

Exercise 3 - TFY4345 Classical Mechanics

2020

1 Pendulum on spinning a wheel

(FIGUR)

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

(FIGUR)

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

(FIGURE)

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

(FIGURE)

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 its 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.)