

EE 598: DIGITAL SYSTEMS DESIGN WITH FPGAS

BASIC INFORMATION

EE 598

Number of credits: 4 credits

Quarter and year: Fall 2022

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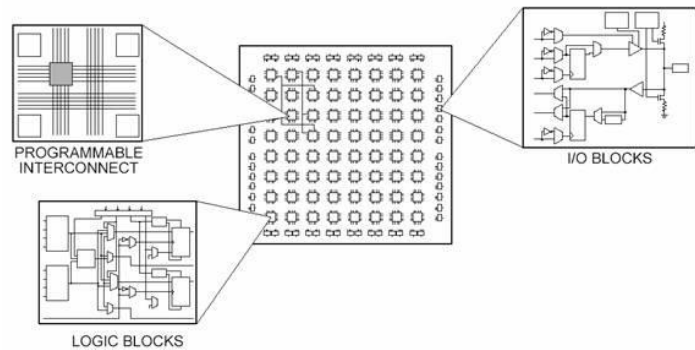


Figure 1. The Different Parts of an FPGA.¹

SUMMARY

Recent trends have shown a clear need for technologies that offer rapid prototyping, programmability, and re-use capabilities. When developing embedded systems with the above capabilities, various components are used, including computer processors/microcontrollers, Field Programmable Gate Arrays (FPGAs), memory, and input/output peripheral devices, to name a few. FPGAs tend to be the go-to platforms to increase the processing speed for hardware acceleration in applications such as Genomic research, financial analysis, and video processing. This course focuses on using FPGAs to design digital. By the end of this course, you will be able to design digital systems by understanding FPGA architectures and their design flow.

COURSE OBJECTIVES

- *Combinational Logic Design*
- *Sequential Logic Design*
- *Algorithmic State Machine (ASM)*
- *Finite State Machines*
- *Clock Domain Crossing and Meta-stability*
- *EDA tools and System Verilog*
- *FPGA Architecture*
- *FPGA Design Process*
- *FPGA Logic Implementation and Features*
- *FPGA Timing Analysis*
- *FPGA Constraints*

BACKGROUND KNOWLEDGE

- Familiarity with Java or C++: Including but not limited to: data abstraction and encapsulation, including stacks, queues, linked lists, binary trees, recursion, and use of predefined collection classes.
- Basic Knowledge of electrical circuits.

TEXTBOOK (OPTIONAL)

- *Reconfigurable Computing: The Theory and Practice of FPGA-Based Computation*, 2008. André, and Hauck.
- *Digital Design and Computer Architecture (ARM Edition)*, 2016. by Harris and Harris
- *Digital Design with RTL Design, VHDL, and Verilog*, 2011. by Vahid

COURSE ELEMENTS AND GRADING CRITERIA

- 20% Homework Assignments (x6)
- 50% Lab Assignments (x4)
- 20% Quizzes (x2)
- 10% ICTE [In-Class Team Exercises] (x6)

COURSE FORMAT

The class will be held in person. It is important that you attend the class meetings to increase your learning experience, especially during In-Class Team Exercises (ICTE). We will provide prefilled slides, recorded lectures, and filled-out notes for you to review asynchronously. We will also provide a zoom option for those who cannot make it in person; however, this is not a hybrid course; hence, the engagement through zoom will be limited.

¹ <https://www.ni.com/en-us/innovations/white-papers/08/fpga-fundamentals.html>