

A1. [12%]

- (a) Please state the fundamental law of gearing. (Either in Chinese or in English is acceptable.) [5%]
- (b) Please translate the following sentences into Chinese. "The force that exists between the follower and the cam acts along a line perpendicular to the tangent drawn to the surfaces in contact. It is therefore necessary to define the pressure angle of a roller follower as the angle between the line of travel of the follower and a normal drawn to the pitch curve." [7%]

A2. [28%] For the Scotch-yoke mechanism as shown in Fig. 1, except the dimensions and state of motion given in the figure, centers of gravity of links 2 and 3 are located at g_2 and g_3 , respectively. If the gravity forces and inertial forces should be considered but frictions are to be neglected, please (a) determine the velocity and acceleration of link 3, (b) give free-body diagrams of links 2 and 3, (c) determine the force that link 2 acts on link 3, (d) determine the power input required at P_3 .

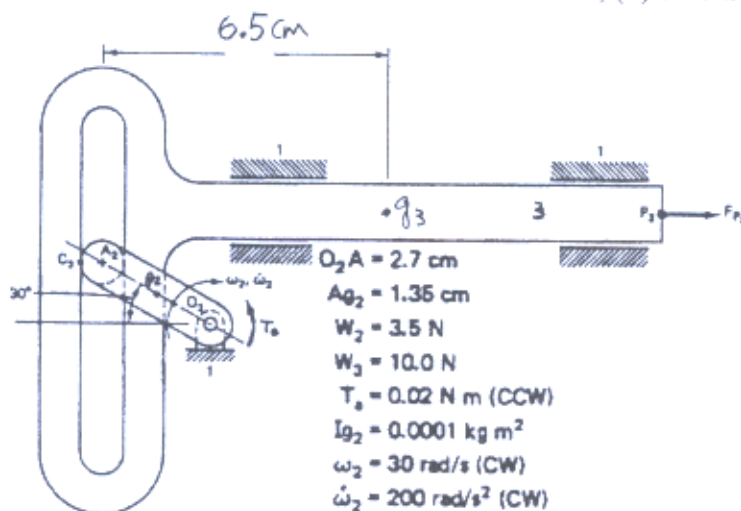


Fig. A1

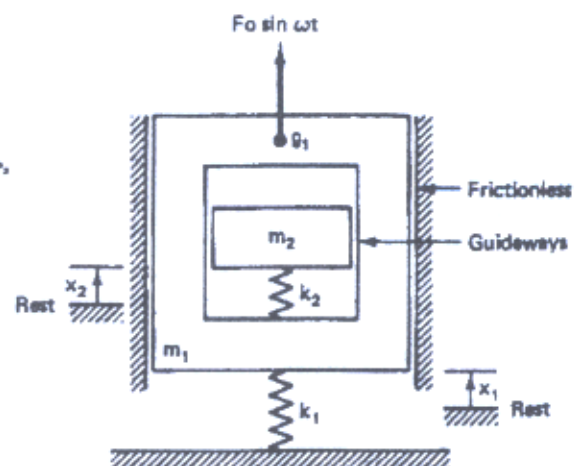


Fig. A2

A3. [10%] For the two-mass system as shown in Fig. 2, m_1 and m_2 are masses of the two bodies, k_1 and k_2 are spring constants of the two springs, body 1 is acted by a sinusoidal force through g_1 , please (a) determine the kinetic energy and potential energy of the system, (b) derive the equation of motion of the system.

(背面仍有題目,請繼續作答)

B1. [15%] The mechanism shown in Fig. B1 is used in a riveting machine. It consists of a driving piston A, three members, and a riveter which is attached to the slider block D.

- (a) Translate the above sentences into Chinese. [8%]
(b) Determine the degrees of freedom of the mechanism. [7%]

B2. [15%] For a short time a motor of the random-orbit sander drives the gear A with an angular velocity of $\omega_A = 40(t^3 + 6t)$ rad/s, where t is in seconds. This gear is connected to gear B, which is fixed connected to the shaft CD. The end of this shaft is connected to the eccentric spindle EF and pad P, which causes the pad to orbit around shaft CD at a radius of 15 mm. (see Fig. B2)

- (a) What is the name of gear A? (1) helical gear, (2) spur gear, (3) herringbone gear, (4) reverted gear, (5) bevel gear, (6) worm gear. [5%]
(b) When $t = 2$ s after starting from rest, the tangential component of acceleration of the spindle EF is (1) 600 m/s^2 , (2) 120 m/s^2 , (3) 32 m/s^2 , (4) 5.81 m/s^2 , (5) 2.70 m/s^2 , (6) 0.185 m/s^2 . [10%]

B3. [20%] The 10-lb slender rod is suspended from the pin at A, Fig. B3. A 2-lb ball B is thrown at the rod and strikes its center with a horizontal velocity of 30 ft/s.

- (a) Consider the ball and rod as a system. (1) is conserved about point A since the impulsive force between the rod and ball is (2) . Also, the weights of the ball and rod are (3) . [6%]
(b) Determine the angular velocity of the rod and the horizontal velocity of the ball just after impact if the coefficient of restitution is 0.4. [14%]

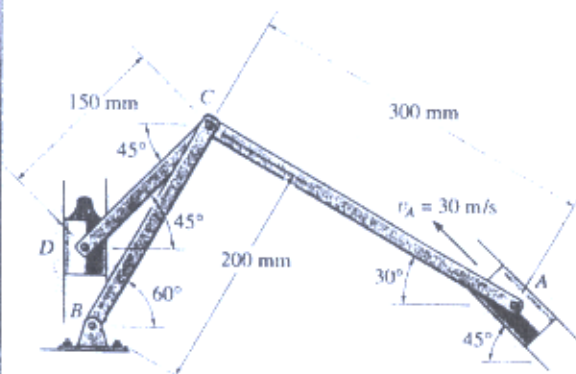


Fig. B1

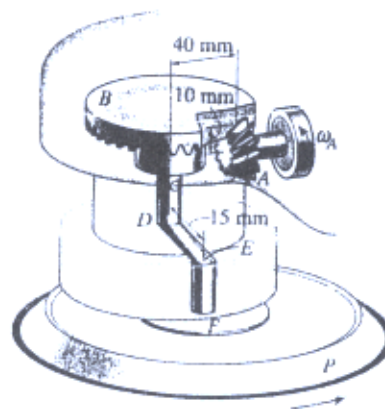


Fig. B2

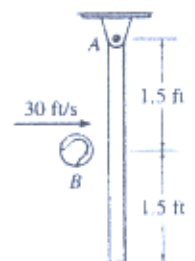


Fig. B3