EEEN 352
System Dynamics and Control, Spring 2020
(6 ECTS)

Instructor Information:

Instructors: Prof. Dr. Mehmet Nur Alpaslan Parlakçı, Assoc. Prof. Dr. Şeref Naci Engin
E-mails: alpaslan.parlakci@bilgi.edu.tr, nengin@yildiz.edu.tr
Office Hours: Mon 16:00-17:00, Wed 12:00-13:00

Office Location: E3-206, E3-214

Teaching Assistant: Sami Utku Çelikok

Office Phone: X7833

Course description:

Analysis of linear control systems by differential equations and transfer function methods using Laplace transforms. Stability of closed loop systems. Routh-Hurwitz criterion, root-locus diagrams. System analysis in frequency domain. Bode and Nyquist plots. Nyquist stability criterion. Introduction to Design and Optimization. Matlab applications.

Course objectives:

This course is designed to enable the students to be equipped with the theoretical and practical skills in the field of control systems theory. After completion, the student will be furnished with a sound background which can be enhanced with more specialized and advanced courses in the related subject areas into which substantial background is provided.

Course Learning Outcomes:

Following the successful completion of this course work, students will be able to:

1 Find mathematical models of dynamic systems.
2 Analyze linear dynamic systems using transient and steady-state response analysis
3 Analyze dynamic systems using their frequency response.
4 Apply root-locus analysis of control systems.
5 Analyze stability of dynamic systems by using Routh-Hurwitz method.
6 Analyze stability of dynamic systems by using Bode and Nyquist plots and stability criteria.
7 Attain an introductory knowledge on System Design and Optimization

Prerequisite: EEEN 201
Special Condition: EEEN 202

Text Book:

N. S. Nise, Control Systems Engineering, 6th edition, John Wiley & Sons, MA, 2011.

Additional References:

- G. F. Franklin, J. D. Powell, and A. Emami-Naeini, Feedback Control of Dynamic Systems, 6th edition, Prentice Hall, NJ, 2010.
- K. Ogata, Modern Control Engineering, 5th edition, Prentice Hall, NJ, 2010.
- C.L. Phillips, and J. Parr, Feedback Control Systems, 5th Ed., Prentice-Hall, 2010.

Requirements

1. Students must attend at least 70 % of the lectures, labs and tutorial sessions. Otherwise they may not be able to enter the final exam.
2. Students who miss a lecture are completely responsible for obtaining the material they missed.
3. No make-up exams will be given.
4. Excused absences must be documented for which the legitimacy is determined by the instructor
5. Adherence to the University Academic Integrity policy is a necessity.

Exams and Grading:

Evaluation Type	Number		Percentage
Quiz	4		10
Homework	4		10
Midterm	1		30
Final Comprehensive Exam	1		50
TOTAL			**100**

Tentative Lecture Schedule

Date	**Subject**
Week 1	Modelling and Feedback Control Systems
Week 2	State Variables, Transfer Functions and Time Response
Week 3	Time Response for First, Second and Higher Order Systems
Week 4	Block Diagrams, Feedback Systems and Effects of P, I, D Terms
Week 5	Stability Analysis via Routh-Hurwitz, Steady-State Error Analysis
Week 6	Properties of Root Locus, Sketching and Refining Root-Locus
Week 7	Root Locus for Cascaded and Feedback Controllers
Week 8	MIDTERM EXAM
Week 9	Sensitivity, Sensitivity of Closed-Loop TF, Steady-State Error and Pole Location
Week 10	Root Locus for PI, PD & PID Controllers Design and Implementation
Week 11	Root Locus for Phase (Lead, Lag) Compensation Design and Implementation
Week 12	PID tuning by Ziegler-Nichols, practical issues in PID implementations
Week 13	Intro. to Frequency Response Techniques, Analytical Expressions, Plotting the Frequency Response (Bode Plots and Nyquist Diagrams)
Week 14	Stability, Gain Margin, and Phase Margin via Bode and Nyquist Plots
Week 15	FINAL EXAM