# 2.004: MODELING, DYNAMICS, & CONTROL II
Spring Term 2003

PLEASE ALSO NOTE THAT ALL PRELAB EXERCISE ARE DUE AT THE START (WITHIN 10 MINUTE) OF THE LAB SESSION, NO LATE WORK IS ACCEPTED.

Pre-Lab Exercise for Experiment 4

1. (a) Consider a "rocker". The rocker consists of a half cylinder placed curve side down on a flat surface acted on by gravity. The geometric constraint is the "rolling without slipping" condition. Please calculate the center of mass of this system? Further calculate the moment of inertial of this rocker.
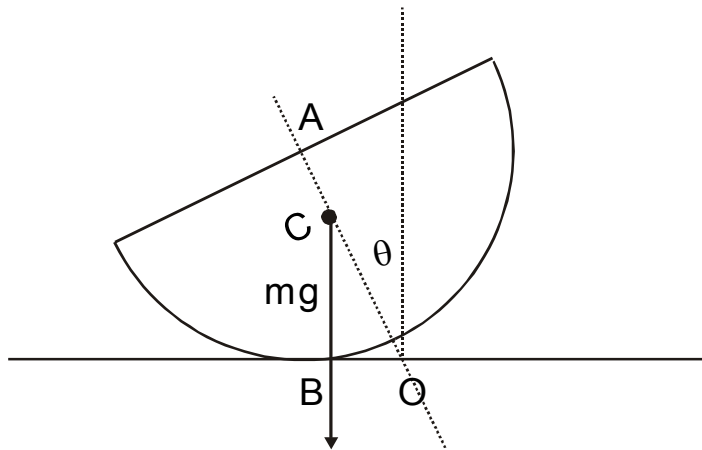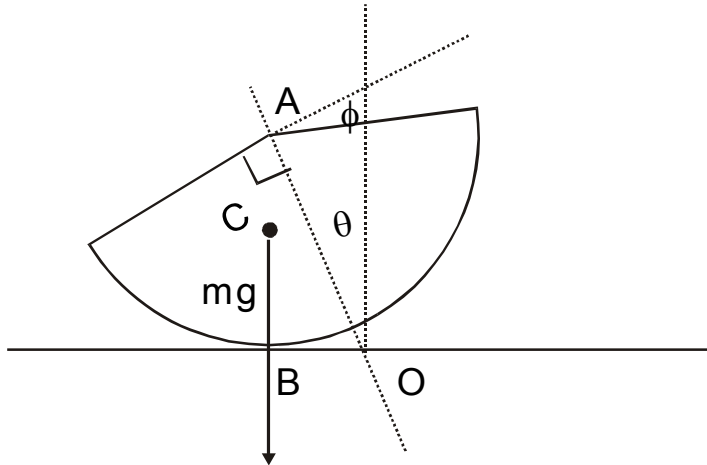
(b) Write down force and torque balance equation reference to the center of mass.

(c) What is the nature frequency of the rocker for small angular oscillation around resting position?

(d) Repeat previous calculation of the natural frequency by writing force and torque balance equations with reference to the moving contact point.

2. Consider an "partial rocker." Please keep the rolling without slipping boundary condition.

A φ C θ mg B O

(a) Calculate the new center of mass. Further calculate the new resting angle of the rocker.

(b) Write down the force and torque balance equations at the center of mass.

(c) Calculate the natural frequency of the rocker for small angular oscillation around the resting angle.

(d) Repeat previous calculation of the natural frequency by writing force and torque balance equations with reference to the moving contact point.