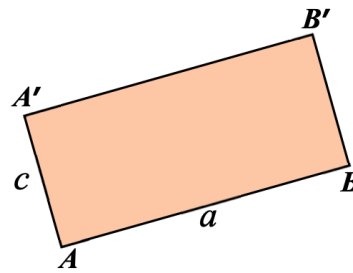
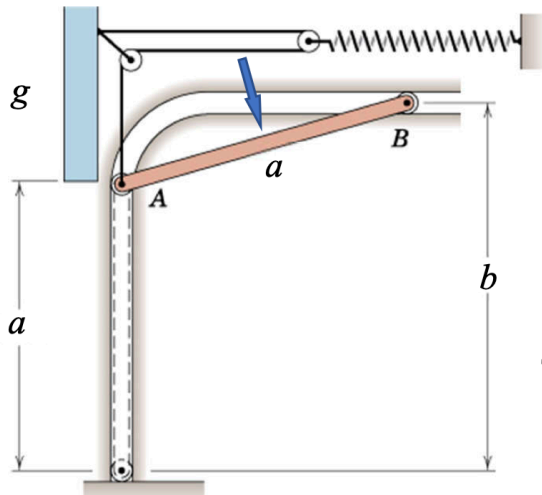


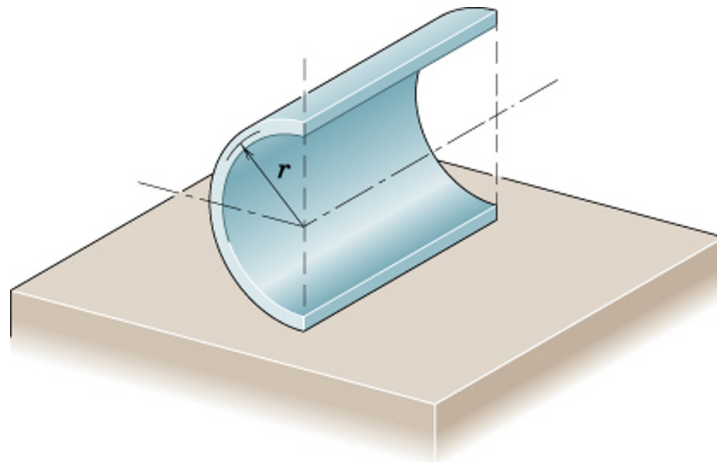
ESO209A: Dynamics: Tutorial 10
(Week: 6-19 Oct. Based on L15-L17)

- (1) In the figure on the left below, the side view of a thin rectangular door $AA'BB'$ is shown. The door slides on the tiny end-rollers in the guide as shown. The dimension of the door are $a = 3$ m and $c = 1.5$ m, and $b = 3.5$ m. Note c is into the plane of the paper. The mass of the door is 150 kg. The corners A and A' of the door are connected to two springs through the rope-pulley arrangements (only one is seen from the side view). The stiffness of each spring is 600 N/m. If the door is released from its rest position as shown, determine the velocity of points A and A' of the door when it will hit the floor. The final position of the door is show with dashed lines.

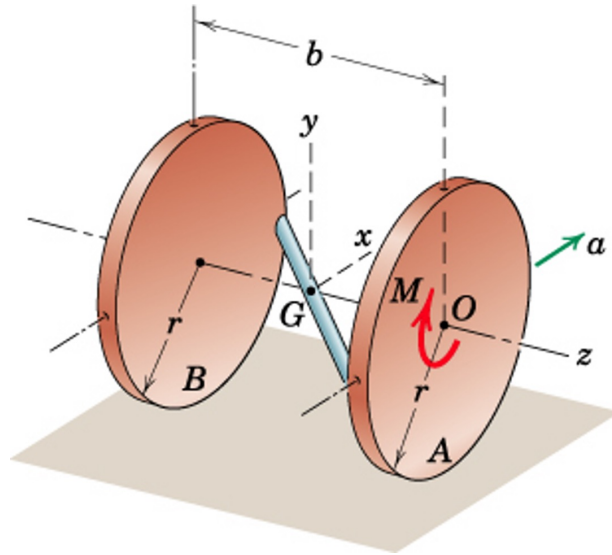


The door as viewed from the direction of the blue arrow.

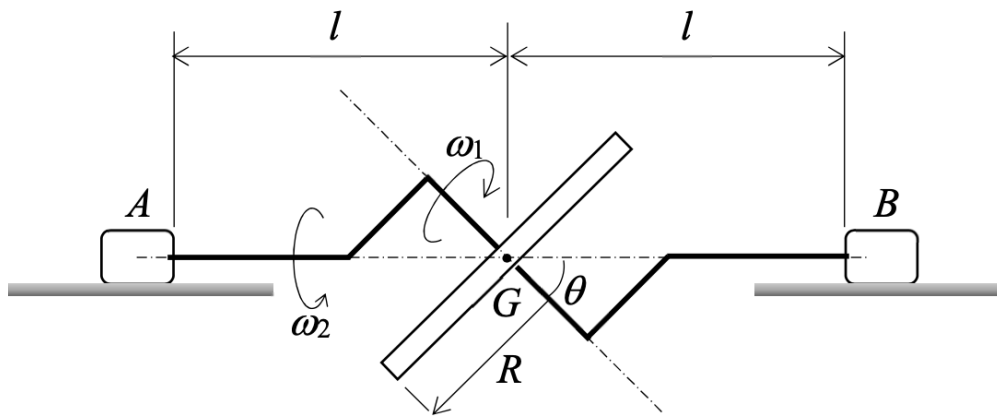
- (2) A uniform thin semi-cylindrical shell of mass 10 kg, length $l = 1$ m and mean radius $r = 0.5$ m, is released from the rest position as shown. Determine the minimum coefficient of friction necessary to prevent any initial slipping of the shell.



- (3) Two circular discs, each of mass m_1 , are connected through an inclined rod such that the discs have the common z -axis, and the rod cuts this common axis at G , as shown. Mass of the rod is m_2 . Initially, the assembly is at rest when a torque M is applied to a disc which results in the acceleration of a of the centres of the discs, as shown. The discs are separated by a distance b and have radii r . Determine the ground reactions on the discs at the instant when M is applied. At this instant, the inclined rod lies in xz -plane.



- (4) The top view of a heavy circular disc of mass m and radius R is mounted on a bent shaft at the instant when is shown. The disc spins at a constant angular velocity ω_1 about its axis. The bent shaft rotates at a constant angular rate ω_2 about the horizontal, as shown. For the geometrical parameters shown and neglecting the mass of the shaft in comparison to that of disc, determine the reactions at bearing locations A and B .



- (5) Two identical circular discs of mass m are connected to each other through a mass-less rod. The entire assembly is spinning freely in the space at a constant angular rate p as shown. For which value of b , the assembly will not suffer precession motion?

