PROBLEM SET #10 FOR 13.013

DUE NOVEMBER 14, 2001

1. You did problem 6-83 for homework number 9.

   a. Determine the undamped natural frequency.
   b. Place a damper parallel to the spring and connected to l_1, a distance 'b' from the pivot. Modify the equation of motion to include the damping term. The dashpot constant is R (units of force/linear velocity).
   c. Find an expression for the damping ratio ζ in terms of the properties of this rotational system.
   d. A positive horizontal force, F_o, is applied at the joint between mass m_2 and mass m_3 on the right hand side. The force lasts for a very short time, Δt, where $\Delta t =<< f_n$. Determine the equivalent initial conditions θ_0 and $\dot{\theta}_0$ which would allow you to compute the transient response of the system.
   e. Sketch the damped response of this system assuming $\zeta = 0.055$.

2. a. In problem 6-100. Do not allow the small cylinder to move. Find a single degree of freedom equation of motion, which describes the motion of the hoop hanging from the cylinder.

   b. Find the natural frequency in both Hertz and radians per second, given that

      $r = 4$ inches
      $R =$ 12 inches

      What is the natural period?

3. a. Find the natural frequency of the pendulum in problem 6-82 for the case $a = b = 1 ft$ and $m_a = m_b = 0.1$ slugs.

   b. What is the value of the torsional damping constant, R_θ, which would result in a damping ratio of 1%? The damping might be due to pivot friction.

4. Find the natural frequency for the system in problem 6-99. Assume that you have 2% damping and initial conditions $\theta(0) = 0.1$ radians and $\dot{\theta}(0) = 0$. Compute the ratio of the amplitude of two peaks separated by five periods of motion.

5. Do problem 8.13 and determine the natural frequency, as well as the maximum possible amplitude.

6. Do problem 8-35. Assume the masses of the shafts are small compared to the propeller.