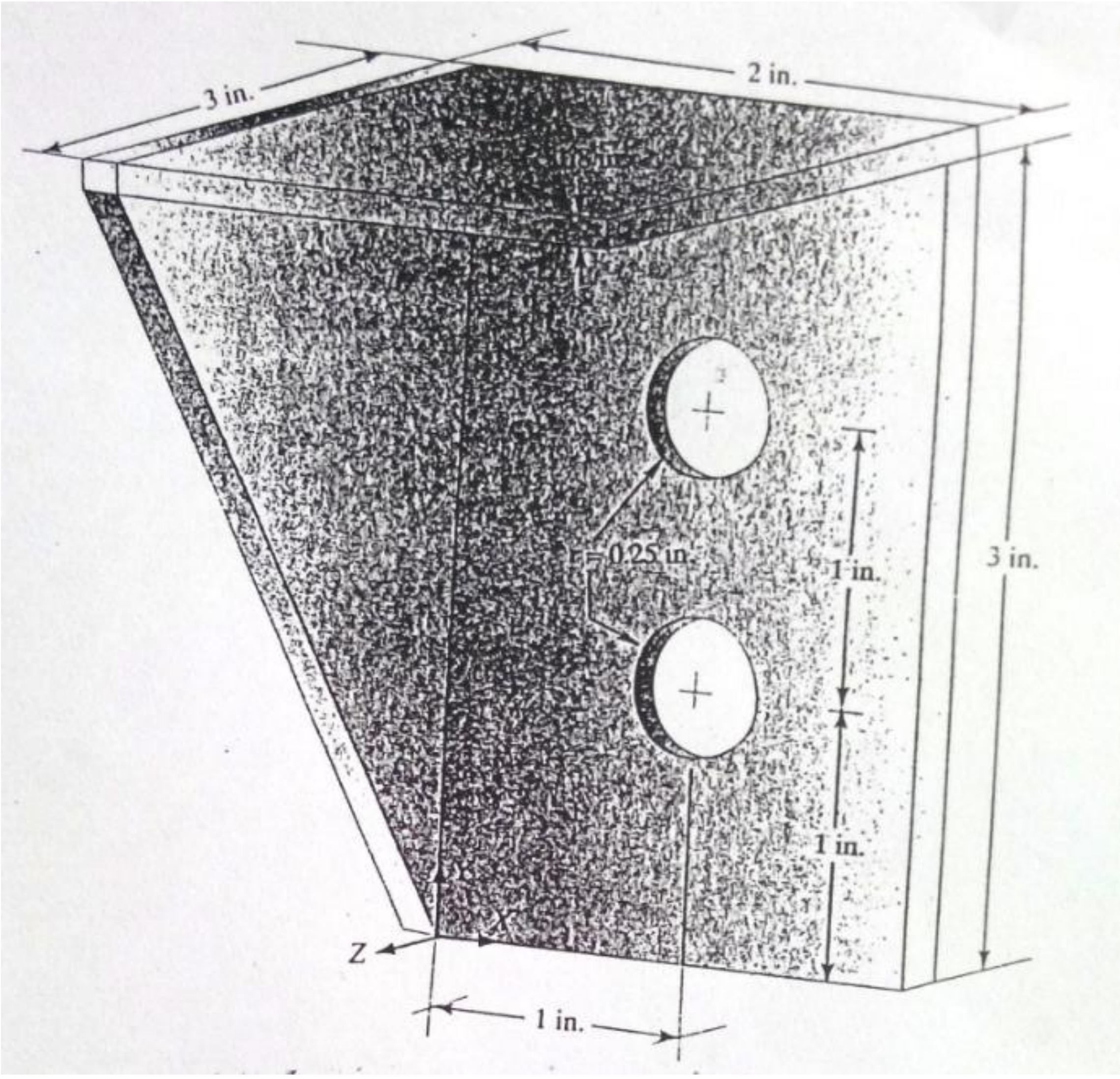
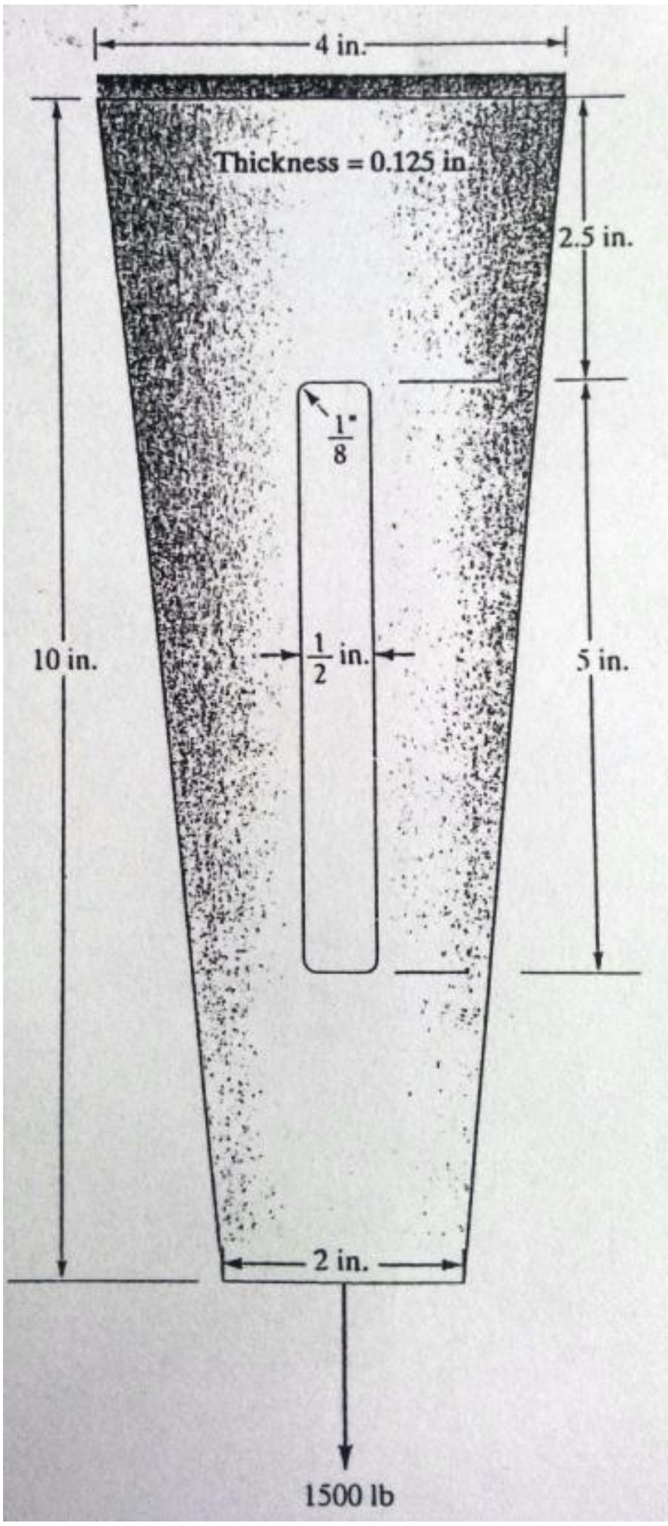


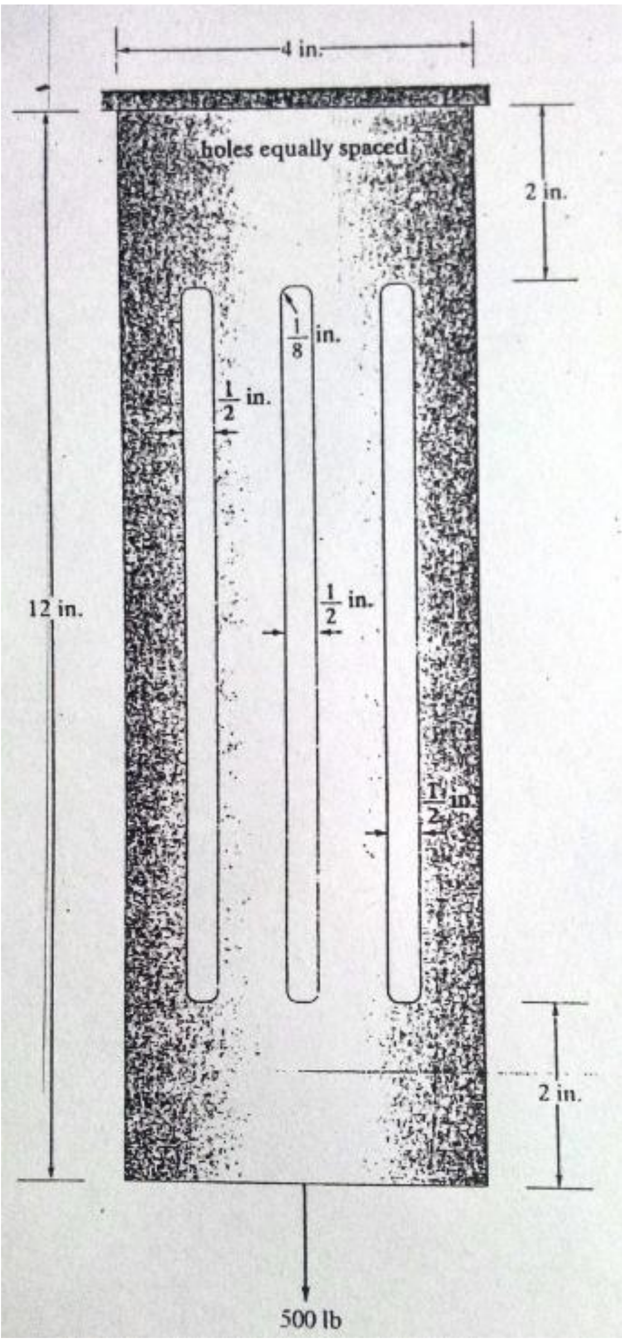
EXAMPLE 10.3

The bracket shown in Figure 10.28 is subjected to a distributed load of 50 lb/in^2 on the top surface. It is fixed around the hole surfaces. The bracket is made of steel, with a modulus elasticity of 29×10^6 lb/in^2 and $\nu = 0.3$. Plot the deformed shape. Also, plot the von Mises stress distribution in the bracket.

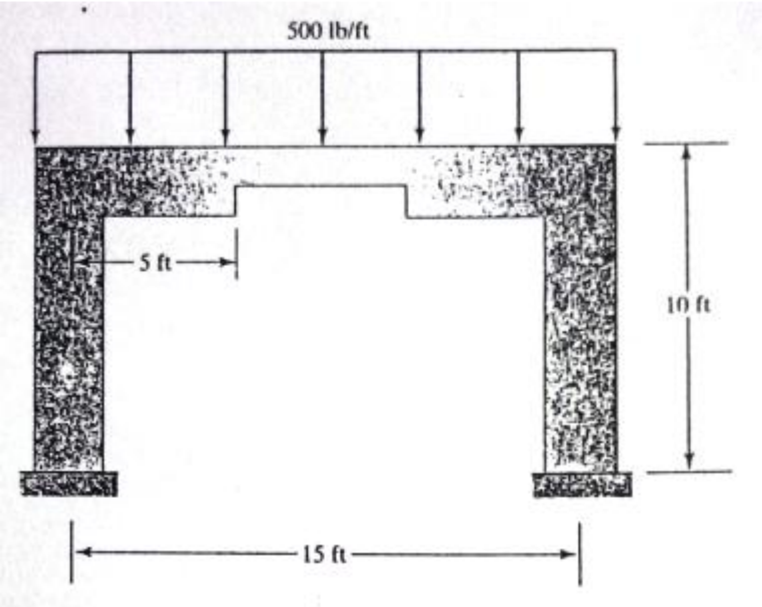


Consider a plate with a variable cross section supporting a load of 1500 lb, as shown in the accompanying figure. Using ANSYS, determine the deflection and the x- and y-components of the stress distribution in the plate. The plate is made of a material with a modulus of elasticity $E = 10.6 \times 10^3$ ksi. In Problem 24 of Chapter 1, you were asked to analyze this problem using simple direct formulation. Compare the results of your direct-formulation model

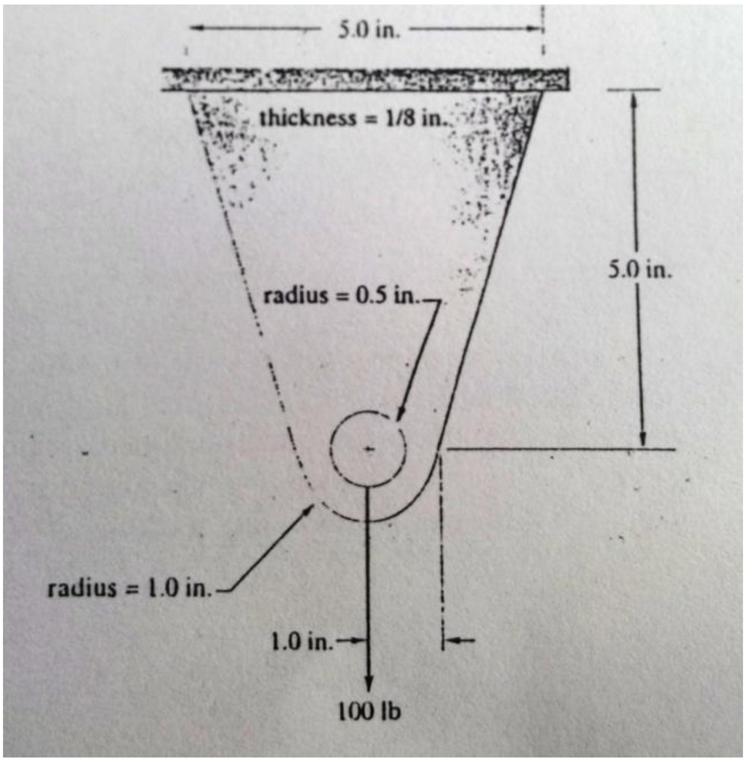
to the results obtained from ANSYS. Experiment with applying the load over an increasingly large load-contact surface area. Discuss your results.



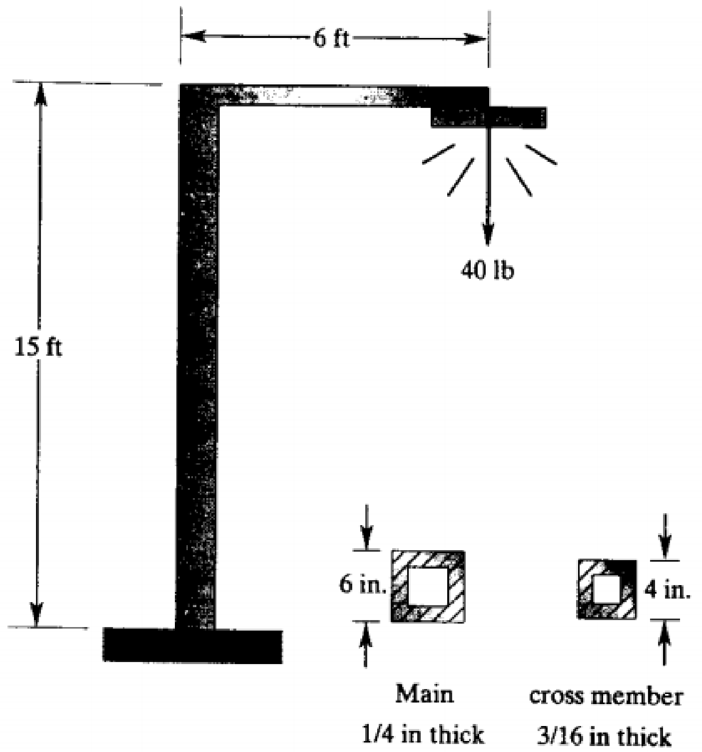
A thin steel plate with the profile given in the accompanying figure is subjected to an axial load. Using ANSYS, determine the deflection and the x and y-components of the stress distributions in the plate. The plate has a thickness of 0.125 in and a modulus of elasticity of $E = 28 \times 10^3$ ksi. In Problem 4 of Chapter 1, you were asked to analyze this problem using simple direct formulation. Compare the results of your direct-formulation model to the results obtained from ANSYS. Experiment with applying the load over an increasingly larger load-contact surface area. Discuss your results.



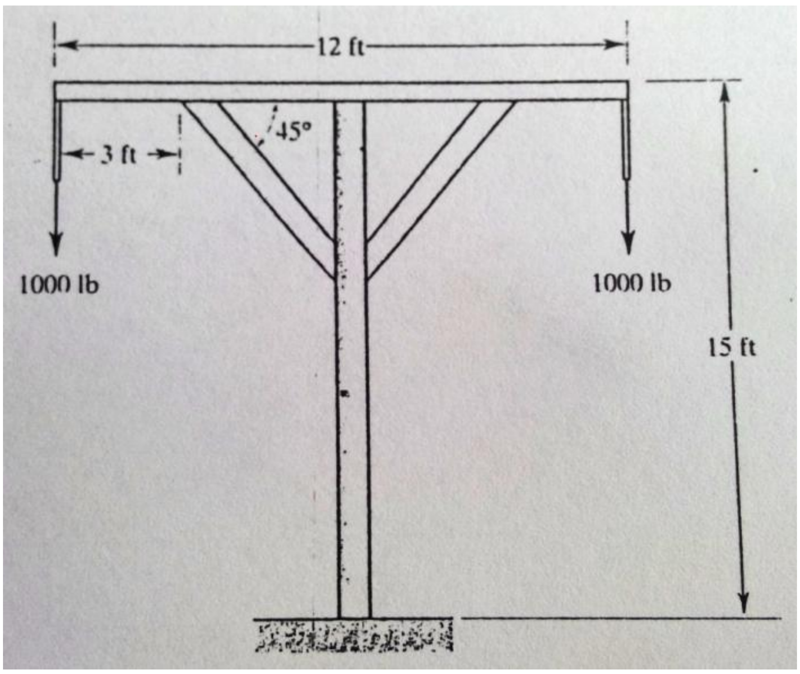
The frame shown in the accompanying figure is used to support a load of 500 lb/ft. Using ANSYS, size the cross sections of each member if standard-size steel square tubing is to be used. Use three different sizes. The deflection of the centerpoint is to be kept under 0.05 in.



A $\frac{1}{8}$-in-thick plate supports a load of 100 lb, as shown in the accompanying figure. The plate is made of steel, with $E = 29 \times 10^6$ lb/in^2 and $\nu = 0.3$. Using ANSYS, determine the principal stresses in the plate. When modeling, distribute the load over part of the bottom portion of the hole.

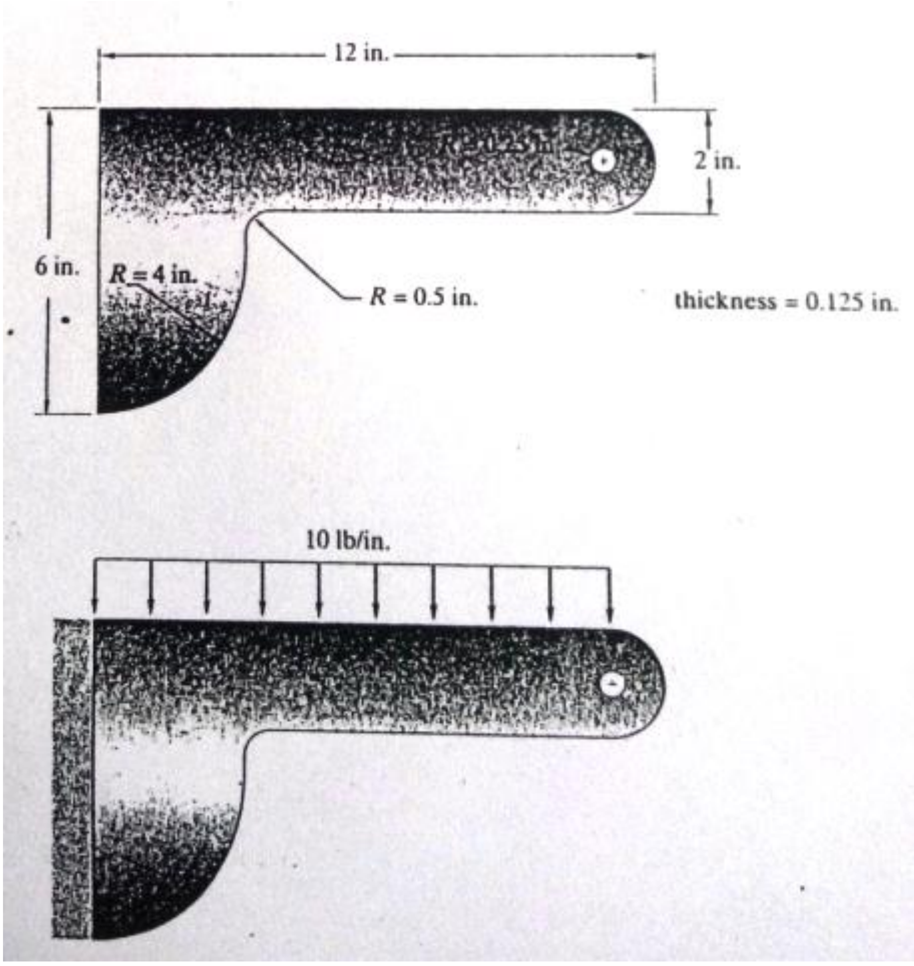


The lamp frame shown in the accompanying figure has hollow square cross sections and is made of steel, with $E = 29 \times 10^6$ lb/in^2. Using hand calculations, determine the endpoint deflection of the cross member where the lamp is attached.



The frame shown in the accompanying figure is used to support a load of 2000 lb. The main vertical section of the frame has an annular cross section with an area of 8.63 in^2 and a polar radius of gyration of 2.75 in. The outer diameter of the main tubular section is 6 in. All other members also have annular cross sections with respective areas of 2.24 in^2 and polar radii of

gyration of 1.91 in. The outer diameter of these members is 4 in. Using ANSYS, determine the deflections at the points where the load is applied. The frame is made of steel, with a modulus elasticity of $E = 29 \times 10^6$ lb/in^2.



Consider one of the many steel brackets ($E = 29 \times 10^6$ lb/in^2, $\nu = 0.3$) used to support bookshelves. The dimensions of the bracket are shown in Figure 6.33. The bracket is loaded uniformly along its top surface, and it is fixed along its left edge. Under the given loading and the constraints, plot the deformed shape; also determine the principal stresses and the von Mises stresses in the bracket.

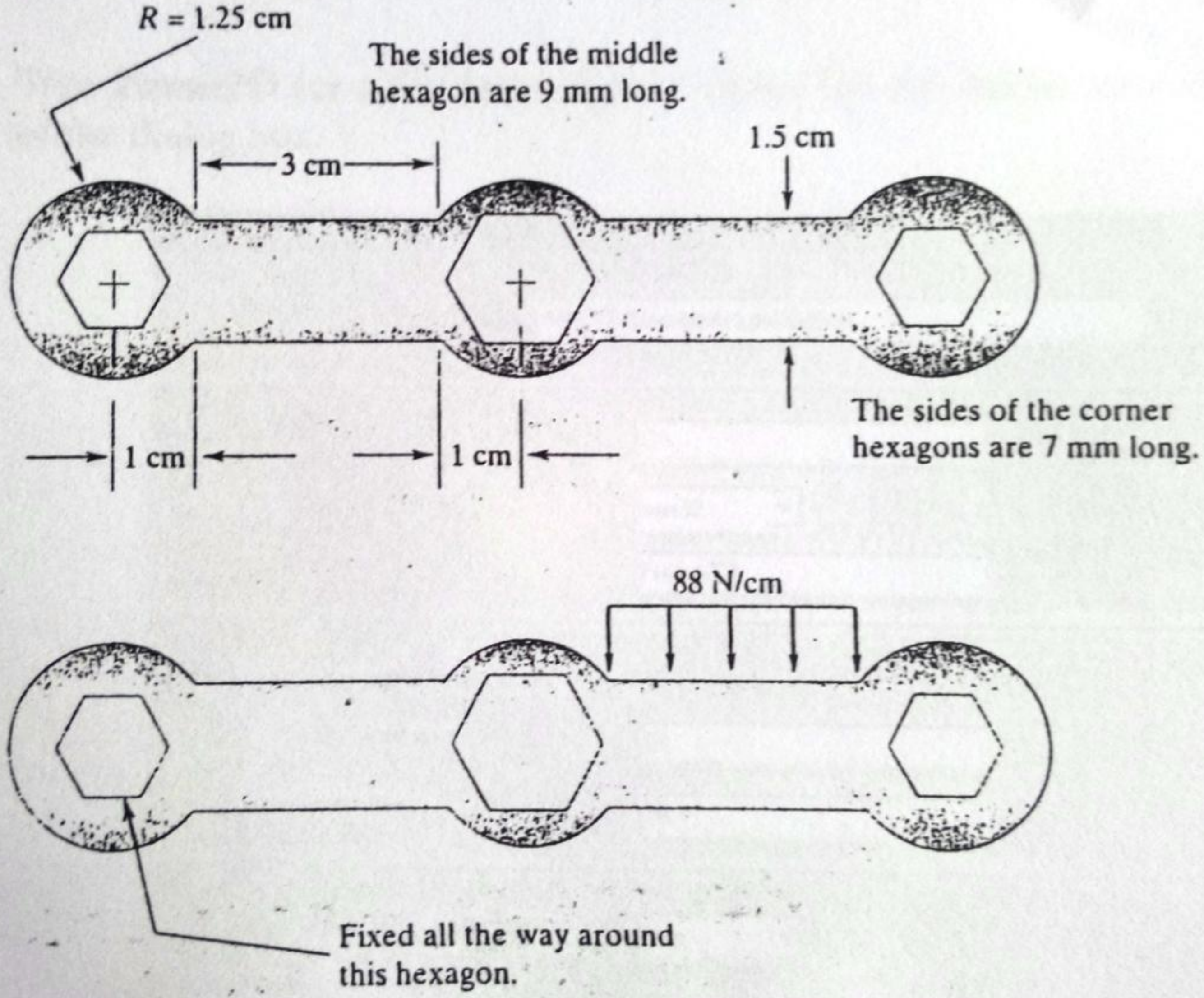
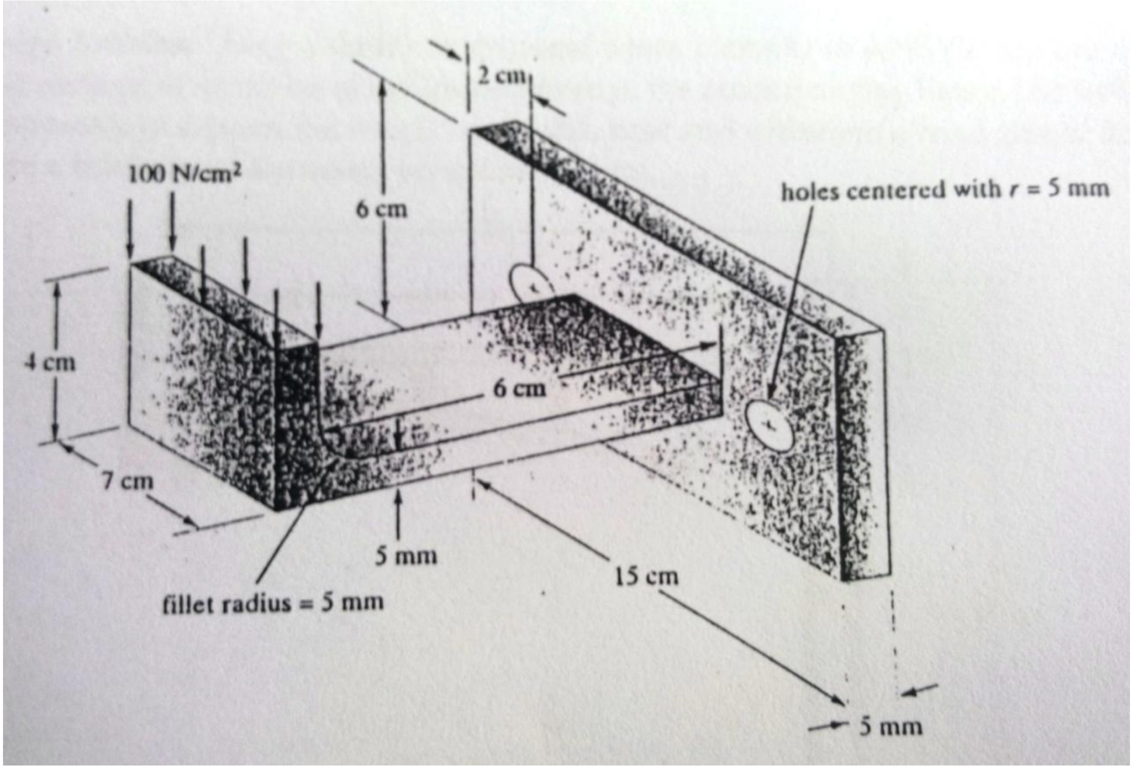
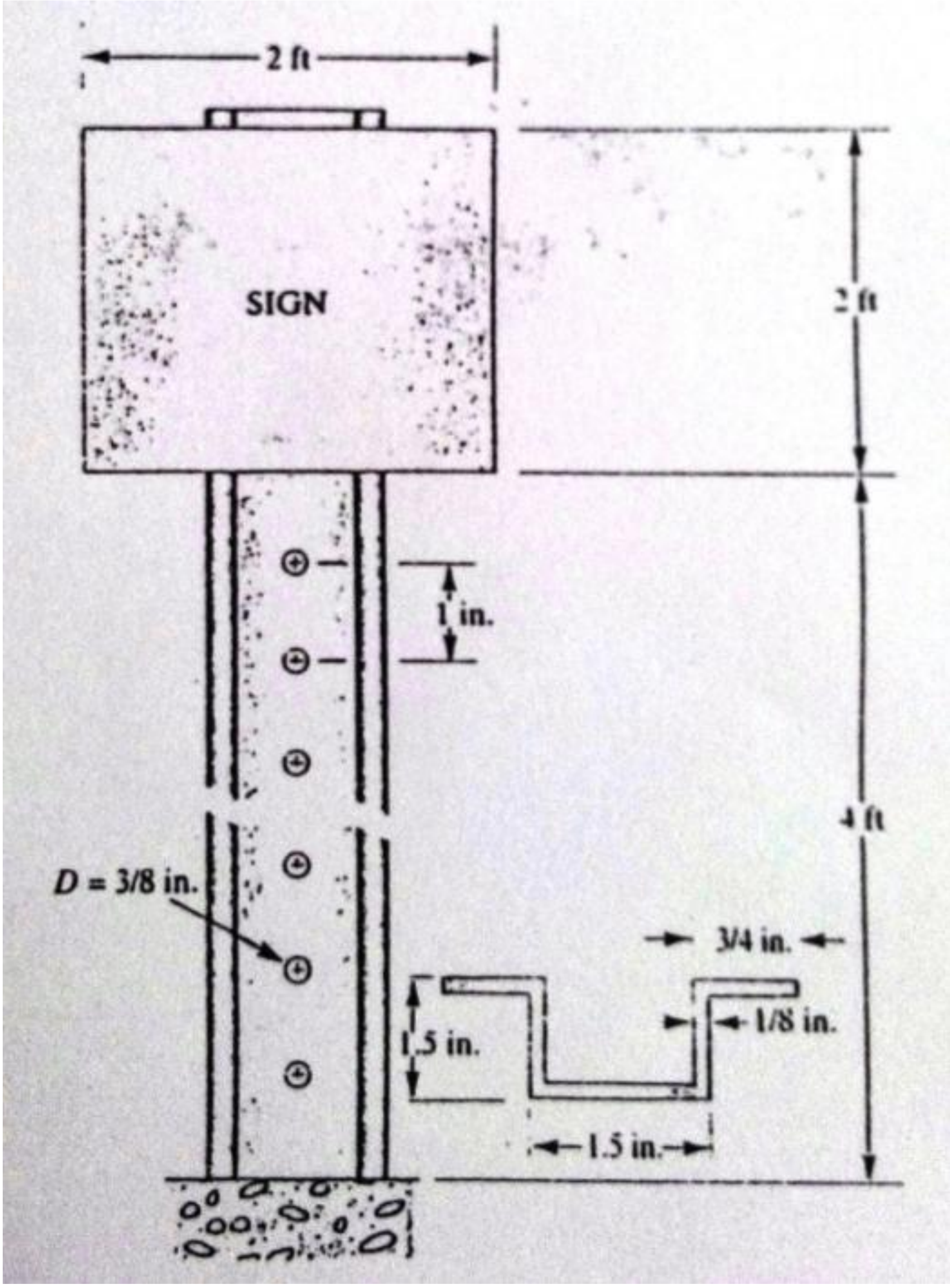


FIGURE 8.20 A schematic for the bicycle wrench in Example 8.4.

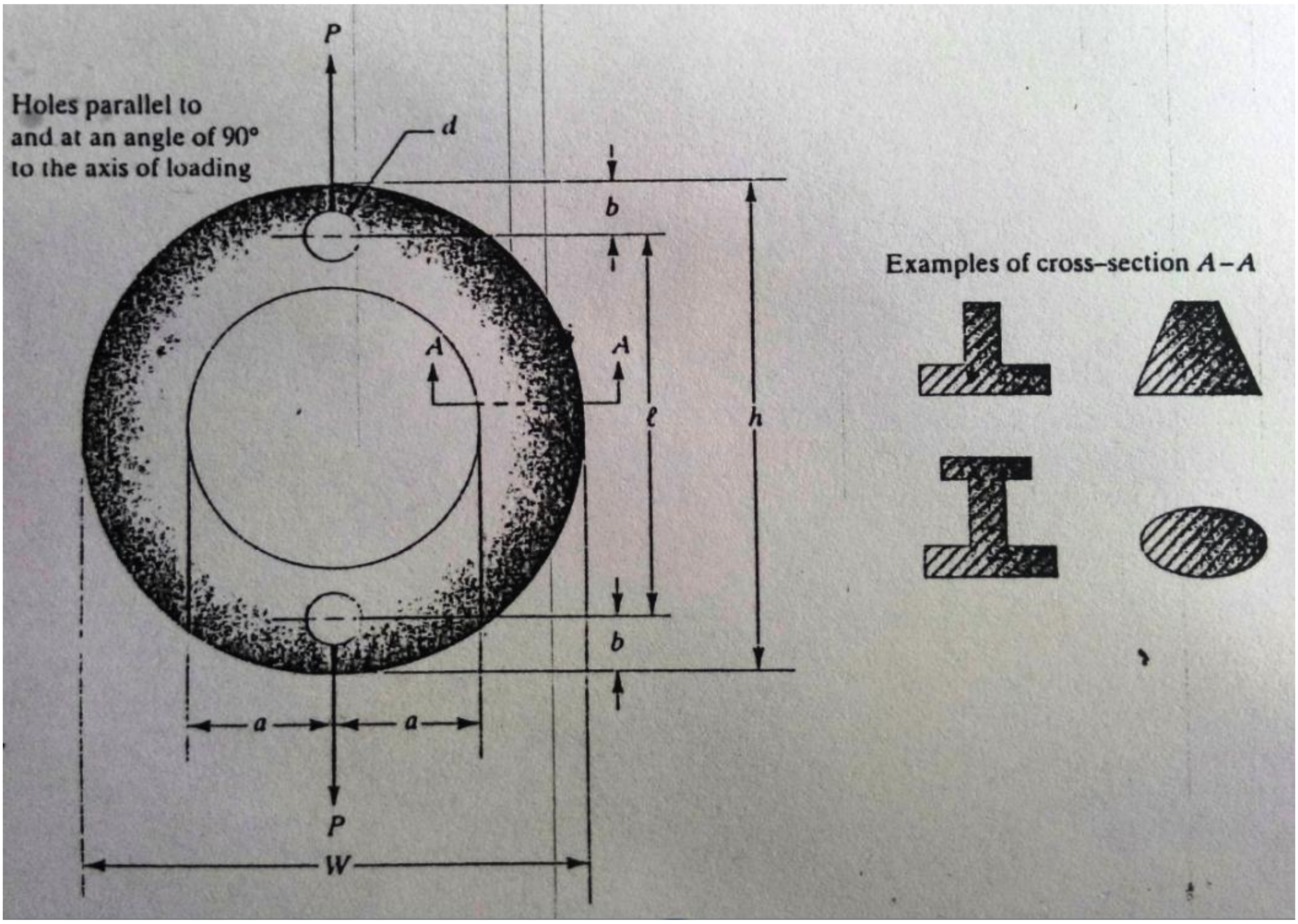
The bicycle wrench shown in Figure 8.20 is made of steel with a modulus of elasticity $E = 200$ GPa and a Poisson's ratio $\nu = 0.32$. The wrench is 3 mm thick. Determine the von Mises stresses under the given distributed load and boundary conditions.



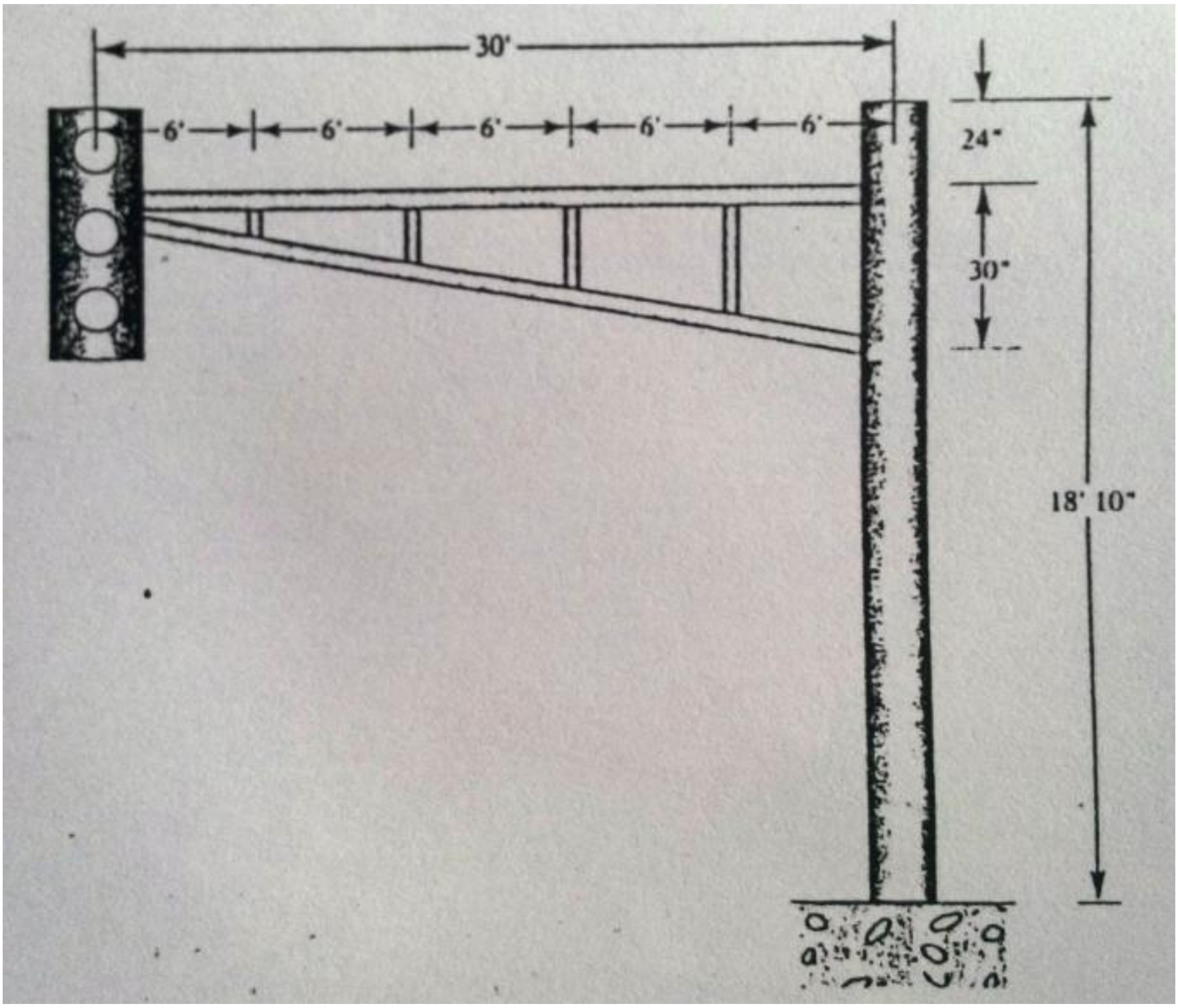
Using ANSYS, calculate and plot the principal stress distributions in the support component shown in the accompanying figure. The bracket is made of steel. It is fixed around the hole surfaces.



Using ANSYS, calculate and plot the von Mises stress distribution in the traffic signpost shown in the accompanying figure. The post is made of steel, and the sign is subjected to a wind gust of 60 miles/hr. Use the drag force relation $F_D = C_D A \frac{1}{2} \rho U^2$ to calculate the load caused by the wind, where F_D is the load, $C_D = 1.18$, ρ represents the density of air, U is the wind speed, and A gives the frontal area of the sign. Distribute the load on the section of the post covered by the sign. Could you model this problem as a simple cantilever beam and thus avoid creating an elaborate finite element model? Explain.



Design Problem Referring to one of the design problems in Chapter 8 (Problem 22), each student is to design and construct a structural model from a $\frac{3}{8}'' \times 6'' \times 6''$ sheet of plexiglas material that adheres to the specifications and rules given in Problem 22. Additionally, for this project, the model may have any cross-sectional shape. Examples of some common sections are shown in the accompanying figure.



Design Problem Using a three-dimensional beam element in ANSYS, you are to size the cross sections of members of the frame shown in the accompanying figure. Use hollow tubes. The frame is to support the weight of a traffic light and withstand a wind gust of 80 miles/hr. Write a brief report discussing your final design.