EE 201C
Modeling of VLSI Circuits and Systems

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Who should and can take this course

Those want to learn timing, signal and power integrity, stochastic power/thermal for both SoC and SiP

Those want to learn modeling for cyber-physical systems (such as smart grid and electric vehicle), or any systems

Background required
- Basics of IC and systems
- Matlab and SPICE (both could be learned in this class)
201C Course Outline and Schedule

Deterministic modeling (3 weeks)
- Parasitic (RLC and thermal RC) extraction
- Delay modeling and model order reduction
- Static timing and noise analysis for logic and on-chip interconnects
- 1 hw (e.g., model order reduction in Matlab)

Stochastic modeling (3 weeks)
- Process variation, and stochastic timing
- Circuit reliability (defects, soft errors and aging)
- Stochastic power and thermal integrity
- 1 hw (e.g., SPICE-based stochastic modeling of SRAM cells or analog circuits)

Beyond-die signal and power integrity (3 weeks)
- High-speed signaling
- Chip-package co-design with signal and power integrity
- Modeling of TSV for 3D IC
- 1 hw (e.g., Matlab-based modeling for high-speed signaling)
Some Details on hws

Example 1: Matlab coding of PRIMA
- Extend single-point model order reduction to multi-point MOR
- Majority of program is given

Example 2: SPICE-based stochastic modeling of SRAM cells
- Reduce the number of SPICE runs for required accuracy
  - Monte Carlo vs Pesudo Monte Carlo vs non Monte Carlo

Example 3: off-chip signal and power integrity
- ISI (inter symbol interference) reduction for high-speed signaling
- Power noise reduction via off-chip decap
Requirement and Schedule for Final Project

Programming project to be done by a single student, or a team of two students

- Reports use ACM style
- Reports uploaded to class wiki

One week to discuss projects, examples include:

- Equivalent circuit based modeling for battery or solar cells (details discussed on week 4)
- Stochastic modeling of SRAM arrays or analog circuits (details discussed on week 6)

These projects may be expanded to be projects for MS degrees, or for publications
Grading Policy

3 Homeworks (mini-projects) 60
   each hw 8 pts for correctness, 2pts for optimality

Programming project 40
   30 pts for solution quality
   10 pts for clarity of presentations

A ⇔ score > 85