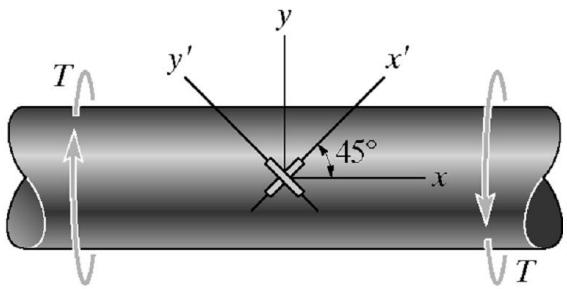
1. Assume zero shear stresses ($\sigma_{xy} = \sigma_{yz} = \sigma_{zx} = 0$). For the case of plane stress ($\sigma_z = 0$), show that the generalized Hooke's law can be written as

$$\sigma_x = \frac{E}{1-\nu^2}\left(\varepsilon_x + \nu\varepsilon_y\right), \qquad \sigma_y = \frac{E}{1-\nu^2}\left(\varepsilon_y + \nu\varepsilon_x\right)$$

2. Consider a circular rod made of aluminum. If it is subjected to a tensile load of 700 N and has a diameter of 20 mm, determine the principal strains at a point on the surface of the rod. E = 73.1 GPa.

3. The shaft has a radius of 15 mm and is made of steel. Determine the strains in the *x'* and *y'* directions if a torque T = 2 kN • m is applied to the shaft. *G* = 75 GPa.



4. A material is subjected to principal stresses σ_x and σ_y. Determine the orientation θ of a strain gauge placed at the point so that its reading of normal strain responds only to σ_y and not to σ_x. The material constants are E and ν.