Due: Thursday, 9/6/07

1) Find a set of state variable equations $\dot{x} = Ax + Bu$ for the system below (assume positions measured from unstretched spring positions)

2) The circuit shown below comes from the textbook used in ME 475 - Control Systems. It is called a “lag-lead compensator” and is used to improve the performance of some control systems. Write the state-variable equations for the system. Determine the output equation for $E_0$.

3) “Continuing Example #1” is a translating mechanical system described on pages 32-36 of your textbook. Use the following parameter values and generate the numerical values for the A and B matrices on the top of p35. Use units of meters for $x_1$ and $x_3$ and units of meters/sec for $x_2$ and $x_4$. Make sure that your units are consistent!

4) “Continuing Example #2” is a rotational electromechanical system described on pages 36-39 of your textbook. Use the equations in the textbook and our example problem in class to develop a different state-space description of this system that uses motor position $\theta(t) = x_1$, motor angular velocity $\dot{\theta}(t) = x_2$, and motor current $i(t) = x_3$, as the three state variables. Note that there is no back-emf constant in this continuing example problem.