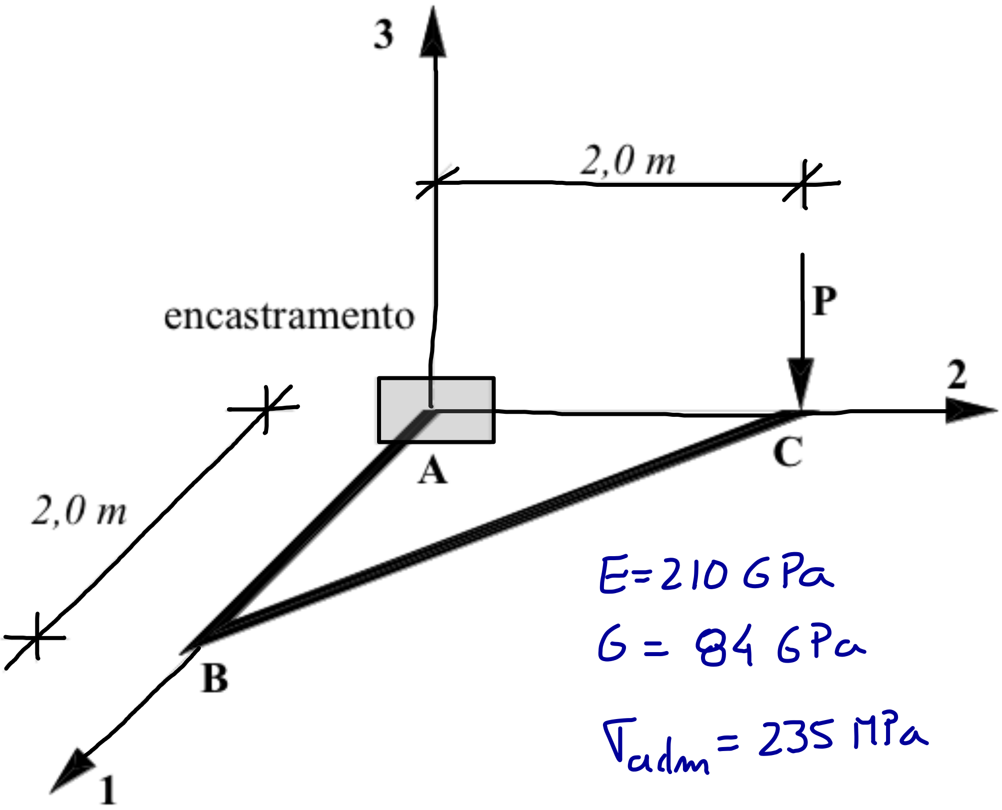
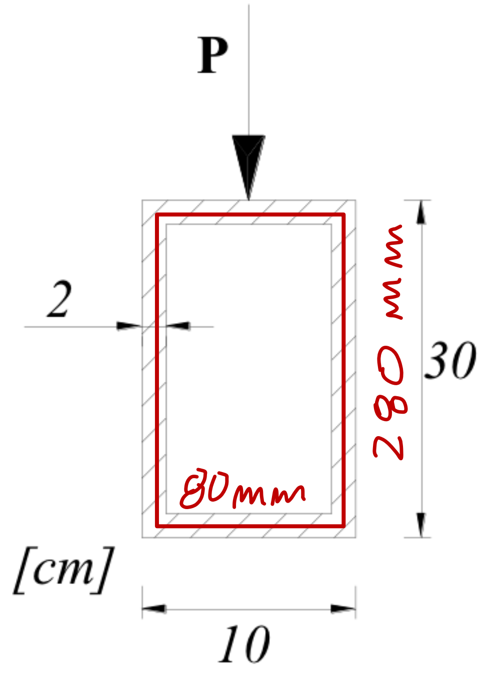


$E = 210\ GPa$

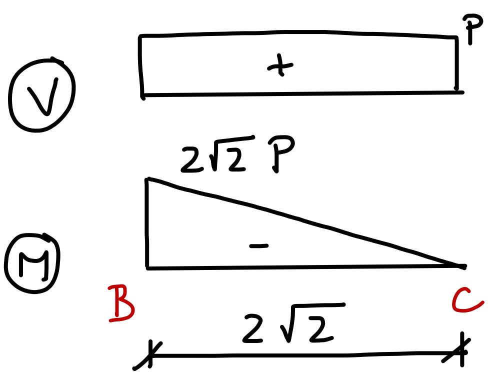
$G = 84\ GPa$

$\sigma_{adm} = 235\ MPa$

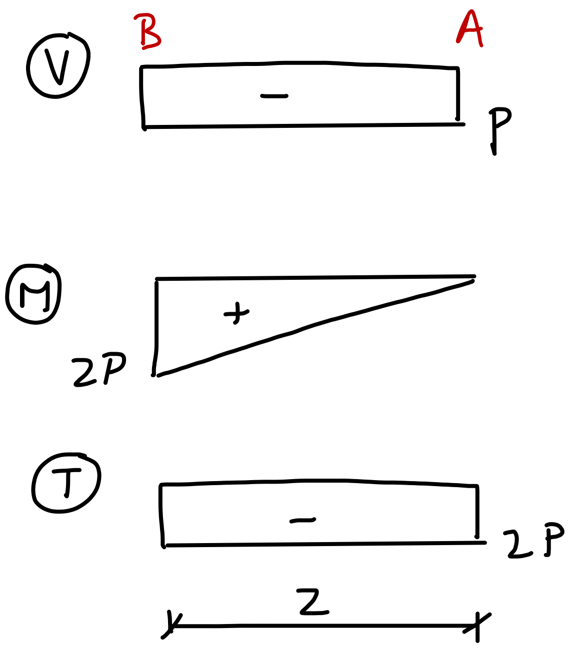


$$I_1 = \frac{100 \times 300^3}{12} - \frac{60 \times 260^3}{12} = 137{,}12 \times 10^6 \ (mm^4)$$

BARRA BC

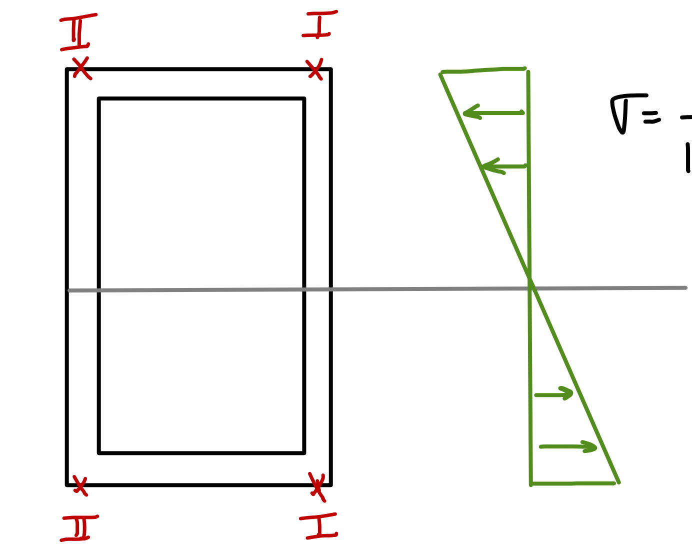


BARRA BA

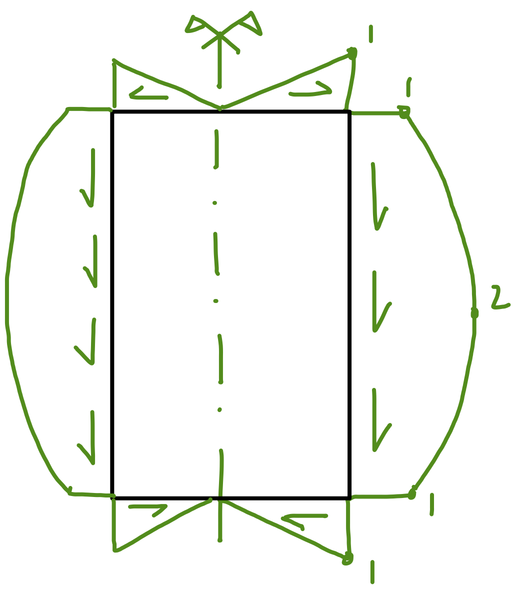


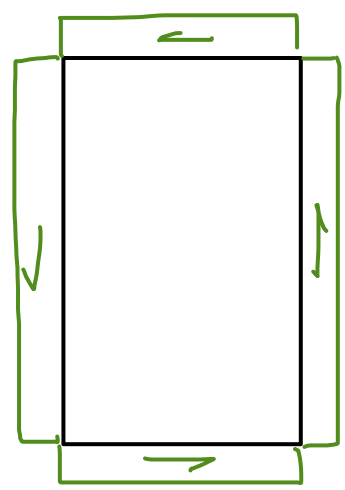
a. Determine o valor máximo da força **P** que pode ser aplicada à estrutura. Utilize o critério de von Mises.

TENSÕES [MPa] P/ ESFORÇOS UNITÁRIOS [kN, m] (positivos)



$$\sigma = \frac{10^6}{137{,}12 \times 10^6} \times 150 = 1{,}094 \text{ MPa}$$





$$T = 2 A_m f$$

$$\tau_1 = \frac{10^3 \times 40 \times 140}{137{,}12 \times 10^6} = 0{,}041 \text{ MPa}$$

$$\tau_2 = 0{,}041 + \frac{10^3 \times \frac{140^2}{2}}{137{,}12 \times 10^6} = 0{,}113 \text{ MPa}$$

$$\tau = \frac{10^6}{2 \times 280 \times 80 \times 20} = 1{,}115 \text{ MPa}$$

SECÇÃO B DA BARRA BC $\rightarrow$ I, II $\rightarrow$ $\sigma_{VM} = P\sqrt{(2\sqrt{2} \times 1{,}094)^2 + 3 \times 0{,}041^2}$

$= 3{,}09P$

SECÇÃO B DA BARRA BA $\rightarrow$ II $\rightarrow$ $\sigma_{VM} = P\sqrt{(2 \times 1{,}094)^2 + 3(0{,}041 + 2 \times 1{,}115)^2}$

$= 4{,}5P$

$4{,}5P = 235 \Rightarrow P = \underline{\underline{52{,}17 \text{ kN}}}$

b. Calcule a rotação da secção **B**.

$$J = \frac{4\,A_m^2}{\oint \frac{1}{t}\,ds} = \frac{4 \times (280 \times 80)^2}{\frac{1}{20}\,(280+80) \times 2} = 55{,}75 \times 10^6 \text{ mm}^4$$

$$\varphi = L \times \alpha = L\,\frac{T}{GJ} = 2 \times \frac{2 \times 52{,}17}{84 \times 10^6 \cdot J} = 0{,}0446 \text{ rad} \rightarrow \underline{\underline{2{,}55^\circ}}$$

$(\nearrow)$