

Nonlinear Systems Course Syllabus

- Professor:** Dr. Frank L. Severance
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- Office Hours:** Monday: 10:00 to 11:00 am
Wednesday: 10:00 to 11:00 am
Thursday: 06:00 to 06:30 pm
Friday: 10:00 to 11:00 am
- Prerequisites:** Graduate student status and ECE 5950 (Linear Systems) or instructor's approval. ECE 5800 is highly recommended.
- Text:** (Required): *Nonlinear Dynamics and Chaos (with Applications to Physics, Biology, Chemistry and Engineering)* by Steven H. Strogatz; Perseus Publishing, 2000.
- Grading Procedure:** Grades will be determined by the following criteria:
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| midterm tests (2): | 40% |
| assignments (6): | 20% |
| Project (1): | 15% |
| final examination: | 25% |
- Final grades will be based on over-all class performance.
All assignments and examinations will be announced well in advance.
- Course Description:** This is a first course in nonlinear systems. In it you will learn to characterize nonlinear phenomena such as limit cycles and chaotic behavior, both analytically and numerically. We will also delve into the world of strange attractors and fractals. All this will be applied to a number of engineering, mechanical, biological and chemical problems. Specifically will consider the family nonlinear control problems (such as the inverted pendulum) and chaotic communication systems (such as the Cummo and Chua circuits.)
- Course Topics:** One-dimensional flows
Bifurcations
Zeeman machines
Flows on the circle
Two-dimensional flows
Linear systems
Phase plane analysis
Limit cycles
Poincare-Bendixson Theorem
Weakly nonlinear oscillators
Bifurcations - applications
Chaos
Lorenz equations
One-dimensional maps
Logistic map
Liapunov exponents
Fractals
Strange attractors
Lorentz attractor
Applications to communication systems