



ON METHODS OF USING ENGINEERING SOFTWARE IN RESEARCH ACTIVITY OF STUDENTS

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ABSTRACT

The article describes the ways and advantages of using engineering programs in the development of research activities of physics students, as well as the ways of using the Multisim program in conducting research.

KEYWORDS

STEAM education, virtual, program, research, electrical circuit, vibration circuit.

INTRODUCTION

We know the reforms carried out in our society require specialists to have not only knowledge but also the ability to research and search. Therefore, attracting students to research activities and developing their research skills is one of the urgent problems.

The step-by-step introduction of STEAM technology is the solution to this problem, which increases the activity, initiative, and curiosity of future professionals

[1,2]. STEAM is a new technology for teaching schoolchildren and is an alternative system to the traditional education system. It is based on the system of simultaneously teaching children Science, Technology, Engineering, Art and Mathematics [3]. In STEAM education, students learn through hands-on and fun project activities. Information processing and practical use form the basis of the STEAM education



program. Based on the STEAM educational technology design method, is based on knowledge and creative (and artistic) research. Such a search is carried out in research works related to obtaining knowledge in the process of practical activity, and then reusing them in practice, that is, creating constructions in games, using elements of technical creativity. The approach based on STEAM education allows young students to systematically study the world, to logically observe the processes taking place around them, to understand their interrelation, and to discover new, unusual and interesting things for themselves. By waiting for something new, the student develops a curiosity in young people, identifies an interesting problem for him, develops an algorithm for finding a solution, critically evaluates the results, and leads to the formation of engineering aspects of thinking [4].

By involving students in research activities, firstly, they develop curiosity and independent research activities; secondly, this activity formed in the student serves as a basis for achieving new successes in the future, that is, it is manifested in active research, rationalization, and later in inventive activity. Personnel with such characteristics are in high demand in our society, and such personnel are considered competitive [5,6].

Research activities of students in schools are usually carried out in the form of extracurricular activities. There are a number of problems in attracting students to research activities outside the classroom, one of them is the lack of material and technical support, laboratory stands, and modern tools and devices in educational institutions [4]. The second is the requirement that students strictly follow the rules of technical safety when working with electrical tools. This, in turn, allows students to study in certain directions, for example, high voltages, high-power electromagnetic waves, etc. restricts the possibility of free research in the field as they wish.

We should not ignore another important aspect, distance education is developing rapidly nowadays, and educational activities are being conducted remotely online. Such a method of teaching creates problems for conducting self-study laboratory exercises and research activities outside the classroom. This problem can be solved by using virtual laboratories in the course of educational and research activities. One such virtual laboratory program is the Multisim software package from National Instruments (NI). The presence of a large library of modern tools in the software complex makes it possible to design, conduct experiments and research from simple to very complex electronic devices [6,7]. Such a tool is ideal for research activities, as it is possible to remove any restrictions on elements and tools. This allows students to research their ideas on a large scale, to conduct research as much as they want without fear of the possibility of failure of electrical equipment due to mistakes, to build a new one without hesitation by discarding the failed research elements, to use modern control and measurement devices. allows you to use it as much as you want.

Another advantage of carrying out research activities using the Multisim program is that there is no need to use laboratory rooms equipped with modern equipment. Having computer equipment, the student will have the opportunity to install the Multisim program and engage in research activities in a convenient place. This is of great importance in the present era when online training is rapidly developing in education. The capabilities of this program can be used to conduct demonstration experiments, laboratory exercises, and educational and research work on subjects related to the "Electrical" department of Physics [8].

As an example, we cite conducting research activities using the Multisim program on the generation of free



electromagnetic oscillations, the study of the dependence of the period of oscillations on the oscillation circuit on the parameters of the capacitor and the coil in the circuit.

To do this, launch the Multisim program and place a constant current source, switch, capacitor, inductive coil, and oscilloscope in the workspace on the elements panel. The elements of the chain are connected using the mouse (Figure 1).

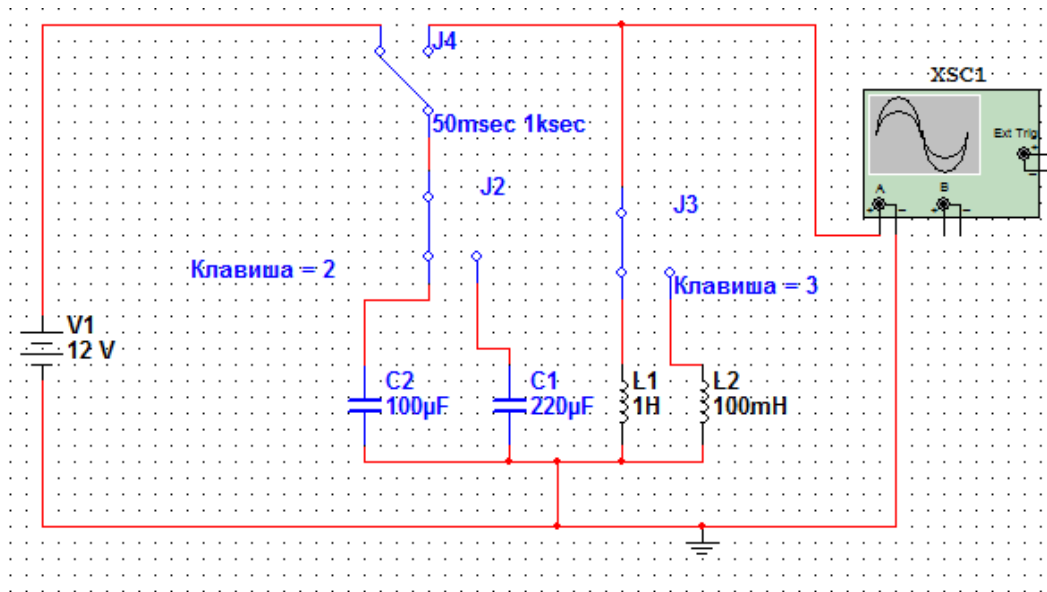


Figure 1. Oscillation circuit diagram.

In order to allow the connection time of the automatic relay to 50msec, the disconnection time is 1ksec, move the mouse over the automatic relay symbol in the working area of the program window, click the left button twice, and from the resulting window, the connection time is set to 50msec, the disconnection time is set to 1ksec (Fig. 2).

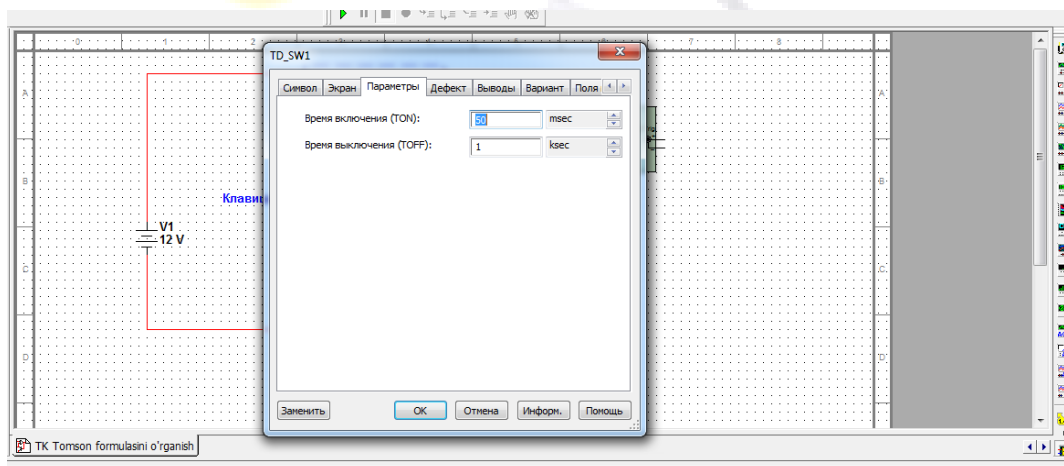


Figure 2. Automatic relay change



You can attach a button on the keyboard to connect the switches. To do this, move the mouse over the key symbol in the working area of the program window and press the left button twice (Fig. 3).

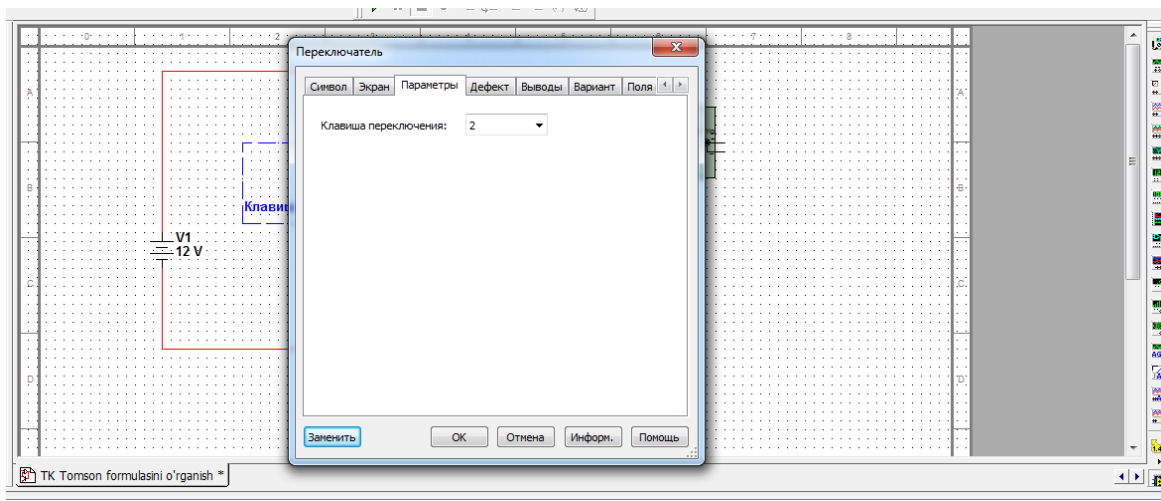


Figure 3. Setting up the switch

In the window that appears, select the button you want to attach (Usually, <Problem> key (Space) key is attached automatically). With the picture, 2 buttons are attached.

To configure the oscilloscope, move the mouse over the oscilloscope icon in the working area of the program window and double-click the left button. They set the oscilloscope settings as shown in the picture (Figure 4).

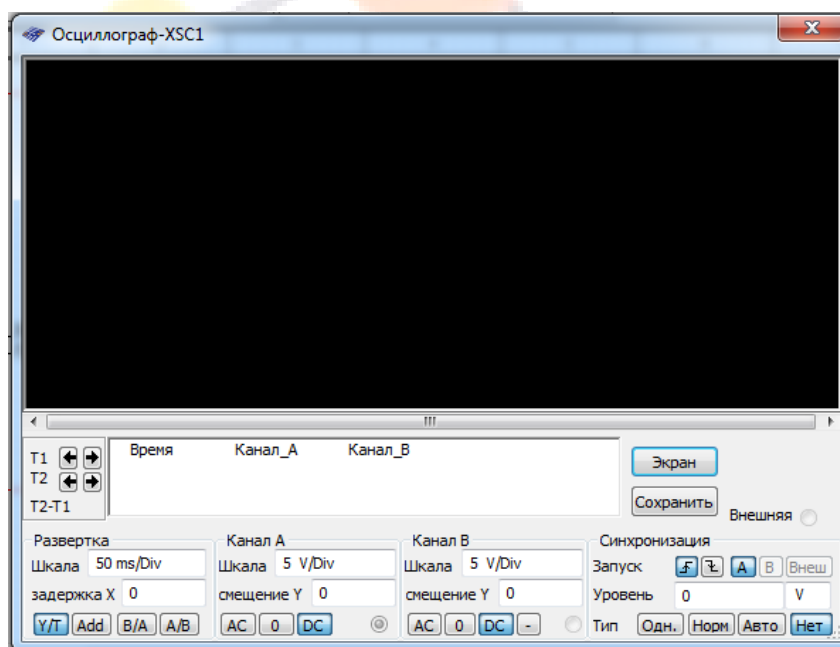


Figure 4. Setting up the oscilloscope.



We observe it started the simulation process and the oscillograph displays (Fig. 5).

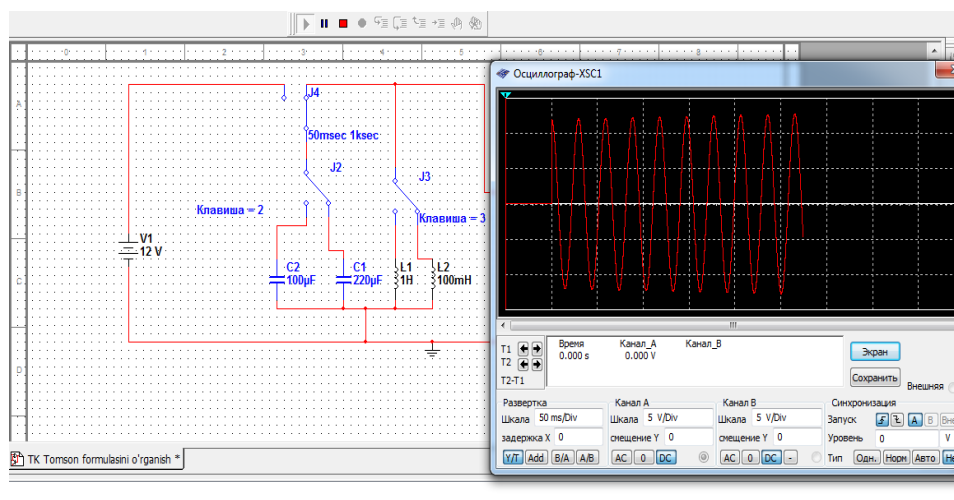


Figure 5. Observation of electromagnetic vibrations.

Capacitors and inductive coils are alternately connected with the help of keyboard buttons (keys 2 and 3 in the picture) installed on the switches, and attention is paid to the changes that occur in the oscilloscope displays.

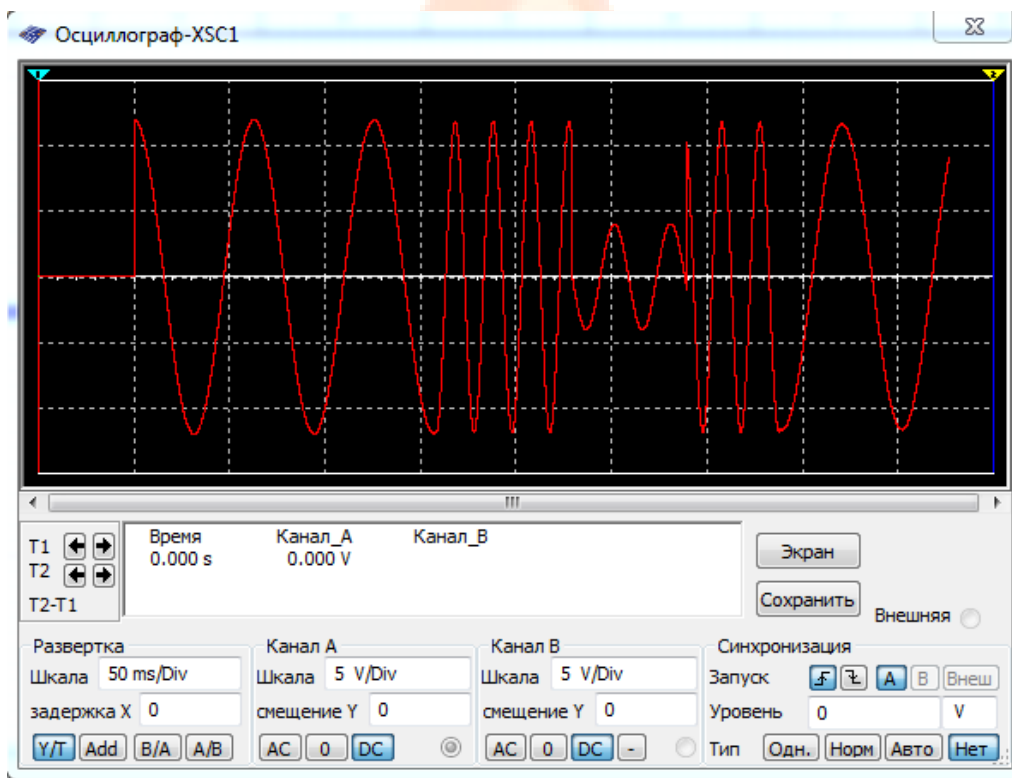


Figure 6. Observation of electromagnetic vibrations.



The period and frequency of oscillations in the circuit are determined by putting the values of capacitor capacitance C and inductance L of the inductive coil connected to the oscillation circuit at the same time into Thomson's formula. They compared it with the image they got on the oscillograph. The parameters of the vibration contour will be changed and we will continue the research work.

In carrying out this research, students will get acquainted with the methods of choosing a research object, elements of an electric circuit, their connection, creating and designing an electric circuit, choosing the measuring and control devices, adjusting them, recording the goat results and analyzing them. Based on the analysis of the goat results, they change the research object and learn to determine the optimal parameters of the object. As a result, planning research work in the direction they are interested in, choosing a research object and determining its main parameters, researching these parameters and looking for ways to make new changes to achieve the expected result develops curiosity in young students. the formation of practical competencies such as identifying an interesting problem for oneself, developing an algorithm for finding a solution, critically evaluating the results, thinking in terms of engineering, generating ideas and implementing them in life is achieved.

CONCLUSION

In conclusion, it can be said that the use of Multisim software in research activities outside the classroom allows students to carry out their research ideas freely, completely safely, in the conditions they want, without any expenses, and most importantly, the conclusion from their own mistakes. makes it possible to learn.

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