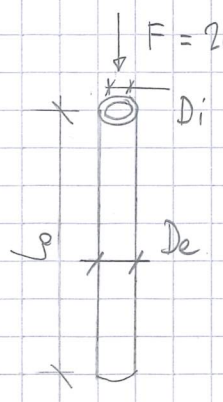
TB_SRM1 Correction Exercices Chapitre 4

Exercice 2



$D_e = 100$ mm, diamètre extérieur

$D_i = 90$ mm, diamètre intérieur

$L_0 = 2$ m

. Contrainte de compression :

$$\sigma = \frac{N}{A_0} = \frac{-F}{\frac{\pi}{4}(D_e^2 - D_i^2)} \quad \text{avec } N = -F$$

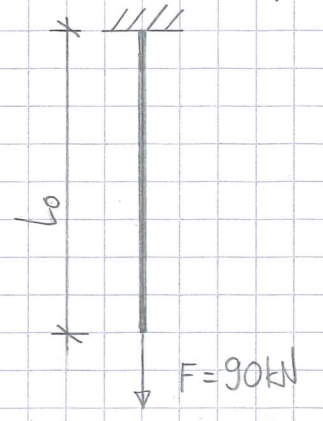
$$= \frac{-200.10^3}{\frac{\pi}{4}(100^2 - 90^2)} = -134 \text{ N/mm}^2$$

. Raccourcissement du tube :

$$\Delta L = \varepsilon_L . L_0 = \frac{\sigma}{E} . L_0 = \frac{N . L_0}{A_0 . E} \quad \text{avec } E = 210 \text{ kN/mm}^2$$

$$= \frac{-200.2.10^3}{\frac{\pi}{4}(100^2 - 90^2).210} = -1,27 \text{ mm}$$

Exercice 1



section rectangulaire

25 mm x 50 mm

$L_0 = 3,5$ m, $\Delta L = 1,2$ mm

. Contrainte normale :

$$\sigma = \frac{N}{A_0} \quad \text{avec } N = F$$

$$= \frac{90.10^3}{25.50} = 72 \text{ N/mm}^2$$

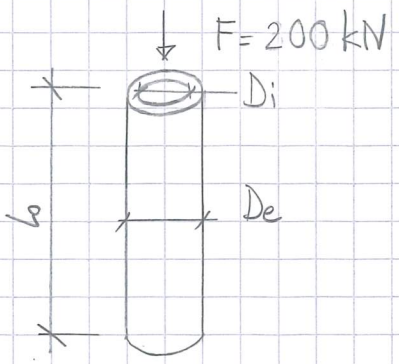
. Déformation :

$$\varepsilon_L = \frac{\Delta L}{L_0} = \frac{1,2}{3,5.10^3} = 0,34 \text{ ‰}$$

. Module de Young :

$$E = \frac{\sigma}{\varepsilon_L} = \frac{72}{0,34 \text{ ‰}} = 210.10^3 \text{ N/mm}^2 = 210 \text{ kN/mm}^2$$

Exercice 3



$D_e = 28\,cm$, $D_i = 26\,cm$

$L_0 = 3\,m$

$\sigma_e = 150\,N/mm^2$

$E = 90\,kN/mm^2$

a) Contrainte :

$$\sigma = \frac{N}{A_0} = \frac{-F}{\frac{\pi}{4}(D_e^2 - D_i^2)} \quad \text{avec } N = -F$$

$$= \frac{-200.10^3}{\frac{\pi}{4}(280^2 - 260^2)} = -24\ N/mm^2$$

Coefficient de sécurité :

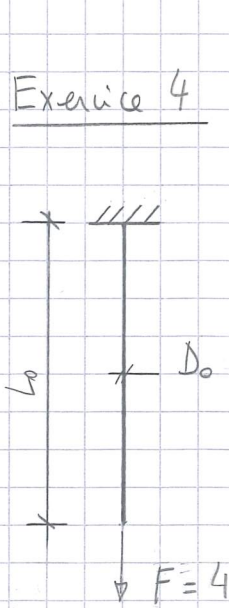
$$s = \frac{\sigma_e}{\sigma} = \frac{-150}{-24} = 6,25$$

b) Raccourcissement :

$$\Delta L = \varepsilon_L L_0 = \frac{\sigma}{E} L_0 = \frac{N . L_0}{A_0 . E}$$

$$= \frac{-200.3.10^3}{\frac{\pi}{4}(280^2 - 260^2).90} = -0,79\ mm$$

Exercice 4



$L_0 = 500\,mm$, $\Delta L = 568\,\mu m$

$D_0 = 16\,mm$, $\Delta D = -5,3\,\mu m$

. Module de Young

$$E = \frac{\sigma}{\varepsilon_L} = \frac{N/A_0}{\Delta L/L_0} = \frac{N . L_0}{A_0 . \Delta L} \quad \text{avec } N = F$$

$$= \frac{48.500}{\frac{\pi}{4} 16^2 . 568.10^{-3}} = \frac{24000}{114} = 210\ kN/mm^2$$

. Coefficient de Poisson

$$\nu = \frac{-\varepsilon_T}{\varepsilon_L} = \frac{-\Delta D/D_0}{\Delta L/L_0}$$

$$= \frac{-(-5,3).10^{-3}/16}{568.10^{-3}/500} = \frac{0,33.10^{-3}}{1,14.10^{-3}} = 0,29$$

. Le matériau est l'acier. ($E = 210\,kN/mm^2$, $\nu = 0,29$)