Chapter 3 Lecture Problems

Problem F3-9

A 10 mm diameter rod has a modulus of elasticity of E=100 GPa. If it is 4 m long and subjected to an axial tensile load of 6 kN, determine its elongation. Assume linear-elastic behavior.

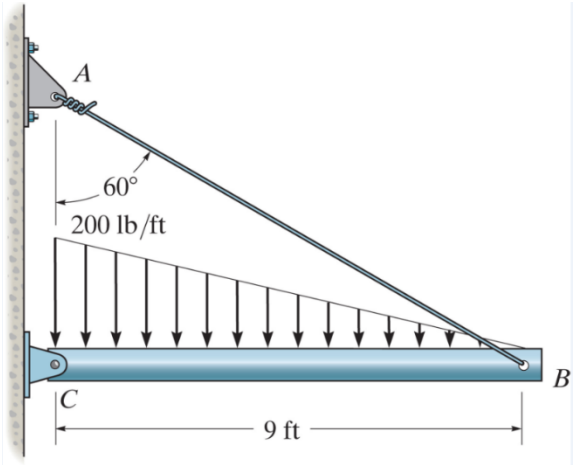
Chapter 3 Lecture Problems

Problem 3-6

A specimen is originally 1 ft long, has a diameter of 0.5 in, and is subjected to a force of 500 lb. When the force is increased from 500 lb to 1800 lb, the specimen elongates 0.009 in. Determine the modulus of elasticity for the material if it remains linear elastic.

Problem 3-8

The strut is supported by a pin at C and an A-36 steel guy wire AB. If the wire has a diameter of 0.2 in, determine how much it stretches when the distributed load acts on the strut.



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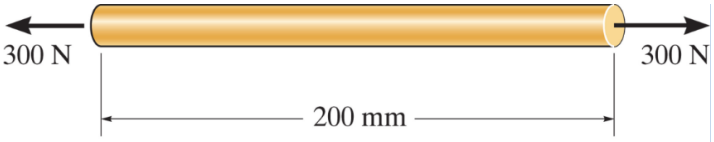
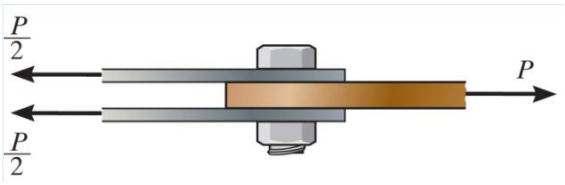
Problem 3-25

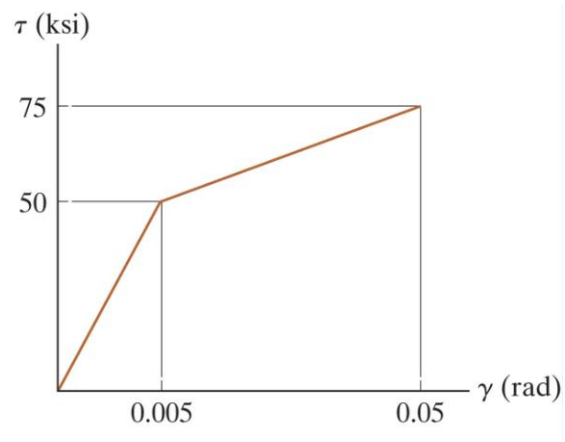


The acrylic plastic rod is 200 mm long and 15 mm in diameter. If an axial load of 300 N is applied to it, determine the change in its length and the change in its diameter. E_p= 2.7 GPa, ν_p= 0.4.

Problem 3-31

The lap joint is connected together using a 1.25 in diameter bolt. If the bolt is made from a material having a shear stress-strain diagram that is approximated as shown, determine the permanent shear strain in the shear plane of the bolt when the applied force P=150 kip is removed.

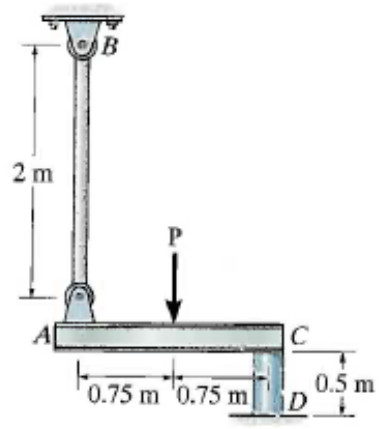


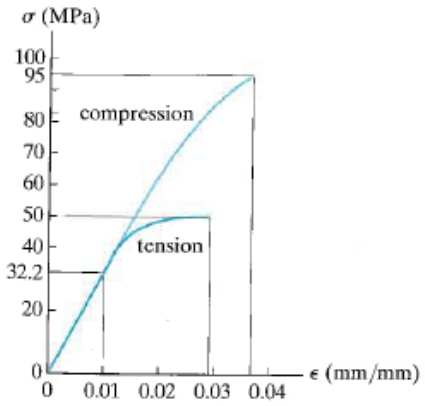


Chapter 3 Lecture Problems

Example 1

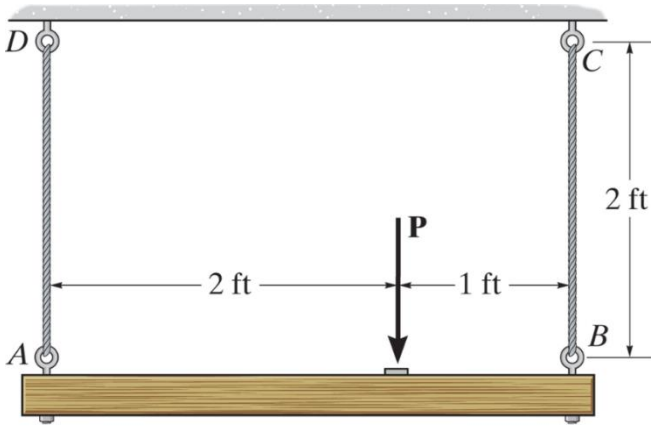
The stress-strain diagram for a polyester resin is given in the figure. If the rigid beam is supported by a strut AB and post CD made from this material, determine the largest load P that can be applied to the beam before it ruptures. Determine the final diameter and length of post CD at rupture if the diameter of the strut is 12 mm and the diameter of the post is 40 mm.





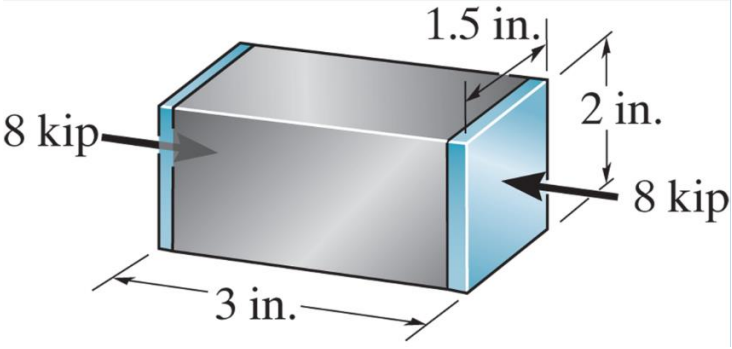
Problem 3-38

The wires each have a diameter of 0.5 in, length of 2 ft, and are made of 304 stainless steel. If P=6 kip, determine the angle of tilt of the rigid beam AB.



Problem 3-33

The aluminum block has a rectangular cross section and is subjected to an axial compressive force of 8 kip. If the 1.5 in side changed its length to 1.500132 in, determine Poisson's ratio and the new length of the 2 in side. $E_{al}=10(10^3)$ ksi.



Problem 3-36

The elastic portion of the tension stress-strain diagram for an aluminum alloy is shown in the figure. The specimen used for the test has a gauge length of 2 in and a diameter of 0.5 in. If the applied load is 10 kip, determine the new diameter of the specimen. The shear modulus is G_{al} = 3.8 x10^3 ksi.