16.61 Handout #8
Prof. J. P. How April 10, 2003
Prof. J. Deyst **Due:** April 17, 2003

16.61 Homework Assignment #8

1. The equations of motion of the mass on the spring pendulum in problem #1 of HW#4 are given by:

$$r^2\ddot{\theta} + 2\dot{r}\dot{\theta} - \Omega^2 \cos\theta(d + r\sin\theta) = -g\sin\theta \quad (1)$$

$$\ddot{r} - r(\dot{\theta}^2 + \Omega^2 \sin^2\theta) + \frac{k}{m}(r - r_0) = g\cos\theta + d\Omega^2 \sin\theta \quad (2)$$

   Assume that $m = 1$, $k = 2$, $r_0 = 1$ is the undeflected length of the spring and $r(0) = 2$, $\dot{r}(0) = 0$, $\theta(0) = 0$, $\dot{\theta}(0) = 0.1$. Use the techniques discussed in class (ODE45) to solve these equations of motion numerically for $r(t)$ and $\theta(t)$. The arm attached to the rotating shaft has length $d = 0.8$m, as shown in the figure. The shaft is rotating with a constant angular velocity $\Omega = 0.4$ rad/sec, but the pendulum is free to Look at page 6–8 of the notes. Please submit all codes for this problem by email.

2. Show that a thin disc thrown up spinning about its major axis with a small nutation angle will make two wobbles to every cycle of spin. Try it - is it true?

3. Do problem 18.66 from Beer and Johnston *Vector Mechanics for Engineers*.