

$\boxed{C_1 = 0 N}$

$M_z(X) = \int [\int q(x).dX]^{0} dX + C_1.X + C_2 \rightarrow M_z(X) = C_2$

$M_z(X=0) = 0 = C_2 \rightarrow \boxed{M_z(X) = 0 N}$

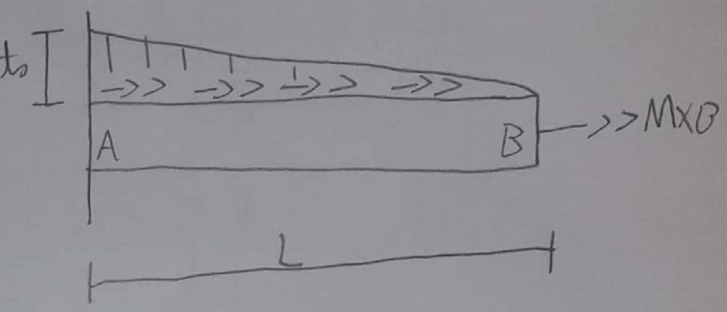
$\boxed{C_2 = 0 N.m}$

Ex - Eq Dif Equil - Torção - 02

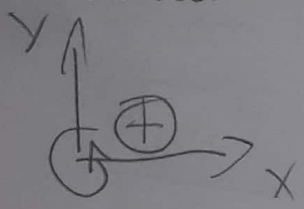
Dados: $M_{xB} = 1000\,N.m$

$t_0 = 500\,N.m/m$

$L = 2\,m$



Convenção Estática



Convenção Resmat

Eq. Dif

$$\frac{dN_x(x)}{dx} = -p(x)$$

$$p(x) = 0$$

$$N_x(x=0) = 0$$

$$N_x(x) = -\int p(x).dx + C_p$$

$$N_x(x) = +C_p$$

$$N_x(x=0) = C_p = 0\,N$$

$$\boxed{N_x(x) = 0\,N}$$

$$\frac{d^2M_{z(x)}}{dx^2} = q(x) \rightarrow q(x) = 0 \rightarrow \left.\frac{dM_{z(x)}}{dx}\right|_{x=0} = 0$$

$$\frac{dM_{z(x)}}{dx} = V_{y(x)} \rightarrow V_y(x=0) = 0$$

$$V_y = \int q(x).dx + C_1 = C_1 \rightarrow C_1 = V_y(x=0) = 0$$

$$\boxed{C_1 = 0\,N} \qquad \boxed{V_y(x) = 0\,N}$$

$$M_z(x) = \iint \left[\int q(x).dx\right] dx + C_1.x + C_2 \rightarrow M_z(x) = C_2$$

$$M_z(x=0) = 0 \rightarrow M_z(x=0) = \boxed{C_2 = 0\,N.m} \Rightarrow \boxed{M_z(x) = 0\,N.m}$$

$$\frac{dM_x(x)}{dx} = -t(x) \rightarrow t_0.\frac{(L-x)}{L} = t(x) \Rightarrow t(x) = \frac{t_0.L - t_0.x}{L}$$

$$M_x(x=L) = M_{xB} \rightarrow M_x(x) = -\int t(x).dx + C_t$$

$$M_x(X) = -\int \left(t_0\frac{(L-X)}{L}\right).dX + Ct = -t_0\int \frac{(L-X)}{L}.dX + Ct$$

$$M_x(X) = -\frac{t_0}{L}\left[L.X - \frac{X^2}{2}\right] + Ct \rightarrow M_x(X=L) = M_{xB}$$

$$M_x(X=L) = M_{xB} = -\frac{t_0}{L}\left[L.(L) - \frac{(L)^2}{2}\right] + Ct \rightarrow M_{xB} = -\frac{t_0.L^2}{L.2} + Ct$$

$$Ct = M_{xB} + \frac{t_0.L^2}{2} = 1000 + \frac{500(2)^2}{2} = 1500\ N.m$$

$$\boxed{Ct = 1500\ N.m}$$

$$M_x(X) = -\frac{t_0}{L}\left[L.X - \frac{X^2}{2}\right] + Ct \rightarrow M_x(x=0) = Ct \rightarrow \boxed{M_x(X=0) = 1500 N.m}$$

$$M_x(X=L) = -t_0\left[L.X - \frac{X^2}{2}\right] + Ct = -t_0\left[L.L - \frac{(L)^2}{2}\right] + Ct$$

$$M_x(X=L) = -t_0\left[\frac{L^2}{2}\right] + Ct = -500\left[\frac{2^2}{2}\right] + 2000 = 1000$$

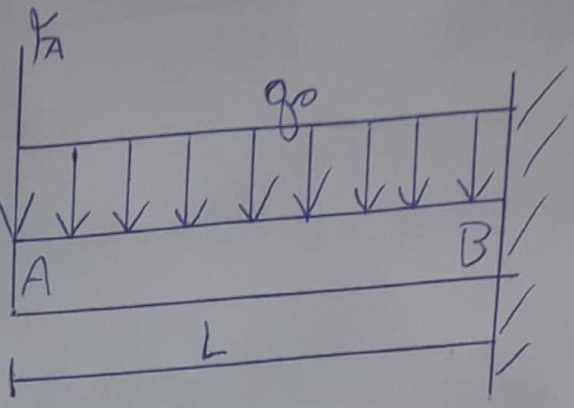
$$\boxed{M_x(X=L) = 1000\ N.m}$$

Exc - Eq Dif Equil - Eleição - 01

Dados: $L = 3m$

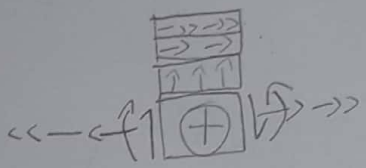
$F_A = 15000\,N$

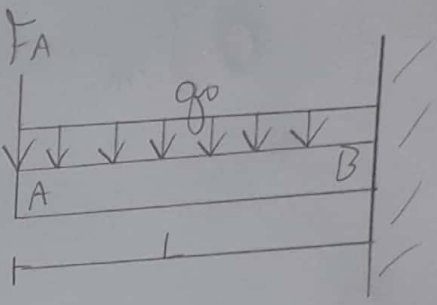
$q_0 = 8000\,N/m$



Estática

Resistência dos Materiais





$$\frac{dN_x(x)}{dx} = -p(x) \rightarrow p(x) = 0 \rightarrow N_x(x=0) = 0\,N$$

$$N_x(x) = -\int \overset{0}{p(x)}\,dx + C_p = C_p \rightarrow N_x(x) = C_p \rightarrow N_x(x=0) = 0 = C_p$$

$$C_p = 0N \rightarrow \boxed{N_x(x) = 0N}$$

$$\frac{dM_x}{dx} = -t(x) \rightarrow t(x) = 0 \rightarrow M_x(x=0) = 0\,N.m$$

$$M_x(x) = -\int \overset{0}{t(x)}\,dx + C_t = C_t \rightarrow M_x(x) = C_t \rightarrow M_x(x=0) = C_t = 0$$

$$C_t = 0N.m \rightarrow \boxed{M_x(x) = 0N.m}$$

$$\frac{dV_y(x)}{dx} = q(x) \rightarrow q(x) = q_0 \rightarrow V_y(x=0) = -F_A$$

$$V_y(x) = \int q(x)\,dx + C_1 = q_0 \cdot x + C_1 \rightarrow V_y(x=0) = q_0 \cdot (0) + C_1$$

$$C_1 = -F_A \rightarrow \boxed{C_1 = -15000N}$$

$$\boxed{V_y(x) = -8000 \cdot x - 15000\,N}$$

$V_y(X=0) = -15000\,N$

$V_y(X=L) = -15000 - 8000 \cdot 3 = -39000\,N = V_y(X=L)$

$\frac{dM_z(X)}{dX} = V_y(X) \rightarrow V_y(X) = -15000 - 8000X = -F_A - q_0 \cdot X$

$M_z(X=0) = 0\,N.m \rightarrow M_z(X) = \int V_y(X)\,dX + C_2$

$M_z(X) = -F_A \cdot X - q_0 \cdot \frac{X^2}{2} + C_2 \Rightarrow M_z(X=0) = C_2 = 0$

$C_2 = +0 \rightarrow C_2 = 0 \rightarrow C_2 = 0\,N.m$

$M_z(X) = -F_A \cdot X - q_0 \cdot \frac{X^2}{2} + C_2 = -15000 \cdot X - 4000X^2 - 0$

$M_z(X=0) = 0\,N.m$

$M_z(X=L) = -15000 \cdot (3) - \frac{8000 \cdot 3^2}{2}$

$M_z(X=L) = -81000\,N.m$