ELEN 689: Advanced Mixed-Signal Interfaces

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Time: M/W/F 12:40 – 1:30 p.m.
Location: ZACH 223A

Course Description

This course introduces emerging and state of art mixed-signal techniques for the design of narrowband, wideband and ultra-wideband transmitters and receivers. The course teaches how the emerging services are demanding highly flexible, programmable and scalable architectures to be able to cope with a large number of applications including several communications standards. Additionally, the course addresses some of the topologies proposed to realize concepts like Software-Defined-Radios and Cognitive-Radios.

Course Outline

1. Transmitter Topologies and DACs
2. Receiver Topologies and ADCs
3. Narrow-band, Wideband and Ultra-wideband Radios
4. Software Defined Radios
5. Cognitive Radios

References

No textbook required. But the following reference books can be useful.

[1] IEEE Transactions Journals on some key topics.
[2] *The Design of CMOS Radio-Frequency Integrated Circuits*, Thomas H. Lee
[3] *Low-Voltage Low Power Integrated Circuits*, E. Sánchez-Sinencio , A. Andreou, IEEE Press,1999.
[4] A.B. Grebene. *Bipolar and MOS Analog Integrated Circuit Design*, John Wiley &Sons, Inc., New York 1984.
[5] B. Razavi, *Principles of Data Conversion*
Gregorian et al*., Analog MOS Integrated Circuits for Signal Processing*, Wiley, 1986.
[6] Razavi, *Principles of Data Conversion System Design*, IEEE Press, 1995.
[7]P.E. Allen and E. Sánchez-Sinencio, *Switched Capacitor Circuits*, Van Nostrand Reinhold, New York 1984.
[8]van de Plassche, *CMOS Integrated Analog-to-Digital and Digital-to-Analog Converters*, Kluwer, 2003.

[9]Norsworthy et al., *Delta-Sigma Data Converters: Theory, Design, and Simulation*, Wiley, 1996.
[10]Gray, et al., *Analysis and Design of Analog Integrated Circuits (4th Ed.)*, Wiley, 2001.
[11]Rodríguez-Vázquez, Medeiro, Janssens, CMOS Telecom Data Converters, Kluwer
[12]Schreier, Temes, Understanding Delta-Sigma Data Converters, Wiley-IEEE Press

CAD Tools

MATLAB, Simulink: Mixed-signal modeling in simulink and plain m-file, analog/digital filter synthesis, etc.

- Spectre RF

  SPICE-type analyses: .dc, .ac, .xf, .noise, .tran, and etc.

  Additional capabilities: pss, pac, pxf, pnoise, pdisto to analyze large-signal nonlinear circuits (e.g., switched-apacitor circuits, RF circuits).

- awd, ocean, icfb, msfb, icde, icms, and etc.

  Cadence GUI suite for design entry, layout, waveform display, and etc.

- Eldo for noise transient analysis.

Helpful Links

- Affirma Spectre RF Simulator User Guide (v446)
- Affirma Spectre RF Simulator Theory (v446)
- HSPICE Manual
- Berkeley SPICE User's Guide

Grading Policy

- Homeworks: 15% Biweekly
- Lab: 10%
- Midterm 1: 20% In class.
- Midterm 2: 20% In class
- Final Project: 15% Assigned after midterm.
- Proj. Presentation: In class.
- Final Exam: 20% University schedule