

所 別：纖維及高分子工程技術研究所 組別：纖維乙組

科目：工程力學

1.

A system is shown rotating freely with an angular speed ω of 2 rad/sec. A mass A of 1.5 kg is held against a spring such that the spring is compressed 100 mm. If the device a holding the mass in position is suddenly removed, determine how far toward the vertical axis of the system the mass will move. The spring constant K is .531 N/mm. Neglect all friction and inertia of the bar. The spring is not connected to the mass.

(25 / 0)

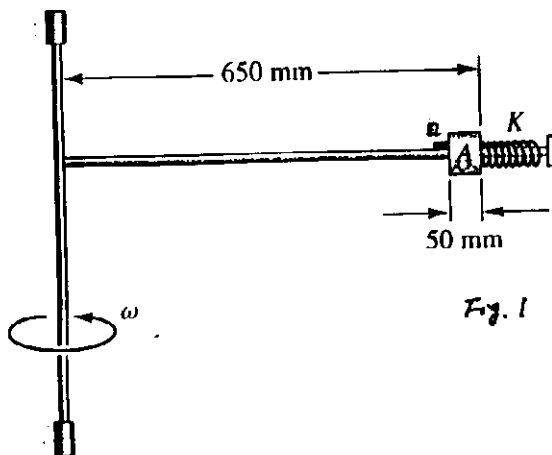


Fig. 1

2.

A single cam A is mounted on a shaft as shown. The cam has a mass of 10 kg and has a center of mass 300 mm from the centerline of the shaft. Also, the cam has a radius of gyration of 180 mm about an axis through the center of mass. The shaft has a mass per unit length of 10 kg/m and has a diameter of 30 mm. A torque T given as

$$T = .001t^2 + 10 \text{ N-m}$$

is applied at coupling D (t is in seconds). What are the force components in the bearings after 25 sec if the cam has the position shown in the diagram at this instant?

(25 / 0)

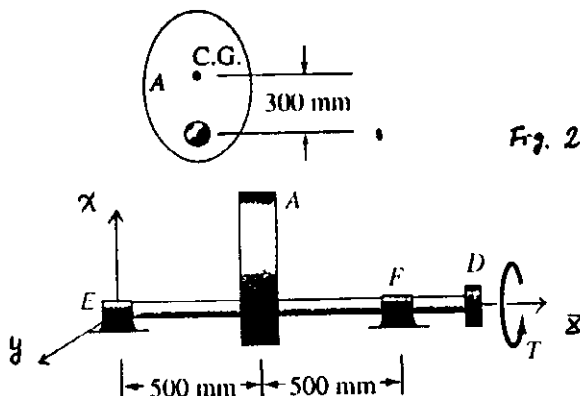


Fig. 2

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3. A box of mass m is placed on a cart as shown. Assuming that the cart is accelerated in the x direction, find the condition for the box to slide and the condition for the box to fall down. Also assume that μ_s , the coefficient of maximum static friction between the box and the floor of the cart, is 0.3. If the acceleration of the cart is increased from zero to $0.4g$, where g is the gravitational acceleration constant, will the box fall down to the floor? (20%)

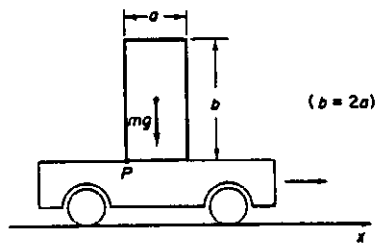


Figure 3. Box placed on a cart.

4. A box of mass m is placed on an inclined plane with the angle of inclination equal to 30° . Find the work done when the box is moved upward at a constant speed along the inclined plane for a distance of 5 m. Assume that mass m is 10 kg and that the coefficient of sliding friction μ_k is 0.3. (15%)

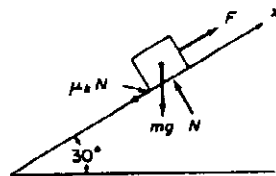


Figure 4. Box placed on an inclined plane.

5. Derive the equation of motion for the pendulum system (with a point mass m). Assume that when the pendulum is vertical there is no spring force. (15%)

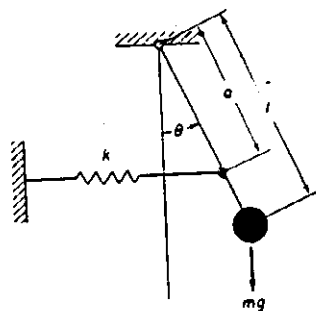


Figure 5. Pendulum system