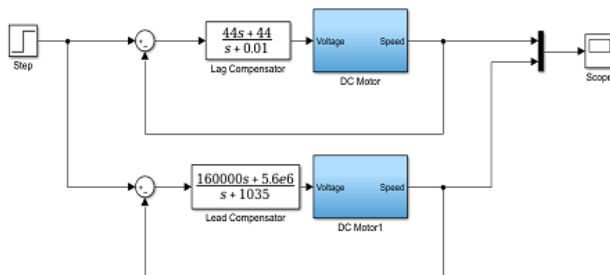


ECE 171A: Linear Control System Theory Fall 2024 Syllabus



Instructors

- **Instructor:** Nikolay Atanasov, Associate Professor, ECE, natanasov@ucsd.edu

Time and Location

- **Lectures:** Monday and Wednesday, 5:00 pm - 6:20 pm, in [PCYNH 121](#)
- **Discussion:** Monday, 3:00 pm - 3:50 pm, in [CENTR 222](#)
- **Final Review:** Monday, December 9
- **Final Exam:** Thursday, December 12, 2024, 7:00 pm - 10:00 pm

Course Description

This is an undergraduate course on classical control theory. The course focuses on single-input single-output linear time-invariant control systems emphasizing frequency-domain methods. The topics include modeling of feedback control systems, transient and steady-state behavior, Laplace transform, stability, root locus, frequency response, Bode plots, Nyquist plots, Nichols plots, PID control, and loop shaping.

In addition to attending in-person lectures, the students are expected to sign up on [Piazza](#) and [GradeScope](#). Discussion and important announcements will happen on [Piazza](#). The homework should be turned in and will be graded on [GradeScope](#).

Prerequisites

- **Calculus:** derivatives, integration, exponential function, Taylor series
- **Introductory physics:** Newton's law, Ohm's law, Kirchhoff's voltage and current laws
- **Programming experience:** Matlab, Python, or similar language
- **Optional:** ordinary differential equations, linear algebra

These prerequisites are fulfilled by **ECE 45: Circuits and Systems** or **MAE 40: Linear Circuits**. It is expected that the students have access to [Matlab](#), which will be used for some of the homework problems.

Grading

- The class assignments consist of several homework sets (35% of the grade), a midterm exam (25% of the grade), a project (10% of the grade), and a final exam (30% of the grade).
- The due date of each homework will be clearly stated when the assignment is released. Late submissions and deadline extensions will **not** be possible because the course schedule is tight.
- The midterm and final exam will be in-class, closed-book, closed-notes, and no electronics will be allowed except calculators. One letter-size sheet of notes (single-sided for the midterm, double-sided for the final) will be allowed.
- A standard grade scale (e.g., 93%+ = A) will be used with a curve based on the class performance (e.g., if the top students have grades in the 83%-86% range, then this will correspond to letter grade A).

References

- **Primary Textbook:** The main reference for the course will be:
 - [Feedback Systems: Åström & Murray](#)
- **Additional References:** There are many excellent books on control systems theory. While none of these will be required to follow the course, this list may be useful if you want to consult additional references:
 - [Modern Control Systems: Dorf & Bishop](#)
 - [Feedback Control of Dynamic Systems: Franklin, Powell & Emami-Naeini](#)
 - [Automatic Control Systems: Kuo & Golnaraghi](#)
 - [Control System Design: Goodwin, Graebe & Salgado](#)
 - [A Mathematical Approach to Classical Control: Lewis](#)
- **Online References:** There are also many excellent online resources for control systems theory. Here is a recommended YouTube playlist:
 - [Brian Douglas's Classical Control Theory](#)

Academic Integrity

Integrity of scholarship is essential for an academic community. To protect the validity of intellectual work both faculty and students must honor this principle. For students, this means that all academic work will be done by the individual to whom it is assigned, without unauthorized aid of any kind. It is dishonest to cheat on exams, copy other people's work, or fake experimental results. Cheating, plagiarism and any other form of academic dishonesty will not be tolerated. An important element

of academic integrity is also fully and correctly acknowledging any materials taken from the work of others. Never claim work or ideas to be yours if they are not, and never aid others in cheating, e.g., by offering them your solutions. Do not upload solutions or assignments online, even after you have finished the course. You are encouraged to discuss the assignments with other students but please note that all assignments in this course are individual and the work you turn in should be entirely your own! Use of other students' course work, in part or in total, to develop, complete or correct course work is unauthorized. Each student is responsible for knowing and abiding by [UCSD's Code of Academic Integrity](#). Instances of academic dishonesty will be penalized by grade reduction at the instructor's discretion and will be reported to the Office of Student Conduct for adjudication. Committing acts that violate Student Conduct policies are cause for suspension or dismissal from UCSD.

Tentative Schedule

Week	Date	Lecture	Material	Assignment
1	Sep 30	Introduction	Ch. 1	
	Oct 02	Feedback Principles	Ch. 2	
2	Oct 07	Discussion		
	Oct 07	System Modeling	Ch. 3	
	Oct 09	Solving ODEs	Ch. 5	HW1
3	Oct 14	Discussion		
	Oct 14	Laplace Transform, Transfer Function	Ch. 9	
	Oct 16	Catch-up		HW2
4	Oct 21	Discussion		
	Oct 21	Block Diagram, Signal Flow Graph		
	Oct 23	Stability, Routh-Hurwitz	Ch. 6	HW3
5	Oct 28	Discussion		
	Oct 28	Transient and Steady-State Response	Ch. 6	
	Oct 30	Transient and Steady-State Response	Ch. 6	
6	Nov 04	Discussion		
	Nov 04	Midterm Exam		
	Nov 06	Frequency Response	Ch. 9	HW4
7	Nov 11	Discussion		
	Nov 11	Nyquist Stability	Ch. 10	
	Nov 13	Nyquist Stability	Ch. 10	HW5
8	Nov 18	Discussion		
	Nov 18	Performance Measures	Ch. 10	
	Nov 20	Root Locus	Ch. 12	Project
9	Nov 25	Discussion		
	Nov 25	Catch-up		
	Nov 27	PID Control	Ch. 11	HW6
10	Dec 02	Discussion		
	Dec 02	Lead-Lag Compensation	Ch. 12	
	Dec 04	Catch-up		
11	Dec 09	Final Exam Review		
	Dec 12	Final Exam		