



Linear Control Systems

University of Kurdistan
Faculty of Engineering
Department of Power and Control Engineering

(Spring 2024)

Instructor: [Hassan Bevrani](#)

- **Course Description**

Linear Control Systems (LCS) provides an undergraduate course to learn most fundamental concepts and basic methods in linear control theorems. First, an introduction on Linear Control with basic definitions, concepts, and a brief history are presented. Then, Laplace transform, mathematical modeling and control performance characteristics are explained. Stability definitions and some frequency response analysis methods are other important topics of the LCS course. Following a brief discussion on state-space modeling, finally a control design method completes the course.

Topics given in this course cover the most important issues in linear control analysis and synthesis approaches. After successful completion of this course, students in addition to understand basics will learn some methodologies to analyze and synthesis of control systems. The lectures are supplemented by numerous examples and MATLAB codes.

- **Topics**

1. An Introduction
2. Laplace Transformation and Mathematical Models
3. Control Systems Characteristics
4. Stability of Linear Feedback Systems
5. The Root Locus Analysis Method
6. The Nyquist Analysis Method
7. The Bode Diagram Analysis Method
8. State-Space Analysis
9. Design of Feedback Controllers

- **Grading**

- Attending and Activities 10%
- Homework 20%
- Mid-Term Exam 1 20%
- Mid-Term Exam 2 20%
- Final Exam 30%

- **Objectives**

Completing the course must give the following knowledge, skills and capabilities to the students who attend all lectures actively:

- 1- A deep knowledge on the preliminary concepts, frameworks, and components of a Linear Control system,
- 2- Learning how to find a simple mathematical model for an electrical/mechanical system,
- 3- Understanding different definitions for stability and performance characteristics,
- 4- Learning how to analyze a control system using several time and frequency response methods,
- 5- Design a basic controller for a given system by programming and simulation in MATLAB environment.

- **Reference**

- [1] H. Bevrani, *Lecture Notes on Linear Control*, University of Kurdistan, Revised Version in 2024.
- [2] Norman S. Nise, **Control Systems Engineering**, 7th Ed., Wiley, 2015.
- [3] K. Ogata, **Modern Control Engineering**, 5th Ed., Prentice Hall, 2010.

- **Course Webpage**

<https://smgrc.uok.ac.ir/timeline/linear-control-university-of-kurdistan-2024/>

- **Teaching Assistant**

Will be introduced in the first meeting.