

Digital Design using VHDL [IT-311]

Assignment

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Discuss the Advantages of Programmable Device

PLD called a programmable logic device, it is a semiconductor device that can be programmed to obtain required logic devices. The advantage of PLD is re-programmability, they have replaced special-purpose different types of logic devices like logic gates, flip flop, counter, and multiplexer in many semi-custom applications. It consists of an array of AND and OR gates, which can be programmed to realize the required logic function.

Advantages of Programmable logic Devices

- ✚ Low development cost
- ✚ Less space requirement
- ✚ Less power requirement
- ✚ It is easy to troubleshoot
- ✚ Less design time
- ✚ High switching speed
- ✚ High design security
- ✚ Easy design modification
- ✚ High reliability
- ✚ Only the connection mask require to be custom made
- ✚ Easy circuit testing
- ✚ There is no need for the time-consuming logic design of some random logic gate network device
- ✚ Design checking easy
- ✚ The design change is also easy
- ✚ The layout is far simpler than that for random logic gate networks
- ✚ Adoption of the new technology is quick and easy

How programmable devices can be used to design GPU?

✚ Verilog or VHDL are languages for designing circuits.

The language itself does not design anything, but a human can use that language to design any circuit.

✚ GPUs like CPUs like any other chip are designed in Verilog or VHDL (or maybe Chisel as the new upcoming HDL) .HDL (Verilog or VHDL) provide method to describe hardware functionality, that functionality may be for ASIC/FPGA/GPU/AI Chip

✚ When AMD bought ATI the GPU's were written in VHDL, and ATI was using VHDL for everything. Then AMD forced conversion to Verilog as it is a lower level HDL and AMD designed at a low level.

✚ To take best advantage of the CMOS process when you are making a CPU or GPU, you might have to instantiate a lot of latches and components at a structural level. HDL synthesis is quite capable of creating netlists using any components when you use it structurally.

✚ AMD and Intel used to do graphical cad (aka polygon) designs for circuits at the lowest level, but nobody does that anymore for digital circuits because it is not cost effective. Instead, small gate level circuits (gates) are designed at the polygon level then stitched together using automatic layout following the netlist that comes from HDL synthesis.

✚ GPUs are particularly complicated and difficult to design since a lot of their function depends on embedded software.

✚ A better methodology would be to use a DSL for describing the GPU as a dataflow machine and then building compilers around that to generate the hardware pieces. RTL is a very inefficient approach, and (single-threaded/SystemC) C++ models run much slower than the actual GPU, but dataflow models run well on FPGA/GP-GPU.

References:

- <https://www.ecstuff4u.com/2021/02/advantages-disadvantages-pld.html>
- <https://dqydj.com/how-to-create-an-fpga-graphics-card/>
- https://en.wikipedia.org/wiki/General-purpose_computing_on_graphics_processing_units
- <https://www.quora.com/Can-an-engineer-use-a-HDL-Verilog-or-VHDL-to-design-a-GPU-I-know-these-languages-can-design-a-CPU-but-what-about-a-GPU>