ECE 6754: Nonlinear Systems Theory

Course Description

Provides fundamental mathematical tools for the analysis of nonlinear dynamical systems. Basic techniques for the synthesis of nonlinear control systems are introduced.

Prior Course Number: 5754 (754)
Transcript Abbreviation: Nonlinear Systems
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Graduate
Student Ranks: Masters, Doctoral
Course Offerings: Spring
Flex Scheduled Course: Never
Course Frequency: Every Year
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:
Exclusions: Not open to students with credit for 5754 (754).
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 fundamental mathematical tools for analysis of nonlinear control systems
Provide an in-depth treatment of Lyapunov and input-output stability theory for nonlinear systems
Introduce examples and applications of nonlinear system modeling and control
Introduce useful physics and engineering concepts from the theory of dissipative systems
Introduce useful engineering concepts for the study of nonlinear oscillatory phenomena

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Nonlinear systems	2.0							
Fundamental properties of solutions	3.0							

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Elementary geometric properties of solutions	3.0							
Stability theory for autonomous systems	4.0							
Invariance principle and asymptotic behavior	2.0							
Center manifold theorems	1.0							
Stability theory for non-autonomous systems	5.0							
Converse Lyapunov theorems	1.0							
Input-to-state stability	3.0							
Input-output stability	3.0							
Dissipative systems & passivity	3.0							
Stability of perturbed systems	3.0							
Singular perturbations and averaging	3.0							

Grades

Aspect	Percent
Homework	30%
Midterm Exam	30%
Comprehensive Final Exam	40%

Representative Textbooks and Other Course Materials

Title	Author
Nonlinear Systems, 3rd Edition	H.K. Khalil

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

Broke up one compound course topic

Change from 5754 March 27, 2014 BLA

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