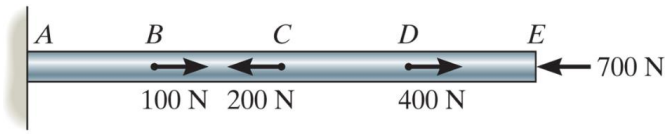
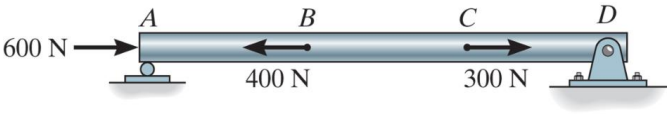
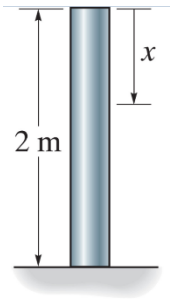
Chapter 4 Lecture Problems

Examples

Calculate the normal internal loadings in each section.

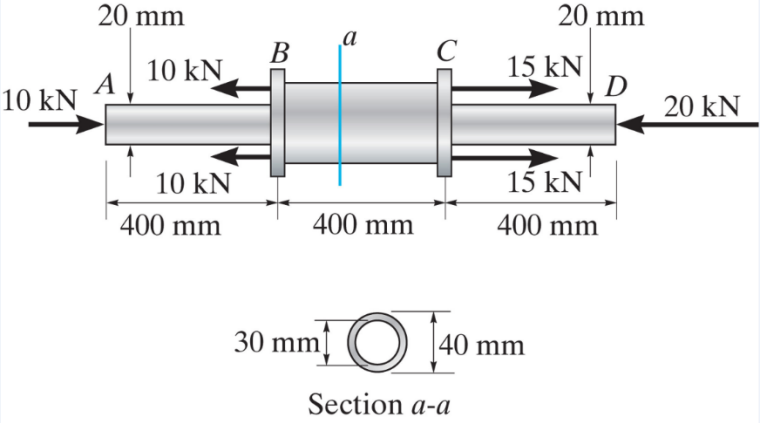






Problem F4-2

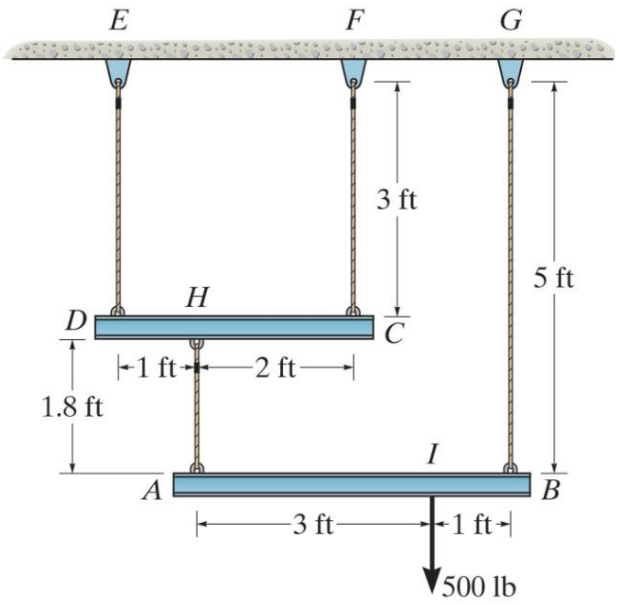
Segments AB and CD of the assembly are solid circular rods, and segment BC is a tube. If the assembly is made of 6061-T6 aluminum, determine the displacement of end D with respect to end A.



Section *a-a*

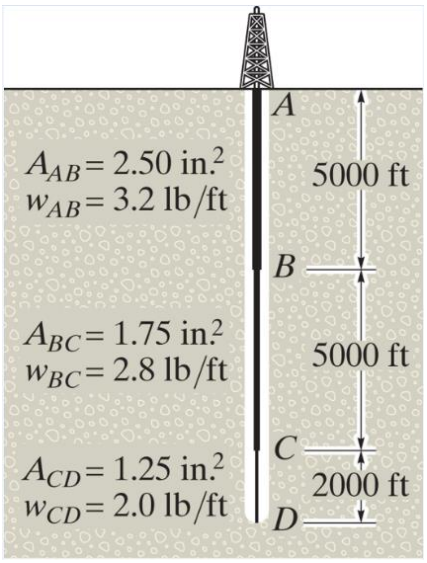
Problem 4-12

The load is supported by the four 304 stainless steel wires that are connected to the rigid members AB and DC. Determine the angle of tilt of each member after the 500-lb load is applied. The members were originally horizontal, and each wire has a cross-sectional area of 0.025 in^2.



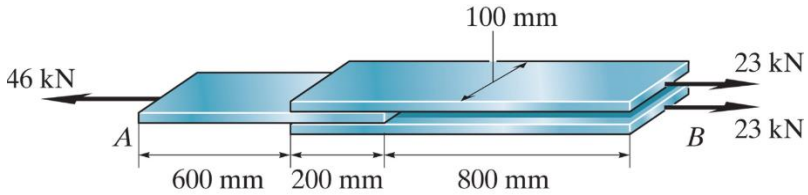
Problem 4-20

The A992 steel drill shaft of an oil well extends 12000 ft into the ground. Assuming that the pipe used to drill the well is suspended freely from the derrick at A, determine the maximum average normal stress in each pipe segment and the elongation of its end D with respect to the fixed end at A. The shaft consists of three different sizes of pipe, AB, BC, and CD, each having the length, weight per unit length, and cross-sectional area indicated.



Chapter 4 Lecture Problems

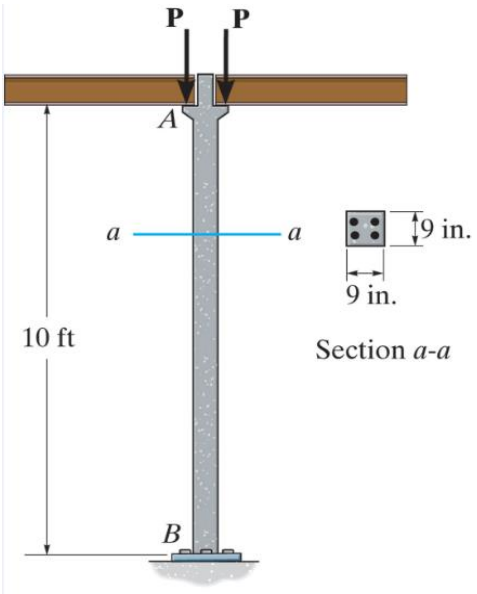
Problem 4-122



The joint is made from three A992 steel plates that are bonded together at their seams. Determine the displacement of end A with respect to end B when the joint is subjected to the axial loads shown. Each plate has a thickness of 5 mm.

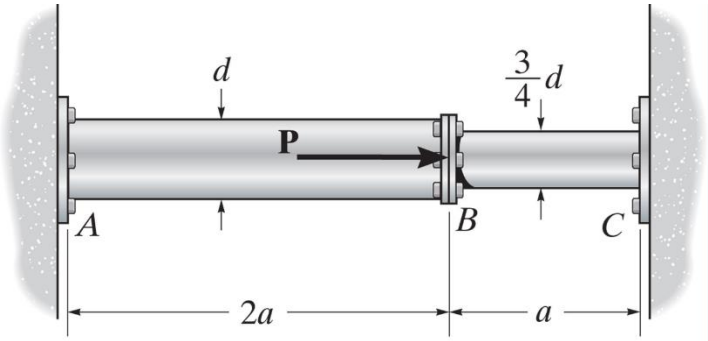
Problem 4-34

If column AB is made from high strength pre-cast concrete and reinforced with four ¾ in diameter A-36 steel rods, determine the average normal stress developed in the concrete and in each rod. Set P= 75 kip.



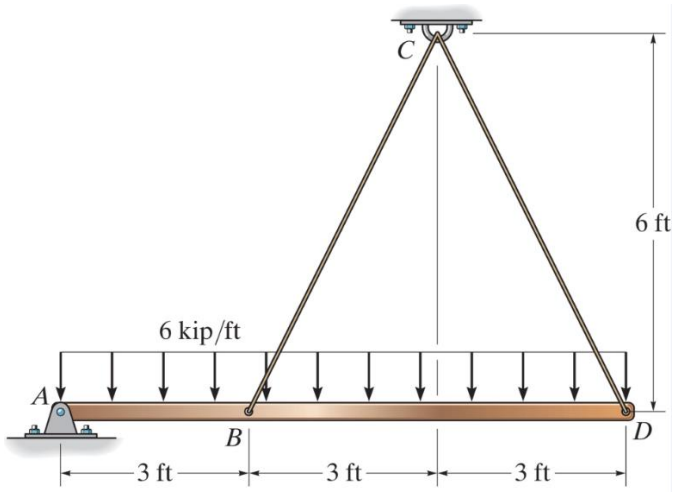
Problem 4-36

Determine the support reactions at the rigid supports A and C. The material has a modulus of elasticity of E.



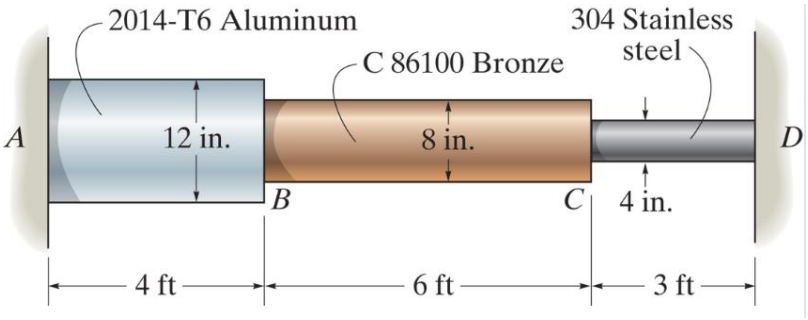
Problem 4-52

The rigid bar is originally horizontal and is supported by two cables each having a cross-sectional area of 0.5 in^2, and E = 31(10^3) ksi. Determine the slight rotation of the bar when the uniform load is supplied.



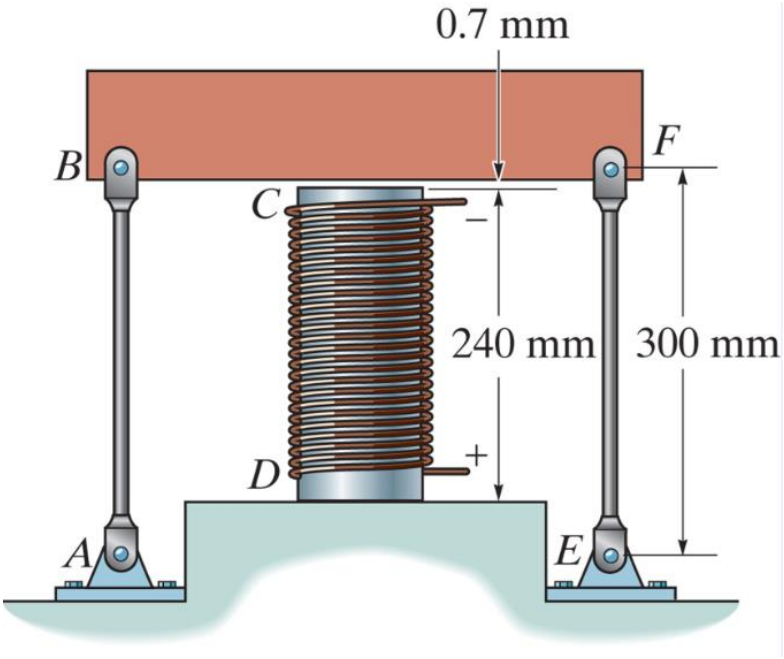
Problem 4-69

The assembly has the diameters and material makeup indicated. If it fits securely between its fixed supports when the temperature is T_1=70°F, determine the average normal stress in each material when the temperature reaches T_2=110°F.

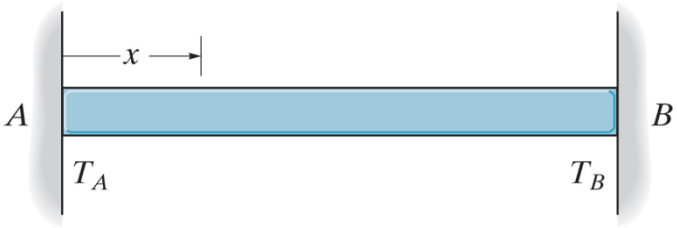


Problem 4-85

The center rod CD of the assembly is heated from T_1=30°C to T_2=180°C using electrical resistance heating. Also, the two end rods AB and EF are heated from T_1=30°C to T_2=50°C. At the lower temperature T_1 the gap between C and the rigid bar is 0.7 mm. Determine the force in rods AB and EF caused by the increase in temperature. Rods AB and EF are made of steel, and each has a cross-sectional area of 125 mm^2. CD is made of aluminum and has a cross sectional area of 375 mm^2. E_{St}=200 GPa, E_{Al}=70 GPa, α_{St}=12(10-6)/°C, and α_{Al}=23(10-6)/°C.



Problem 4-77



The bar has a cross-sectional area A, length L, modulus of elasticity E, and coefficient of thermal expansion α. The temperature of the bar changes uniformly along its length from T_A at A to T_B at B so that at any point x along the bar $T=T_A+x(T_B-T_A)/L$. Determine the force the bar exerts on the rigid walls. Initially no axial force is in the bar and the bar has a temperature of T_A.

Problem 4-92

Determine the maximum normal stress developed in the bar when it is subjected to a tension of P=2 kip.