ME 740
Advanced Vibrations

Homework #9
due Tuesday, March 19, 2013

1. Using Lagrange's equations for a discrete system, solve the following:

The two identical cylinders of mass m, radius r, and centroidal mass moment of inertia $\bar{I} = mr^2/2$ shown in the accompanying figure are attached to each other and to rigid supports by springs having the stiffnesses shown. Assuming that the cylinders roll without slipping, determine (a) the differential equations of motion of the system in terms of the generalized coordinates θ_1 and θ_2 shown in the figure.

Partial ans:
$$\begin{bmatrix} 3m/2 & 0 \\ 0 & 3m/2 \end{bmatrix}\begin{Bmatrix} \ddot{\theta}_1 \\ \ddot{\theta}_2 \end{Bmatrix} + k\begin{bmatrix} 3 & -2 \\ -2 & 5 \end{bmatrix}\begin{Bmatrix} \theta_1 \\ \theta_2 \end{Bmatrix} = 0$$