

# ME215B: Applied Dynamical Systems II

## Winter 2017

### Important Information

Lectures: Tuesday, Thursday 12:30-1:45PM, Engr II Bldg Room 2243

Office Hours: Wednesday 10:00AM-11:00 noon, 2341 Engr II Bldg

Questions? Contact (email preferred):

Jeff Moehlis

office: 2341 Engr II Bldg

phone: 893-7513

email: moehlis@engineering.ucsb.edu

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 covers conservative systems.

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

- bifurcations of fixed points of vector fields (Ch. 20)
- Takens-Bogdanov bifurcation (Ch. 20, 33)
- Melnikov's method (Ch. 28)
- bifurcations of fixed points of maps (Ch. 21)
- the Smale horseshoe (Ch. 23)
- symbolic dynamics (Ch. 24)
- Liapunov exponents (Ch. 29)
- averaging (Guckenheimer and Holmes, Ch. 4)

According to class interest and time, the following may be covered:

- global bifurcations, including homoclinic explosions and Shil'nikov bifurcation (Ch. 27)
- phase models / coupled oscillators
- canards
- dynamical systems with symmetry

These topics build on the topics covered in ME215A, Applied Dynamical Systems I.

## Homework/Grading

- Grades will be determined by performance on homework sets.

## Other Useful Books 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*