

EE 382M-23: Design for Low-Power and Robustness

(formerly EE 382V – Nanometer Scale IC Design)

Spring 2016

Instructor: Prof. Michael Orshansky

Lecture Hours: Tu Th 9:30-11:00AM, SZB 426

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Course Number: 16753

This course explores two major challenges of digital integrated circuit design in advanced CMOS technologies: power consumption and variability. The students will learn about the impact of new physical effects on the traditional circuit design solutions and methods, and on ways they need to adopt to enable successful integrated circuit design. The primary themes of the course will be the challenges of ensuring *low-power operation, robustness, and manufacturability* of advanced integrated circuits.

Prerequisites

Digital Integrated Circuit Design: EE360S *or consent of the instructor*

Solid-State Electronic Devices: EE339 *or equivalent*

Tentative Course Plan

1. CMOS technology and design scaling
2. Nanometer transistors and their models
3. Design time power optimization (circuit-level techniques, architecture, interconnect, memory)
4. Standby-mode power optimization (circuits and systems, memory)
5. Runtime power optimization (circuits and systems)
6. Sources of variability
7. Statistical data collection and analysis of variance
8. Statistical circuit simulation and timing analysis
9. Manufacturability and resolution enhancement techniques

High-Level Course Objectives

The students will learn to:

- (1) Identify the *challenges* to IC design created by the new technology trends;
- (2) Analyze the above challenges using rigorous *mathematical models*;
- (3) Read research-level publications and identify their substantial contributions to the existing body of knowledge;
- (4) Carry out independent research that addresses open issues in literature, using the concepts and skills learned in class.

Course Reading

- J. Rabaey, *Low Power Design Essentials*, Springer, 2009.
- M. Orshansky, S. Nassif, D. Boning, *Design for Manufacturability and Statistical Design: A Constructive Approach*, Springer, 2008.

Course Website

We will use the web-based course management system “Canvas”. The students are responsible for regularly checking the course web page for announcements and postings at <https://utexas.instructure.com/>.

Course Notes

Course notes (slides) will be available for most *but not all* lectures. When available, they will be downloadable from the website, and will be published prior to the class time.

Exams and homework assignments

Several homework assignments will be given out in the course of the semester. There will be one midterm exam. There will be no final exam.

Project

The class project may be either a theoretical or practical investigation of open problems in areas discussed in the course. The projects will be carried out in groups of two people. The students will write a series of reports throughout the semester, and will present intermediate project results as well as final results in class. Both the quality of results and the quality of written and oral presentation will determine the project grade.

Grading

30% Homework, 20% Midterm, 50% Project

Collaboration on homework assignments and projects is encouraged. Turning in identical homework or exam solutions is considered cheating.

Academic dishonesty

Academic dishonesty in any form will not be tolerated. Academic dishonesty includes but is not limited to cheating on exams and homework assignments, interfering with another student’s work, and plagiarizing.