

Digital System Architecture

Background: Hardware Description Language (HDL) based digital design process and rapid prototyping tools such as Field Programmable Gate Arrays (FPGA) have become ubiquitous components in the design of complex digital systems. Their applications include signal processing algorithms, serial data communication systems and custom Intellectual Property (IP).

Topics:

- Introduction to digital design methodology
- Introduction to logic design with Verilog HDL.
- Fundamentals of sequential logic design – Mealy , Moore machines
- Behavioral modeling of combinational and sequential logic
- Synthesis of combinational and sequential logic
- Design and synthesis of Datapath Controllers
- Arithmetic processing – Multiplication, Division of signed/unsigned integers and fractions
- Single cycle, multi cycle and pipelined processor architectures
- Signal processing algorithms using HDL
- Serial Data communication, e.g. UART, LIN, CAN, Modbus using HDL
- Hardware-Software co-design using soft processors and HDL based accelerators.
- Programmable Logic Device(PLD) platforms
 - Technologies for PLD – SRAM, Flash, Anti-fuse
 - Simulation of hardware control scheme in Matlab Simulink® environment.
 - Components of typical PLD. Embedded memory, PLL, Dedicated computation blocks
 - Functional simulation of design using on-chip resources; Use of vendor provided canned functionality. Example – Xilinx Coregen®
 - Synthesis ; Post Synthesis Design tasks , design constraint implementation – Timing, Floor Planning, pin-locking of a design using PLD Vendor tools.

Reference Books (In alphabetical order)

1. Michael Ciletti – Advanced digital design using Verilog HDL, Pearson
2. Samir Palnitkar – Digital Design using Verilog HDL, Pearson
3. Vendor Data sheets and application notes