ECE 317: Feedback and Control Systems

Catalog Description

Control of continuous single-input/single-output linear systems using classical feedback techniques. Time and frequency domain analysis. Design in the s-plane and frequency domain. Use of time and frequency system identification techniques for developing plant models. Design of feedback compensators for steady-state error reduction, disturbance rejection, transient stability, and dynamic response.

Credit hours: 4

Goals

This course introduces classical control theory for the feedback design of continuous time single-input single-output (SISO) systems. Students will learn to apply classical control principles to the design of continuous time control system and operate software that aids in the design process.

Prerequisites

ECE 316

Course Coordinator and Committee

James McNames (coordinator)
Fu Li
John Lipor
Mark Martin
Martin Siderius
Richard Tymerski

Textbooks

Modern Control Engineering, Ogata, K., Pearson Prentice Hall, 2009, 5th Ed. (required).

Matlab for Control Engineers, Ogata, K., Pearson Prentice Hall, 2008 (reference).

The course instructor may choose to use a different textbook. Please check with your instructor before purchasing.

Learning Outcomes

At the end of this course, students will be able to:

1. Understand and apply block diagrams.
2. Identify and apply fundamental compensator architectures.
3. Understand and derive responses of 1st- and 2nd-order systems.
4. Determine steady-state error of a tracking system.
5. Understand and apply pole-zero plots and root locus plots.
6. Understand and apply Bode plots; gain and phase margins.
7. Perform system identification to create s-domain plant models.
8. Design compensation systems for closed-loop controllers (PID, lead, lag, etc).

Topical Outline

- Control systems representation.
- 1st- and 2nd-order systems.
- Stability criteria, system performance.
- System performance, steady state error.
- Design using root-locus plots, poles & zeros.
- Nyquist stability criterion.
- Bode and Nyquist plots.
- Feedback system analysis and design using Bode plots.
- Determination of plant models.
- Design of various compensators (PI, PD, PID, lag, lead, lag-lead).

Course Structure

The class meets for four hours of lecture each week. The grade is based on in-class exams, in-class quizzes, a final exam, and a project. For details of the grading criteria, please see the syllabus provided by your instructor.

Relevant Program Outcomes

The following program outcomes are supported by this course:

(1) An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics

(5) An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives

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Prepared By: James McNames

Last revised: 4/3/23