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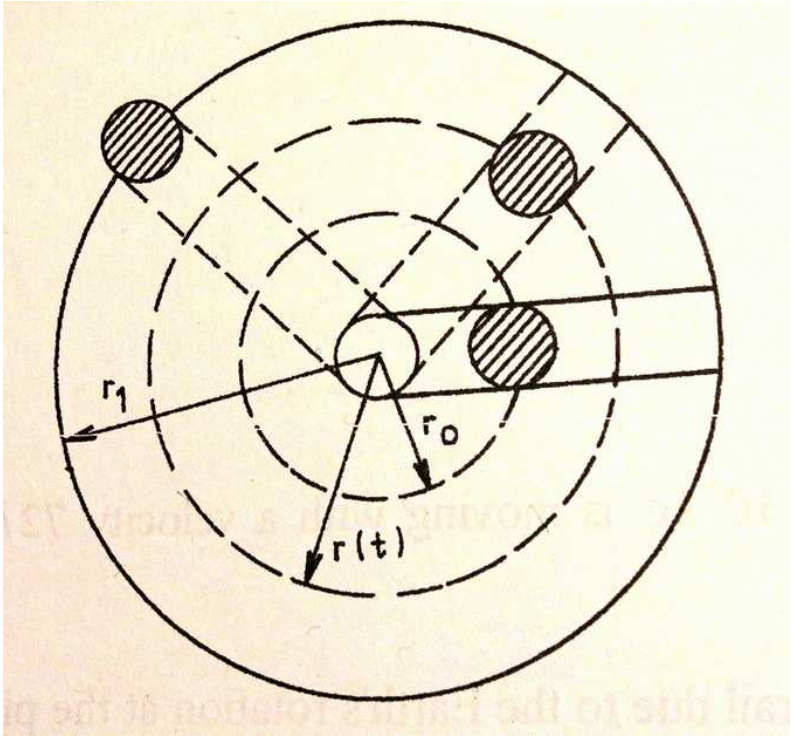
Homework 4 for the Physics for OI

This homework is focused on the motion in a rotating system and on the Coriolis' force calculation.

The problem: A circular disk of radius r_1= 2 m rotates around the vertical axis with constant angular velocity ω= 8 s^{-1}. At a distance r_0= 0.5 m from the axis there is a sphere of mass m= 0.25 kg inside a radial groove on the disk. Assume that the sphere is fixed at the r_0 position and released at the moment t= 0.



Your tasks:

a) To evaluate and plot the time dependence of the distance of the sphere from the disk centre r(t).
b) To evaluate and plot the time dependence of the sphere's velocity relative to the center of the disk v(t).
c) To evaluate and plot the time dependence of the centrifugal acceleration acting on the sphere $a_n(t)$.
d) To evaluate and plot the time dependence of the magnitude of Coriolis' force acting on the sphere $F_c(t)$.

Additional instructions and hints:

Build up the basic differential equation. You will need the second Newton's law and the relation for the centrifugal force. Use initial conditions as additional equations for the *DSolve*.
Calculate consequently r(t), v(t), $a_n(t)$ and $F_c(t)$.
Calculate exact time corresponding to the moment when the sphere reaches the edge of the disk (*FindRoot*).
Plot all four graphs separately using blue thick line and choose convenient *PlotRange*.
Each graph should contain the maximum value corresponding to the edge of the disk (r_1). The value can be represented by horizontal dashed red line, for example.

Recommended functions for the *Plot – GridLines*, *Frame*, *PlotStyle* and *PlotRange*.

Note: You can check your general solution for the r(t) at the problem 1-57 in the textbook.

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