

1. A solid circular bar with fixed ends is acted upon by two oppositely directed torques T_0 and $2T_0$ at locations shown in figure 1. Obtain formulas for the reactive torques T_a and T_b , the angle of twist ϕ_m at the midsection of the bar, and the strain energy U of the circular bar AB.

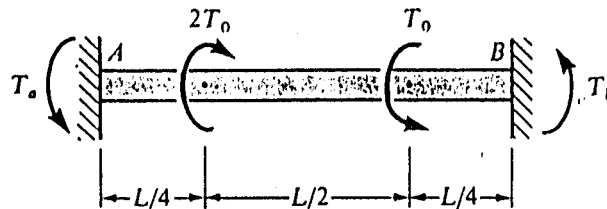


Figure 1

2. A horizontal bracket ABC (see figure 2) consists of two perpendicular arms AB and BC, the latter having a length of 0.4 m. Arm AB has a solid circular cross section with diameter equal to 64 mm. At point C a load $P_1=4$ kN acts vertically and a load $P_2=6$ kN acts horizontally parallel to arm AB. Considering only the forces P_1 and P_2 , calculate the maximum tensile stress σ_t , the maximum compressive stress σ_c , and the maximum in-plane shear stress τ_{max} at point p, which is located support A on the side of the bracket at midheight.

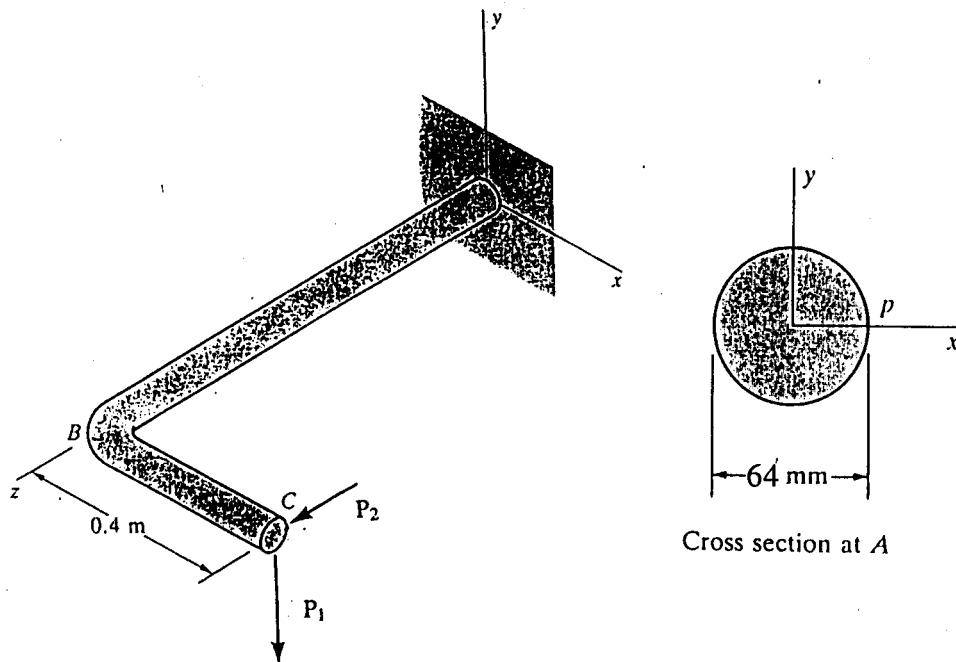


Figure 2

3. A steel beam ABC is simply supported at A and held by a high-strength steel wire at B (see figure 3). A load $P=240$ lb acts at the free end C. The wire has axial rigidity $EA=200 \times 10^3$ lb, and the beam has flexural rigidity $EI=20 \times 10^6$ lb-in.² If $b=10$ in., what is the deflection δ_c of point C due to the load p ?

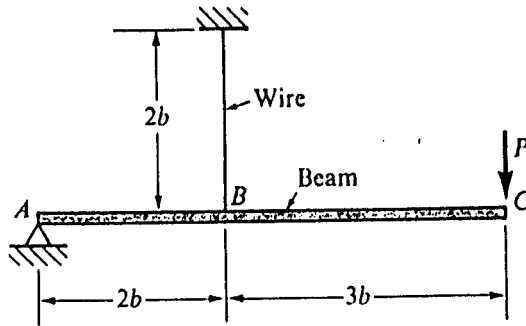


Figure 3

4. Determine the reactions R_a , R_b , and M_a for the propped cantilever beam with an overhang (see figure 4). Also, draw the shear-force and bending-moment diagrams for the beam, labeling all critical ordinates.

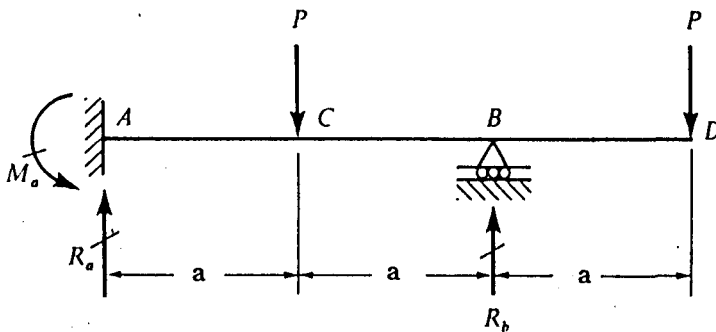


Figure 4