

## EPFL-MSE 440 Composite Technology

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Exercises 2024

- 1) The modulus of a UD composite is measured at 250 GPa. The fibres are carbon fibres with a modulus of 400 GPa and the epoxy resin has a modulus of 3 GPa. What is the amount of fibres in this composite ?
- 2) Propose 2 methods for determining the transverse module of a composite with 40% volume of continuous fibres (Modulus= 140 GPa) in an elastomeric polymer of 500 MPa modulus. Determine the 2 moduli with the 2 methods. Compare the 2 obtained values and explain the difference. Compare these transverse moduli with the longitudinal modulus of the same composite.
- 3) Glass fibres ( $E=70\text{GPa}$ ) reinforce PP ( $E= 1\text{ GPa}$ ) in a bumper ( $V_f=0.3$ ) They have an initial length of 3 mm and a diameter of 20  $\mu\text{m}$ . After injection in the mould the fibre length is 400  $\mu\text{m}$ . What is the reduction of modulus induced by the processing ?
- 4) What is the modulus  $E_1$  of the lamina of a (0/90) laminate, 1mm thick, having a  $A_{11}$  coefficient of  $7.5 \cdot 10^{10}\text{ N/mm}$   
Its transverse modulus and Poisson's coefficient are  $E_2= 10\text{ GPa}$ ,  $\nu_{12}=0.2$ ,  $\nu_{21}=0.014$
- 5) Describe the deformation modes of a symmetric laminate loaded only by a torsion moment  $M_{xy}$ .
- 6) What is the effective dilatation coefficient of a kevlar /epoxy laminate containing 40 % of  $45^\circ$  plies, 10 % of  $0^\circ$  and 50% of  $90^\circ$  plies ?