AE3531 Syllabus – Summer 2026

Control System Analysis and Design – RLI – 3 credit hours

Instructor Information

Instructor: Prof. Jay Nagy

Email: jay.nagy@gatech.edu

Class meeting times: Mon-Tue-Wed-Thu

Office hours: Please refer to my booking page (link embedded in Canvas)

General Course Information

Description

This course covers the fundamentals of control systems theory and design, with emphasis on aerospace applications. You will learn how to describe and analyze feedback systems in time- and frequency-domains, followed by state-space approaches. Real-world aerospace systems, including aircraft autopilot, flight control systems, missile and spacecraft attitude control examples, are integrated throughout the course to demonstrate practical relevance of control theory.

Course Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Analyze the dynamic behavior of Linear Time-Invariant (LTI) feedback systems using transfer functions and state-space representations.
2. Evaluate system stability and stability margins using algebraic and graphical methods.
3. Design feedback controllers to meet performance specifications using classical and modern techniques.
4. Apply control design techniques to real-world aerospace engineering problems.
5. Interpret and communicate the recommended control system design through engineering documentation and presentations.

Required Course Materials

Powell, J. D., Emami-Naeini, A. and Ivler, C. M., “Feedback Control of Dynamic Systems” (9th ed.), Pearson (ISBN-13: 978-0-13-809500-0)

Note: Previous editions of the main textbook are acceptable, refer Franklin, G. F., Powell, J. D., Emami-Naeini, A., "Feedback Control of Dynamic Systems" (from 6th ed.). You need to add errata sheets and class notes.

Additional reference:

There are many excellent books on the subject. Below is a partial list (in alphabetical order).

Astrom, K. J. and Murray, R. - Feedback Systems: An Introduction for Scientists and Engineers, Princeton University Press (from ver2.10b)

Dorf, R. and Bishop, R. - Modern Control Systems, Addison-Wesley, (from 9th ed.)

Nise, N. S. - Control Systems Engineering, John Wiley, New York, (from 5th ed.)

Ogata, K., "Modern Control Engineering" (5th ed.), Pearson / Prentice Hall, 2010 (ISBN-13: 978-0136156734)

Ogata, K., "System Dynamics" (4th ed.), Pearson / Prentice Hall, 2004 (ISBN-13: 978-0131424623)

Required software:

We will use MATLAB in this course. This must be downloaded to your personal computer following the instructions at https://www.matlab.gatech.edu/.

Grading Policy:

The grading breakdown is as follows:

- Homework: 50%
- Quiz: 25%
- Final Exam: 25%
- Extra Credit: 0-7.5% (active participation during lectures)

Final grades for this course will be assigned based on the following scale:

A	B	C	D	F
90-100%	80-89%	70-79%	60-69%	<60%

Description of Graded Components

Homework Assignments (50%)

Homework problems are designed to help you practice and apply the material learned during lectures. You will need to upload your solutions to Gradescope. You have 1 week from receipt of graded homework to request a regrade; after that 1 week, all grades are

final. It is my policy to drop your lowest grade and replace it with your average homework score.

I expect my students to be proud of the work they submit for review, i.e. homework must be legible, structured, and show all engineering steps. You are encouraged to work with other students, provided that each student writes up their own complete solution and can explain their work. All MATLAB code and graphs must be supported by screenshots.

Quiz (25%)

A midterm quiz will assess your understanding of fundamental concepts and application of basic control system theory. The quiz is open-book and individual work. You may not collaborate with other students during the quiz. Make-up exams will be offered only for documented extenuating circumstances with instructor approval.

Final Exam (25%)

The final exam is a comprehensive test, covering material from the entire course. The exam will be administered at the end of the class period. The final exam is open-book and individual work. Only approved materials will be permitted during the exam. Further details will be provided during class.

Course Policies

Attendance and/or Participation

In my experience, students who attend class achieve higher grades and retain better skills in control systems design. Proficiency in controls will serve you well when studying flight or space dynamics and related subjects.

In saying that, if you become ill, please do not come to class. Please let me know as soon as you are able. In case of a documented illness, it is my policy to automatically grant a penalty free period. Should your illness persist for a longer period, please reach out to me so that we can discuss a way forward.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct.

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me at the start of the semester, so that we can discuss your specific learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Pre- &/or Co-Requisites

AE 3530 System Dynamics

Note: Students must have a strong foundation in differential equations, complex variables, Laplace transforms, and matrix algebra. If you have not completed the pre-requisite course, contact me as soon as possible.

Extra Credit Opportunities

You may earn extra credit for active participation in the classroom. During lectures I frequently pose questions to my students, checking your understanding of key concepts and your ability to apply those concepts to real-world engineering challenges.

Use of Generative AI

I encourage the use of local AI models (running on your personal computer) as study aids for consulting lecture notes, reviewing concepts, and generating practice questions. However, the following restrictions apply:

- You are not authorized to upload/query my assignments via online tools.
- AI-generated solutions may not be submitted as homework, quiz, or exam responses.
- If you had to rely on a local AI tool to solve a homework problem, you must clearly document this usage with comments identifying the applicable section.
- All homework solutions must reflect your own understanding, and you must be able to explain it in your own words.

- Violations of these policies will be treated as academic misconduct per the Georgia Tech Honor Code.

Extensions and Late Assignments

Assignments turned in after the time limit published in Gradescope will be penalized 25 percent per 24 hours late. No homework is accepted after the initial 24 hours late period. If you have technical issues with Gradescope around the submission deadline, you should immediately e-mail your instructor and the TA with the assignment attached and a brief explanation of the issues. If you experience a loss of internet access, you may inform the instructor via text message to be granted a short extension.

Extensions may be granted in cases where extenuating circumstances prevented the student from reasonably completing an assignment on time. Examples include illness, emergencies, family situations, and institute approved absences. For simple matters, you may request these extensions by directly contacting the instructor. If you have a more complex situation or one which you wish to keep private, you should work with the Office of the Vice President and Dean of Students. They can assist students with documented emergencies by contacting professors on behalf of the student. You can get more information on this process here: https://studentlife.gatech.edu/content/class-attendance

I expect you to notify me in advance (more than 24 hours before the deadline) if you require an extension, unless there is an extraordinary circumstance that prevents you from doing so, in which case you can notify me as soon as it is feasible.

Student Use of Mobile Devices in the Classroom

Laptops and tablets may be used during lectures for note-taking and accessing course materials. Cell phones and other electronic devices must be silenced and not used during class, quizzes, or exams. During quizzes and exams, only approved devices and materials are permitted.

Course Communication

Course materials, announcements, and assignments will be distributed primarily through Canvas. You are responsible for checking Canvas regularly and monitoring your Georgia Tech email for important announcements.

Course Feedback

At the end of the semester, you will be asked to complete a Course Instructor Opinion Survey (CIOS), which provides valuable feedback on the course and my teaching effectiveness. Your honest, constructive feedback is appreciated and will be used to improve the course for future students.