TASKS TO ACCOMPLISH FOR THE ELECTROMECHANICS PART OF THE ENGINEERING CLASS

The idea is to come up with an electric circuit whose governing differential equations match the differential equations that govern a spring driven oscillating system. To that end, you are going to need some information about your system. Specifically, you will need to determine the **spring constant** for the springs, the **damping constant** for the eddy currents, the **mass** of the cart and *position versus time* graphs for both the dampened and undampened situations.

What follows is a suggested guide to that goal.

FOR THE CART SYSTEM:

1.) At some point you need to determine the mass of your cart.

2.) At some point you need to determine the spring constant *k* for your springs (the two should have the same constant, so finding one means you know the other). All I'll say about that is that the units for the spring constant are *newtons per meter*, which means the spring constant evidently tells you how many newtons you need to apply to get the spring to elongate a given distance. From that information, you should be able to figure out what you need to do to determine *k*.

3.) You will need a printout of the *velocity versus time* graph for both the dampened and undampened situation, and a *position versus time* graph for both.

4.) Those printout will be important because they will allow you to determine the period of oscillation *T* for each situation. Why might that be of interest? That information will allow you to determine the damping constant D (which you will need). What follows is additional information that will help in that quest:

a.) It turns out that the frequency ν of an oscillating system is related to the period T of the system by the relationship $T = \frac{1}{\nu}$. Additionally, the frequency ν is also related to the system's angular frequency ω by the relationship $\omega = 2\pi\nu$. And lastly, the damping constant is related to the system's free-run oscillating angular frequency ω_o and its damped angular frequency ω_d by the relationship $\omega_d = \omega_o\left(1 - \frac{D^2}{4mk}\right)^{1/2}$.

b.) Sooooo, use the use all of that information and your graphs to determine the damping constant.

5.) We would like to scale the mechanical and electric system. Use an Impedance Bridge to determine the inductance L of the coil in the system. Then determine the scaling factor needed to make the coil's value and its mechanical counterpart the same. With that scaling factor, determine how large the capacitor and resistor would have to be to exactly mimic the mechanical system.

6.) When done, build your electrical circuit, hook the resistor across an oscilloscope and view the output. DOES IT LOOK AT ALL LIKE WHAT YOU WOULD EXPECT. Explain.