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

ECE 35800 and ECE 3010

Prerequisites by Topics

Synthesizable Hardware Description Language, theory and principles of signals and systems

Reference books

1) Uwe Meyer-Baese, Digital Signal Processing with Field Programmable Gate Arrays, 3rd Edition, Springer, 2007, ISBN: 978-3540726128.

2) Mark Zwolinski, Digital System Design Using VHDL, 2nd Edition, Prentice Hall, ISBN: ISBN 0-13-039985-X

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.
2. an understanding of the implementations of Finite Impulse Response filters, Infinite Impulse Response filters.
3. an understanding of the implementations of multirate signal processing.
4. an understanding of FFT implementations
5. an understanding of the implementations of modulation and demodulation.

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.

Date

03/02/2018