1. (25 points) A composite plate is composed of two steel and a copper layer. The temperature distribution of the composite plate is raised by 50 °C calculate the stresses in each layer of the composite plate. \( \alpha_{st} = 12 \times 10^{-6}/^\circ C \), \( E_{st} = 210 \text{ GPa} \), \( \alpha_{cu} = 17 \times 10^{-6}/^\circ C \) and \( \frac{E_{cu}}{E_{st}} = \frac{8}{15} \).

2. (25 points) A prismatic block is inserted into a hollow whose the front and back faces are open. If a uniform load \( P \) is applied to the top surface of the block, calculate (a) the changes in the lengths of the edges \( b \) and \( c \), (b) the pressure on the block caused by the rigid side surfaces of the hollow.

3. (25 points) A state of plane stress consists of a tensile stress \( \sigma_0 = 100 \text{ MPa} \) exerted on vertical surfaces and of unknown shearing stresses. Determine (a) the magnitude of the shearing stress \( \tau_0 \) for which the largest normal stress is 140 MPa, (b) the corresponding maximum shearing stress.

4. (25 points) The strains determined by the use of a rosette attached as shown to the surface of a structural component are \( \varepsilon_1 = +110 \mu \), \( \varepsilon_2 = +212.5 \mu \), \( \varepsilon_3 = +240 \mu \). Determine (a) the orientation and magnitude of the principal strains in the plane of the rosette, (b) the maximum in-plane shearing strain, (c) the maximum shearing strain.

5. (25 points) A cylindrical storage tank used to transport gas under pressure has an inside diameter of 800 mm and a wall thickness of 40 mm. Strain gages attached to the surface of the tank in transverse and longitudinal directions indicate strains of 300 \( \mu \) and 80 \( \mu \) respectively. Knowing that a torsion test has shown that the modulus of rigidity of the material used in the tank is \( G = 90 \text{ GPa} \), determine (a) the gage pressure inside the tank, (b) the principal stresses and the maximum shearing stress in the wall of the tank.

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