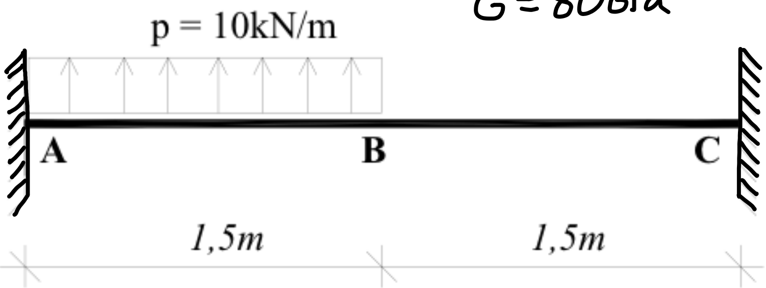
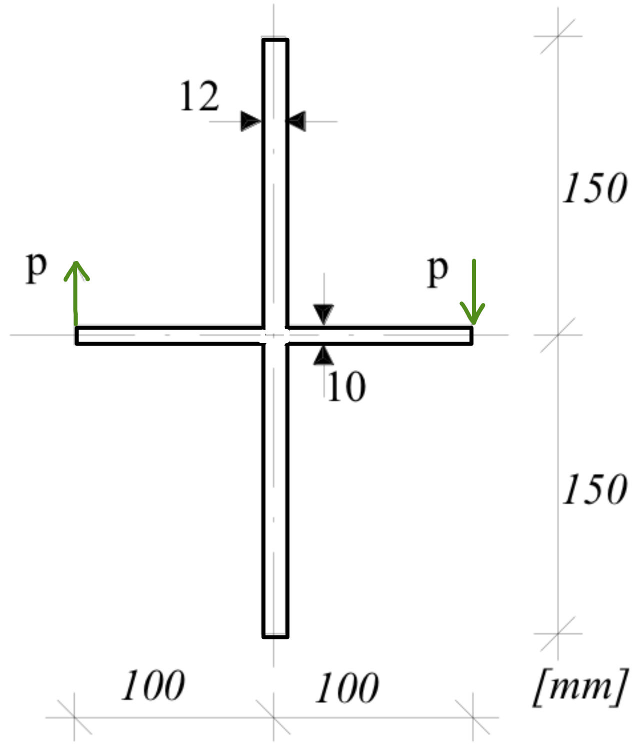
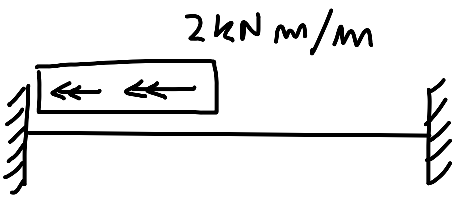
$G = 80\,GPa$



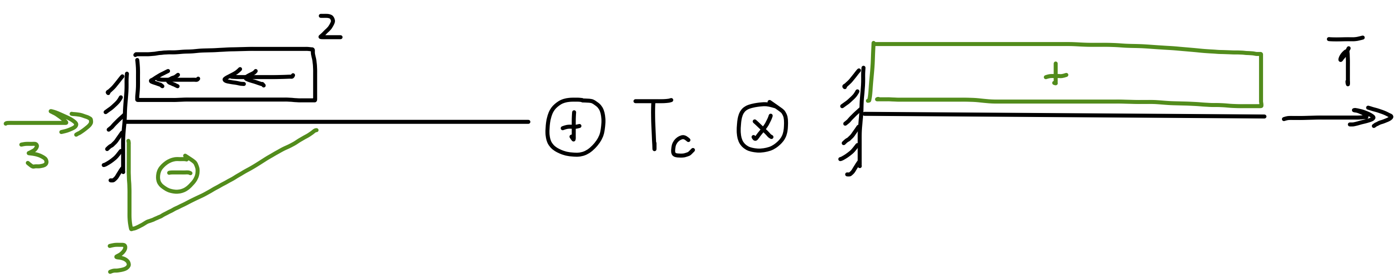


$$\tau = \frac{T}{J}\,\ell$$

$$J = \sum \frac{\ell\, t^3}{3}$$



Método das Forças

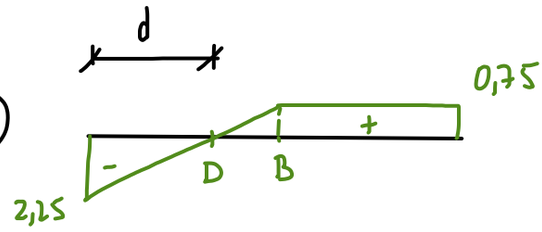


$$\theta_p^c = \frac{1}{GJ}\int (\text{diagrams}) \, dx = -\frac{2{,}25}{GJ}$$

$$\theta_c^c = \frac{1}{GJ}\int (\text{diagram})^2 \, dx = \frac{3}{GJ}$$

$$-2{,}25 + 3\,T_c = 0 \Rightarrow T_c = 0{,}75\ kNm$$

(T)



$$\begin{matrix} 3 & — & 1{,}5 \\ 2{,}25 & — & d \end{matrix} \Big\} \quad d = 1{,}125$$

NOTA: D é o ponto de rotação máxima

$$\theta^{max} = \frac{1}{G\,J} \int_{2{,}25}^{1{,}125} dn = 6{,}6 \times 10^{-2}\ rad = 3{,}78^{\circ}\ (\Leftarrow)$$

$$J = \Sigma \frac{lt^3}{3} = \frac{2}{3}\left(150 \times 12^3 + 100 \times 10^3\right) = 239467\ mm^4$$

$$\tau^{max} = \frac{2{,}25}{J} \times 0{,}012 = 112{,}75\ MPa$$