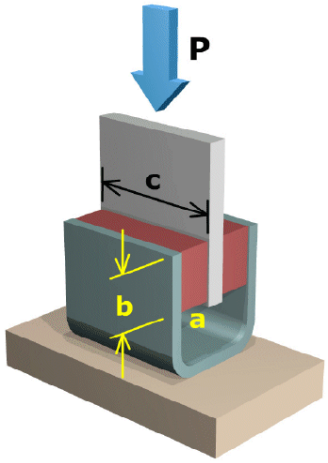
IDE 110 - Mechanics of Materials - Winter 2006

Name:

Exam 1 – Stress; Strain; Axial Structures

Section: D

1. Two hard rubber blocks are used in an anti-vibration mount to support a small machine as shown. An applied load of P = 150 lb causes a downward deflection of 0.25 in. Determine the shear modulus G of the rubber blocks. Assume a = 0.5 in, b = 1.0 in, and c = 2.5 in.



Write legibly – box answers
Include proper units

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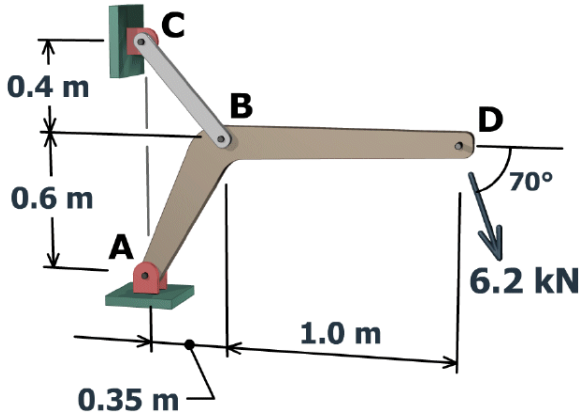
2. Rigid bar ABD is supported by a pin connection at A and a tension link BC. The 8-mm-diameter pin at A is supported in a double-shear connection, and the 12-mm-diameter pins at B and C are both used in single shear connections. Link BC is 30 mm wide and 6 mm thick. The ultimate shear strength of the pins in 330 MPa, and the yield strength of link BC is 250 MPa.

Determine:

(a) The factor of safety in pin B with respect to the ultimate shear strength.

(b) The factor of safety in link BC with respect to the yield strength.



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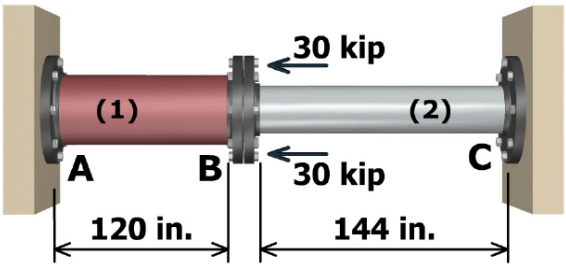
3. A steel [E = 30,000 ksi] pipe column with a cross-sectional area of $A_1 = 5.60\ in^2$ is connected at flange B to an aluminum alloy [E = 10,000 ksi] pipe with cross-sectional area of $A_2 = 4.40\ in^2$. The assembly is connected to rigid supports at A and C. Determine the normal stresses in steel pipe (1) and aluminum pipe (2).



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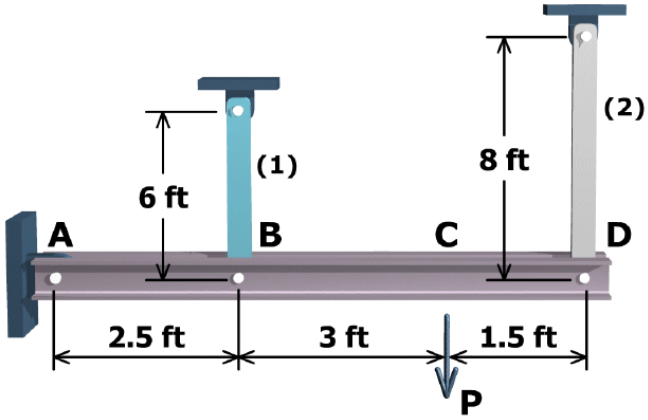
4. A load P will be supported by a structure consisting of a rigid bar ABCD. A polymer [E = 2,300 ksi, $\alpha = 2.9 \times 10^{-6}/^{o}F$] bar (1) and an aluminum alloy [E = 10,000 ksi, $\alpha = 12.5 \times 10^{-6}/^{o}F$] bar (2). Each bar has a cross-sectional area of 2.00 in^2. The bars are unstressed when the structure is assembled at $30^{o}F$. After a concentrated load of P = 26 kips is applied and the temperature is increased to $100^{o}F$, determine the normal stresses in bars (1) and (2).



Write legibly – box answers
Include proper units