Course: ECE 56700 - FPGA Designs for Signal Processing Applications

Type of Course:
- Core course for the CmpE option of the MSE program
- Elective course for the EE option of the MSE program
- Elective course for the CmpE and EE undergraduate programs

Catalog Description:
This course introduces methodologies of FPGA designs for signal processing applications. It provides system design experience using hardware description language (HDL) and commercial EDA tools. Topics covered include computer arithmetic, fixed-point vs floating point, FIR/IIR implementations, multirate signal processing, implementations of FFT, modulation/demodulation using FPGA. Literature readings from IEEE Xplore will be assigned to students. Students are required to complete a course project that implements and simulates a signal processing algorithm using FPGAs.

Credits: 3

Contact Hours: 3

Prerequisite Courses:
1) ECE 358 – Intro to VHDL or a demonstrated proficiency with synthesizable VHDL or Verilog
2) ECE 301 – Signals and Systems

Prerequisites by Topics:
Synthesizable Hardware Description Language, theory and principles of signals and systems

Reference books:
3) Xilinx DSP Primer, 2011 Version

Course Objectives:
To introduce the basic approaches and methodologies of FPGA design for signal processing systems
**Course Outcomes**

A student who successfully fulfills the course requirements will have demonstrated:

1. an understanding of computer arithmetic such as binary multipliers, binary divider, floating-point vs fixed point, distributed arithmetic, CORDIC, etc [a,e,k]
2. an understanding of the implementations of Finite Impulse Response filters, Infinite Impulse Response filters [a,e,k]
3. an understanding of the implementations of multirate signal processing [a,e,k]
4. an understanding of FFT implementations [a,e,k]
5. an understanding of the implementations of modulation and demodulation [a,e,k]

**Lecture Topics**

1. Introduction to FPGA
2. Computer Arithmetic
3. Finite Impulse Response Digital Filters
4. Infinite Impulse Response Digital Filters
5. Multirate Signal Processing
6. Fourier Transforms
7. Modulation and Demodulation such as ASK, PSK and FSK
8. Exams and Project Presentations

**Computer Usage**

High

**Laboratory Experience**

High

**Design Experience**

High

**Coordinator**

Guoping Wang, Ph.D.

**Cross-listed Course**

**Date**

3/16/2015