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 deterministic stochastic modeling for 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
- Project 1 (e.g., model order reduction in Matlab)

Stochastic modeling (3 weeks)

- Process variation, and stochastic timing
- Stochastic power and thermal integrity
- Stochastic circuit modeling and optimization (PVG variations and aging)
- Project 2 (e.g., SPICE-based stochastic modeling and ckt optimization)

Beyond-die signal and power integrity (3 weeks)

- High-speed signaling
- Chip-package co-design with signal and power integrity
- Equivalent ckt Modeling and stress modeling of TSV for 3D IC
- Project 3 (e.g., Matlab-based modeling for high-speed signaling)

Some Details on Example Projects

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 and optimization of circuit cells (e.g., SRAM, FF)

- 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, or TSV modeling

- ISI (inter symbol interference) reduction for high-speed signaling
- Power noise reduction via off-chip decap
- Stress or RLC modeling for TSV

Grading Policy

~3 Homeworks 15

3 mini-projects 60

each hw 15 pts for correctness, 5 pts for optimality

single-student (no team work)

1 take-home 1-day exam 25

A ⇔ score > 85