

HOW TO USE COMPUTER SOFTWARE IN ORGANIZING PRACTICAL EXERCISES IN PHYSICS

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ABSTRACT

This article discusses the advantages and virtual exercises performing methods in physics classes using computer applications, and shows how to perform practical exercises with Multisim software using a specific example in the textbook.

Key words: STEAM education, virtual, software, simulation, practical training, electrical circuit, design.

1. Introduction

As in all spheres, the ongoing reforms in our country to raise the education quality to world standards set a number of urgent tasks that need to be implemented in this area. Such tasks include the advanced foreign experience introduction in the education system, modern pedagogical technologies in the educational process, including innovative teaching methods, the creation of a new generation of educational and methodological literature, fundamental and practical implementation of scientific research, new state educational standards and curricula development, as well as the gradual implementation of STEAM (science, technology, engineering and mathematics) methods [1].

The competence to consolidate the theoretical knowledge acquired in the teaching physics and to apply it in everyday life is formed through practical training and laboratory work. There is a need for effective hands-on activities to develop such competencies in students. Because, there is an opportunity to consolidate and understand the knowledge that has taught in the theoretical lessons in the practical training process in physics. This will help students develop the skills to apply their knowledge in practice.

But for the most part, this doesn't work. Examples of such a negative situation are the lack of laboratory stands in secondary schools, the lack of modern equipment. This problem can be solved by introducing the special computer programs use in practice.

There are many such computer programs on the world market today. These include Tina-Ti, Logisim 2.7.1, Electronics, NI Multisim and similar programs. National Instruments' (NI) Multisim electronic program is one of the programs that allow you to practice physics and laboratory classes virtually. NI Multisim is a popular software suite that allows you to simulate electronic circuits and place printed circuit boards. The main NI Multisim feature is a simple visual interface, powerful tools for graphical analysis of simulation results, the

virtual measuring tools presence that copy real analogues. The library of elements contains components of SPICE-models of more than 2,000 well-known manufacturers such as [National Semiconductor](#), [Analog Devices](#), Phillips, and [NXP](#). There are electromechanical models, switching equipment, power supplies, and power converters. The Convergence Assistant store automatically corrects the SPICE settings to correct simulation errors. In addition to the interactive components, the program can work with NI myDAQ hardware platforms (control and measurement equipment library) and NI ELVIS (virtual tools for the training workshop), which allows all virtual laboratories of control systems, energy, mechatronics and energy allows you to create. The latest program versions have improved features, new tools for modeling, an expanded elements database, so the electrical projects development and creation can be done more accurately and quickly. The modern tools presence in the program allows you to design electronic devices, from simple to very complex, to conduct practical training. This tool is ideal for teaching because it has the ability to remove any restrictions on elements and tools. In addition, the NI Multisim program can serve as a simulator for learning the operation principles of real electronic and measuring instruments and circuits [2,3].

Currently, this program is effectively used by leading countries in the world for practical training [3,6,7]. In particular, some work is being done in the country to introduce this program use in the practical training conduct in physics and laboratory work in secondary schools [4,5].

These program capabilities can also be used in practical and laboratory classes in the Electrical physics department. The interesting thing about the program is that the program interface is simple and clear, as well as it is very convenient to access a large library of elements and select the desired tool from it, modern measuring instruments are placed on a separate panel and can be dragged and used directly on the work area with the mouse.

As an example, let's look at a practical exercise implementing process called "Current adjustment using rheostat" (Chapter 22, pages 63-64 of the textbook) in the 8th grade physics program. The multimedia program interface consists of a menu, a toolbar, a measuring control panel (on the right side of the program window) and a workspace (Figure 1).

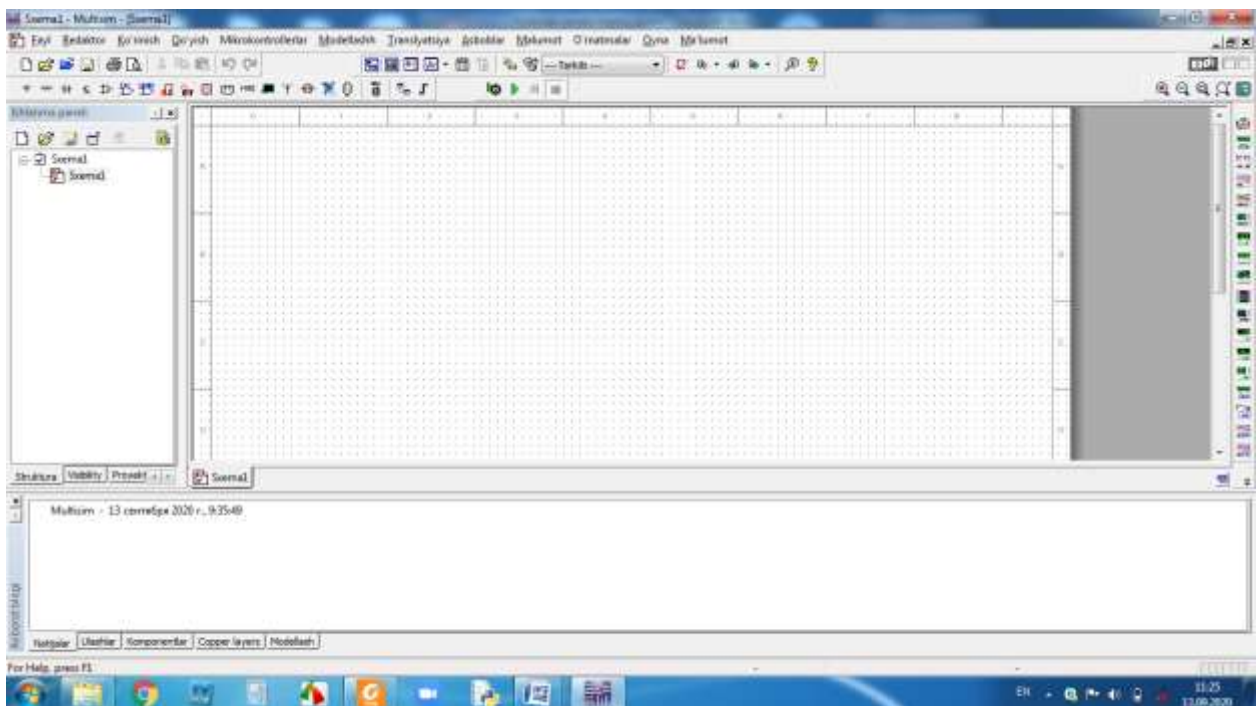
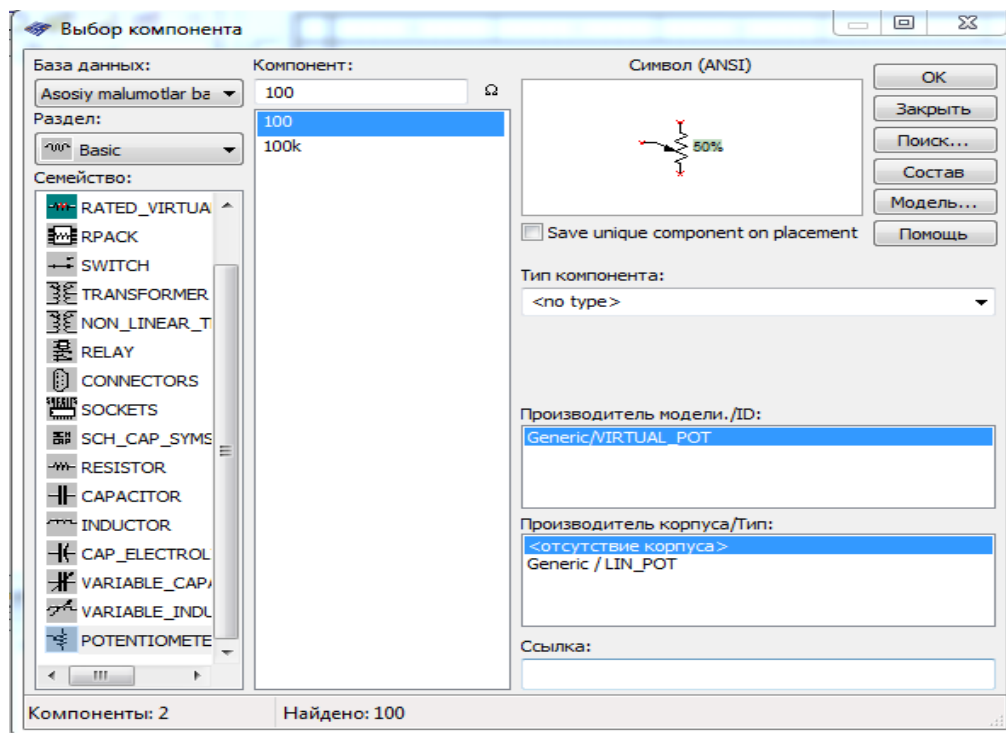
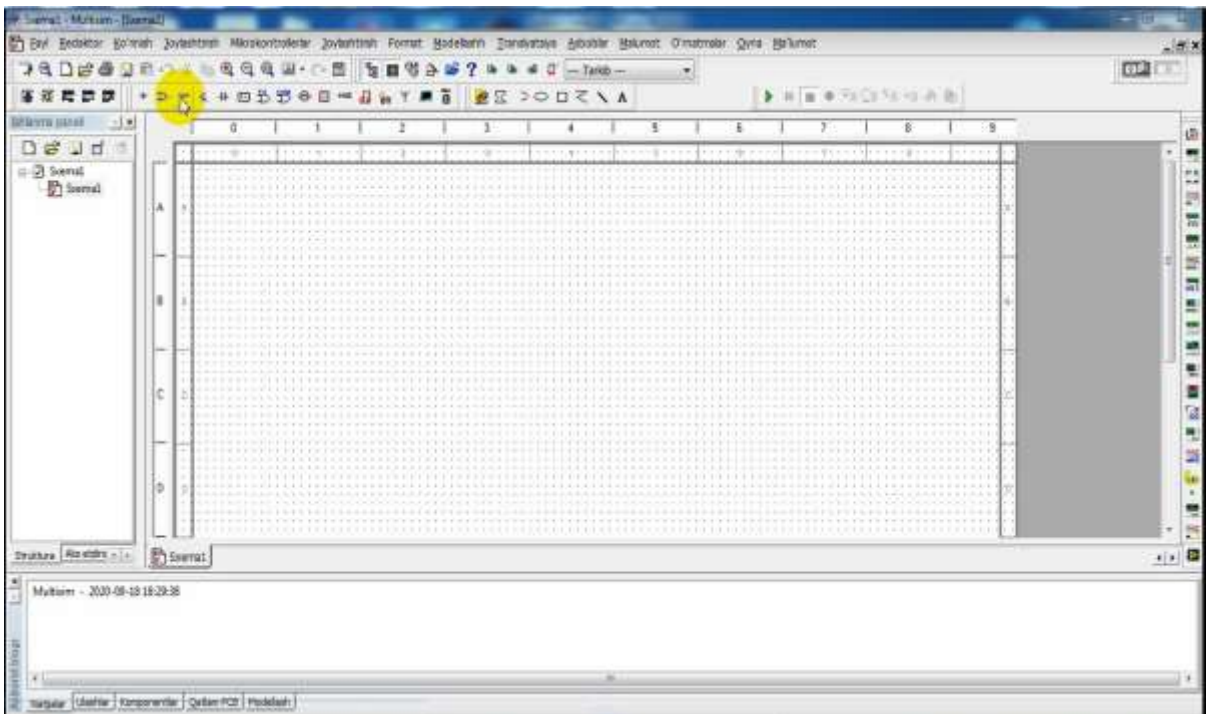


Figure 1. Multisim complex interface.

1. From the toolbar, select the tools needed to create a schematic diagram for practical lesson (for example,

the following figure shows the rheostat selection) and press the <Ok> button (Figures 2,3).



Figures 2 and 3. Select the desired tool from the toolbox.

2. The selected tools are placed in the program workspace (Figure 4).

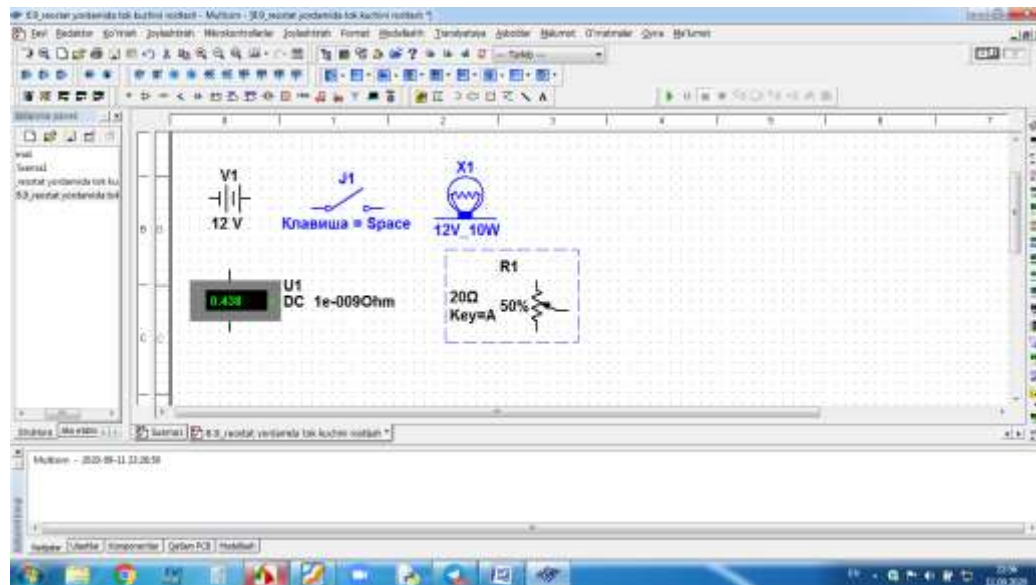


Figure 4. Tools needed to create a practical lesson scheme.

2. In the program workspace, we place the tools in the desired location and connect them using the connecting wires (drawn by dragging with the left mouse button) to create a scheme as shown in the figure (Figure 5).

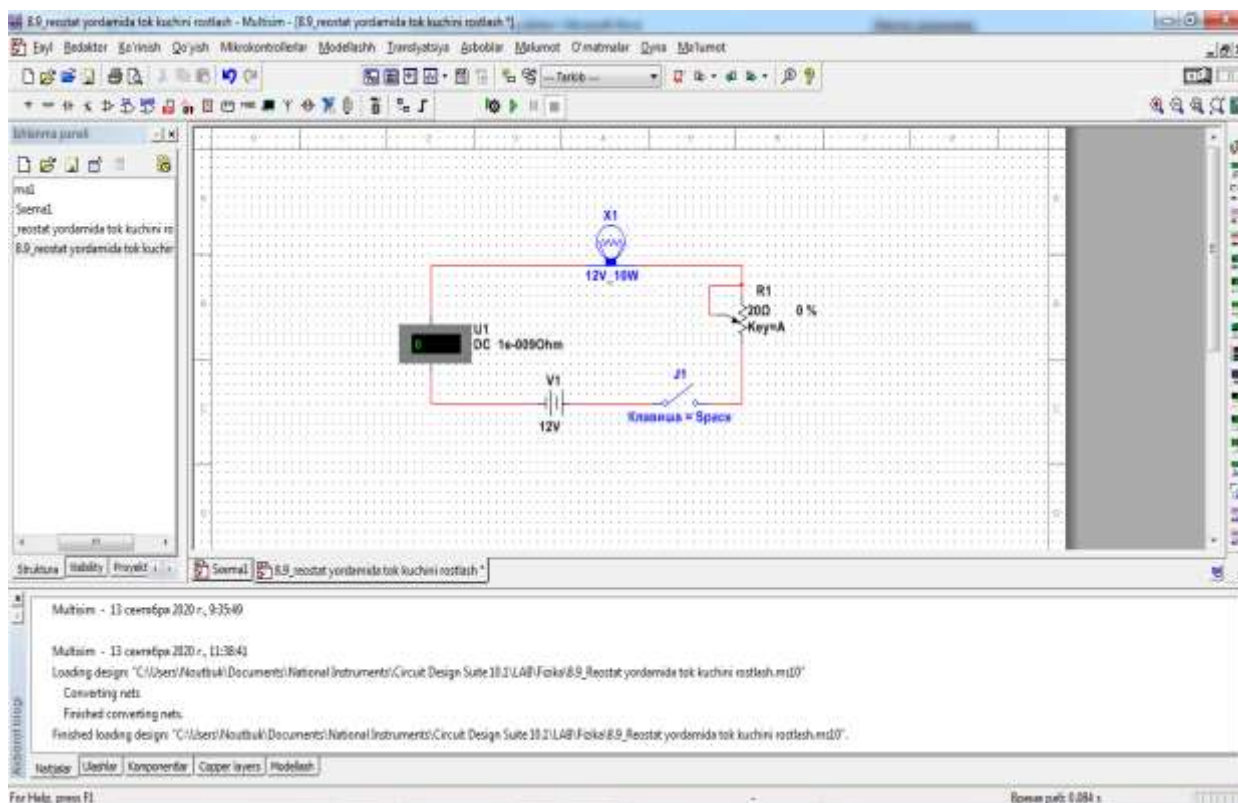



Figure 5. Schematic diagram of the practical lesson.

3. In the ready circuit, we start the simulation process using a disconnector . Use the mouse (using the “space bar”) to connect the key. Adjust the current by moving the rheostat slider (visible when the mouse is moved) and monitor the ammeter indicators (Figure 6).

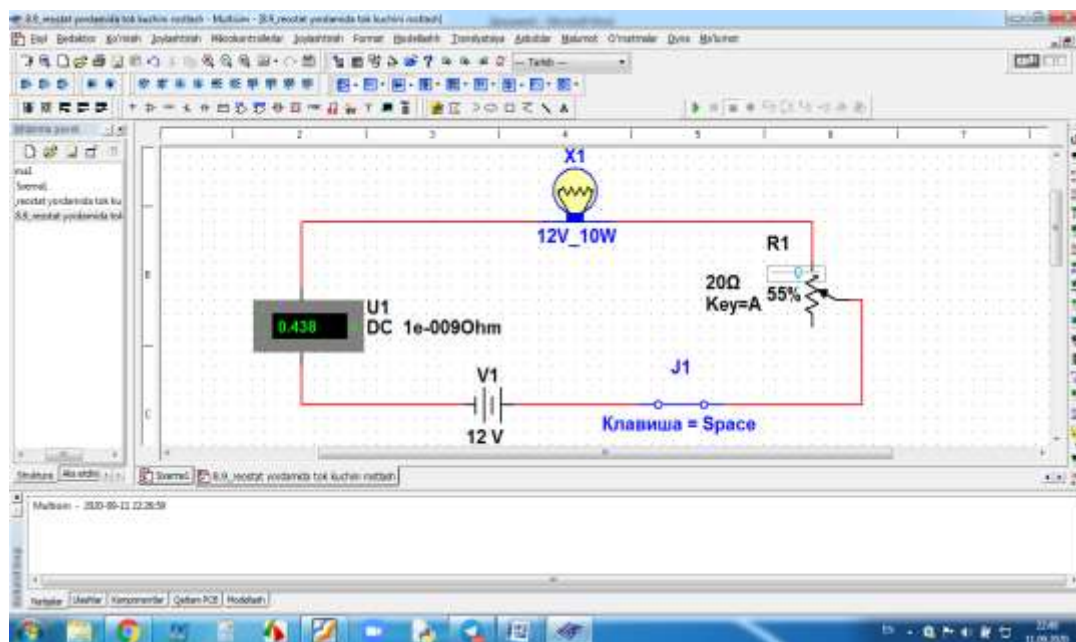


Figure 6. The performance of practical lesson

4. We change the resistance by moving the rheostat slider and monitor the ammeter indicators. We record the results in the following table:

| Rheostat slider cases. | 1 | 2 | 3 | 4 | 5 |
|------------------------|---|---|---|---|---|
| Current power (A). | | | | | |

5. The results are analyzed and a conclusion is drawn.

Questions and assignments for reinforcement:

1. How many connections are there in the rheostat?
2. Draw a rheostat connection diagram to the electrical circuit.
3. What do you mean by current adjustment?
4. Draw a device diagram used in the lesson in your notebook.

Through such programs use in the classroom, students will have the opportunity to perform practical exercises, as well as to better understand and master them. In the circuit diagram creating process on this topic, students have the opportunity to learn the English names of the elements that make up the circuit, the circuit diagram design to be built, to ask for help (communication) from each other.

In conclusion, it should be noted that practical exercises implementation using practical computer programs that model physical processes in the teaching physics will strengthen students' theoretical knowledge and enable them to apply it in practice, further increase students' ICT literacy.

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