CSCE 5013: Design Automation of VLSI Circuits and Systems

Catalog Description:
This course studies physical design, analysis and optimization of VLSI circuits and systems with emphasis on computational realizations and optimization. We start with some related topics such as graph algorithms, and discuss various well-known algorithms and methodologies in the design process of VLSI circuits, including design partitioning, logic synthesis, floorplanning, routing, static timing analysis and performance-driven layout. It requires a basic knowledge of digital circuit design, data structure, and object-oriented programming.

Prerequisites: CSCE 2114 Digital Design, CSCE 3193 Programming Paradigms

Textbook/required material:
There is no required textbook for this course. Course notes for all lectures will be used. However, the following books are recommended:

- Practical Problems in VLSI Physical Design Automation, Sung Kyu Lim, Springer, 2008, ISBN 978-1402066269
- VLSI Physical Design Automation: Theory and Practice, Sadiq M. Sait and Habib Youssef, World Scientific, 1999, ISBN 978-9810238834

Course objective:
The objective of this course is to study algorithms and methodologies to solve practical problems in computer-aided VLSI design. We shall discuss how to transform a circuit from a structural to a gate-level representation, and finally into layout and masks. Because of design complexity, such transformation needs to be efficiently carried out using computers so that the resulting layout satisfies topological, geometric, timing, power and manufacturability constraints. Students will also learn to compare the complexity and efficiency of various algorithms for physical design, analysis and optimization, and can implement such algorithms with a programing practice.

Topics covered:

- Introduction to computer-aided design
- Design partition
- Logic synthesis
- Floorplanning
- Placement
- Routing
- Static timing analysis
- Interconnect optimization

Class schedule:
Meets either 3 times a week for 50 minutes or 2 times a week for 1 hour 20 minutes for 15 weeks.

Homework assignments and project:
Homework will be assigned. Optional final project can be used to substitute the final exam.

Grading:
Homework assignments: 30%
Midterm exam #1: 20%
Midterm exam #2: 20%
Final Exam or Project: 30%