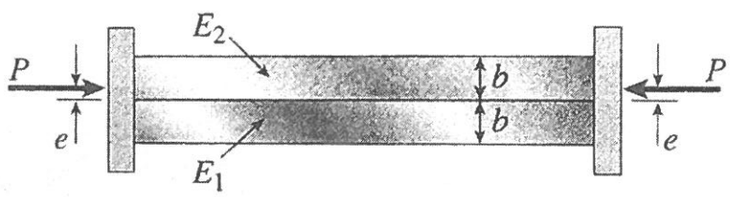
1. A bimetallic bar of square cross section with dimension $2b \times 2b$ is constructed of two different metals having moduli of elasticity E_1 and E_2 as shown in Fig. 1. The two parts of the bar have the same cross sectional dimensions. The bar is compressed by forces P acting through rigid end plates. The line of action of the loads has an eccentricity e of such magnitude that each part of the bar is stressed uniformly in compression.
   (a) Determine the axial forces P_1 and P_2 in the two parts of the bar. (10%)
   (b) Determine the eccentricity e of the loads. (8%)
   (c) Determine the ratio σ_1/σ_2 of the stresses in the two parts of the bar. (7%)



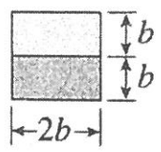


Fig. 1

2. The cross section of a bimetallic strip is shown in Fig. 2. Assume that the moduli of elasticity for metals A and B are E_A=196 GPa and E_B=98 GPa, respectively.
   (a) Determine the section moduli for metals A and B of the beam, respectively. (15%) (Note that the section moduli is defined as the bending moment divided by the maximum bending stress)
   (b) In which material does the maximum stress occur? (10%)

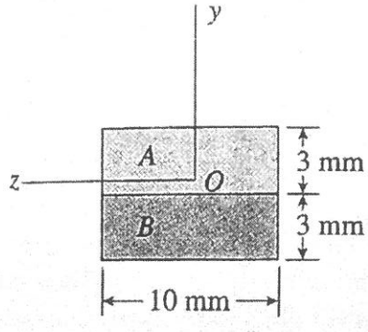


Fig. 2

3. As shown in Fig. 3, the joint is subjected to a force of P = 2 kN and F = 2 kN. The member has a rectangular cross-sectional area of width 18 mm and thickness 12 mm.
(a) Determine the state of stress at point A. (10%)
(b) Determine the state of stress at point B. (10%)
(c) Sketch the results on differential elements located at points A and B. (6%)

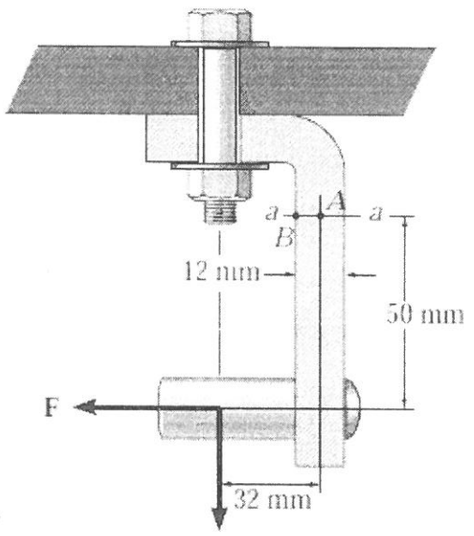


Fig. 3

4. As shown in Fig. 4, the steel pipe has an inner diameter of 70 mm and an outer diameter of 80 mm. If it is fixed at *C* and subjected to the horizontal 100-N force acting on the handle of the pipe wrench at its end, determine the principal stresses in the pipe at point *A*, which is located on the surface of the pipe. (24%)

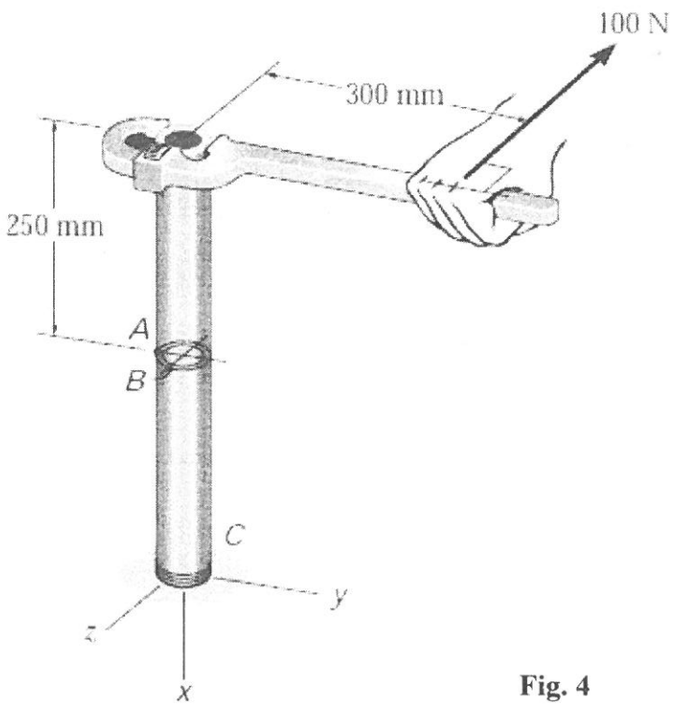


Fig. 4