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Virtual Electronic Construction Kits in Technical Subjects

Introduction

Modern approaches to teaching engineering disciplines require significantly transformed into educational practice the latest methods of scientific knowledge. Among some of the most important experimental methods are currently based on modern computer technology.

In the field of technical computing experiments with use and continues to be used primarily to conduct experimental activities, its evaluation and treatment of experimental data and their presentation. Another possibility is simulation and modeling or forecasting results.

Teaching is generally technically oriented subjects can be understood according to J. Stoffa [2000] as a systematic and controlled process of intentional formation of personality in relation to technology so that it got brought up in the process of educating the correct attitudes towards technology and the use of technology in life (the creation of so-called technical literacy). These goals must be achieved on a scientific basis, consciously and activities pertaining to technology, with which it encounters in the life of every individual, ie, which may affect his life. Content and content is in understanding the links between technology, society and nature. It is therefore a highly versatile content of technical education, covering a wide range of techniques and activities associated with the technology.

In the implementation of technically-oriented training courses are created [Kropáč 2004]:

- knowledge about technology, its manufacture and use;
- skills, habits and skills in the implementation of activities related to technology;
- creative skills and ability to work with technology;
- positive relationships.

1. The technical experiment and modeling

Technical experiment is an important part of the learning process and allows thorough mastery of knowledge. It is actually an implementation of the heuristic method of exposure to new knowledge through elaborate procedures for the examination, observation, measurement and evaluation of observed or otherwise sensually perceived and therefore exact, ie, measuring the property identified in order to obtain new information on the phenomenon etc. [Škára 1996].

Technical experiment in the teaching process develops independent and creative activity and logical thinking, speaking abilities of students, a positive attitude toward technology, developing new opportunities for detecting patterns and knowledge.

The technical realization of the experiment very closely related to the concept of modeling. Model and modeling is derived from the Latin modus, modulas which meant peace, design, method. Model is meant a simplification of the real purpose or the abstract object that has the same physical nature as the original [Novák 1997: 56]. Model in a technical experiment is a means to an understanding and actually represents a bridge between theory and objective reality.

The basic function of an explanatory model is a function that allows you to find solutions to the problem. The basis of the similarity is of the relationship between reality and model their behaviour or similarities.

2. Construction kits and virtualization

Among the primary means of instruction in technically oriented courses at many elementary, middle and high schools are working with various types of technical construction. From the perspective of electrical engineering are mainly electrical and electronic kits. The aim of using these kits is to teach pupils and students a simple form with basic knowledge of electrical engineering and electronics, to deepen and broaden their knowledge of and theoretical knowledge of electrical engineering and electronics, to create and improve work skills and habits and to help develop logical and creative thinking.

The name of technical kit can be understood as a set of articles for the compilation and in any merger, often well-defined units, their assembly and disassembly. From the pedagogical point of view is defined as a tool kit that allows you to build technical objects (devices) given the defined components and structures [Chamilla 1982].

According to the dictionary [Němeček a kol. 1985] kits are generally defined as a unified, mutually compatible physical and logical functional parts (blocks), which enables to create reports for various industrial applications or laboratory nature. It is therefore a kind of a set of articles for the compilation or associated in some units, enabling relatively easy disassembly. The definition can be referred to perceive that the possibility of drawing up individual devices are to some extent have been pre-defined components and their respective structures.

From the perspective of the learning process is the basic purpose of construction:

- increase the effectiveness of teaching;
- closer to the field of technology;
- explain the fundamental laws, concepts and principles;
- help thinking about and solving problems;

– stimulate imagination and creativity;
– introduce playful elements into teaching;
– etc.

According to A. Chamilly [Chamilla 1982] is the process of compiling using kits always closely linked with mental processes such as imagination, fantasy, technical creative thinking etc. have a significant influence on the personality development of pupils.

With the development of information technology and construction are beginning to associate with computer technology [Rudolf, Tvarůžka 2006: 147] and is also fully replace the physical appearance of its modular virtual reality. Technical experiment and in the case of this kit to connect the computer (or part thereof) becomes a new character, a new dimension. Replace the kit but if a computer program, we'll get into the virtual world construction. These are very close to today's children and computer games, which is now accompanied not only on the Playstation, computers, the Internet, but also mobile phones.

Virtual kits are computerized form real construction kits, the components or entire modules, measuring devices and switching elements are formed by a special computer program, either in flesh or as animations on the Internet [Láníček 2002; Michael 2001]. Examples of Internet applications can be a Set EDU[1], or Electronic Puzzle[2]. If these kits are implemented correctly and can be used as a real kit to assist students in acquiring knowledge and skills in engineering or technological processes.

A great advantage of virtual construction is especially affordability, ease of implement ability and the safety and reliability. The „design" virtual programming parts kits are in a closed system that can expand further limited by the program and the number of models database components or devices. Virtual asset construction, in addition to the above, the simplicity and intuitiveness of the work in the field of electronics and that the compiled circuits are arranged, arrangement of individual elements and functional blocks including a leadership connecting lines (cables) is illustrative. Teaching in virtual construction kits can greatly distinguish the process of a student's work and transfer it easily into the home environment (whether by license or work on the network). In terms of teaching, however, is a major lack of real inability to see the blocks, components, and devices fair, he is physically impossible to „feel".

The vast majority of virtual instruments in the field of electrical and electronics work based on the electrical schematic diagram of the brand. The exception is the virtual construction – Multimedia Laboratory Edison (for electrical and electronics) – see fig. 1[3]. These program use a virtual 3D environment that accurately simulates reality.

[1] http://www.el-go.pl/en/schematicTools.asp
[2] http://it.pedf.cuni.cz/strstud/puzzle
[3] http://designsoftware.com

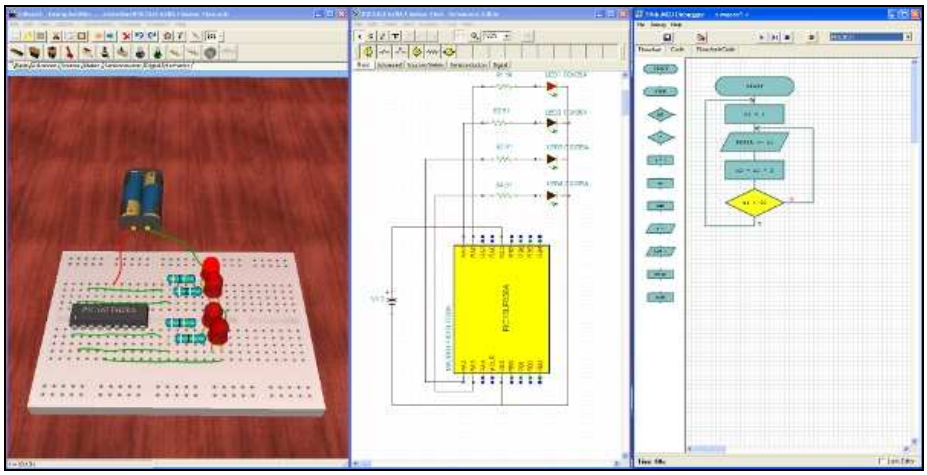


Fig. 1. Virtual kits – Edison

Virtual construction kits due to its 'virtuality' can easily run both in student performance when students are working individually either at school or home environment (students can perform experiments and using the Internet for videoconferencing), and the demonstration, the teacher using the slide projector and interactive whiteboard or a web camera program uses to explain concepts, demonstration of the functionality circuits or to check pupils knowledge and skills (which can be applied in school and in the case of web cameras and home environment). These methods can be combined with each other just for using web cameras and the internet.

Higher levels of virtual building blocks are powerful forms of simulation systems, analyzing, designing and testing in real time and in the case of electronics and PCB design. These systems allow not only the virtual work, as well as linking computers with specialized hardware. The computer can thus become a powerful, multifunction T & M instrument. An example may be program TINA – see fig. 2a[4] or Multisim – see fig 2b[5].

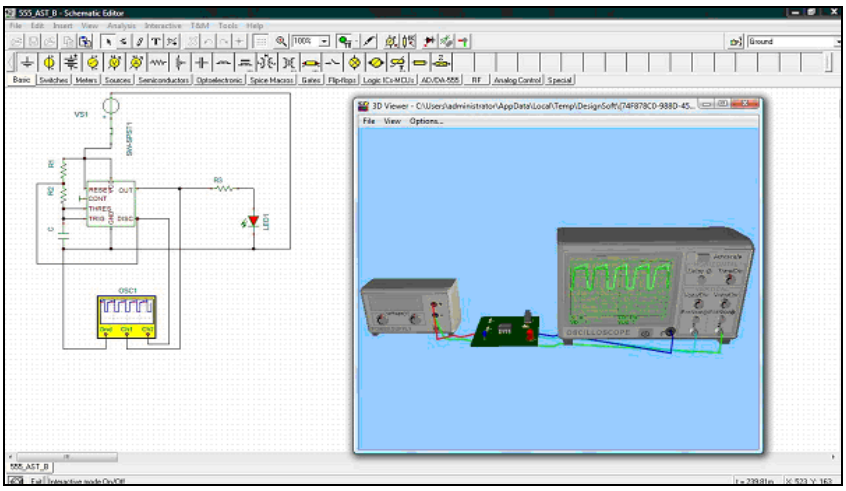
Conclusions

The current technology – modern technology-based information and communication technologies (ICT) brings with it the emergence of new techniques and methods of experimental work, which is inevitably reflected in preparing young people for future careers.

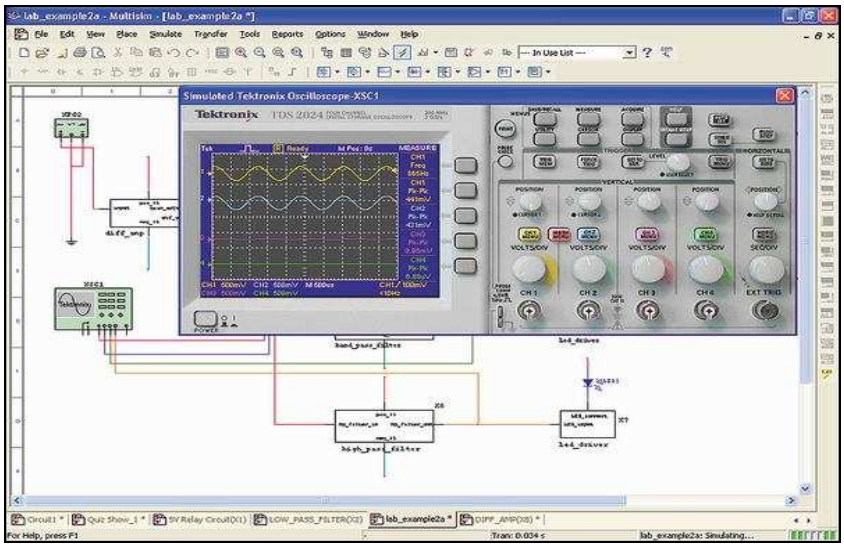
Electrical engineering is still developing. The practice is already common for the management, control and electrical control systems using computers. This trend must necessarily respond to education at all levels, which is part of

[4] http://designsoftware.com
[5] http://www.electronicsworkbench.com

the electronics in his didactic transformed form. Through the transformation of teaching ensures that learning content is age appropriate student and graduate profiles. An obvious part of these transformations are Electrical and construction.



(a)



(b)

Fig. 2. Virtual electronic laboratory systems: TINA (a), Multisim (b)

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Abstract

Electronics is one of the fastest developing branches of technology. Teaching the contents in the scope of electronics shall be one of the most significant elements of technical education at all stages of education. The article presents the opportunities of computer software allowing for constructing and verifying virtual electronic systems.

Key words: virtual model ling, electronics, computer aids of teaching.

Wirtualne konstrukcje elektroniczne w nauczaniu techniki

Streszczenie

Elektronika jest jedną z najszybciej rozwijających się gałęzi techniki. Nauczanie treści z zakresu elektroniki powinno być jednym z ważnych elementów nauczania techniki na wszystkich poziomach kształcenia. W artykule przedstawione są możliwości programów komputerowych, umożliwiających konstruowanie i weryfikowanie wirtualnych układów elektronicznych.

Słowa kluczowe: wirtualne modelowanie, elektronika, komputerowe środki nauczania.