Syllabus

MEEG 873 – Applied Nonlinear Control

Spring 2012

Lecture:

TuTh 6:30–7:45pm, Pearson 114

Instructor: Bert Tanner

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Office Hours:	Wed 10:00am-12:00

Prerequisites Information: None. Existing prerequisites are a remnant of an older description which has been already revised. Until the new description hits the books, you need to contact Mrs. Bonavita at Spencer 126 to override the constraint and have you registered.

Having said that, the course does require a basic foundation in calculus, topology, differential equations and linear algebra. Without them, you will be struggling.

Text: *Nonlinear Systems*, by Hassan Khalil, 3rd edition, Prentice Hall.

For further reading, I also recommend:

- S. Sastry, *Nonlinear Systems: Analysis, Stability, and Control*, Springer 1999.

- J.J Slotine and W. Li, *Applied Nonlinear Control*, Prentice Hall, 1991.

Description: An introduction to nonlinear systems theory and control. Stability analysis will be based primarily on the Lyapunov framework. Some related basic feedback control design tools will be introduced. The course is mathematically oriented and intended for intermediate graduate students. It aims at bringing the student at a level which is suitable for self-study of more advanced material.

Material to be Covered (in variable depth): Examples of nonlinear systems and qualitative behavior; fundamental properties of nonlinear ordinary differential equations; Lyapunov stability; advanced analysis methods; nonlinear design tools

Specific topics coverage plan:

- Mechanical nonlinear models
- Main differences in qualitative behavior between linear and nonlinear systems
- Existence and uniqueness of solutions
- Continuous dependence of solutions
- Comparison principle
- Stability of time-invariant systems
- Stability of time-varying systems
- Converse theorems
- Vanishing and nonvanishing perturbations, input-to-state stability
- Invariance-like theorems
- Sliding mode control, Lyapunov redesign, and backstepping

Evaluation methods:

- Homework are assigned on a weekly schedule. They will be due on a specific day when class meets. Homework papers are supposed to be submitted at *before* the lecture begins. Late homework is accepted at the expense of a 20% penalty for each additional day. Homework problems are selected from the textbook for the most part, with the intention to put in practice the material presented during the lecture.
- There will be a midterm exam (in class).
- The final exam is scheduled at the time and date specified by the University, and it is TBD. No modifications on the time or date of the final exam can be made, unless special accommodations are required.

All exams will be open book. No computation tools allowed (or will be required). Bring own paper.

Grade distribution:

Homework	20%
Midterm	40%
Final Exam	40%

A	96–100	A-	92–95	B+	88–91	B	84–87
B-	80–83	C+	76–79	C	72–75	C-	68–71
D+	64–67	D	60–63	D-	56–59	F	0–55

Working Together: Collaboration is accepted on homework, but solutions should be given based on individual justification and reasoning, which needs to be clear on your paper. Collaboration on exams is of course is forbidden.

Absences: You are expected to attend every class. It is not acceptable to give priority to assignment completion over class attendance.

Plagiarism: The University's *minimum penalty* for cheating or plagiarism is *a failure in the course*.