



Louisiana Tech University
Department of Electrical Engineering



ELEN 557 – Nonlinear Systems

Course Information

Spring 2007

- Description: Introduction to nonlinear systems, equilibrium points, phase-plane analysis, limit cycles, examples of nonlinear systems, Lyapunov stability, feedback linearization, nonlinear observers, adaptive control.
- Instructor: Dr. Rastko R. Selmic, Email: rselmic@latech.edu,
Web: <http://www.latech.edu/~rselmic/Courses/>
Tel: 318-257-4641, Office: Nethken Hall 229.
- Class Hours: TR, 2:00 pm – 3:50 pm, NH 120
- Office Hours: MTWRF 9:00am – 11:00am or by appointment
- Prerequisites: ELEN 471 – Automatic Control Systems
- Textbook: *Applied Nonlinear Control*, J. J. Slotine and W. Li, Prentice Hall, Englewood Cliffs, New Jersey, 1991.
- Additional Reference: *Nonlinear Control Systems: Analysis and Design*, H. J. Marquez, John Wiley & Sons, Inc., Hoboken, New Jersey, 2003.
- Recommended Software: MATLAB
- Grading: There will be homework, project, presentation, mid-term exam and final exam. If you have a question on grading of an assignment or an exam, please contact me about your question within one week of the time the grade is received. Here is weighting of grades:
- Homework: 20%
 - **Project and presentation: 15%; Plagiarizing the project will result in minus 15% (-15%).**
 - Mid-term Exam: 30% (closed book and notes), Thursday, April 12
 - Final Exam: 35% (closed book and notes), Thursday, May 10.
- Scale used: A = 100-90%, B = 89-80%, C = 79-70%, D = 69-60%, F = below 60%.
- Projects and Presentations: Research project, proposal due Thursday, April 5. Students need to write a paper in IEEE format, and present it in class. Paper is due on Thursday, May 3. The paper should be 4 pages long, double column, following strict IEEE standard including references. Example of the format:
(<http://www2.latech.edu/~rselmic/Courses/ELEN557/SelmicPhohaLewisCDC2003.pdf>).
- No late proposals or papers will be accepted. There will be -5% of project part of the grade subtracted for every day that the project or paper is late.

- Tests: All tests will be closed book and closed notes. You will be allowed to bring one sheet of notes (8.5" x 11") one side for the final exam, and a calculator. Students will be required to clear the memory of the calculator prior to beginning the test. No make up exams unless approval is obtained prior to the scheduled test date.
- Homework: Weekly homework will be assigned. Homework will be graded. No late homework will be accepted. Some homework may require computer simulation using MATLAB.
- Other Policy:
- a. Class attendance is governed by university regulations published each year in the university bulletin (page 26).
 - b. In the event of the appeal, student is responsible for keeping all original graded materials (exams, homework, and projects).

Course Topics:

1. Introduction
2. Linear Time-Invariant Systems
3. Nonlinear Systems
4. Equilibrium Points
5. Phase-plane Analysis
6. Limit Cycles
7. Lyapunov Stability
8. Input-Output Stability
9. Feedback Linearization
10. Nonlinear Observers
11. Adaptive Control
12. Advanced Topics:
 - a. Observer Design
 - b. Quadratic Optimal Control Systems
 - c. Intelligent Control Systems
 - d. Neural Networks
 - e. Adaptive Control