ECE 7855: Large Scale and Cyber-Physical Systems

Course Description

Decentralization, hierarchy and their effects on modeling, stability analysis, and optimal controller design. Hybrid system based modeling and design of Cyber-Physical Systems.

Prior Course Number: 855
Transcript Abbreviation: Lrg Sc & CP Systms
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Graduate
Student Ranks: Masters, Doctoral
Course Offerings: Autumn
Flex Scheduled Course: Never
Course Frequency: Even Years
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Prereq: 5750 (750).
Exclusions: Not open to students with credit for 855.
Cross-Listings:

Course Rationale: Existing course.

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1001
Subsidy Level: Doctoral Course

Course Goals

Give advanced students in control an introduction to the problems associated with controlling large, distributed/interconnected systems with a decentralized information structure
Examples in interconnected power systems, traffic networks, large space structures are considered
The complexity of decision-making, the analogies between engineering, economic and societal systems, and the interdisciplinary nature of control engineering practice is stressed

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Examples of large-scale systems	2.0							
The issues of interconnection, decentralization, hierarchy, modeling, use of graphs	3.0							

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Stability analysis of large interconnected systems	3.0							
Decentralization. Decentralized fixed modes, decentralized compensators	5.0							
The decentralized quadratic regulator, computational issues and suboptimality	5.0							
Two time-scale systems, time-scale hierarchy and introduction to singular perturbations	4.0							
Functional hierarchies, goal-task decompositions	3.0							
Problems in CyberPhysical Systems. Examples	10.0							
Hybrid Systems and testing	10.0							

Grades

Aspect	Percent
Homework Final 40%	20%
Midterm	20%
Final	40%
Project	20%

Representative Textbooks and Other Course Materials

Title	Author
No text.	

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
***	a	An ability to apply knowledge of mathematics, science, and engineering.
	b	An ability to design and conduct experiments, as well as to analyze and interpret data.
***	c	An ability to design a system, component, or process to meet desired needs.
	d	An ability to function on multi-disciplinary teams.
**	e	An ability to identify, formulate, and solve engineering problems.
	f	An understanding of professional and ethical responsibility.
	g	An ability to communicate effectively.
**	h	The broad education necessary to understand the impact of engineering solutions in a global and societal context.
**	i	A recognition of the need for, and an ability to engage in life-long learning.
**	j	A knowledge of contemporary issues.
***	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Additional Notes or Comments

Updated abbreviation, prereqs, exclusions, goals and topics to conform to university format 3/29/12

Prepared by: Betty Lise Anderson