Math 330  Advanced Ordinary Differential Equations

TTh 4:00pm - 5:15pm, VOTYEY 369

**Textbook:** Nonlinear Dynamics and Chaos, by Steven Strogatz

**Supplemental materials:** posted at my website:

http://www.cems.uvm.edu/ jyang/Teaching.htm

**Instructor:** Prof. Jianke Yang

Room 401, Mathematics-Statistics Building

16 Colchester Avenue

Phone: 656-4314, jxyang@uvm.edu

**Office hours:** TTh 1:00-2:00pm. Additional time by appointment.

**Homework:** homework problems will be given on irregular basis. Computers will need to be used on some of the problems.

**Exams:** There will be a midterm in-class exam (on Oct. 18), and a final exam (on Dec. 13, 4:30 - 7:15 PM). Students are given the option to do a term project in lieu of the final exam. Those interested in this option should talk to this instructor right after the midterm exam.

**Grading:** homework: 50%; two exams: 25% each.

**Topics:**

1. Linear equations with constant coefficients: analytical solutions ( ~ one week).
2. Linear equations with periodic coefficients: the Floquet theory, Mathieu’s equation, Bloch bands and bandgaps ( ~ two weeks)
3. One-dimensional nonlinear systems and bifurcations (one week)
4. Plane autonomous systems: critical points; linearization analysis; phase portraits; limit cycles; Van der Pol equation (two – three weeks)
5. Weakly nonlinear oscillations: the multiscale perturbation method; weakly nonlinear Duffing’s equation (with and without forcing); weakly nonlinear Mathieu’s equation (~ two weeks)
6. Two-dimensional bifurcations (~ two weeks)
7. Lorenz equations, chaos, strange attractors and fractals (two – three weeks)