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Study by research in improving of EDA tools teaching in a technical university

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ABSTRACT: This paper is based on the findings and results of a recent survey taken of final year engineering students. The investigation had two principle objectives: the first to assess engineering students' views on the status and inclusion of environmental issues and topics in general engineering disciplines, and the second to assess what students understand to be the qualities and attributes of a professional engineer. In researching these issues particular emphasis is placed on the creation of a uniform engineering education curriculum that addresses sustainable development and environmental issues and concerns in the development of the skills and attributes that are vital for the formation of a modern professional engineer. The paper suggests some revisions and improvements of existing engineering curricula in order to include important topics and ideas of environmental engineering and sustainable development.

INTRODUCTION

The dynamical changes of computer branch put before technical universities complex scientific, methodical and organizational problems.

Fast development both the complicating of real methods and tools of designing of digital devices result that the electronic design automation (EDA) tools, investigated by the students, already do not exist or they have hardly changed at the moment of completion of education. Necessity of careful learning of fundamental methods and receptions of designing follows from it.

However an answer on a question about general fundamental knowledge in computer branch is completely not obvious. The traditionally stated classical computer knowledge constitutes already a small part of the computer reality. Dynamics of computer branch causes universities permanently to revise a content of education. The serious problem is, that the process of modification of educational programs has no the good scientific and methodical substantiation and requires special research.

The constant complicating of the practical requirements, huge growth of dimensions of decided tasks, necessity of multi alternative synthesis, rating and optimization of projects require more deep understanding of the theory of sets, graph theory, combinatorics, theory of complexity of algorithms by computer engineers. The important role is gained by skills to evaluate complexity of synthesis, to choice of the conciliatory variants by criteria of time, cost and quality.

In these conditions the study by research becomes a major principle of obtaining and fixing of computer knowledge and skills.

The accent in teaching should be done on understanding by the students of the internal behavior of a EDA tools, applied ideas and methods. There is a need for special educational EDA tools with wide visual presentations of processes of designing, demonstrations of internal operation of the tool, possibilities of measurements of quality and speed of designing.

A prospective direction is the organization of education and research laboratories for synthesis and simulation of digital devices with usage of Internet resources. The training of the students with mentioned systems provides fast adaptation to operation in computer industries to them.

PROPERTIES OF MODERN ELECTRONIC DESIGN AUTOMATION AND SIMULATION TOOLS

Now Verilog language has become the standard de facto for the description of hardware. Its interface allows firmware tools easily to receive access to outcomes and other internal functions of simulation. VHDL language, on the other hand, formed by many competing developers, and the standard VHDL did not determine the program interface of the language or common formats of files for various tools. Therefore there was a necessity in the specifications for each system of simulation. Some tools have a possibility of work with two languages, but not all tools have possibilities of association of means for simulation and synthesis facilitating a debugging and verification. Among a wide spectrum of tools and languages, some tools are accessible only for one of hardware description languages, instead of for all. As in total tools superimpose a wide range of functions from input of the project through verification to physical layout of conductors, or even to manufacturing.

The analyzers of a code historically came from tools of software engineering. The tools of determination of operative ranges of the code differ with new features. The outcomes of work of these tools show as far as the project confirms the requirements of some kinds of functionality, such as testability, operative range of malfunctions or operative range of the code of the project.

Formatters of a code will transform input files to ensure that synthesis and simulation tools will work with correct data.

They can fast look through the description of the project for search of incorrect constructions, uncertain entry or exit points, codes which are not giving in to synthesis. Formatters improve readability of project listings.

The generators of a code receive the source descriptions in other languages and convert them in HDL formats for simulation. Some tools generate an information for management of time, transform data to restrictions for synthesis.

STUDY OF DESIGN CYCLE AND EDA TOOLS

The cycle of design of digital systems with using of EDA tools for programmable logic devices (PLD) includes solutions of the following main problems:

- description of a designed system in a source language of the EDA system
- choice of PLDs for realization of the system
- synthesis of the designed system in selected PLDs
- generation of test sequences for verification tasks
- verification of the project by methods of logic simulations
- evaluation of characteristics of the digital system
- -optimization of the project
- manufacturing the system
- experimental verifications
- experimental evaluations of efficiency

The traditional way of study of EDA tools by the students is based on the concept of "a black box " and assumes:

- study of a user documentation on applications of a tool
- practical assimilation of main functionality
- description of typical projects in source language
- automatic synthesis of the typical projects
- simulation of the synthesized system
- realization on PLD or FPGA

In such approach the significant part of fundamental theoretical knowledge obtained by the student, and his or her creative abilities are not used.

It is a corollary of some features of investigated EDA tools:

- the internal operation of the tool is latent
- the intra system mechanisms of a decision making for designing are latent
- there are no possibilities for an evaluation of efficiency of operation of the tool
- there are no possibilities for forecasting a behavior of the tool with a growth of dimensions and complexity of the project.

Actually now there are no tools demonstrating the internal operation during of design problem solving and giving evaluations of quality of own operations.
The development of such tools with education and research directions is an actual scientific and methodical problem for the industry and universities.

EXTENSION OF RESEARCH WORK IN EDUCATION PROCESS

At Donetsk State Technical University the following active forms of realization of student's scientific research are applied:

- preparation of the abstracts with the analysis of scientific outcomes in research of EDA tools
- laboratory research of EDA tools
- course projects with research tasks
- diploma projects with elements of scientific research

The outcomes of student's scientific research are discussed on scientific conferences and workshops.

CONCLUSIONS

The research and study of properties of EDA tools during their practical application allows the students deeply to acquire fundamental regularities of construction of computers and software, base functions and methods of organization of the tools. The fulfillment of research works on the evaluation of quality of operation of tools and evaluation of efficiency of received solutions helps the students to see regularities of their development and improvements. The knowledge of these regularities essentially facilitates adaptation of the graduates to conditions of practical engineering activities and assimilation by them of new EDA systems. For the fulfillment of such education research works by the students the industrial systems should have the greater openness of their internal arrangement, means of measurement both evaluation of a quality of behavior and outcomes of designing.