

1. (20%) The bar AB has weight $W=1000$ N and length $L=1.2$ m. The spring is unstretched when the bar is vertical ($\alpha=90^\circ$). The spring constant k is 4.8 KN/m. Determine the minimum value of height h for which the bar is stable in the equilibrium position $\alpha=90^\circ$.

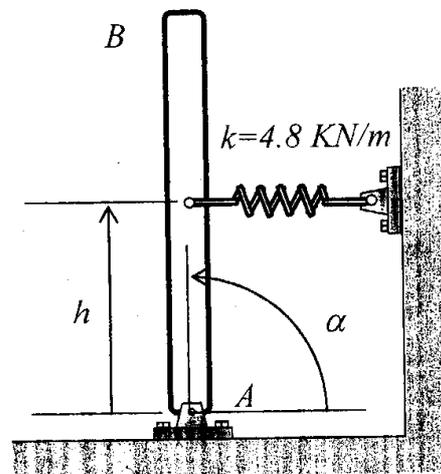


Figure 1

2. (20%) A uniform steel plate 360 mm square with a mass of 30 kg is suspended in the horizontal plane by the three vertical wires as shown in Figure 2. Determine the three tensions in each wire.

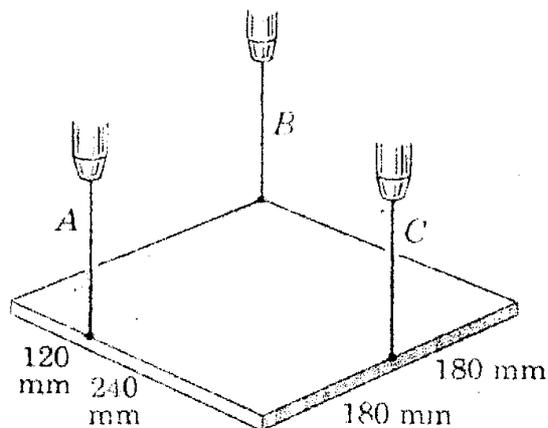


Figure 2

3. (20%) A 20-g bullet is fired horizontally into the 250-g block which rests on the smooth surface. After the bullet becomes embedded into the block, the block moves to the right 0.2 m before momentarily coming to rest. Determine the speed v_{BI} of the bullet. The spring has a stiffness of $k = 300 \text{ N/m}$ and is originally unstretched.

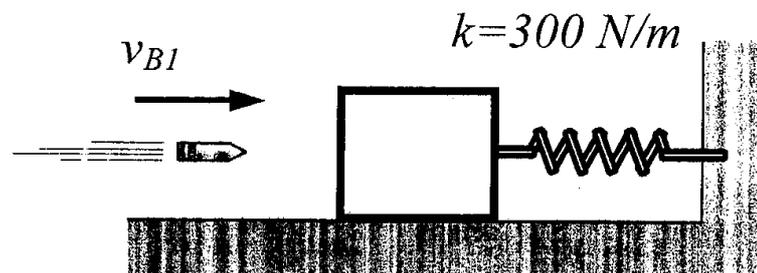


Figure 3

4. Derive the equation of motion in terms of the variable x for homogeneous circular cylinder as shown in Figure 4, which rolls without slipping on the horizontal surface (15%). Determine its nature frequency with parameters spring constant $k = 1.5 \text{ kN/m}$ and mass $m = 3 \text{ kg}$ (5%).

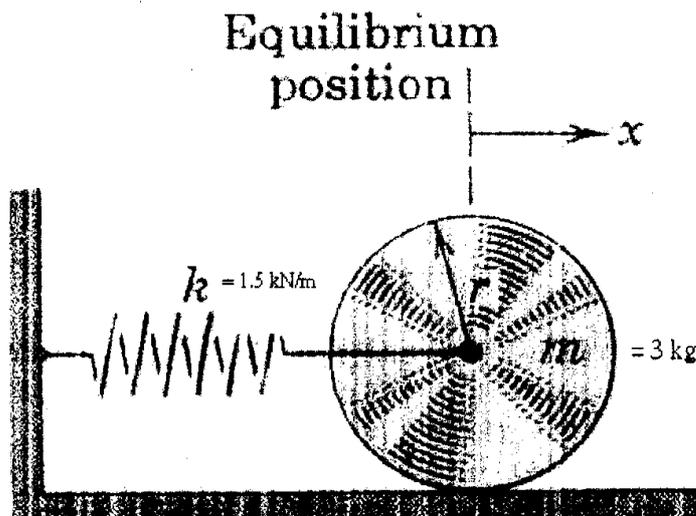


Figure 4

5. (20%) Determine the angular velocity of link AB at the instant shown if block C is moving upward at 12 in./s.

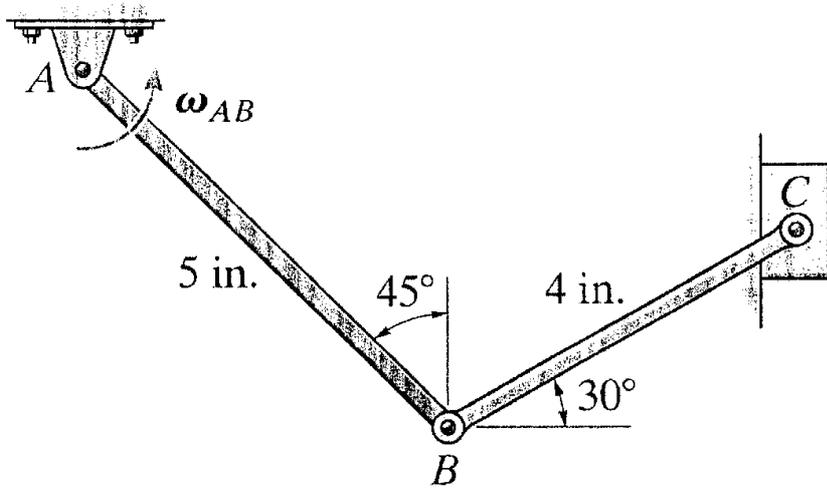


Figure 5