ECE 7850 (Approved): Hybrid Dynamical Systems: Theory and Applications

Course Description

Introduction to hybrid systems (continuous dynamics coupled with discrete logic rules). Topics include stability analysis, optimal control, model predictive control, reachability, and state estimation of hybrid systems. Emphasis will be placed on applying existing hybrid systems theories to a wide range of applications in networked control systems, smart grid, power electronics, and robotics.

Transcript Abbreviation: Hybrid Dyn Systems
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Graduate
Student Ranks: Masters, Doctoral
Course Offerings: Spring
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: 6750 or 5750 (750).
Exclusions:
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

Introduce the students to the recent theoretical and application advances in modeling, control, and estimation of hybrid dynamical systems.
Train the students' skill and ability of independent research and technical writing

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
General hybrid system framework and examples	3.0							
Reachability Analysis and Safety Verification	6.0							

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Stability Analysis	6.0							
Hybrid Controller Synthesis	15.0							
Estimation of Hybrid Systems	9.0							

Representative Assignments

bi-weekly homework
final project

Grades

Aspect	Percent
Homework assignments	20%
Midterm exam	30%
Final Project	50%

Representative Textbooks and Other Course Materials

Title	Author
The Art of Hybrid Systems (reference)	J. Lygeros, C. Tomlin, and S. Shankar
Switching in Systems and Control (reference)	Daniel Liberzon
Hybrid Dynamical Systems: Modeling, Stability, and Robustness (reference)	Rafal Goebel, Ricardo, G. Sanfelice, and Andrew Teel

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

Course description changed 10/1/13 BLA

MAde consistent with university 4/5/14 BLA

Update prereqs to include 6750 (the old 5750) 4/16/15

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