

The following problems are designed to be solved with a computer. Write each program so that it can be used with either SI or U.S. customary units and in such a way that solid cylindrical elements may be defined by their cross-sectional area.

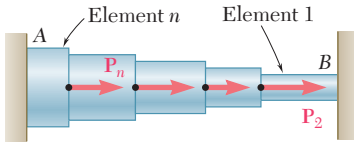


Fig. P2.C2

2.C2 Rod AB is horizontal with both ends fixed; it consists of n elements, each of which is homogeneous and of uniform cross section, and is subjected to the loading shown. The length of element i is denoted by L_i , its cross-sectional area by A_i , its modulus of elasticity by E_i , and the load applied to its right end by \mathbf{P}_i , the magnitude P_i of this load being assumed to be positive if \mathbf{P}_i is directed to the right and negative otherwise. (Note that $P_1 = 0$.) (a) Write a computer program that can be used to determine the reactions at A and B , the average normal stress in each element, and the deformation of each element. (b) Use this program to solve Prob. 2.41.

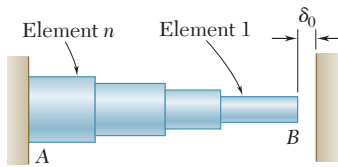


Fig. P2.C3

2.C3 Rod AB consists of n elements, each of which is homogeneous and of uniform cross section. End A is fixed, while initially there is a gap δ_0 between end B and the fixed vertical surface on the right. The length of element i is denoted by L_i , its cross-sectional area by A_i , its modulus of elasticity by E_i , and its coefficient of thermal expansion by α_i . After the temperature of the rod has been increased by ΔT , the gap at B is closed and the vertical surfaces exert equal and opposite forces on the rod. (a) Write a computer program that can be used to determine the magnitude of the reactions at A and B , the normal stress in each element, and the deformation of each element. (b) Use this program to solve Prob. 2.53.

2.41 Two cylindrical rods, one of steel and the other of brass, are joined at C and restrained by rigid supports at A and E . For the loading shown and knowing that $E_s = 200$ GPa and $E_b = 105$ GPa, determine (a) the reactions at A and E , (b) the deflection of point C .

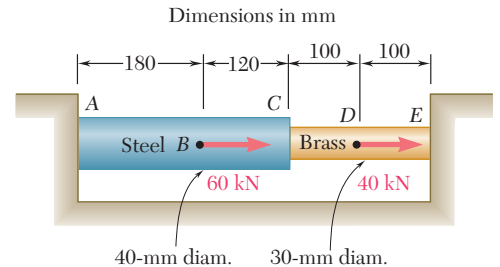


Fig. P2.41

2.53 A rod consisting of two cylindrical portions AB and BC is restrained at both ends. Portion AB is made of steel ($E_s = 29 \times 10^6$ psi, $\alpha_s = 6.5 \times 10^{-6}/^\circ\text{F}$) and portion BC is made of aluminum ($E_a = 10.4 \times 10^6$ psi, $\alpha_a = 13.3 \times 10^{-6}/^\circ\text{F}$). Knowing that the rod is initially unstressed, determine (a) the normal stresses induced in portions AB and BC by a temperature rise of 70°F , (b) the corresponding deflection of point B .

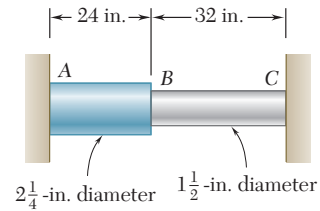


Fig. P2.53