

Mechanics of Material Review – Combined Loading

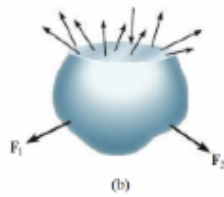
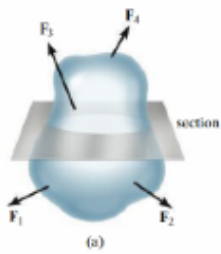


Fig. 1-2

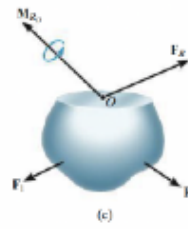
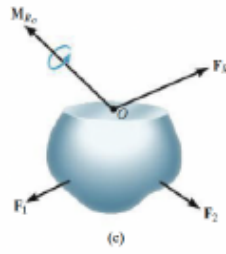
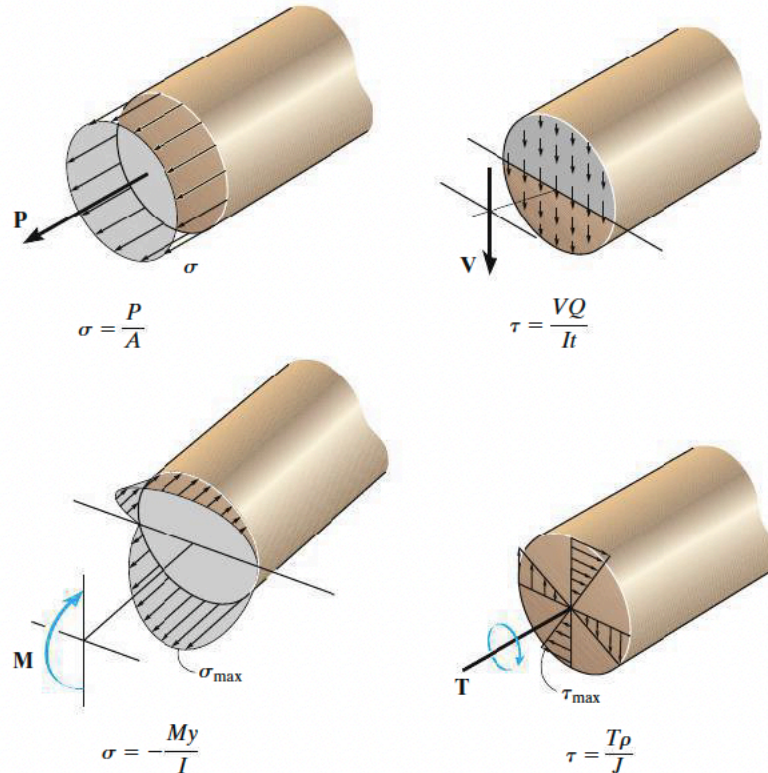
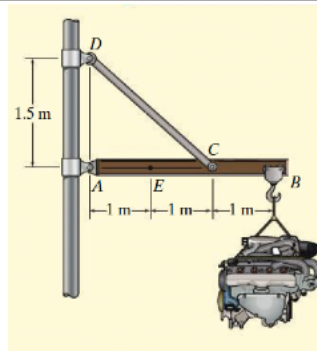


Fig. 1-2 (cont.)

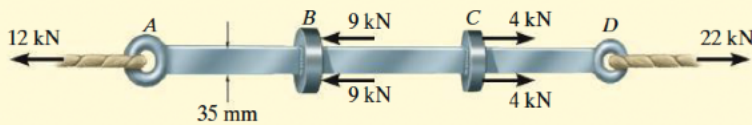
Superposition of stress components can be used to determine the normal and shear stress at a point in a member subjected to a combined loading. To do this, it is first necessary to determine the resultant axial and shear forces and the internal resultant torsional and bending moments at the section where the point is located. Then the normal and shear stress resultant components at the point are determined by algebraically adding the normal and shear stress components of each loading.



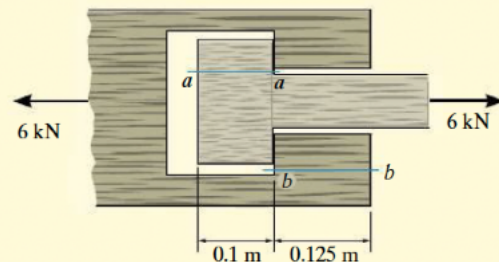
The 500-kg engine is suspended from the crane boom in Fig. 1-5a. Determine the resultant internal loadings acting on the cross section of the boom at point E.



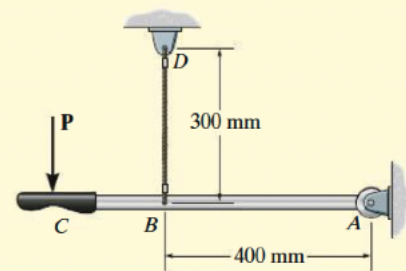
The bar in Fig. 1–15a has a constant width of 35 mm and a thickness of 10 mm. Determine the maximum average normal stress in the bar when it is subjected to the loading shown.



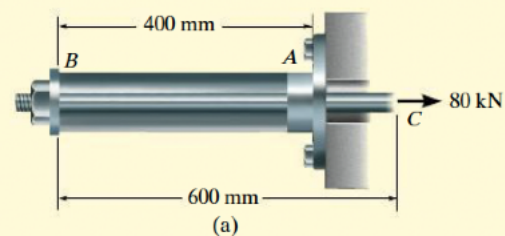
If the wood joint in Fig. 1–22a has a width of 150 mm, determine the average shear stress developed along shear planes $a-a$ and $b-b$. For each plane, represent the state of stress on an element of the material.



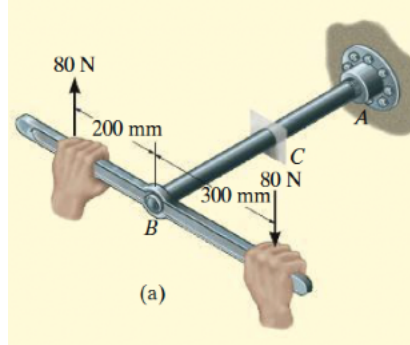
When force P is applied to the rigid lever arm ABC in Fig. 2–5a, the arm rotates counterclockwise about pin A through an angle of 0.05° . Determine the normal strain developed in wire BD .



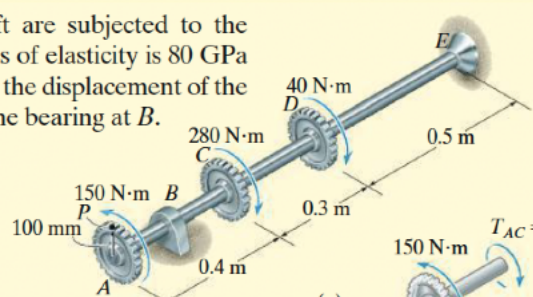
The assembly shown in Fig. 4–6a consists of an aluminum tube AB having a cross-sectional area of 400 mm^2 . A steel rod having a diameter of 10 mm is attached to a rigid collar and passes through the tube. If a tensile load of 80 kN is applied to the rod, determine the displacement of the end C of the rod. Take $E_{st} = 200 \text{ GPa}$, $E_{al} = 70 \text{ GPa}$.



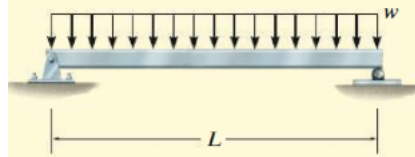
The pipe shown in Fig. 5–12a has an inner diameter of 80 mm and an outer diameter of 100 mm. If its end is tightened against the support at A using a torque wrench at B , determine the shear stress developed in the material at the inner and outer walls along the central portion of the pipe when the 80-N forces are applied to the wrench.



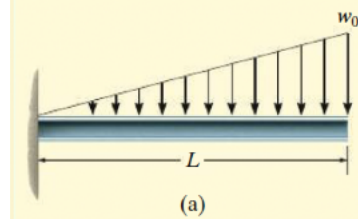
The gears attached to the fixed-end steel shaft are subjected to the torques shown in Fig. 5–19a. If the shear modulus of elasticity is 80 GPa and the shaft has a diameter of 14 mm, determine the displacement of the tooth P on gear A . The shaft turns freely within the bearing at B .



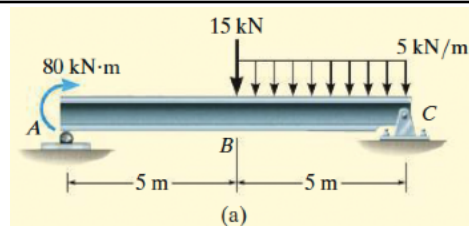
Draw the shear and moment diagrams for the beam shown in Fig. 6-4a.



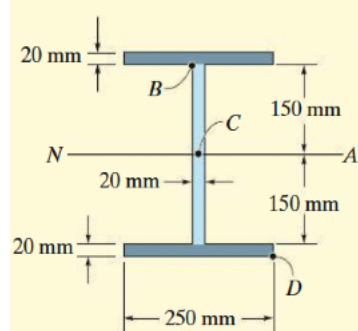
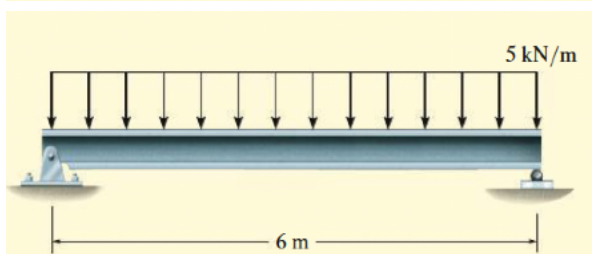
Draw the shear and moment diagrams for the beam shown in Fig. 6-5a.



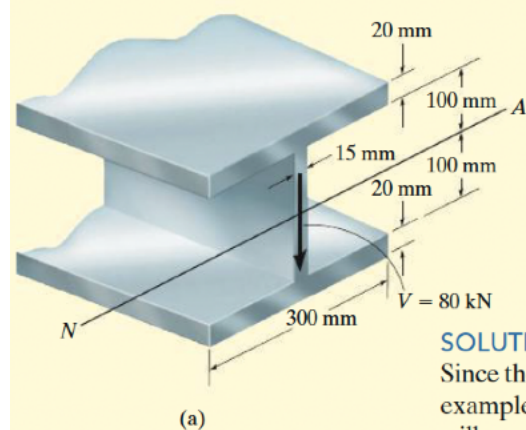
Draw the shear and moment diagrams for the beam shown in Fig. 6-7a.



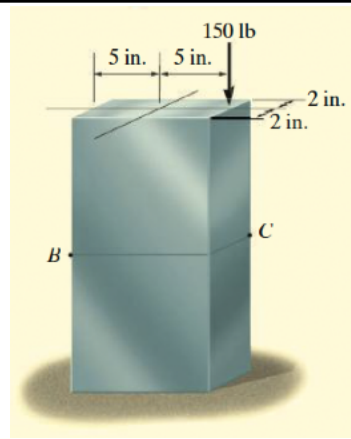
The simply supported beam in Fig. 6-26a has the cross-sectional area shown in Fig. 6-26b. Determine the absolute maximum bending stress in the beam and draw the stress distribution over the cross section at this location.



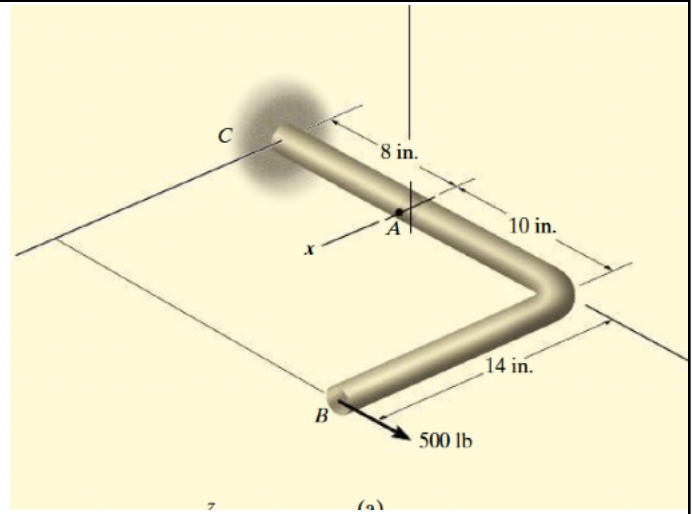
A steel wide-flange beam has the dimensions shown in Fig. 7-1. If it is subjected to a shear of $V = 80$ kN, plot the shear-stress distribution acting over the beam's cross-sectional area.



A force of 150 lb is applied to the edge of the member shown in Fig. 8–3a. Neglect the weight of the member and determine the state of stress at points *B* and *C*.



The solid rod shown in Fig. 8–6a has a radius of 0.75 in. If it is subjected to the force of 500 lb, determine the state of stress at point *A*.



The solid rod shown in Fig. 8–7a has a radius of 0.75 in. If it is subjected to the force of 800 lb, determine the state of stress at point *A*.

