

# Fall 2002

## EE/ME 559. NONLINEAR CONTROL AND STABILITY

Take\_Home Examination #1; Due Date: October 1, 2002

**Problem #1.** Apply Krylov-Bogoliubov method to Rayleigh equation  $\ddot{y} + \mu \left( \frac{\dot{y}^3}{3} - \dot{y} \right) + y = 0$ .

Solve the same equation using perturbation method to obtain the solution to the first order in  $\mu$ . Compare the solutions of both methods with the plots obtained from Matlab simulation.

**Problem #2.** Consider the second order equation  $\ddot{y} + \alpha \dot{y} + \beta y = 0$  where  $\alpha$  and  $\beta$  are scalar real parameters. Show the boundaries of different stability regions (e.g., stable and unstable foci, stable and unstable nodes, saddle point, and center point) on the  $\alpha - \beta$  plane.

**Problem #3.** Five parts of Problem 2.20 (Khalil, 3<sup>rd</sup> ed., p. 83).

**Problem #4.** Two parts of Problem 2.23 (Khalil, 3<sup>rd</sup> ed., p. 84).

