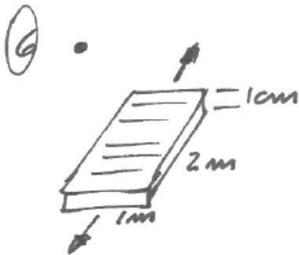


Composites Polymères

Mécanique des composites

Corrections Exo 2025



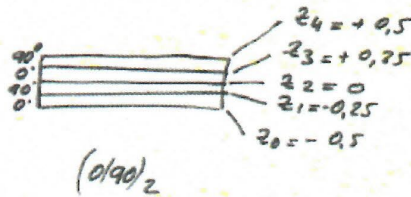
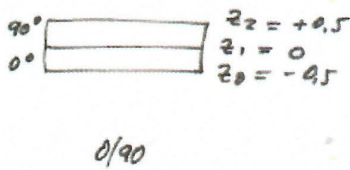
a) $\epsilon_2 = \frac{\sigma_2}{E_2} = 0,01 \rightarrow \Delta y = 4 \cdot \epsilon_2 = 2 \text{ cm}$

$\epsilon_1 = S_{12} \cdot \sigma_2 = -\frac{S_{12}}{E_1} \cdot \sigma_2 = -0,2 \cdot 10^{-3} \rightarrow \Delta x = -0,2 \text{ mm}$

b) $\epsilon_1 = 0 = S_{11} \sigma_1 + S_{12} \sigma_2 \rightarrow \sigma_1 = -\frac{S_{12}}{S_{11}} \cdot \sigma_2 = \nu_{12} \cdot \sigma_2$

$N_x = \sigma_1 \cdot A_x \rightarrow N_x = 4 \cdot 10^5 \text{ N}$
 $= 2 \cdot 10^7 \text{ N/m}^2$

(7)



$$A_{ij} = \bar{a}_{ij}/(0 - (-0,5)) + \bar{a}_{ij}/(0,5 - 0)$$

$$A_{ij} = \frac{1}{2} \bar{a}_{ij}/_{0^{\circ}} + \frac{1}{2} \bar{a}_{ij}/_{90^{\circ}}$$

$$A_{ij} = \bar{a}_{ij}/_{90^{\circ}} (0,25 - (-0,5)) + \bar{a}_{ij}/_{90^{\circ}} (0 - (-0,25)) + \bar{a}_{ij}/_{0^{\circ}} (0,25 - 0) + \bar{a}_{ij}/_{90^{\circ}} (0,5 - 0,25)$$

$$= \frac{1}{2} \bar{a}_{ij}/_{0^{\circ}} + \frac{1}{2} \bar{a}_{ij}/_{90^{\circ}}$$

$$\Rightarrow A_{ij}/(0/90) = A_{ij}/(0/90)_2$$

$$B_{ij}/(0/90) = \dots = -\frac{1}{8} \bar{a}_{ij}/_{0^{\circ}} + \frac{1}{8} \bar{a}_{ij}/_{90^{\circ}}$$

$$B_{ij}/(0/90)_2 = \frac{1}{2} B_{ij}/(0/90) \Rightarrow \text{lozsgue } N \rightarrow \infty \Rightarrow B_{ij} \rightarrow 0$$

$$D_{ij}/(0/90) = D_{ij}/(0/90)_2 = \frac{1}{24} \bar{a}_{ij}/_{0^{\circ}} + \frac{1}{24} \bar{a}_{ij}/_{90^{\circ}}$$

Application

$$\bar{a}_{11}/_{0^{\circ}} = \cos^4 \theta \cdot a_{11} + \dots + \sin^4 \theta \cdot a_{22} = a_{11} = \frac{E_1}{(1 - \nu_{12} \nu_{21})} = 41,1 \text{ GPa}$$

$$\bar{a}_{12}/_{0^{\circ}} = a_{12} \cdot \cos^4 \theta = a_{12} = \frac{\nu_{12} E_2}{(1 - \nu_{12} \nu_{21})} = 3,7 \text{ GPa}$$

$$\bar{a}_{22}/_{0^{\circ}} = a_{22} \cdot \cos^4 \theta = a_{22} = \frac{E_2}{(1 - \nu_{12} \nu_{21})} = 12,3 \text{ GPa}$$

$$\bar{a}_{66}/_{0^{\circ}} = \cos^4 \theta a_{66} = a_{66} = a_{12} = 4 \text{ GPa}$$

$$\bar{a}_{11}/_{90^{\circ}} = \cos^4(90) a_{11} + \dots + \sin^4(90) \cdot a_{22} = a_{22} = 12,3 \text{ GPa}$$

$$\bar{a}_{12}/_{90^{\circ}} = a_{12} \quad \bar{a}_{22}/_{90^{\circ}} = a_{11}$$

$$A_{ij} = \begin{bmatrix} 26,7 & 3,6 & 0 \\ 3,6 & 26,7 & 0 \\ 0 & 0 & 4 \end{bmatrix} \quad B_{ij}/_{0/90} = \begin{bmatrix} 3,59 & 0 & 0 \\ 0 & 3,3 & 0 \\ 0 & 0 & 0 \end{bmatrix} \quad D_{ij} = \begin{bmatrix} 2,22 & 0,31 & 0 \\ 0,31 & 2,22 & 0 \\ 0 & 0 & 0,33 \end{bmatrix}$$

\swarrow N/m \swarrow N $N \cdot m$