High Speed Mixed Signal and Communication IC design

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web: http://www.ece.ucsb.edu/Faculty/rodwell/Classes/mixed_signal/ mixed_signal.htm
Level: both Graduate and Senior-level Undergraduate

Transistor and passive component models. High frequency broadband amplifier design. High speed digital IC design at the transistor level. Circuit noise, signal/noise rations, digital communication receiver sensitivity. Latched comparator design. Fiber optic and microwave digital transceivers. Overview of ADCs, DACs, DDS.

Topics:

Review:
- Transistor models, characteristics, figures of merit
- transmission-lines, terminations, reflections

High speed broadband amplifier design:
- Transfer functions, time constants methods
- gain bandwidth limits
- tuning networks for gain peaking / broadbanding
- Darlington and ft-doubler gain stages
- transimpedance-transconductance ("Cherry Hooper") stages
- gain control

High speed digital IC design at the transistor level
- ECL and CML gate designs, DC design
- circuit structures for and / or / xor / latches …
- large-signal delay analysis, design for high speed
- transmission line interconnects, signal distribution
- power-delay relationships

Amplifier noise / sensitivity
- review of probability, random variables, physics of random processes
- noise models of transistors and passive elements
- input referred noise voltage, noise current, noise power, noise temperature…
- signal/noise ratio relationships in analog and digital communications

Fiber optic transceivers
- transmitter and receiver architectures
- circuit blocks: front-end, linear channel, AGC loop, timing recovery
- design at the circuit and system level.
- sensitivity analysis at the level of Smith and Personik

Brief overview of ADC and DAC concepts and architectures.