CND 321: Advanced Analog Building Blocks

Course Description

The main objective of this course is to involve the students in in-depth design and simulation of the communication circuits, reference circuits, data conversion techniques, and DC-to-DC converters. The students will practice "hands-on" analog IC design using modern industrial CAD tools.

Prerequisites

Introduction to Analog Electronics

Learning Outcomes

After successful completion of this course, the student will be able to:

1. Have a top-level understanding of communication circuits including modulators, analog multipliers, mixers, PLLs, as well as D2A and A2D converters.
2. Design and simulate efficient reference circuits and LDOs.
3. Use modern advanced CAD tools to design and simulate analog electronic circuits.

Course Materials

Textbook:

- Paul R. Gray, Paul J. Hurst, Stephen H. Lewis, Robert G. Meyer, Analysis and Design of A Analog Integrated Circuit Design, 2nd Edition
- Tony Chan Carusone, David Johns, Kenneth Martin, analog Integrated Circuits, 5th Edition, Wiley.
- Asad A. Abidi, Paul R. Gray, Robert G. Meyer, Integrated Circuits for Wireless Communications. 1st Edition, Wiley-IEEE Press.
- Sergio Franco, Design with Operational Amplifiers and Analog Integrated Circuits. 4th Ed, McGraw-Hill Education.

References:

- Material derived from the IEEE Journal, Transactions, and the International Solid-state Circuits Conference (ISSCC) proceedings.

Course Topics and Schedule

- Communication circuits
  - AM and FM receivers,
  - Linear multipliers,
  - Mixers
  - Phase-locked loops
- Data conversion circuits
  - Analog switches
  - Sample-and-hold circuits
  - Digital-to-analog and analog-to-digital converters,
  - Voltage-to-frequency and frequency-to-voltage converters.
- Reference circuits
  - Important features: accuracy and stability
  - Error definition
  - Voltage Noise
  - Line Regulation/PSRR
  - Load Regulation
  - Dropout Voltage
  - Supply Range
  - Supply Current
- DC-DC converters
  - Linear
  - Buck
  - Switched Cap