



Design of Feedback Control Systems

Syllabus

Postgraduate Studies/ MSc. Courses
Electrical Engineering Department
College of Engineering
Salahaddin University - Erbil

February 2024

Course Name : **Design of Feedback Control Systems**
Course Number :
Type of Study : **MSc. Course**
One Semester - Spring
15 weeks - 3h/w
Specialist : **Computer and Control Engineering**
Schedule : **Sunday 01:00 – 04:00**
Academic Year : **2023-2024**
Instructor : **Assist. Prof. Dr. Fadhil T. Aula**

Course Description

- **Feedback control systems are widely used in manufacturing, mining, automobile and other hardware applications.**
- **In response to increased demands for increased efficiency and reliability, control systems are being required to deliver more accurate and better overall performance in difficult and changing operating conditions.**
- **In order to design control systems to meet the needs of improved performance and robustness when controlling complicated processes, control engineers will require new design tools and better control theory.**
- **This course develops the fundamentals of feedback control using linear transfer function system models.**
- **It covers analysis in time and frequency domains; design in the s-plane (root locus) and in the frequency domain (loop shaping)**
- **Describing functions for stability of certain non-linear systems; extension to state variable systems and multivariable control with observers; discrete and digital hybrid systems and the use of z-plane design.**

Course Objectives

- **Analyzing control systems in frequency domain**
- **Analyzing control systems in time domain**
- **Designing control systems using root-locus method**
- **Designing control systems using bode, polar, and Nyquist methods**
- **Designing PID Controller**
- **Linearization of nonlinear control systems**

Course Requirements

References:

- 1. K. Ogata, Modern Control Engineering, 5th Edition, Prentices Hall, 2010**
- 2. A. Mutambara, Design and Analysis of Control Systems, CRC Press, 1999**

Prerequisites:

Control Engineering, Mathematics, MATLAB.

Tentative Course Outline

Week	Subject
1 st	Introduction
2 nd	Frequency Domain Modeling and Analyzing
3 rd	Root-Locus Analysis
4 th	Root-Locus Design Part 1
5 th	Root-Locus Design Part 2
6 th	Frequency-Response Analysis
7 th	Frequency-Response Design
8 th	State-Space Modeling and Analyzing
9 th	State-Space Design Part 1
10 th	State-Space Design Part 2
11 th	PID Controller
12 th	Nonlinear Systems
13 th	Seminar
14 th	Dead Week
15 th	Final Exam

Course Requirements

- **Midterm Exm**
- **Quizzes**
- **Seminar**
- **Review Article (4000 – 5000 words)**
- **Final Exams**

Attendance

- **Positive attitude is a key to success.**

Grading Policy

➤	Annual	50 %
	<i>Midterm Exam</i>	<i>20%</i>
	<i>Quizzes</i>	<i>5%</i>
	<i>Seminar</i>	<i>10%</i>
	<i>Review Article</i>	<i>15%</i>
➤	Final Exam	50%
➤	Total	100%

Review Articles

- 1. Pitch Control in Variable Speed Wind Turbine**
- 2. Load Frequency Control in Power System**
- 3. Adaptive Cruise Control in Automotive**
- 4. Aircraft Automatic Pilot System**
- 5. Power Control in Cellular Mobile Communication**
- 6. Speed Control of Permanent Magnet Synchronous Motor Drive System**
- 7. Satellite Geostationary Control**
- 8. Dynamic Thermal Management for Microprocessors**
- 9. Air Condition Control Systems**
- 10. Fault Tolerant Control in Aerospace Systems**
- 11. Autonomous Precision Landing of Space Rockets**
- 12. State-of-Charge (SOC)-Balancing Control of a Battery Energy Storage System**

Academic Honesty and Plagiarism

- **Plagiarism is using the words or ideas of others and presenting them as your own. Plagiarism is a type of intellectual theft. It can take many forms, from deliberate cheating to accidentally copying from a source without acknowledgement.**
- **You are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Student should allow sufficient time for research, drafting and the proper referencing of sources in preparing all assessment tasks.**
- **If plagiarism is found in your work when you are in first year, your lecturers will offer you assistance to improve your academic skills. They may ask you to look at some online resources or resubmit your work with the problem fixed. However, more serious instances in first year, such as stealing another student's work or paying someone to do your work, may be investigated under the Student Misconduct Procedures.**
- **Repeating plagiarism (even in first year), plagiarism after first year, or serious instances, may also be investigated under the Student Misconduct Procedures. The penalties under the procedures can include a reduction in marks, failing a course or for the most serious matter (like plagiarism in an honors thesis) even suspension from the university.**

End of Syllabus!