ECE 7854 (Proposed): Nonlinear and Adaptive Control

Course Description

Advanced analysis of uncertain nonlinear systems. Design methodologies for complex interconnected nonlinear systems. Applications of nonlinear and adaptive control design to aerospace and robotic systems.

Prior Course Number: ECE 857, ECE 852
Transcript Abbreviation: Nonlin Adap Contr
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Graduate
Student Ranks: Masters, Doctoral
Course Offerings: Autumn
Flex Scheduled Course: Never
Course Frequency: Odd 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: 6754 (5754 or 754) and 6750 (5750 or 750).
Exclusions: Not open to students with credit for 857.
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

Develop advanced tools for the control of nonlinear interconnected systems
Provide a broad treatment of classical results in the stabilization of nonlinear systems
Give a detailed exposition of adaptive back-stepping and control-Lyapunov function techniques
Introduce the students to some of the most recent results in robust nonlinear regulation and tracking
Introduce realistic and challenging examples of nonlinear control systems design

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Normal forms of nonlinear systems	3.0							
Linearization by feedback	5.0							

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Zero-dynamics and local stabilization	4.0							
Robust and adaptive Lyapunov redesign	4.0							
Global stabilization by state feedback	4.0							
Passivity-based control	3.0							
Semi-global stabilization	4.0							
Nonlinear separation principle and output-feedback design	4.0							
Stabilization by saturated control	3.0							
Adaptive back-stepping design	4.0							
Nonlinear adaptive regulation	4.0							

Grades

Aspect	Percent
Homework	30%
Final Exam	40%
Final Project	30%

Representative Textbooks and Other Course Materials

Title	Author
Nonlinear Systems (required)	H.K. Khalil
Nonlinear Control Systems I	A. Isidori
Nonlinear Control Systems II	A. Isidori

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

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

update prereqeq to new cours numbers 6/15/15
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edited text info 5/10/17 CED

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