ENEE411: Advanced Analog and Digital Electronics

Credits: 3

Description

Prerequisite: Minimum grade of C- in ENEE303.

Restriction: Must be in one of the following programs (Engineering: Electrical; Engineering: Computer) ; and must have permission of the department.

Credit only granted for: ENEE411 or ENEE419A.

Formerly: ENEE419A.

Examination of analog and digital device models for analysis, design, and simulation of transistor level electronic circuits, emphasizing Metal Oxide Silicon Field Effect Transistors (MOSFETs); fundamental single transistor configurations; frequency response, feedback, and stability of multi-transistor circuits, such as current mirrors, differential amplifiers, voltage references, operational amplifiers and data converters; complementary Metal Oxide Silicon (CMOS) implementations of static and clocked digital as well as mixed signal circuits.

Semesters Offered

Fall 2017, Fall 2018, Fall 2019, Fall 2020

Testudo

Learning Objectives

- Consolidate and apply key concepts in semiconductor devices, analog circuits and digital circuits, introduced earlier in the electrical and computer engineering curricula
- Analyze and design complex CMOS integrated circuits including: DC, transient and small signal responses of components such as current mirrors and differential pairs and circuits such as op-amps
- Optimize complex analog circuits in terms of performance characteristics such as phase margin, gain, and frequency response trade-offs, and optimize digital circuits in terms of fan-out and minimum propagation delay
- Use circuit simulators to confirm analysis and predict performance
- Understand how semiconductor physics influences chip design rules and sets limits on integrated circuit performance

Topics Covered

- Device models for analog and digital design
- The inverter and static logic gates

- Clocked circuits: latches, transmission gates, flip-flops
- Current mirrors: basic and cascode
- Amplifiers: fundamental configurations
- Differential amplifiers: passive and active loads
- Frequency response
- Operational amplifiers
- Feedback
- Stability compensation
- Data converters