

MAE 143B
Linear Control (4 units)

Class/Laboratory Schedule: four hours of lecture, eight hours of outside preparation.
12 hours/week total

Course Coordinator(s): Mamadou Diagne

Textbooks/Materials:

1. Fundamentals of Linear Control: A Concise Approach, Mauricio de Oliveira, Cambridge University Press, May 2017

Catalog Description: Analysis and design of feedback systems in the frequency domain. Transfer functions. Time response specifications. PID controllers and Ziegler-Nichols tuning. Stability via Routh-Hurwitz test. Root locus method. Frequency response: Bode and Nyquist diagrams. Dynamic compensators, phase-lead and phase-lag. Actuator saturation and integrator wind-up.

Prerequisites: MAE 143A or consent of instructor.

Course Type: Required

Performance Criteria:

Objective 1:

- 1.1 Students will demonstrate understanding of how to find a closed loop transfer function of a complex block diagram involving feedback interconnections
- 1.2 Students will demonstrate the ability to select system parameters to meet performance specifications in time domain and to achieve closed-loop stability

Objective 2:

- 2.1 Students will demonstrate understanding of how to select the controller gain, as well as the poles and zeros of dynamic compensators, to place closed-loop poles in a desired region in the complex plane using the root-locus method
- 2.2 Students will demonstrate the ability to determine phase and gain margins in Bode and Nyquist plots

Objective 3:

3.1 Students will demonstrate the ability to relate examples from basic control applications to control objectives, choices of control inputs and outputs, and choices of compensator types for particular applications

Course Objectives:

1. To teach the students the mathematical methods for analysis of performance and stability of feedback systems.
2. To introduce the students to the basics of design of feedback control systems.
3. To introduce the students to elementary applications of control systems from a broad array of problems in aerospace and mechanical engineering.

Course Topics:

1. Analysis of Feedback systems
2. Dynamic models
3. Differential equation models and transfer functions
4. Dynamic response
5. Stability, tracking and regulation
6. Design of feedback systems
7. PID control
8. Root-locus method
9. Frequency response
10. Bode and Nyquist diagrams

Last Updated: March 2025