PROBLEM DISCUSSION

FUTURING LEARNING SOLUTIONS

May 24, 2022

Suppose a system has 2 degree of freedom. Which among the following are possible Lagrangian.

1. $L = \frac{1}{2}m(\dot{x}^2 + \dot{y}^2 + \dot{z}^2) + mgz$
2. $L = \frac{1}{2}m(\dot{x}^2 + \dot{y}^2) + mgz$
3. $L = \frac{1}{2}m(\dot{y}^2 + \dot{z}^2) + mgz$
4. $L = \frac{1}{2}m(\dot{y}^2 + \dot{z}^2) + mgz - \frac{1}{2}ky^2$

A system of 3 degrees of freedom has Langrangian
$L = \frac{m}{2}(\dot{x}^2 + \dot{y}^2 + \dot{z}^2) - \frac{1}{2}k(x^2 + y^2)$

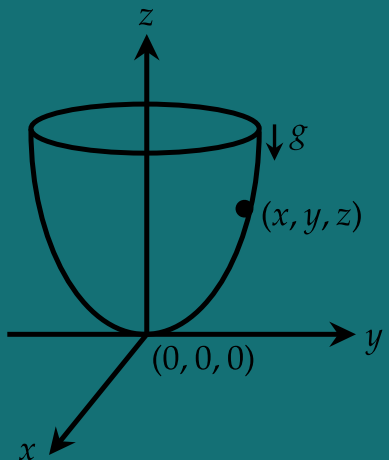
1. Find generalized momentum
2. Find cyclic coordinates
3. Write Lagrangians equation of motion

$$L = \frac{1}{2}m(\dot{x}^2 + \dot{y}^2 + \dot{z}^2) - \frac{1}{2}k(x^2 + y^2)$$

1. Transform L to cylindrical coordinate
2. Find generalized momentum
3. Find cyclic coordinate
4. Write down equation of motion

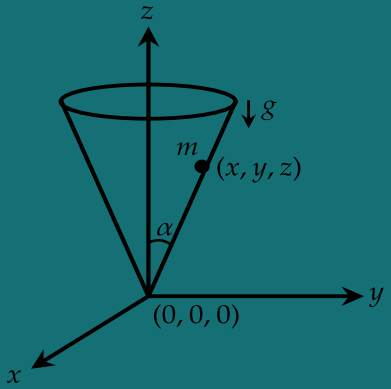
A particle of mass m moving in inner surface of a parabola with equation $z = \frac{1}{2}b(x^2 + y^2)$ (paraboloid) under the influence of gravity in z direction.

1. Write Lagrangian in cylindrical coordinates
2. Identify cyclic coordinates
3. Write equation of motion


z
g
(x, y, z)
y
(0, 0, 0)
x

Particle is constrained to move in inner surface of cone under gravity. Find

1. L in spherical polar coordinates
2. Cylindrical coordinates
3. Equation of motion


z
g
m
(x, y, z)
α
y
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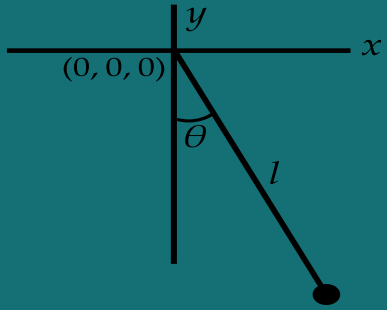
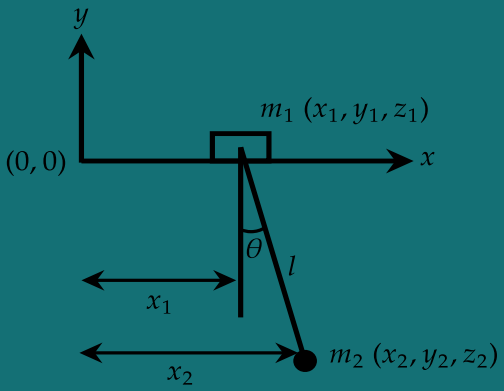
m_1 and m_2 connected to massless strength at length l. m_1 is constrained to move on the surface of table. m_2 can only move vertically z direction. Find equations of motion

Simple pendulum



Moving pendulum



Double pendulum