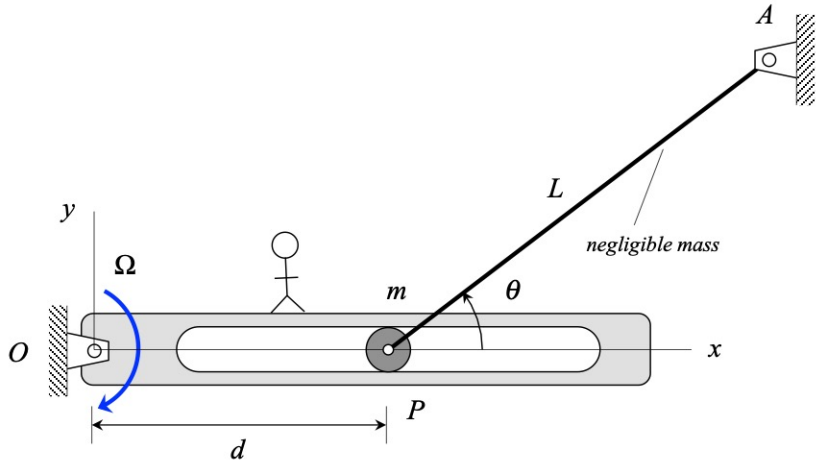
Homework H.4.E

Given: A slotted arm is rotating about end O with a constant rate of Ω. Particle P (of mass m) is attached to link AP, with the mass of AP assumed to be negligible compared to the mass of P. P is constrained to move within a smooth, straight slot. At the position of interest, AP is at an angle of θ measured counterclockwise from the slotted arm. Note that AP is a two-force member. The mechanism moves in a horizontal plane.

Find: For this position,

(a) Determine the velocity and acceleration of P. Write your answers as vectors, in terms of their xy coordinates. It is suggested that you use the moving reference frame equations in your analysis for the velocity and acceleration of P. Use an observer attached to the slotted arm.

(b) Determine the normal force acting on P and the force acting on P by link AP.



HORIZONTAL plane

Use the following parameters in your analysis: $m = 20$ kg, $\theta = 36.87°$, $d = 0.75$ m, $L = 2$ m and $\Omega = 5$ rad/s.

Homework H.4.F

Given: Particle P (having a mass of m) is constrained to move around the wall of a horizontal circular cavity, with the path of P in the cavity being a circle of radius R. The horizontal surface on which P moves is smooth, with the wall of the cavity along which P moves is rough having a coefficient of kinetic friction between the wall and P of μ_k. When at position A, P is known to have a speed of v_A.

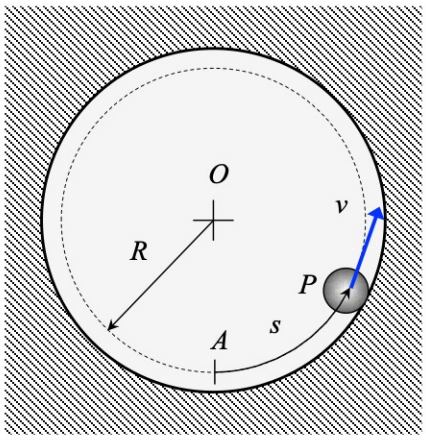
Find: For this problem,

(a) Show that the speed of P as it moves around the cavity is governed by the differential equation: $dv/ds = -\mu_k v/R$, where s is the distance traveled by P.

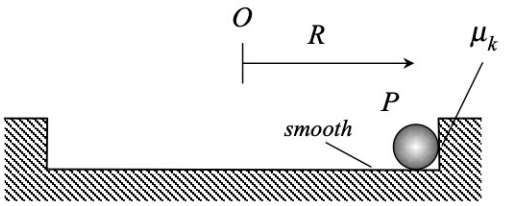
(b) Using the result of (a) above, determine the speed v of P as a function of s as it moves around the cavity wall. (HINT: Integrate the differential equation found in (a).) Leave your answer in terms of, at most, v_A, μ_k, R and s.

(c) How far does P travel before it comes to rest?

motion of P in the HORIZONTAL plane



TOP view



SIDE view