ESE 553: Homework Set #4

Ground rules for HW Sets:

You are encouraged to talk to each other like professionals about approaches to problems and even nonassigned work ***in general terms***.

However, for your own sake, do not resort to copying. You will never make this subject into your own world view that way.

HW#4 is *due* on Friday, April 25, 2008 *in class* ***with no exceptions***.

The first assignment from the text is: Consider Problem #4 on page 212 for all real epsilons. Carefully determine the stability of the origin in each case, giving a complete justification for each of your steps, e.g., Lyapunov's theorem, LaSalle's Theorem, etc. In addition do part (b) carefully as well.

The second assignment from the text is: Problems #2, #3, and #7 on pages 232 - 233.

We have two additional problems, Problem A and Problem B.

Problem A. Consider the dynamical system

$$\dot{x} = -x^3 + y \tag{1}$$
$$\dot{y} = x - ky \tag{2}$$

where $k > 0$. Show this is a gradient system and give a rigorous description of its global phase portrait in $\mathbb{R}^2$.

Problem B. Consider the dynamical system

$$\dot{y_1} = y_2 - y_1^3 \tag{1}$$
$$\dot{y_2} = ay_1 - y_2^3 + z^2 \tag{2}$$
$$\dot{z} = -z + y_1^3 - 3y_1^5 + 3y_1^2 y_2, \tag{3}$$

where $a \neq 0$. Determine the stability properties of the origin.