Problem 3.3-9  Three identical circular disks A, B, and C are welded to the ends of three identical solid circular bars (see figure). The bars lie in a common plane and the disks lie in planes perpendicular to the axes of the bars. The bars are welded at their intersection D to form a rigid connection. Each bar has diameter \( d_1 = 0.5 \) in. and each disk has diameter \( d_2 = 3.0 \) in.
Forces \( P_1, P_2, \) and \( P_3 \) act on disks A, B, and C, respectively, thus subjecting the bars to torsion. If \( P_1 = 28 \) lb, what is the maximum shear stress \( \tau_{\text{max}} \) in any of the three bars?

Problem 3.4-5  A hollow tube \( ABCDE \) constructed of monel metal is subjected to five torques acting in the directions shown in the figure. The magnitudes of the torques are \( T_1 = 1000 \) lb-in., \( T_2 = T_4 = 500 \) lb-in., and \( T_3 = T_5 = 800 \) lb-in. The tube has an outside diameter \( d_2 = 1.0 \) in. The allowable shear stress is 12,000 psi and the allowable rate of twist is 2.00/ft.
Determine the maximum permissible inside diameter \( d_1 \) of the tube.

Problem 3.4-12  A prismatic bar \( AB \) of length \( L \) and solid circular cross section (diameter \( d \)) is loaded by a distributed torque of constant intensity \( t \) per unit distance (see figure).
(a) Determine the maximum shear stress \( \tau_{\text{max}} \) in the bar.
(b) Determine the angle of twist \( \phi \) between the ends of the bar.

Problem 3.5-9  A solid steel bar \((G = 11.8 \times 10^6 \text{ psi})\) of diameter \( d = 2.0 \) in. is subjected to torques \( T = 8.0 \) k-in. acting in the directions shown in the figure.
(a) Determine the maximum shear, tensile, and compressive stresses in the bar and show these stresses on sketches of properly oriented stress elements.
(b) Determine the corresponding maximum strains (shear, tensile, and compressive) in the bar and show these strains on sketches of the deformed elements.
Problem 3.8-1 A solid circular bar $ABCD$ with fixed supports is acted upon by torques $T_0$ and $2T_0$ at the locations shown in the figure.

Obtain a formula for the maximum angle of twist $\phi_{\text{max}}$ of the bar. (Hint: Use Eqs. 3-46a and b of Example 3-9 to obtain the reactive torques.)