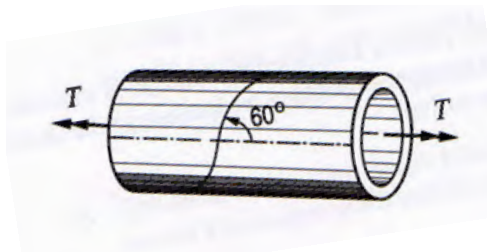


Introduction to materials modelling

7. exercise – orthotropic elastic material model

1. Carbon fibre reinforced epoxy cube (side length 50 mm) is stretched in direction 1, such that the elongation in that direction is 0.5 mm. In direction 3 the cube is supported by rigid frictionless walls and in direction 2 the faces are free. Determine the normal stresses in directions 1 and 3 and strain in direction 2. $E_1 = 155$ GPa, $E_2 = E_3 = 12$ GPa, $\nu_{12} = \nu_{13} = 0.25$, $\nu_{23} = 0.46$.
2. Winded thin-walled tube has a central diameter $d = 50$ mm and the wall $t = 3$ mm. The tube is loaded by a torque $T = 200$ Nm and the length is $L = 500$ mm and the fibre angle is 60° . Determine the change in length of the tube. $E_1 = 40$ GPa, $E_2 = 10$ GPa, $G_{12} = 3$ GPa, $\nu_{12} = 0.25$.



3. Consider a fibre reinforced plate having thickness 20 mm and width in the fibre direction 1 is 800 mm and in the fibre 2 direction 500 mm. Determine the changes in thickness and width. The material coefficients are $E_1 = 40$ GPa, $E_2 = 5$ GPa, $\nu_{12} = 0.3$, $\nu_{13} = 0.2$ and $\nu_{23} = 0.1$.

