Exercise 1

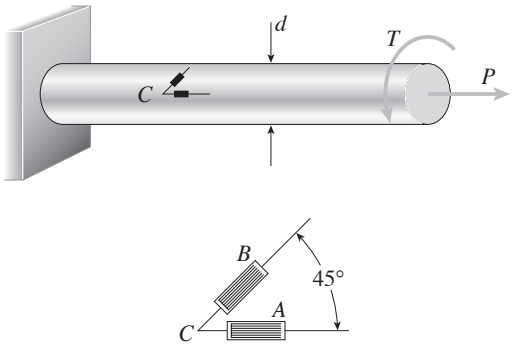


Figure 1: Circular bar and strain gauges A and B

A solid circular bar with a diameter of $d = 32\,\text{mm}$ is subjected to an axial force P and a torque T (see Figure 1). Strain gauges A and B mounted on the surface of the bar give readings $\varepsilon_A = 140 \times 10^{-6}$ and $\varepsilon_B = -60 \times 10^{-6}$. The bar is made of steel having $E = 210\,\text{GPa}$ and $\nu = 0.29$.

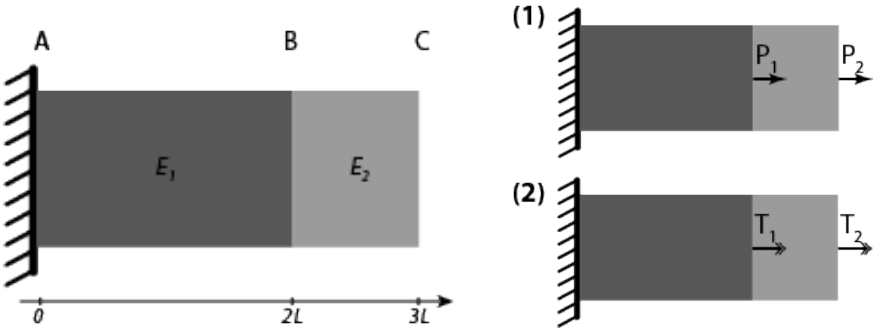
a) Determine the axial force P and the torque T.

b) Determine the maximum shear strain γ_{max} and the maximum shear stress τ_{max} in the bar.

Exercise 2

Reminder about non overconstrained systems : There is no need to use the displacement stiffness method when the system is not overconstrained.

We consider a cylindrical beam made out of two materials as depicted Fig.3a. Its radius is r, young modulus are E_1, E_2 and Poisson ratio are ν_1, ν_2 .



(a) Beam made out of two materials (b) Two configurations

Figure 2

a) For the configuration 1 in Fig.3a (forces),

- What is the internal force in the beam ?
- What is and where is the maximum stress ?
- What is the displacement of points A, B and C ?

b) For the configuration 2 in Fig.3b (torques),

- What is the internal torque in the beam ?
- What is and where is the maximum shear stress ?
- What is the angle of points A, B and C ?