

1.053/2.003 Dynamics and Control I
Fall 2007

Problem Set 8

Out: Tuesday, November 6th, 2007
Due: Wednesday, November 14th, 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.

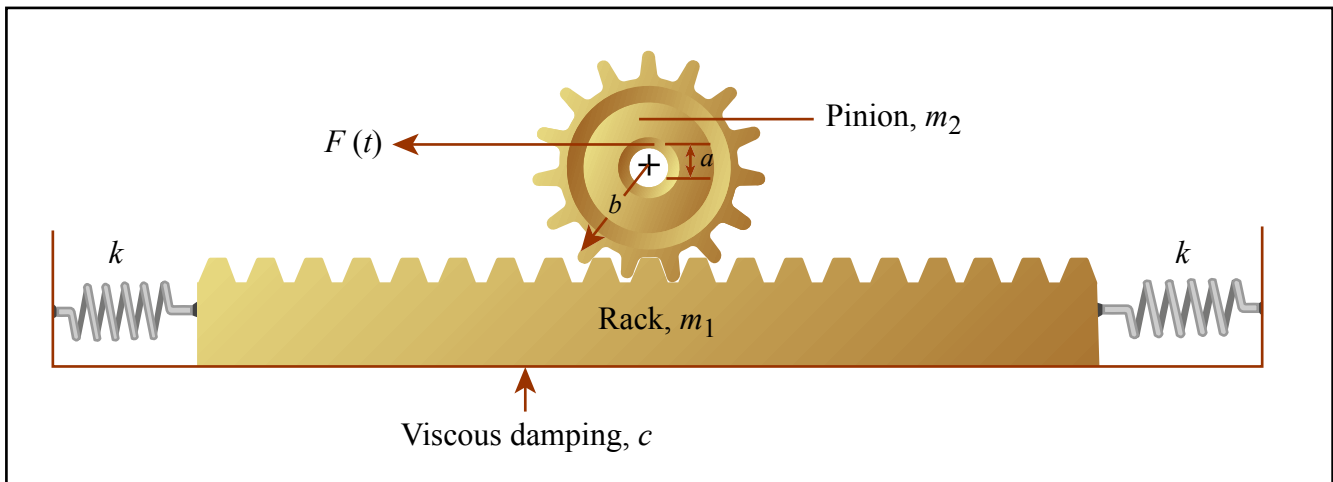


Figure by MIT OpenCourseWare.

2. **Problem 6-101 from Williams.**

3. **Problem 6-103 from Williams.**

4. **Problem 6-110 from Williams.**