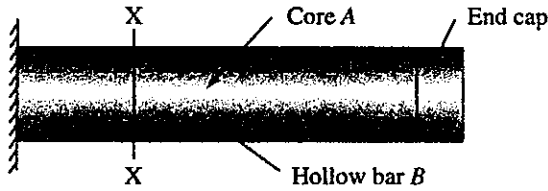


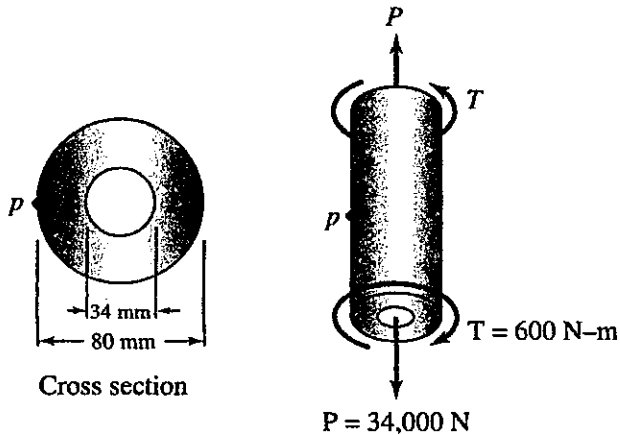
Problem 1 (25%)

The composite bar consists of a cylindrical core A with radius  $R_A$  contained within a hollow cylindrical bar B of a different material with outer radius  $R_B$ . The circular end plate is bonded to the end of the bar. Suppose that an axial torque  $T_0$  is applied to the end plate. Determine the resulting angle of twist of the composite bar.



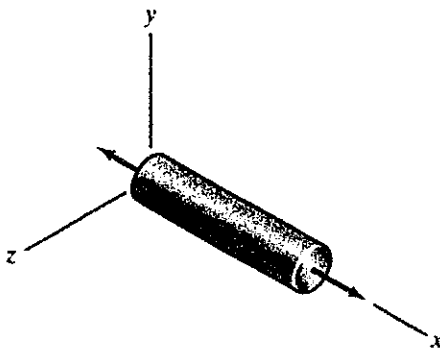
Problem 2 (25%)

A shaft has the hollow circular cross section shown in the figure below. The shaft is subjected to an axial load  $P = 34,000$  N and a torque  $T = 600$  N-m. Determine the principal stresses and the absolute maximum shear stress at a point  $p$  on the outer surface of the shaft.



Problem 3 (25%)

The cylindrical bar consists of an isotropic linear elastic material and is subjected to axial loads. As a result, the bar is subjected to a normal stress  $\sigma_x = 420$  MPa, and the other components of stress are zero. By measuring the changes in the bar's length and diameter, it is determined that the axial strain is  $\epsilon_x = 0.006$  and the lateral strain is  $\epsilon_y = \epsilon_z = -0.002$ . Determine the modulus of elasticity, Poisson's ratio, shear modulus, and bulk modulus of the material.



Problem 4 (25%)

Determine the shear force and bending moment diagrams for the beam shown below and the deflection at point C.

