METHODS OF CREATING VIRTUAL LABORATORIES IN THE "LABVIEW" PROGRAM

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Abstract. Methods of modelling physical processes and experiments using computer technologies are investigated in the fields of physics and electronics education. Modelling of physical processes in the LabVIEW program creates many conveniences for students. We will investigate the possibilities of using LabVIEW program technology in the educational process. The spectrum of optical and electromagnetic signals is investigated using the LabVIEW program.

Keywords: modelling, information technology, animations, dynamic models, Laboratory Virtual Instrument Engineering Workbench.

Introduction

One of the developing areas of application of information and computer technology in physics education is the computer modelling of physical processes and experiments. Computer models promote these traditional and unconventional lesson processes, create many reliefs on the teacher's course, and make it easy to understand all physical processes. It provides opportunities to show laboratory work to students by displaying it on the screen and repeating it several times [1].

Laboratory practice in training institutions and manufactures is carried out with traditional laboratory practices, demonstration laboratory practices, distance laboratory practices, and virtual laboratory practices. Doing all laboratory works of learning physical processes with virtual laboratory practices includes mathematical modelling and virtual connections with laboratory equipment.

Currently, computer technologies are widely used in the fields of theoretical physics and astrophysics, and astrophysical objects similar to black holes and wormholes are modelled. [4].

Analysis and results.

The efficiency of the application of Information Technology in the educational process of educational institutions, the connection with the content, form and methods of teaching today, can be determined by the following goals. If technical colleges, engineering institutions, manufacturers, chemical institutions and technological uiversities use programs, such as Multisim, Proteus, EdrawMax, PhET and LabVIEW with the flowcharts 2D and 3D, teachers who is teaching physical laws in real life will have a number of advantages:

Save time;

The level of "accessibility" of students in the educational process;

Implementation of a single approach of students;

The degree of "mechanisation" of pedagogical methods.

Let's look at the possibilities of using the application technology "LabVIEW" which is intended for conducting physical experiments in the educational processes.

LabVIEW (Laboratory Virtual Instrument Engineering Workbench) is a complex software created by a company National Instruments (USA). It uses the intuitive graphical programming

language G, which does not require knowledge of other traditional programming languages to learn. Because the LabVIEW program has a wide range of capabilities in performing calculations and mathematical modelling, it can easily compete with popular mathematical complex programs such as MATHLAB, MathCAD, Mathematica, MAPLE. The LabVIEW program consists of two panels which are named as front panels and back panels. To start the program, we select the Windows show panel from the menu to switch to the structural scheme from the front panel. When creating a new object on the front panel, select the Controls palette "Windows show controls palette". A rectangular icon will be created in the object created in the front panel, and we can enter the text we want into it. We can continue the work in this order [2].

We receive and distribute thousands of texts, tables, graphics, images, Gifs, and other types of information in our daily life. In order to transmit information from the first spatial point to the second point, we need to load it into a physical process, which means we need to turn it into a signal.

The Signal is said to change one or more parameters of a physical process in accordance with the message. An electrical signal is said to change one or more parameters of this electrical process according to the message. These signals are repeated and obey a certain mathematical law. Let's observe such signals using signals in the form of harmonic oscillations.

$u(t)=U_0 cos(\omega_0 t+\varphi_0)$. (1)

Voltage-time equation of electromagnetic signals varies according to equation (1).

To study the spectrum of optical and electromagnetic signals from the LabVIEW program, we start the LabVIEW program by choosing the "New project" command and a "Signal Processing" section opens from the front panel. We select the "Wfm Generator" section from this section. From this section we download the "Basic FuncGen" control panel. Select the control indicator from the Create section and connect the control indicator to the input of the Basic FuncGen control panel.

This control indicator acts as a regulator of the frequency of the incoming signal. We select the control command from the Create section to the second entry of the Basic FuncGen control panel. This "control" command allows us to control the properties of amplitude of incoming signal. In order to change the signal type, we need to select the "control" command from the Create section in the Signal tire section of the Basic FuncGen control panel. We go to the back panel by the "Window" command. We download the Waveform Graph section in the oscilloscope panel to plot the resulting signal graph. and we go to the front panel and connect the signal output of the Basic FuncGen command to the input of the Waveform Graph section. And the real graph of signal will generate on the screen of the Waveform oscillograph. Let's give the name this signal as incoming signal.

In the process of studying the spectra of various electromagnetic and optical signals, the study of signal frequencies and amplitudes within certain limits can cause many difficulties. To overcome such difficulties, we can use signal filters to study the values of amplitude and frequency of signals within a certain limit.

We connect the filter to the oscilloscope to limit the amplitude and frequency of signals. To do this, we go to the front panel of LabVIEW and enter the Signal Processing section using the right mouse button and from this section we enter the Wfm Generator section, from this section we load the Basic FuncGen command into the front panel.
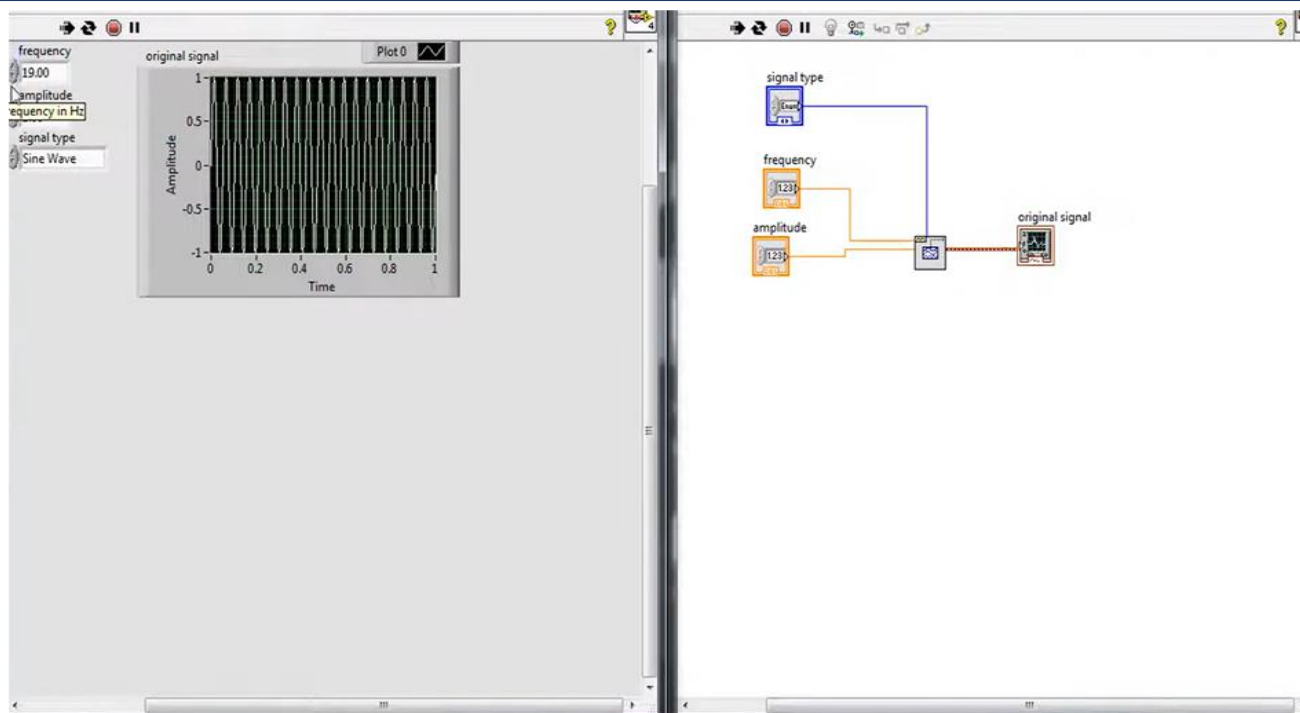
Figure 1.

We connect the input of the resulting oscilloscope to the output of the Add indicator.

We download it to the front panel by selecting the "Signal Processing" section from the front panel using the "Window" command, and selecting the "FFT Power Spectrum" command from the "Wfm Measure" panel from this section.

This command helps us determine the spectrum of a given signal. We connect the oscilloscope "Waveform Graph" panel to the input of the oscilloscope so "FFT Power Spectrum" command detects the noise of the incoming signal. We select the "Finite impulse response (IIF)Filter" command.

Then a filter will appear on the screen. From the back panel, we will again create the "Waveform Graph" section that we need on the screen and connect the "Filtered Signal" output part of the filter to the "Waveform Graph" input of the oscilloscope from the front panel.

We connect the incoming signal part of the filter with the incoming signal to "FFT Power Spectrum".

With the help of the first oscillograph, which is shown on this screen, we can learn how to control the amplitude and frequency of real signals at the same time. And with the help of a second oscillograph, we can see the real parameters of the spectrum of the noisy signal.

In the third oscillograph, it is possible to capture a certain repetitive part of noisy signals.

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In the fourth oscilloscope, we can study the part of the noisy signals generated in the filtered state.

We can study the signals in the filtered state by changing the thresholds of the filter measurements in these collected oscilloscopes from any part of the signals.
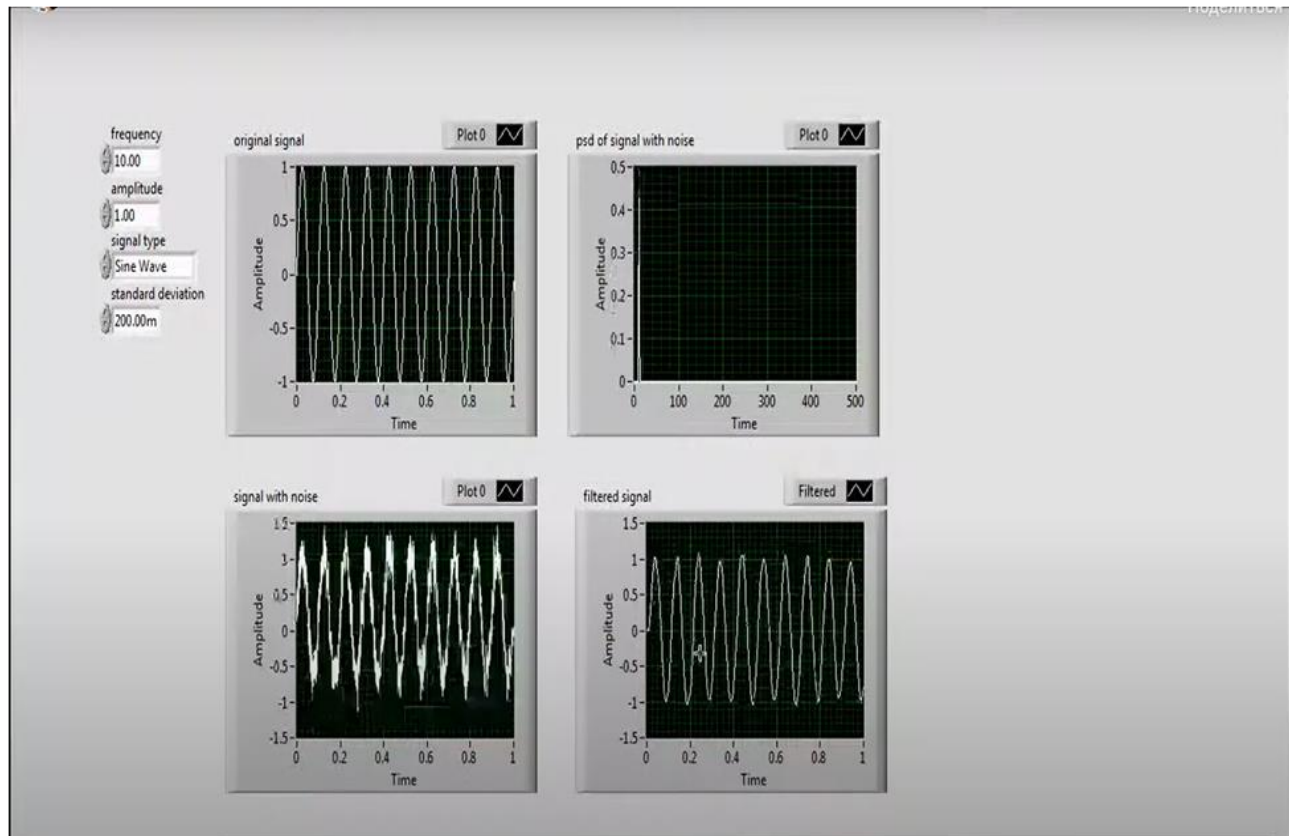
Figure 2

Conclusion

We have shown here that without cancelling traditional methods of teaching physics, chemistry and all science subjects it is possible to develop teaching methods by modern technologies and software programs. One of them is creating virtual labaratory works and programming physical processes and to use them productively during the lessons. Textbooks, methodical manuals, and a number of scientific studies that can be used in physics education were analysed, and it was proved that one of the important factors is the improvement of physics education on the basis of information technology.

Creating a model of physical laboratory training allows students to fully control each physical process independently.

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