ABET COURSE OUTLINE

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Course Instructor: ***Cong Wang***
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office hours:
Tuesday and Friday mornings 12pm – before the course (1:30pm)
24/7 by e-mail.
Appointments.

Course Number and Title: ***ECE 432: Control Systems***
(3 credits, 2×1.5 contact hours, senior elective course)
Reference books:
Control System Design - An Introduction to State-Space Methods, by Bernard Friedland
Control Systems Engineering, by Norman Nise, 6th edition

Course Catalog Description (including prerequisites and co-requisites):
A continuation of the study of automatic control systems with emphasis on the modern control theory. Topics covered include state space models, stability, controllability and observability, state feedback control, observers, linear quadratic regulator and optimal control.

ECE 431 Introduction to Feedback Control Systems is a prerequisite.

Students are advised to take ECE 439 Control Laboratory at the same time.

Specific Course Learning Outcomes (CLO):
Students will be able to

1. Understand the role, strength, and limits of Modern Control methods (i.e., State Space methods) in control theories, with respect to the Classical Control methods they learned in the prerequisite course ECE 431 Introduction to Feedback Control Systems.
2. Model and analyze the stability, response, controllability, and observability of dynamic systems in real world problems with state space methods in time domain.
3. Design state feedback control algorithm for regulation and tracking tasks via pole placement and optimal control.
4. Design state observer algorithms to facilitate state feedback control.

Relevant Student Outcomes (ABET criterion 3):

(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (CLOs 2, 3, 4)
(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. (CLOs 3, 4)
(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts. (CLO 1)
(7) (an ability to acquire and apply new knowledge as needed, using appropriate learning strategies CLO 1)

Course Outline:

Week	Contents	Assignments
1,2	Review of linear algebra / differential equation	HW1,2
3	Introduction to state-space methods	HW3
4	Response analysis and stability	HW4
5	Quiz # 1 Controllability	HW5
6	Controllability and Observability	HW5,6
7,8	State feedback control and pole placement	HW6
9	(Spring Recess)	
10	State feedback control and pole placement Midterm	HW6
11	Observers	HW7
12	Discrete Systems	HW8
13 (only Tuesday)	Quiz # 2	
14,15	Introduction to optimal control	HW9
16 (only Tuesday)	Review	
17	Final Exam	

Grading weights:
Homework (and attendance) - 10%
Quiz # 1 - 10%
Midterm - 20%
Quiz # 2 - 10%
Final Exam - 50%