

2.050J/12.006J/18.353J Nonlinear Dynamics I: Chaos, Fall 2012

Problem Set 3

Due at 12:01 pm on Friday, September 28th, in the box provided. No late psets are accepted. If you collaborated with other students in the class, list their names on the title sheet. The work that you submit must be your own.

Main concepts: fixed points in nonlinear systems, their stability, phase portraits, conservative systems and nonlinear centers, non-dimensionalization.

Reading: Strogatz Ch. 6.

Problem 1: NL systems, linearization, phase portraits

Strogatz 6.5.19

Problem 2: Conservative systems: Glider

Strogatz 6.5.14

Problem 3: Conservative systems: General relativity and planetary orbits

Strogatz 6.5.7

Problem 4: Conservative systems

For the following system $\ddot{x} = (2 \cos x - 1) \sin x$,

1. Find the potential and the conserved quantity,
2. Rewrite the equation as a system in the (x, y) plane using $y = \dot{x}$, find the fixed points, their stability
3. Sketch the phase portrait, plot it in MATLAB.

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