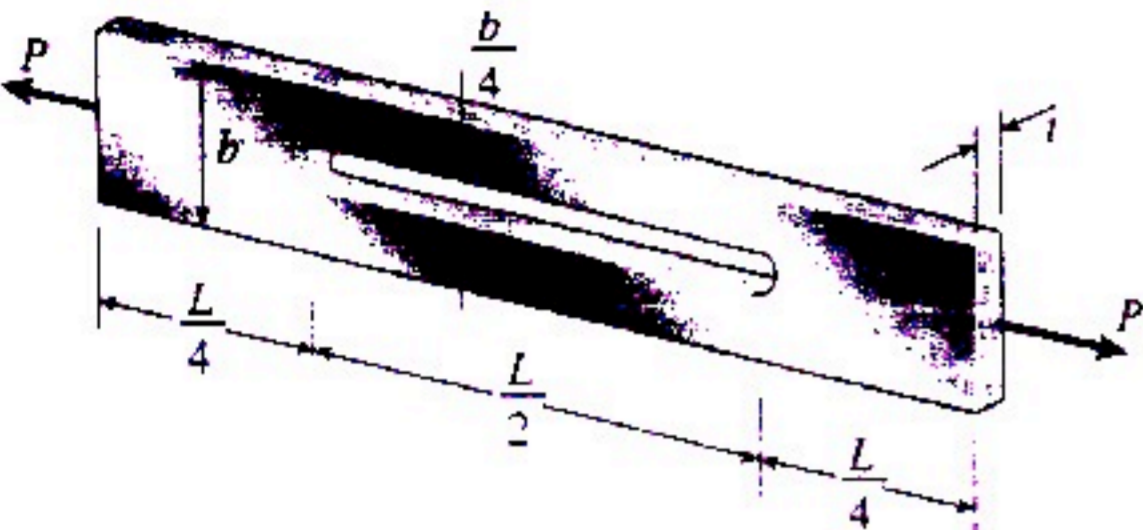


2.3-4 A rectangular bar of length L has a slot in the middle half of its length (see figure). The bar has width b , thickness t , and modulus of elasticity E . The slot has width $b/4$.

(a) Obtain a formula for the elongation δ of the bar due to the axial loads P .

(b) Calculate the elongation of the bar if the material is high-strength steel, the axial stress in the middle region is 160 MPa, the length is 750 mm, and the modulus of elasticity is 210 GPa.



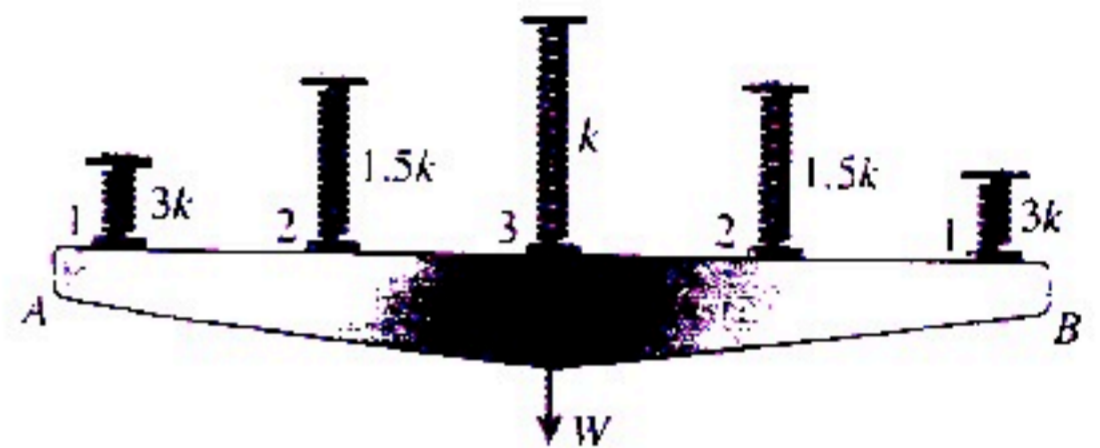
2.7-8 The statically indeterminate structure shown in the figure consists of a horizontal rigid bar AB supported by five equally spaced springs. Springs 1, 2, and 3 have stiffnesses $3k$, $1.5k$, and k , respectively. When unstressed, the lower ends of all five springs lie along a horizontal line. Bar AB , which has weight W , causes the springs to elongate by an amount δ .

(a) Obtain a formula for the total strain energy U of the springs in terms of the downward displacement δ of the bar.

(b) Obtain a formula for the displacement δ by equating the strain energy of the springs to the work done by the weight W .

(c) Determine the forces F_1 , F_2 , and F_3 in the springs.

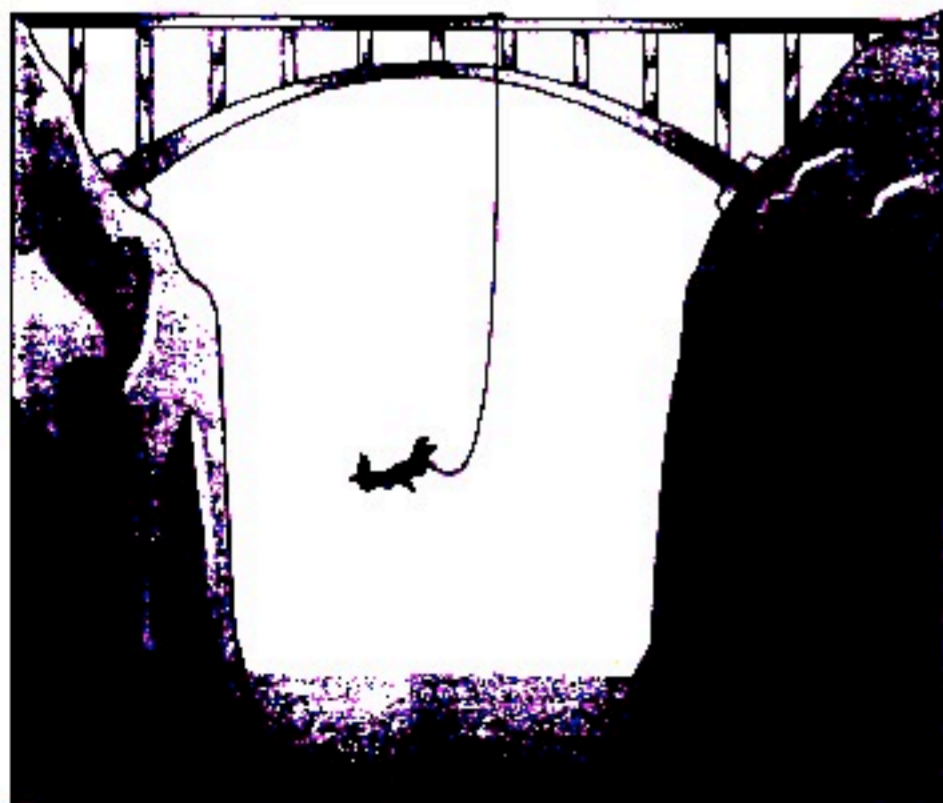
(d) Evaluate the strain energy U , the displacement δ , and the forces in the springs if $W = 600$ N and $k = 7.5$ N/mm.



PROB. 2.7-8

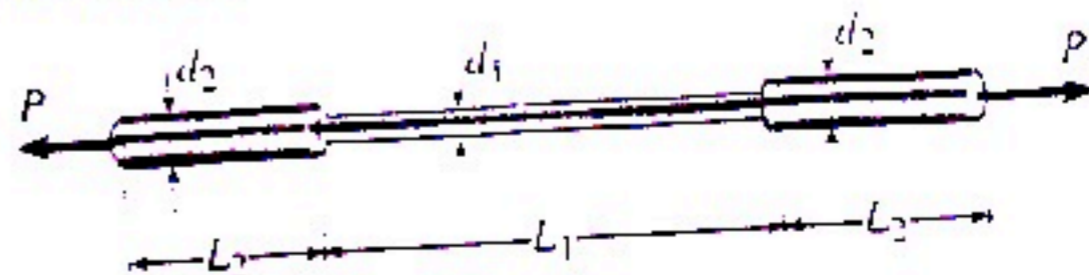
8-12 A bungee jumper having a mass of 55 kg leaps from a bridge, braking her fall with a long elastic shock cord having axial rigidity $EA = 2.3$ kN (see figure).

If the jumpoff point is 60 m above the water, and if it is desired to maintain a clearance of 10 m between the jumper and the water, what length L of cord should be used?



2.10-4 A round brass bar of diameter $d_1 = 20$ mm has upset ends of diameter $d_2 = 26$ mm (see figure). The lengths of the segments of the bar are $L_1 = 0.3$ m and $L_2 = 0.1$ m. Quarter-circular fillets are used at the shoulders of the bar, and the modulus of elasticity of the brass is $E = 100$ GPa.

If the bar lengthens by 0.12 mm under a tensile load P , what is the maximum stress σ_{max} in the bar?



PROBS. 2.10-4 and 2.10-5

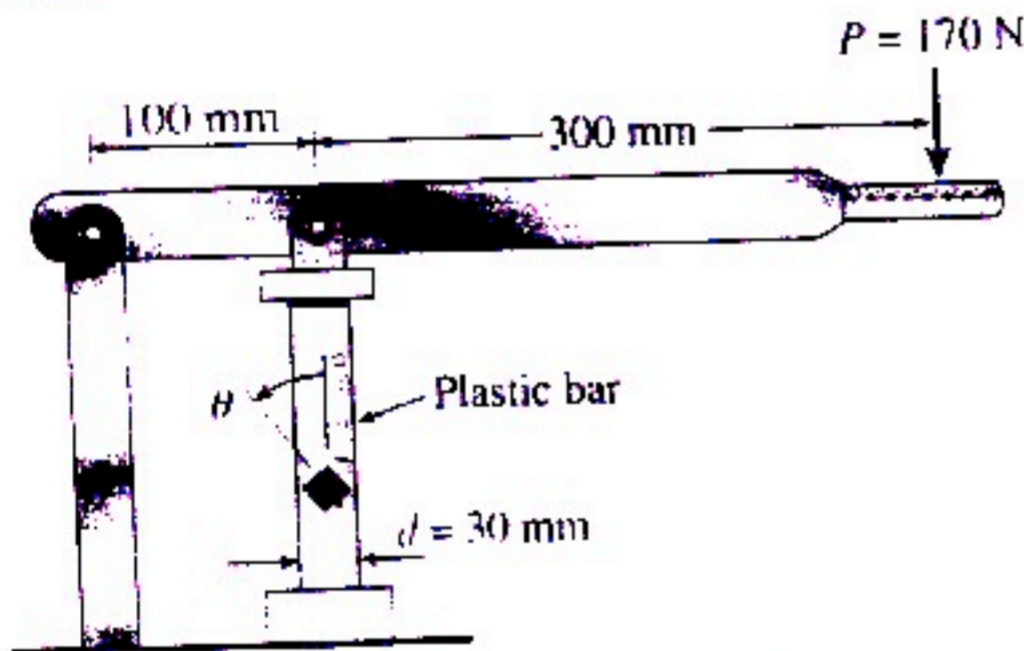
2.10-5

PROBS. 2.3-4 and 2.3-5

PROB. 2.6-9

2.6-10 A plastic bar of diameter $d = 30$ mm is compressed in a testing device by a force $P = 170$ N applied as shown in the figure.

Determine the normal and shear stresses acting on all faces of stress elements oriented at (a) an angle $\theta = 0^\circ$, (b) an angle $\theta = 22.5^\circ$, and (c) an angle $\theta = 45^\circ$. In each case, show the stresses on a sketch of a properly oriented element.



PROB. 2.6-10