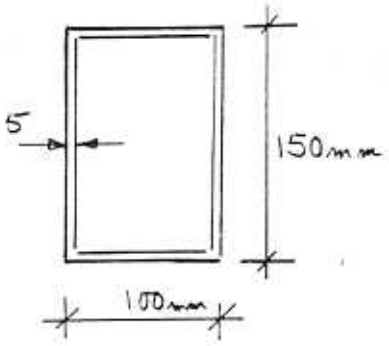
NOTIONS COMPLÉMENTAIRES DE TORSION

EXEMPLE NUMÉRIQUE



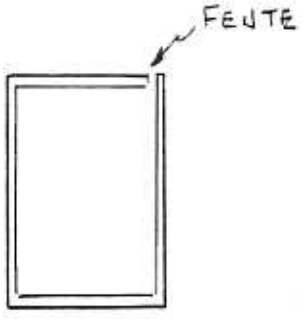
SECTION FERMÉE (TUBE) HSS 150 x 100 x 5

$$\bar{A} = (100-5)\times(150-5) = 13.77\times10^3$$

$$\tau_{xs} = \frac{T}{2\bar{A}t} = \frac{T}{2\times13.77\times10^3\times5} = \frac{T}{137.75\times10^3}$$

$$J = \frac{4\bar{A}^2}{\oint ds/t} = \frac{4\times(13.77\times10^3)^2}{2\left(\frac{145}{5}+\frac{95}{5}\right)} = 7.91\times10^6\ mm^4$$

$$\theta = \frac{TL}{GJ}$$



SECTION OUVERTE (MÊMES DIMENSIONS)

$$J = \frac{1}{3}\sum b_i t_i^3 = \frac{2}{3}(95\times5^3 + 145\times5^3) = 20000$$

$$\tau_{xs} = \frac{Tt}{J} = \frac{T\times5}{20000} = \frac{T}{4000}$$

SOIENT ACIER $E = 200\times10^3$ MPa $\nu = 0.3 \rightsquigarrow G = \frac{E}{2(1+\nu)} = 76.9\times10^3$ MPa

$S_Y = 350$ MPa

$L = 4$ m.

AU DÉBUT DE L'ÉCOULEMENT

SECTION FERMÉE $\rightsquigarrow T_Y = 137.75\times10^3\left(\frac{S_Y}{2}\right) = 24.11$ kN·m (350 TRESCA)

$$\theta_Y = \frac{T_Y L}{GJ} = \frac{24.11\times10^6\times4\times10^3}{76.9\times10^3\times7.91\times10^6} = 0.158\ \text{RAD}\ (9.1^\circ)$$

SECTION OUVERTE $\rightsquigarrow T_Y = 4000\left(\frac{S_Y}{2}\right) = 0.7$ kN·m

$$\theta_Y = \frac{T_Y L}{GJ} = \frac{0.7\times10^6\times4\times10^3}{76.9\times10^3\times20\times10^3} = 1.82\ \text{RAD}\ (104.3^\circ)$$

POUR $\theta = \begin{cases}0.158\ \text{RAD}\\ 9.1^\circ\end{cases}$ $T = 0.061$ kN·m $\tau_{xs} = 15.25$ MPa