

MODELING DIGITAL DEVICES WITH THE HELP OF VHDL PROGRAMMING LANGUAGE

Khalima Y. Abaskhanova

**Associate Professor, Tashkent University Of Information
Technologies Named After Muhammad Al-Khwarizmi, Uzbekistan**

Markhamat Y. Khaydarova

**Associate Professor, Tashkent University Of Information
Technologies Named After Muhammad Al-Khwarizmi, Uzbekistan**

ABSTRACT: This article presents the modeling of digital devices based on the VHDL programming language, and an important advantage of FPGAs is their versatility and programming capabilities to perform the functions of almost any digital device.

KEYWORDS: VHDL programming language, digital devices, FPGA, integrated circuits, macro cell, module interface, logic elements, diagrams, converters.

INTRODUCTION

Nowadays, the demand for computer technology is increasing day by day. Information technology has penetrated into all spheres and is making a significant contribution to the development of this sphere. The field of programming is currently becoming the most profitable and the field that introduces the country to the whole world. The programs created for various fields are increasing the productivity of employees working in this field by automating their daily activities. All organizations and educational institutions are trying to automate their activities and control of employees. Creating embedded system devices and writing software for them is the most demanding but lucrative field today. Every personal computer user wants to identify and troubleshoot computer problems, especially designing various circuits in programmable logic integrated circuits. Interest in the field of programming in the Republic of Uzbekistan is increasing. The decisions and laws adopted in this regard, the work being carried out within the framework of the project of one million programmers, are the reasons for the increase in the number of programmers. The field of programming has several directions, one of which is the field of programming of logical devices. Programs for automatic processing devices, industrial robots, and smart buildings are the products of this field. That's why our president has issued a number of decrees on information technologies, paying great attention to the development of

this field in our country and the proper place of Uzbek programs in the world market. Therefore, students studying computer science and information technologies are given a number of programming languages as a subject, and students are required to master this subject in depth. Currently, programmable logic integrated circuits (FPGA) are used in the development of digital devices. An important advantage of FPGAs is their versatility and ability to be quickly programmed to perform the functions of almost any digital device. FPGA is a semi-finished product, based on which a developer with a personal computer can design a digital device in record time. It is simple and relatively inexpensive software and is provided by special software called automatic design system (ALT). A programmable logic integrated circuit is an electronic component used to create digital integrated circuits. Unlike traditional digital chips, FPGA operating logic is set by programming using special tools: programmers and software.

THE MAIN FINDINGS AND RESULTS

The main problems at all stages of VLSI design are to ensure defect-freeness and reduce design time. Since modern VLSI contain millions of semiconductor structures on a chip, the solution to these problems is possible only through the extended use of various methods of design automation in CAD, based on a powerful computing base. As you know, the basis of any CAD is software that allows you to implement methods and algorithms for computer-aided design. For different stages of design, different algorithms and programs are used and, of course, different initial data.

FPGA programming is done using Verilog and VHDL hardware description languages. At a high level, these languages are very similar - the hardware model is described in the form of interacting blocks (modules), and the interface and implementation are defined for each of them.

```
package wire is
  function RES_FUNC(DATA: in bit_vector) return bit;
  subtype RESOLVED_BIT is RES_FUNC bit;
end;
package body wire is
  function RES_FUNC(DATA: in bit_vector) return bit is
  begin
    for I in DATA'range loop
      if DATA(I) = '1' then return '1';
      end if;
    end loop;
    return '0';
  end;
end;
```

Figure 1. VHDL packages. Synthesis and modeling system.

The function of the system is defined as the transformation of input values into output values, and the time in this transformation is specified explicitly. The organization of the system is given by a list of related components. The VHDL language is currently used as an international standard

for describing computer systems (CS) of any level of complexity (microcircuit, board, unit, device, computer, complex). The VHDL description language can be used at all stages of the development of electronic systems: design, verification, synthesis and testing of equipment, transfer of project data.

Module interfaces describe the input, output, and bidirectional ports through which modules connect to each other to exchange data and control signals. The implementation defines the elements of the internal state and the procedure for calculating the values of the output interfaces based on this state and the values of the input ports, as well as the rules for updating the internal state. Overview of the Digital Device Design Route The design of FPGA-based devices is carried out using special ALT systems. Designing with such ALT systems involves consistent use of the software tools provided. In ALT terminology, this process is called the modeling path. Modeling is traditionally divided into stages: systematic, structural, algorithmic, technological and functional. At the system stage, the entire project is divided into parts, their purpose and relationships are determined, a decision is made on how to implement the parts, and the method of describing the device is chosen. The modeling and technological stage is related to the choice of the method of characterizing the device.

CONCLUSION

To conclude, programmable logic integrated circuits (FPGA) are used in the development of digital devices. An important advantage of FPGAs is their versatility and ability to be quickly programmed to perform the functions of almost any digital device. FPGA is a semi-finished product, based on which a developer with a personal computer can design a digital device in record time. The main problems at all stages of VLSI design are to ensure defect-freeness and reduce design time. Module interfaces describe the input, output, and bidirectional ports through which modules connect to each other to exchange data and control signals.

REFERENCES

1. Kh.Yu.Abaskhonova U.B.Amirsaidov, Microprocessors. Study guide for higher educational institutions. Tashkent 2015.-350 pages
2. Kh. Yu. Abaskhanova, Digital technology. Textbook for technical school students. Tashkent 2021.-350 pages
3. Kh.Yu. Abaskhanova, Juraev L.N, Khoshimova FR. Digital technique. Study guide for technical school students. Tashkent 2021.-250 pages
4. Bibilo P.N. Basic language VHDL: ucheb. posobie. - Izd. 6-e. - M.: LIBROKOM, 2014. – 328 p.