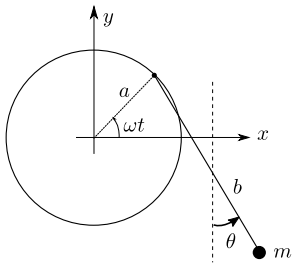
Exercise 3 - TFY4345 Classical Mechanics

2020

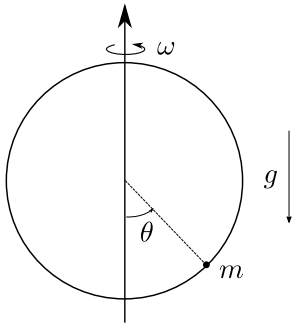
1 Pendulum on spinning a wheel

The point of support of a simple pendulum of length b moves on a massless rim of radius a, rotating with a constant angular velocity ω. Obtain the expression for the Cartesian components of the velocity and acceleration for the mass m. Obtain also the angular acceleration for the angle θ, shown in the figure, by using Euler's equation.



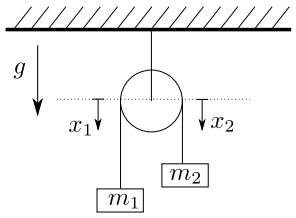
2 Bead on a ring

A bead is attached to a ring with radius R where it can slide frictionless. The ring itself is attached to a vertical shaft which rotates with a constant angular velocity (let us assume that the shaft does not affect the bead motion). Obtain by using the Euler equations the equilibrium position of the bead.

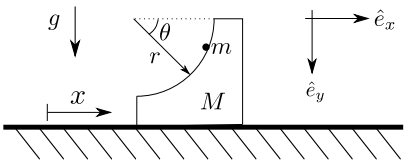


3 Atwood's machine

Determine the Hamiltonian and Hamilton's equations of motion for a s simple Atwood's machine (one pulley), as shown in the figure. The pulley radius i a and the moment of inertia I.



4 Particle on a moving wedge



A particle of mass m slides down a smooth, circular wedge of mass M as shown in the figure. The wedge rests on a smooth, horizontal table with coordinate x.

(a) Find the equation of motion m and M.

(b) Find the reaction of the wedge on m, as a function of θ and it's derivatives.

(Note: This one is tedious, focus on the 3 others first)
(Hint: Use the method of Lagrange's undetermined multiplier. Select x and θ as generalized coordinates.)