MECH 417: Control Systems

WALTER SCOTT, JR. COLLEGE OF ENGINEERING
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Instructor:
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Description:
The course covers dynamic process modeling, controller stability and tuning, and control system simulation and design.

Prerequisite:
MATH 340 and MECH 307.

Textbook:
Carlos A. Smith, Armando B. Corripio, Principles and Practices of Automatic Process Control, 3rd Edition, J. Wiley & Sons, Vital Source eBook ISBN: 9781119894254.

Disability Accommodation:
Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 requires Colorado State University to provide academic adjustments or accommodations for students with documented disabilities. Students seeking academic adjustment or accommodations must self-identify with the Office of Resources for Disabled Students (ORDS). After meeting with ORDS staff, and based on their recommendations, students are encouraged to meet with their instructors to discuss their needs, and if applicable, any lab safety concerns related to their disabilities.

Resources:
The CSU Writing Center is an excellent resource to support the development of your writing skills throughout your college career. While students are not required to access services, you are strongly encouraged to seek consultation on your writing projects required for this course. In addition to contact information, there are useful resources available on their website. The Morgan Library reference librarians can direct you to books and articles for the research paper and the oral presentation.

Professional Honesty:
This course adheres to the Academic Integrity Policy of the Colorado State University General Catalog and the Student Conduct Code. Honors students enrolled in this course are held to high standards of integrity. Academic integrity is expected within all assignments for this course. Students will be required to make an honor pledge to complete this course. The honors pledge will be completed as a class. It is expected that students will use their own knowledge and skill for assignments unless directed to do otherwise. Incidents of cheating, plagiarism or knowingly providing false or incorrect information are considered serious and will be treated seriously. Consequences of these incidents are at the discretion of the faculty member involved and may consist of confiscation of assignments, an F-grade, or reporting to the CSU Student Conduct office. It is expected that students will demonstrate concern for others, respect the confidentiality of information about, the property of and the decisions made by others.

Assessment:

Course learning outcomes are assessed using the following rubric:

Homework	0%
Laboratory	50%
Exam I (Chapters 1 – 6)	25%
Exam II (Chapters 7 – 12)	25%

Learning Outcomes:

- Become more comfortable modeling and analyzing dynamic systems.
- Develop an understanding of time and frequency response analysis.
- Learn how to analyze and design control systems.
- Develop an understanding of and intuition for PID control.
- Become proficient with the basics of MatLab and Simulink.
- Develop interest in pursuing further study in the area of controls.

Laboratory Assignments:

- Lab 1: Introduction to Simulink
- Lab 2: Process Control Model
- Lab 3: Control Instrument Model
- Lab 4: Single Loop Control System
- Lab 5: Cascade Control System

Topics:

Week	Module	Chapter	Topic	Homework	Lab
1	Process Modeling and Characterization	1	Introduction		
2		2	Mathematical Tools	2-2, 2-6, 2-7, 2-16, 2-24	
3					
4		3	First Order Dynamic Systems	3-1, 3-9, 3-15, 3-19, 3-24	
5		4	Higher Order Dynamic Systems	4-1, 4-3, 4-5, 4-7, 4-9	
6	Controller Design, Tuning, and Stability	5	Components of Control Systems	5-1, 5-5, 5-10, 5-15, 5-19	
7		6	Design of Control Systems	6-1, 6-8, 6-10, 6-18, 6-25	
8		7	Tuning Feedback Controllers	7-1, 7-2, 7-15, 7-20, 7-25	
9		8	Root Locus & Frequency Response	8-1, 8-5, 8-9, 8-14, 8-17	
10	System Modeling and Simulation	13	Simulation of Control Systems	5 lab assignments instead of HW	Lab 1
11					Lab 2
12	Control System Configuration and Design	9	Cascade Control	9-1, 9-2, 9-3, 9-4, 9-5	Lab 3
13		10	Ratio, Override, Selective Control	10-5, 10-10, 10-19, 10-21, 10-23	Lab 4
14		11	Feedforward Control	11-2, 11-5, 11-9, 11-12, 11-13	Lab 5
15		12	Multivariable Process Control	12-2, 12-4, 12-6, 12-8, 12-10	

Laboratory: Lab 1: Introduction to Simulink, Lab 2: Process Model, Lab 3: Instrument Model, Lab 4: Single Loop Control, Lab 5: Cascade Control