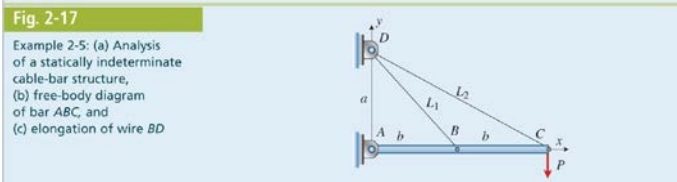
材料力學　作業 4

學號：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿姓名：＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿＿

Example 2-5

A horizontal *rigid* bar *ABC* is pinned at end *A* and supported by two wires (*BD* and *CD*) at points *B* and *C* (Fig. 2-17). A vertical load *P* acts at end *C* of the bar. The bar has a length of 2*b* and wires *BD* and *CD* have lengths of L_1 and L_2, respectively. Also, wire *BD* has a diameter of d_1 and modulus of elasticity E_1; wire CD has a diameter of d_2 and modulus E_2.

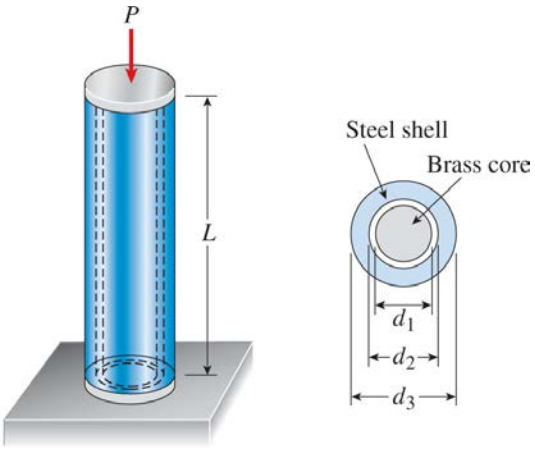


Calculate the allowable load *P* for the following conditions: Wire *BD* is made of aluminum with a modulus $E_1 = 72$ GPa and a diameter of $d_1 = 4.2$ mm. Wire *CD* is made of magnesium with a modulus $E_2 = 45$ GPa and a diameter of $d_2 = 3.2$ mm. The allowable stresses in the aluminum and magnesium wires are $\sigma_1 = 200$ GPa and $\sigma_2 = 172$ GPa, respectively. Dimensions are $a = 1.8$ m and $b = 1.2$ m in Fig. 2-17.

2.4-1 The assembly shown in the figure consists of a brass core (diameter $d_1 = 6$ mm) surrounded by a steel shell (inner diameter $d_2 = 7$ mm, outer diameter $d_3 = 9$ mm). A load P compresses the core and shell, which have length $L = 85$ mm. The moduli of elasticity of the brass and steel are $E_b = 100$ GPa and $E_s = 200$ GPa, respectively.

(a) What load P will compress the assembly by 0.1 mm?

(b) If the allowable stress in the steel is 180 MPa and the allowable stress in the brass is 140 MPa, what is the allowable compressive load P_{allow} ? (*Suggestion:* Use the equations derived in Example 2-6.)



2.4-9 The aluminum and steel pipes shown in the figure are fastened to rigid supports at ends A and B and to a rigid plate C at their junction. The aluminum pipe is twice as long as the steel pipe. Two equal and symmetrically placed loads P act on the plate at C.

(a) Obtain formulas for the axial stresses σ_a and σ_s in the aluminum and steel pipes, respectively.

(b) Calculate the stresses for the following data: $P = 50$ kN, cross-sectional area of aluminum pipe $A_a = 6000 mm^2$, cross-sectional area of steel pipe $A_s = 600 mm^2$, modulus of elasticity of aluminum $E_a = 70$ GPa, and modulus of elasticity of steel $E_s = 200$ GPa.