ECEN 751 - Spring 2014

Advanced Computational Methods for Integrated System Design

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Lectures  2:20 – 3:35pm TR  BLOC 121

Office Hours  3:45 – 4:35pm TR

Class Website  http://dropzone.tamu.edu/~pli/751Spring14/

Course Description

Advanced computational techniques are essential enablers for analysis and design of complex integrated circuits and systems. These methods form the backbone of modern design automation technologies that support the development of integrated circuits with growing complexity. With a focus on VLSI computer-aided design, this course is designed to look at a range of circuit design problems from a computational stand. In particular, a number of VLSI CAD subjects that include circuit simulation, interconnect analysis, model order reduction, design and analysis of IC subsystems, process variation and manufacturability issues will be discussed. In addition to fundamental application-specific algorithm design, parallel computing will be leveraged for addressing computationally challenges. Computational techniques developed for selected new emerging applications will be introduced. Interaction between computational algorithms and circuit/system design will also be targeted in lectures and class projects.

Prerequisites

ECEN454/474 or equivalents, knowledge of basic circuit theory, circuit design and engineering mathematics, and proficiency in C/C++/Matlab programming.

Course Objectives

The students are expected to develop in-depth understanding on a number of computational algorithms and techniques and their interactions with circuit/system design. Furthermore, they will be exposed to parallel programming and expected to be able to develop suitable algorithms and implementations for related computational applications. Circuit/system design explorations will also be promoted in lectures and projects.

Topics (tentative)

1. Introduction
2. Basic circuit analysis
3. Introduction to fundamental numerical methods
4. Device modeling in circuit analysis
5. Circuit simulation
6. Model order reduction
7. Design and analysis of IC subsystems
8. Process variability and manufacturability
9. Emerging parallel computing systems
10. Introduction to parallel programming
11. Introduction to parallel algorithms
12. Parallel VLSI CAD applications
13. Analog/mixed-signal circuit verification
14. Analysis and design of semiconductor and emerging memories
15. Modeling and computational techniques for biological applications
16. Introduction to brain-inspired neuromorphic circuits

References
[1] Research papers from various journals and conference proceedings and other sources.
[8] Online MPI tutorial from Lawrence Livermore Labs: http://www.llnl.gov/computing/tutorials/mpi

Grading
Assignments: 35%
Midterm: 25% (in class)
Final class project (research oriented): 40%

Americans with Disabilities Act (ADA)
The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have disability requiring an accommodation, please contact Disability Services, in Cain Hall, Room B118, or call 845-1637. For additional information visit http://disability.tamu.edu

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