ECE 7822: Advanced Nonlinear Microwave Circuit Engineering

Course Description

Large-signal characterization and modeling of nonlinear RF circuits; power amplifiers; oscillators; modulators; wideband linearization, power efficient design.

Transcript Abbreviation: Nonlinear RF
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: 5027 or 723.
Exclusions: Not open to students with credit for 694K or 694.02.
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

Modern RF radios developed for broadband services require nonlinear RF front ends that handle wide bandwidth, operate linearly & are power efficient. These requirements are reviewed & figures of merit such as PARP, CCDF, ACPR & EVM will be defined
Introduce microwave/RF engineers to modern large-signal characterization, design and linearization techniques which have been developed to address these challenges
Application to the design and simulation of power amplifiers, oscillators and modulators with power efficiency, linearity and wide bandwidth as a target

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Review of modern communication requirements and associated figure of merits such as PARP, CCDF, ACPR and EVM	5.0							

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
Large-signal vector measurement techniques with LSNAs	5.0							
Direct model extraction of transistor from large signal load lines	5.0							
Behavioral modeling of power RF amplifiers with memory	5.0							
Interactive load-line-based design of power RF amplifiers	5.0							
Kurokawa theory of oscillator design and advanced phase-noise theory	5.0							
Characterization and linearization of microwave modulators	5.0							
Frequency-selective linearization of power RF amplifiers with memory	5.0							

Representative Assignments

Homework assignment
Term paper
Computer Aided Simulation

Grades

Aspect	Percent
Homework	25%
Midterm	25%
Term paper	25%
Final exam	25%

Representative Textbooks and Other Course Materials

Title	Author
Nonlinear RF Circuits and Nonlinear Vector Network Analyzers: Interactive Measurement and Design Techniques	Patrick Roblin (Cambridge University Press)

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

Updated textbook 4/14/13

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