*M&AE 203 – DYNAMICS – Lab Demo Experiment*

**1-dof Vibrating System – Spring 2014** **Due: Thursday, March 27th, 6 pm**

**Note:**

You may freely discuss this Lab Exercise with your classmates however the work you hand-in must be your own.

Given the data collected in class, please complete the following tasks.

1. Use the *ring-down* data of peak displacement amplitudes and damped vibration period to recover the system's damping coefficient, $c$, and spring stiffness, $k$. You are given that the mass is 0.330 kg and the spring has mass 0.026 kg. Use for the system moving mass: $0.330 + (1/3)(0.026) = 0.339$ kg.

   If you want to get extra credit, please provide a clear explanation or proof why the system's mass $m$ should include one-third of the mass of the spring, e. g, $m_s/3$, (which is also moving) so that the system's total moving mass is $(m + m_s/3)$.

2. Use the found values of $m$, $c$, and $k$, to create a synthetic transient displacement signal. Compare it to the original, measured signal. You will likely need to adjust the *scale* and *phase* of your synthetic signal to bring it into alignment with the measured signal.

3. From your observations of the driven *mass-spring-damper* system, write down your observations of the motion of the mass as the excitation frequency was increased from very low values, through *resonance*, to high values.

4. Use the measurements of the frequency response curves of the driven loudspeaker – with and without the added mass $\Delta m$ – to reverse engineer the loudspeaker. That is, determine the loudspeaker's moving mass, $m$, damping coefficient, $c$, and spring stiffness $k$.

   For this part of the experiment, you may assume that the damping ratio $\zeta$ is reasonably small so that $\omega_n \approx \omega_d = \omega_n\sqrt{1-\zeta^2}$ of the loudspeaker.