COE-C2001 - Foundations of Solid Mechanics

Assignment for Week-1

(1) Deadline: 12:00, Monday, November 8, 2021

(2) Free format submission

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1. Two solid cylindrical rods AB and BC are welded together at B and loaded as shown. Knowing that the average normal stress must not exceed 200 MPa in rod AB and 170 MPa in rod BC, determine the smallest allowable values of d_1 and d_2. (10 points)

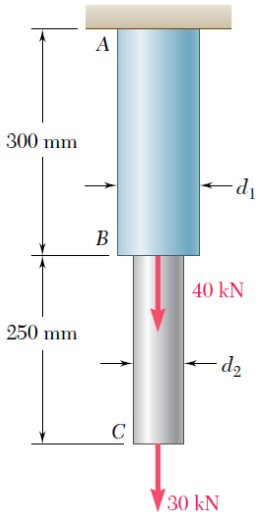
2. Two solid cylindrical rods AB and BC are welded together at B and loaded as shown. Knowing that d_1=30 mm and d_2=20 mm, find the average normal stress at the midsection of (a) rod AB, (b) rod BC. (10 points)

3. Two brass rods AB and BC, each of uniform diameter, will be brazed together at B to form a nonuniform rod of total length 100 m which will be suspended from a support at A as shown. Knowing that the density of brass is 8470 kg/m^3, determine (a) the length of rod AB for which the maximum normal stress in ABC is minimum, (b) the corresponding value of the maximum normal stress. (20 points)

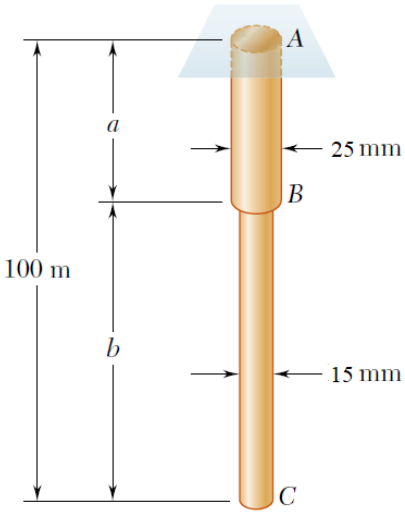
4. At room temperature (20°C) a 0.5-mm gap exists between the ends of the rods shown. At a later time when the temperature has reached 150°C, determine (a) the normal stress in the aluminium rod, (b) the change in length of the aluminium rod. (20 points)

5. 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. (20 points)

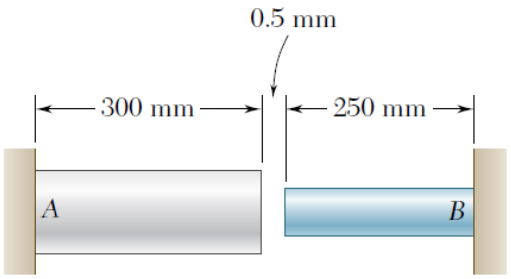
6. As shown in below, a rigid beam is supported by three springs with different spring constants of k_A, k_B, and k_C ($k_A = 2k_B = 4k_C$). The deadweight of the rigid beam is $5wL$. Determine the reaction forces of R_A, R_B, and R_C. (20 points)



Q1 & Q2



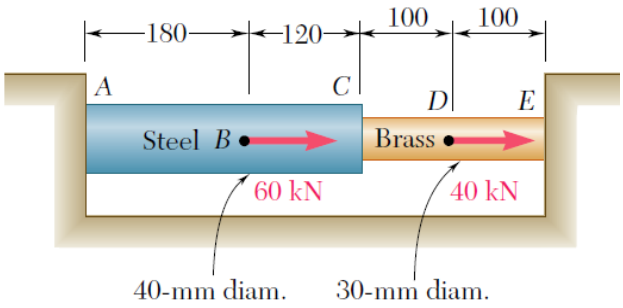
Q3



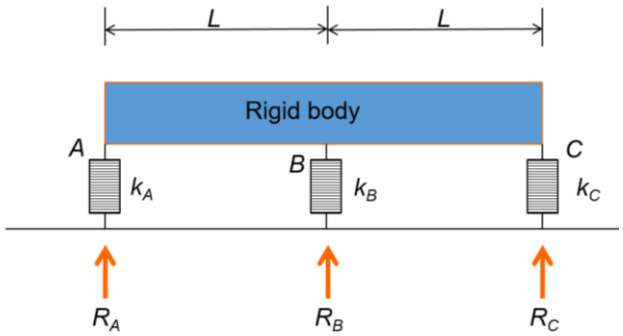
Aluminum
$A = 2000\ \text{mm}^2$
$E = 75\ \text{GPa}$
$\alpha = 23 \times 10^{-6}/^{\circ}\text{C}$

Stainless steel
$A = 800\ \text{mm}^2$
$E = 190\ \text{GPa}$
$\alpha = 17.3 \times 10^{-6}/^{\circ}\text{C}$

Q4



Q5



Q6