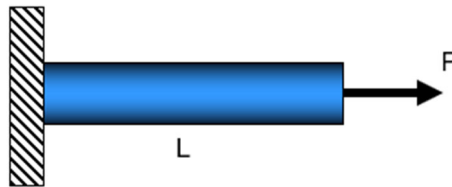


**Objective**

The purpose of this assignment is twofold: first, to understand and compute normal stress and strain values in a uniaxially loaded material, and second, to begin to consider these quantities in your work for Project #2.

You **must** hand in the cover sheet for the assignment and your calculations on engineering paper for Part 1.

**Part 1:** Consider the linear-elastic prismatic bar fixed on the left-hand side and loaded by axial forces  $P$  at the right-hand side, as shown in the figure below (assume all measurements are "exact"). In all cases, report answers to three significant figures.



1. If the allowable stress at failure for the material is  $\sigma = 15,000$  psi and the applied load on the bar is  $P = 5,000$  lb., what is the minimum area required to prevent failure?
2. If the bar fails at strains  $\epsilon > 0.050$  and the original length of the bar is  $L = 30$  in., what is the maximum allowable deformation before failure?
3. If the material in the bar is considered linear-elastic and the tensile stress  $\sigma = 15,000$  psi and the tensile strain  $\epsilon = 0.01$ , what is the modulus of elasticity of the material?
4. If the original length of the bar is  $L = 10$  ft. and it deforms 0.12 in., what is the stress in the material if the modulus of elasticity  $E = 29,000$  ksi?
5. Determine the cross-sectional area  $A$  of a steel cable required to support a 10,000 lb. tensile force over 100 ft. while not exceeding the allowable tensile stress of  $\sigma = 60,000$  psi or a maximum elongation of  $\delta = 0.1$  ft. Assume the modulus of elasticity of steel is  $E = 29,000,000$  psi.