ME215A: Applied Dynamical Systems I
Fall 2010

Important Information

Lectures: Monday, Wednesday 11:00-12:15, GIRV 2110

Office Hours: Tuesday 11:00-12:00, 2350 Engr II Bldg

Course Webpage: `http://www.engineering.ucsb.edu/~moehlis/ME215A`

Questions? Contact (email preferred):

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Textbook: *Introduction to Applied Nonlinear Dynamical Systems and Chaos, Second Edition* by Stephen Wiggins, Springer-Verlag, 2003

Course Description

This course will cover dynamical systems theory, and the application of dynamical systems techniques to mathematical, physical, biological, and technological systems described by ordinary differential equations or maps. The primary focus will be on dissipative systems, so that the course is complementary to the Advanced Dynamics sequence (ME 201 and 202) which primarily focusses on conservative systems.

The following topics will be covered (chapters are from the textbook by Wiggins)

- fixed points for vector fields and maps, and their stability properties (Ch. 1)
- Liapunov functions (Ch. 2)
- invariant manifolds for linear and nonlinear systems (Ch. 3)
- periodic orbits (Ch. 4)
- index theory (Ch. 6)
- asymptotic behavior, attractors (Ch. 8)
- Poincaré-Bendixson Theorem (Ch. 9)
- Poincaré maps (Ch. 10 and 11)
- structural stability (Ch. 12)
- center manifolds (Ch. 18)
- normal forms (Ch. 19)
- bifurcations of fixed points of vector fields (Ch. 20, 22)
- bifurcations of fixed points of maps (Ch. 21)
- Takens-Bogdanov bifurcation (Ch. 20 and 33)
- Melnikov's method (Ch. 28)
- the Smale horseshoe (Ch. 23)
- symbolic dynamics (Ch. 24)
- chaos and strange attractors (Ch. 30)

Homework/Grading

- Grades will be determined by performance on several homework sets and a take-home final exam.

  The homework will be due at the time given on the assignments. Please get the assignments in on time!

Other Useful Resources on Dynamical Systems

- J. Guckenheimer and P. Holmes, *Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields*
- S. H. Strogatz, *Nonlinear Dynamics and Chaos: With Applications in Physics, Biology, Chemistry, and Engineering*
- P. Glendinning, *Stability, Instability, and Chaos*
- `http://www.scholarpedia.org`