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ELSEVIER



SRN
Societal Research Network

Universal
Impact Factor



**USE OF INNOVATIVE TECHNOLOGIES IN TEACHING THE SCIENCE OF
PROGRAMMABLE DIGITAL DEVICES**

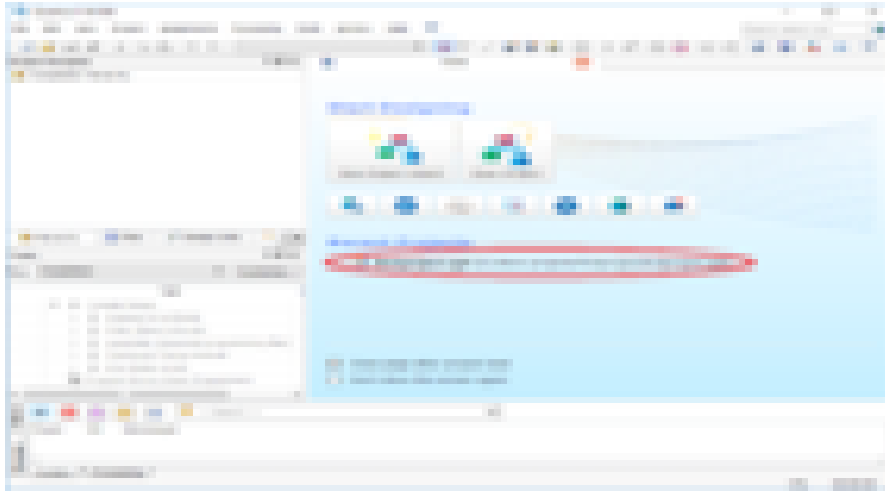
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Abstract: This article presents the modeling of digital devices based on the VHDL programming language, and an important advantage of FPGAs is their versatility and the ability to program them to perform the functions of almost any digital device.

Key words: VHDL programming language, digital devices, DMIS(FPGA)), integrated circuits, macrocell, module interface, logic elements, diagrams, converters.

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 logic devices. Automatic devices, industrial robots, programs for smart buildings are the products of this field. That is why the President has issued a number of decrees on information technologies, paying great attention to the development of this field in our country and the rightful place of Uzbek programs in the world market. Currently, programmable logic integrated circuits (programmable logic integrated circuit DMIS(FPGA)) are used in the development of digital devices. A major 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 that allows a developer with a personal computer to design a digital device in record time. This is provided by a simple and relatively inexpensive software and special software called Automatic Design System (ALT (CAD)). It uses a minimally detailed view of the system being designed at a high level, showing only the overview and benefits. In the following levels, the view will expand, in which the system will be in the form of individual blocks, rather than a general one. Such an approach allows each problem to be formed and solved in a certain level of complexity, and it is easy for the student to understand and creates a wide range of design tools. 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 terms of interacting blocks (modules), and an interface and implementation are defined for each of them. 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 Designing FPGA-based devices is carried out using special ALT (CAD) systems. Modeling is traditionally divided into stages: systemic, structural, algorithmic, technological and functional.



Picture 1. Design environment Quartus II IDE

Modern ALT systems use several methods of device description: o hardware description (VHDL, Verilog, AHDL, etc.) and use of a special text editor; o a schematic method of description using a visual model program that allows the developer to place functional blocks on the workspace and connect them. At the end of the visual model, the diagram becomes a language representation; o a graphic image of digital machines in a specialized editor that converts the obtained graphic image into a language description; o description of combinational logic using truth table, Carnot card, Boolean algebra functions. The compiler performs a special analysis and creates a list of all elements of the diagram and the relationships between them, i.e. a network list. In addition to Verilog primitives, the Quartus II IDE provides many other macro functions and a library of module library functions from parameters optimized for specific architectures and tasks. 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.

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A developer designer uses component instance instances to include macrofunctions, LPMs, and user-defined component instances. VHDL (Hardware Description Language) can be clearly distinguished among the variety of digital hardware design languages, which, due to its versatility, allows to describe the structure and operation of a simple logical element.

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