ENEE 460 Fall 2016 **Homework Set 6**: Assigned Wednesday October 12, 2016 - due back at the start of class on Wednesday, October 19, 2016

1. Read Chapter 6 on Linear Systems (2nd edition of book) – section 6.4 on Linearization, and how it comes in handy in solving stability problems as illustrated in section 5.3 of Chapter 5 on Dynamic Behavior. Read Chapter 5, sections 5.1 – 5.3 inclusive.

2. Do Problem
   6.10

3. Consider solution to problem 2(a) in mid-term 1, setting the constants a_1, a_2, b_2 all equal to 1, but without the small angle assumption or approximation. Write a MATLAB simulation with general control input u allowed. Now consider control input u(t) = sin(at + b), for a range of frequencies a and phase values b
Run the simulation and determine a suitable range of these parameters such that the pendulum is stabilized about the straight up equilibrium in your numerical experiments. Provide plots of your results and copies of your code. Clearly state your experimental results.

4. Consider the dynamics (5.6) obtained by perturbing a linear oscillator. First verify by simulation that Figure 5.5 is indeed the right behavior. Next, suggest a new version of equation 5.6 (hint – we are looking for a slightly different perturbation) so that the resulting numerical behavior is qualitatively the same as in Figure 5.5, but the trajectories tend toward a circle of radius 2.

5. Determine the linearization of the dynamics (5.6) around the equilibrium at (0, 0). How well do the trajectories of the linearization correspond to the trajectories of the nonlinear system (5.6)?