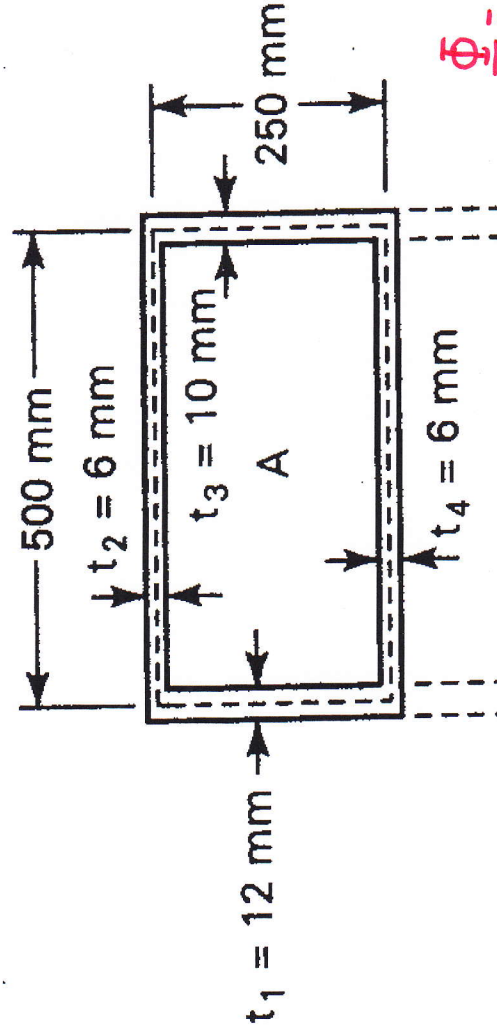


Example

A hollow aluminum tube of rectangular cross section is subjected to a torque of 56.5 kN-m along its longitudinal axis. Determine the shearing stresses and the angle of twist. Assume $G=28 \text{ GPa}$.



$$T = 56.5 \text{ kN}\cdot\text{m}$$

$$\tau_1 = \frac{56.5(10^3) \text{ N}\cdot\text{m}}{2(0.012 \text{ m})(0.5 \text{ m})(0.25 \text{ m})} = 18.83 \text{ MPa}$$

$$\tau_2 = \tau_4 = \frac{56.5(10^3) \text{ N}\cdot\text{m}}{2(0.006 \text{ m})(0.5 \text{ m})(0.25 \text{ m})} = 37.66 \text{ MPa}$$

(a)

$$\tau_3 = \frac{56.5(10^3) \text{ N}\cdot\text{m}}{2(0.01 \text{ m})(0.5 \text{ m})(0.25 \text{ m})} = 22.6 \text{ MPa}$$

$$\frac{\Phi}{L} = \frac{56.5 \text{ kN}\cdot\text{m}}{4[(0.5 \text{ m})(0.25 \text{ m})]^2} \cdot 28(10^9) \frac{\text{N}}{\text{m}^2} \left[\frac{0.25 \text{ m}}{0.012 \text{ m}} + \frac{0.25 \text{ m}}{0.006 \text{ m}} \right]$$

$$= 0.00686 \text{ } ^\circ/\text{m}$$