

工程力學

1. A simple harmonic motion is discussed in Figure 1.  
 10% Mass  $m$  is moving along  $y$ -axis in simple harmonic motion (SHM) with respect to a fixed point  $O$  as the origin. The SHM system is moving along  $x$ -axis in constant speed  $V$ .
- a. Figure out the locus of mass  $m$  in this compound motion.  
 b. Discuss what force exerts on the mass  $m$  in this motion system.

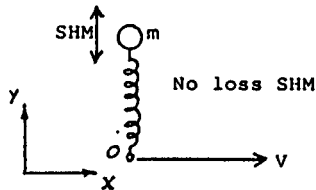


Figure 1.

2. A pulley system as shown in Figure 2.  $m_2$  is a free falling body, while  $m_1$  is pulled through a roller. Frictions  $f_0$  and  $f_1$  on the surface and in the roller are included. Note that the roller is massless. Discuss the force balance and write down the equation of motion of the system.

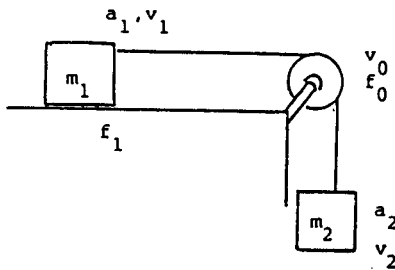


Figure 2.

3. Consider a half-ring given in Fig. 3. The radius of the circular cross section of the ring is small compared with  $r$ .
- 10% a. Determine the moment of inertia of the half-ring of mass  $m$  about the axis that goes through  $a$  and is perpendicular to the ring.
- 20% b. Determine the natural frequency of the half-ring for small  $\theta$  when rocking without slip on the surface.

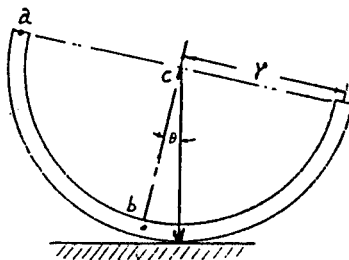
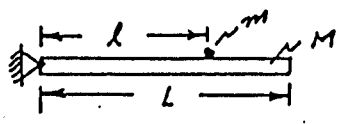
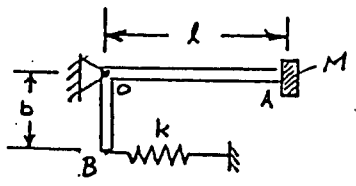


Figure 3.

4. A particle of mass  $m$  rests at a distance  $l$  from the hinged end of a horizontal, uniform rod of length  $L$  and mass  $M$ . The particle is not attached to the rod.
- Compute the reaction force between the particle and the rod as a function of  $l$  at the instant after release of the rod from the rest position.
  - For the case in which  $l = L$ , compute the angular velocity of the rod as it passes through the vertical position.



5. Compute the period of oscillation for small motions of the system shown. The stiffness of the spring is  $k$ , and the system is in equilibrium when the arm holding the mass  $M$  is horizontal. The link  $AOB$  and the spring are taken to be massless.



飛行力學

1. An airborne vehicle is initially at an equilibrium condition for quite a long time and the pilot incidently falls into asleep. If, suddenly, a short burst of strong gust with both a downward velocity component and an into the left hand side (as the pilot would see it if he is awake) velocity component appears. Discuss what subsequent motion the vehicle will respond to this gust without the pilot's attention.