FPGA Structure (1A)

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2/6/19

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This document was produced by using LibreOffice.

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2/6/19

Based on

The VLSI Handbook, edited by Wai-Kai Chen, CRC

RAM enabled FPGA

Fuses or anti-fuses :

logic function cannot be changed once realized

RAM to FPGA hardware:

logic function can be easily changed
by changing information stored in the RAM

not a straightforward extension to the gate arrays

programmability of an FPGA is comparable to that of a CPU

an FPGA performs much faster than software on computer
but slower than ASICs

Hardware of FPGAs

The layout of a unit is repeated in a matrix form

The unit is consisting of

- PLDs
- Logic gates
- Random access memory
- Non-volatile memory
- Other types of component

A logic block or a logic cell
A large number of pre-laid connecting lines

Some call these LBA (Logic Block Array)

Routing channels in a LBA

- Similar to a gate array
- Similar to sea-of-gate array
- Similar to standard cells
- Bus lines
- Other types of component

A logic block or a logic cell
A large number of pre-laid connecting lines

Some call these LBA (Logic Block Array)

Routing channel similar to gate arrays

Routing channel similar to sea-of-gate arrays

Routing channel similar to standard cell arrays

Routing channel similar to bus-based arrays

Logic Block Structure

- SRAMs for look-up tables
- PALs
- NAND gates
- Multiplexers
- Flip-flops

Programmable Switches

pre-laid vertical and horizontal lines (short line segments)
are connected to the inputs and output of logic blocks
by **programmable switches**

- Fuses, Anti-fuses
- RAM
- Non-volatile memory

Each programmable switch consists of
many switching elements
typically hundreds of thousands or more switching elements
arranging these elements effects
the performance, cost, and size

IO Control Block

Blocks for inputs to receive signals
from the outside of the FPGA
Blocks for outputs to send signals
to the outside

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Advantages of SRAM based FPGAs

Logic functions can be realized
by writing design information
into SRAM and flip-flops

Complex logic functions
requires a large number of logic gates
PALs and other types of FPGA are suitable

Quick realization of complex logic function
is possible with SRAM based FPGAs

Disadvantages of SRAM based FPGAs

If the power supply is turned off
    all the information is lost

the design information must be re-written
    each time the power is turned on

Compared to the mask programmable gate arrays
    the chip size is larger
    the speed is slower

Compared to software run on the general computer
    the speed is faster

References

[1] ftp://ftp.geoinfo.tuwien.ac.at/navratil/HaskellTutorial.pdf
[2] https://www.umiacs.umd.edu/~hal/docs/daume02yaht.pdf