



Introduction to Linear Control Systems
ECE 4090, Sections 001
Spring 2021

Meeting Time and Location: MWF, 10:10AM-11:00AM

Instructor: Richard E. Groff, Riggs Hall, Room 302, 864-656-5906

Office Hours: Office hours will be held using Zoom. See “eLearning Office Hours” page under Modules for the Zoom link and the office hours schedule. Available without appointment during scheduled office hours. Any temporary changes in office hours will be posted on Canvas. Also available by appointment outside of scheduled hours (schedule an appointment via email).

Email: regroff@clemson.edu In the subject line of any email related to the course, please use “ECE4090:” as a prefix to your specific subject and include a short, descriptive subject. For example, a good subject line might be “ECE4090: Question regarding HW4 P3”. I will attempt to respond to email inquiries with 48 hours.

Course Modality: Online Synchronous

Course Description: Introduction to classical linear control systems. Topics include continuous and discrete descriptions of systems, time and frequency response, stability, system specification, system design of continuous and discrete systems.

Prerequisites: ECE 3300 with a grade of C or better

Required Materials:

Recommended Text:

- R. Dorf and R. Bishop, *Modern Control Systems*, 12th ed., Pearson, 2010.

Supplementary Texts:

- R. Dorf and R. Bishop, *Modern Control Systems*, Pearson, any edition.
- Gene F. Franklin, J. David Powell, and Abbas Emami-Naeini, *Feedback Control of Dynamic Systems*, Pearson, any edition.
- K. Ogata, *Modern Control Systems*, Pearson, any edition.
- A. Stubberud, I. Williams, and J. DiStefano, *Schaum’s Outline of Feedback and Control Systems*, McGraw-Hill, any edition.

Software:

MATLAB and Simulink will be used regularly on homework assignments. Any recent version is acceptable (e.g. last 5 years). MATLAB and Simulink may be downloaded and installed on a personal computer using the Clemson license www.cecas.clemson.edu/matlab. You can also use Matlab Online <https://matlab.mathworks.com/>.

Students are required to have a laptop computer, internet connectivity capable of transmitting and receiving video, a video camera, a microphone, and a cell phone.

Topical Outline:

1. Introduction to Control Systems
2. Modeling Systems in the Laplace Domain
3. Block Diagrams
4. Second-Order Systems Properties and Specifications
5. Properties of Feedback
6. Root Locus Analysis
7. Frequency Response Analysis
8. Practical Issues in Control Design (Time permitted)
9. State Space Analysis (Time permitted)

Grading:

Homework & Projects	15%
Midterm Exams	60%
Final Exam	25%

Letter grades are based on numeric course grade calculated using the above weights. The numeric grade to letter grade conversion is 90-100 A, 80-90 B, 70-80 C, 60-70 D, 0-60 F.

Attendance and Cancellation Policy: Live lectures will be held during schedule class time in Zoom. The Zoom link may be accessed from the Zoom tab on Canvas. Lectures will be recorded and posted on Canvas, generally several hours after class time. Students are highly encouraged to attend live lectures. Students are responsible for all material covered, all announcements made, and all assignments given in every lecture. Lecture PDFs will be posted on Canvas and the student is responsible for preparing the latest lecture slides for handwritten or electronic markup before coming to class.

Class is cancelled if the instructor is more than 15 minutes late to class.

Homework/Projects:

- Homework problems will be assigned and collected for credit via Canvas.
- Homework will be must be prepared and submitted in accordance with the “**ECE4090 Homework Submission Guidelines**” document posted on Canvas.
- You should attempt every problem on your own. You are encouraged to discuss homework with your peers, but you should start and finish problems yourself. All submitted work must be completed by you individually.
- You must cite any resources (other than class notes, handouts, and textbook) used while solving the homework.
- Several “projects” may be assigned during the semester. These are essentially longer, more heavily weighted homework assignments with a more formal write up. Unlike homework assignments, you are not allowed to discuss projects with your peers.
- Late homework/projects will be penalized 25% per 12 hour period after the Homework Deadline.

Accessibility: Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to a class should let the instructor know and make an appointment to meet with a staff member in Student Accessibility Services as soon as possible. You can make an appointment by calling 864-656-6848 or by emailing studentaccess@lists.clemson.edu. Students who receive Academic Access Letters are strongly encouraged to request, obtain, and present these to their instructors as early in the semester as possible so that accommodations can be made in a timely manner. It is the student's responsibility to follow this process each semester. You can access further information here: <http://www.clemson.edu/campus-life/campus-services/sds/>.

Title IX: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education Amendments of 1972. The University is committed to combatting sexual harassment and sexual violence. As a result, you should know that University faculty and staff members who work directly with students are required to report any instances of sexual harassment and sexual violence, to the University's Title IX Coordinator. What this means is that as your professor, I am required to report any incidents of sexual harassment, sexual violence or misconduct, stalking, domestic and/or relationship violence that are directly reported to me, or of which I am somehow made aware. There are two important exceptions to this requirement about which you should be aware:

Confidential Resources and facilitators of sexual awareness programs such as "Take Back the Night and Aspire to be Well" when acting in those capacities, are not required to report incidents of sexual discrimination.

Another important exception to the reporting requirement exists for academic work. Disclosures about sexual harassment, sexual violence, stalking, domestic and/or relationship violence that are shared as part of an academic project, a research project, classroom discussion, or course assignment, are not required to be disclosed to the University's Title IX Coordinator.

This policy is located at <http://www.clemson.edu/campus-life/campus-services/access/title-ix/>. Ms. Alesia Smith is the Executive Director for Equity Compliance and the Title IX Coordinator. Her office is located at 223 Holtzendorff Hall, phone number is 864.656.3181, and email address is alesias@clemson.edu.

Safe Campus: Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency:

- a. Ensure you are signed up for emergency alerts (<https://www.getrave.com/login/clemson>)
- b. Download the Rave Guardian app to your phone (<https://www.clemson.edu/cusafety/cupd/rave-guardian/>)
- c. Learn what you can do to prepare yourself in the event of an active threat (<http://www.clemson.edu/cusafety/EmergencyManagement/>)

Academic Integrity: As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a 'high seminary of learning.' Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form. In instances where academic standards may have been compromised, Clemson University has a responsibility to respond appropriately to charges of violations of academic integrity. Further information on Academic

Integrity can be found in the [Undergraduate Announcements](#) and in the [Graduate School Policy Handbook](#).

Copyright: Materials in this course are copyrighted. They are intended for use only by students registered and enrolled in this course and only for instructional activities associated with and for the duration of the course. They may not be retained in another medium or disseminated further. They are provided in compliance with the provisions of the Teach Act. Students should be reminded to refer to the Use of Copyrighted Materials and “Fair Use Guidelines” policy in on the Clemson University website for additional information: <https://clemson.libguides.com/copyright>.

Modification: The instructor reserves the right to modify any aspect of the syllabus at any time during the semester for reasons including but not limited to COVID-related situations.