## 1.053/2.003 Dynamics and Control I Fall 2007

## Problem Set 8

Out: Tuesday, November 6<sup>th</sup>, 2007 Due: Wednesday, November 14<sup>th</sup>, 2007

## 1. Rack and pinion (Modified from Williams, Problem 6-109)

A rack and pinion system is sketched in Figure P6-109. The axis of the pinion is fixed in frictionless bearings. A massless rocket is attached to the circular massless pulley of radius a at a point along its edge as shown in the figure. It exerts thrust F(t) which remains tangential to the pulley at all times. Assume that the pinion can be modeled as a uniform cylinder of mass  $m_2$  and radius b and that the friction between the rack and the horizontal surface can be modeled as viscous damping having a dashpot constant c. Derive the equation(s) of motion for the system using Lagrangian approach.



Figure by MIT OpenCourseWare.

## 2. Problem 6-101 from Williams.

- 3. Problem 6-103 from Williams.
- 4. Problem 6-110 from Williams.

Cite as: Sanjay Sarma, Nicholas Makris, Yahya Modarres-Sadeghi, and Peter So, course materials for 2.003J/1.053J Dynamics and Control I, Fall 2007. MIT OpenCourseWare (http://ocw.mit.edu), Massachusetts Institute of Technology. Downloaded on [DD Month YYYY].