

CDS 104
Spring 2008
Homework #4
Due Friday May 9th at 5pm

Problem 1 — Harmonic Oscillator (Pendulum)

In Strogatz Chapter 6 it was shown that the origin is a nonlinear center for the pendulum example.

Let $\ddot{x} + \sin x = 0$.

(a) Can you prove stability of the origin using linearization? Use an appropriate Liapunov function to prove that the origin is a stable fixed point.

(b) Lets add a “damping term” $\ddot{x} + \epsilon(1 - x^2)\dot{x} + \sin x = 0$. Study the stability of the origin for different values of ϵ ($\epsilon > 0$, $\epsilon < 0$.)

Perko:

Problem 4, pg 135

Strogatz:

7.1.2, 7.1.8, 7.2.9