

ECE6552 - Nonlinear Systems and Control (3-0-3)

School of Electrical and Computer Engineering
Georgia Institute of Technology

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Inquiry Room: TSRB 442

Inquiry Hours: After class on Tuesday, and Tuesday 4pm-5pm (<https://gatech.zoom.us/j/9256120304>)

Prerequisite: ECE 6550 or ME 6401 (Linear Systems and Control)
Either MATLAB or Python experience is advisable.

Course Book: Hassan Khalil, Nonlinear Systems, 3rd edition
Purchase not required. (Lecture notes will be provided)

Optional Refs: Shankar Sastry, Nonlinear Systems: Analysis, Stability and Control.

Catalogue Description: Classical analysis techniques and stability theory for nonlinear systems. Control design for nonlinear systems, including robotic systems. Design projects.

Scope and Goals: To be familiar with the theory and applications of nonlinear systems (phase plane, describing functions, Lyapunov methods), geometric control, variable structure control, adaptive control, applications to robots and spacecraft, and nonlinear optimal control.

Course Mechanics and Grading: The course meets two times a week, TuTh 8:00-9:15AM in Allen Sustainable Education Building Room 110.

The course grading criteria consist of the following components whose percentage of the total grade calculation is also given,

	Homework (4)	Exam 1	Exam 2	Final Project
Percent of Final Grade	20%	30%	30%	20%

where the contributions are based on total points per category (e.g., total points for homework).

Attendance Policy. To encourage attendance for in-person students, I will be hosting an in-person quiz (via Kahoot) at the start of every lecture. These quizzes will not be scored, but will be used to track attendance. At the end of the semester, if you have attended at least 80% of the lectures in-person, you will be given a 2% bonus to your final grade. Your attendance grade will also be taken into account if your final grade is on the borderline between two letter grades.

For remote/virtual students, attendance will be instead be tracked by reflecting on the material within a week's duration. After watching the lecture recording, remote students are asked to submit a one-paragraph reflection on the material covered in that week's lectures. These reflections will not be scored, but will be used to track attendance. At the end of the semester, if you have submitted reflections for at least 80% of the weeks, you will be given a 2% bonus to your final grade. Your attendance grade will also be taken into account if your final grade is on the borderline

between two letter grades. Submission form: <https://docs.google.com/forms/d/e/1FAIpQLSdt0qVEWsLtd7Y5ertgmp7wasw9JQG21vKA3sPsmrneSaEjpA/viewform?usp=sharing&ouid=105069307580164250871>.

Homeworks. Homework assignments will be due on Wednesday (11:59pm). All material should be submitted virtually on Gradescope via Canvas.

All students are automatically given three days for extensions. These days can be broken up in any way. For example, three assignments can be handed in one day late each, or one assignment can be handed in three days late, or any other combination. Once your three extension days have been used, homeworks can be submitted up to 72 hours late, without request, for a 20% penalty per 24 hours. After 72 hours, solutions for the homework will be posted. Once the solutions are posted, late homework *will not be accepted*. For any other extensions, or unusual circumstances, please make sure to contact me prior to the solutions being posted.

While collaboration is encouraged regarding the homework material, all work to be turned in is expected to be individually completed. It is presumed that we are all operating under the Georgia Tech Honor Code.

Exams. There will be two exams administered throughout the semester. These exams will be held on February 26th and April 21st during class. These exams will be given in class. For distance-learning students, the exams will be a timed take-home exam.

No make-up exams will be given without prior approval (at least 7 days in advance). In case of a documented emergency, the Dean of Students will contact the instructor on the student's behalf (please see the excused absences section below).

Final Project. In lieu of a final exam, students will complete a final project. The final project be due on the final day of class, April 28th. This final exam will involve the application and analysis of various control techniques to a nonlinear system of the student's choosing. More details will be provided later in the semester.

Communication. I will typically make an effort to be available for a short period after class for any questions that may arise. You should also feel free to e-mail me if homework statements are unclear or to set up an alternative time to meet, however please be sure to include the string "ECE6552" in the subject heading.

Excused Absences. In the event of a medical emergency or an illness that is severe enough to require medical attention, students are responsible for contacting the Office of the Dean of Students as soon as possible to report the medical issue or emergency, providing dated documentation from a medical professional and requesting assistance in notifying their instructors. The medical documentation will be handled confidentially within the Office of the Dean of Students and will inform a decision as to whether communication with instructional faculty is appropriate. It is the expectation of the Institute that instructional faculty will honor a request from the Office of the Dean of Students to excuse a medical emergency or illness and allow make-up of the work missed, including homeworks, quizzes, presentations, examinations, or other class assignments.

Course Websites. Our course has two websites, the official Canvas site which will have the zoom

recordings and Gradescope (used for homework submissions and grading of exams), as well as an external website which will have lecture notes, code examples, and a course schedule. The external website can be found at <https://maegantucker.com/ECE6552/>.