



Design and Implementation of Virtual Simulation Teaching System Based on LabVIEW

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Abstract: Build a virtual Simulation experiment teaching system based on the LabVIEW development environment. The system uses a scalable modular design, with login management system, experimental operating system and experimental management system, three sub-module system. Taking oscilloscope experiment as an example, it mainly introduces the design and realization of experiment module and experiment result management module.

Keywords: LabVIEW; Virtual experiment; Digital oscilloscope.

1. Introduction

The experiment teaching is very important in higher education for science and engineering colleges. The traditional way of experiment has many defects, for example: the instrument has a large volume and covers a large area, meantime, it needs a lot of money to repair and the experimental equipment and methods can't keep up with the pace of scientific development. At the same time, updating the experimental equipment will spend huge sums of money, low openness, poor learning response and so on. These defects will affect and restrict the development of experimental teaching. This paper designs virtual simulation experiment teaching system uses LabVIEW2014 as the development platform ^[1]. LabVIEW is widely accepted in academia, research laboratories, and industry. It can be used for data acquisition, analysis, storage and other operations. It also provides a wide range of interfaces that can be called with various software, such as DLL, VB, MATLAB etc^[2].

2. The overall plan of virtual simulation teaching system design

I set up the virtual experiment teaching system platform based on graphical programming language LabVIEW development environment, at the same time ,the calculation can improve the running speed of the whole system and the function of the size of extensible modular design。 The virtual teaching experiment system consists

of two parts: login management module and test management module. To further refine the program in these two modules and debug one by one to succeed, We design the framework of the program combined to form a whole final system of experimental teaching program acting the "dynamic loading VI" as the main technology finally [3]. The system uses Microsoft Access as the database system, and uses SQL technology to exchange and transmit the data of the login management system. The system has been developed and implemented a series of virtual experiments, such as: the design of digital filter, convolution, spectrum analyzer, modulation and demodulation, sampling theorem, experimental design, and combined with the network publishing technology of virtual experiment system. The server and the exchange of information between the client are realized through the Http achieving remote access to the client and the LabVIEW own Web Service (Network Publishing) technology besides the B/S structure system.

3. Module design of digital filter virtual simulation experiment

The programming of the digital filter is divided into three parts: signal generation, signal processing, and result display [4].

The output of the analog signal is through the "basic function generator" control, which contains four kinds of signals such as sine wave, triangle wave, square wave, and sawtooth wave. Analog signal parameters After the parameters of the analog signal are passed the "unbundle by name" function control, they are divided into two different types of data sources "signal type" and "signal frequency" and input to the "basic function generator" control, and the sampling information parameters are directly used as the basic The input value of the function generator.

The output terminal of the basic function generator is directly connected to the signal processing module. The signal processing is based on the original signal output by the signal generator and processed by the FIR filter or IIR filter function control in the condition structure to obtain the "filtered signal" waveform array 、 "amplitude frequency response function" cluster data and " Phase frequency response function" cluster data. Connect the two cluster data to the input terminals of the two display controls "phase frequency response function curve" and "amplitude frequency response function curve", and the result information will be displayed in waveform. The block diagram of the program is shown in Figure 1.

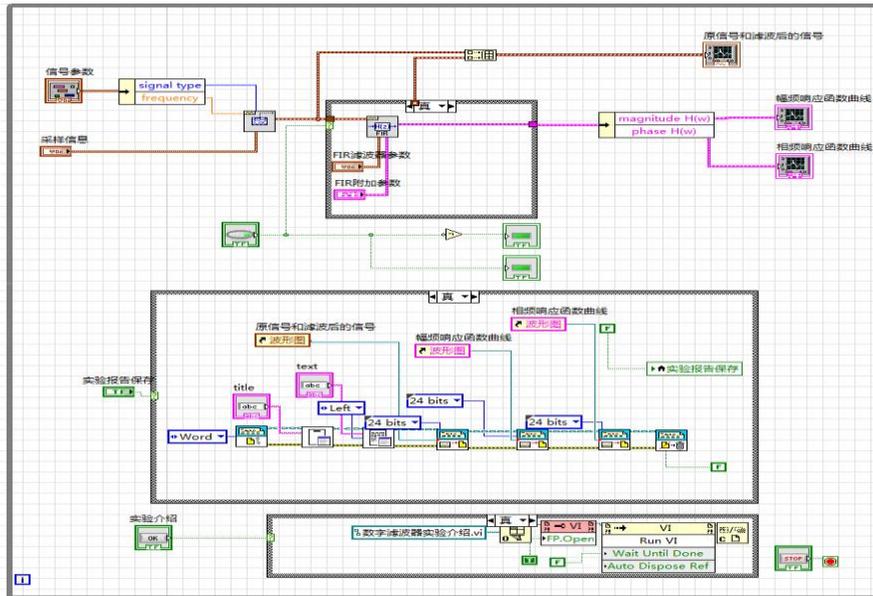


Fig 1 Block diagram of FIR filter

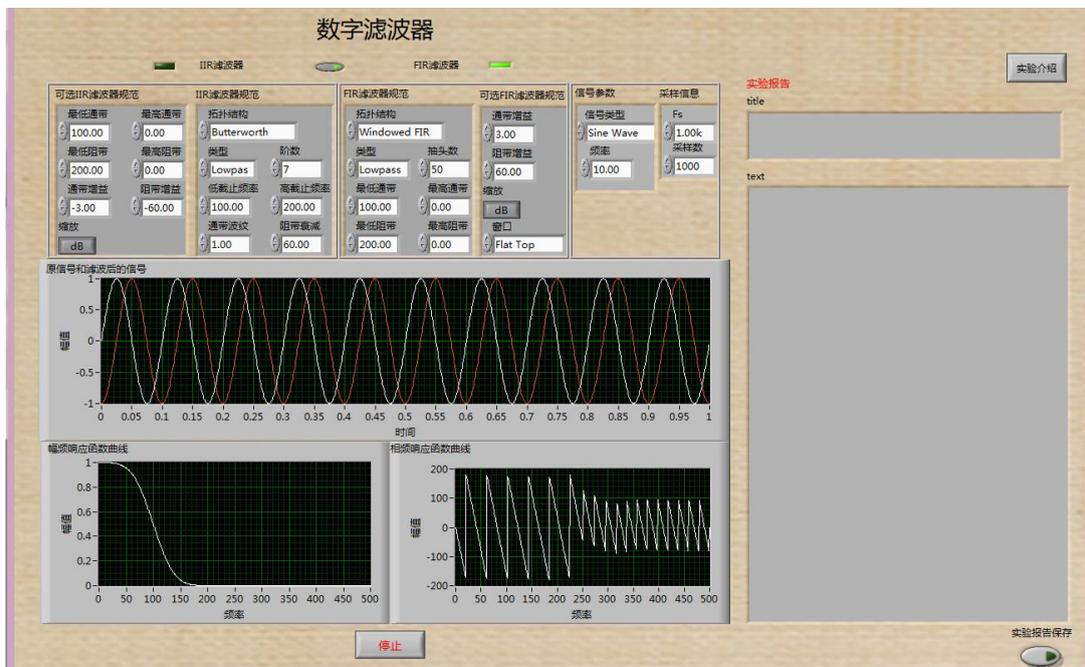


Fig 2 FIR filter front panel

In the experimental module of the virtual experimental teaching system, not only experimental simulation is important, the results of experimental simulation and the writing and generation of experimental reports are the core of online virtual teaching. The entire "experiment introduction" button is controlled by a condition structure in the While loop. When the "experiment introduction" button is pressed, the condition structure is true, the VI is executed, and the oscilloscope experiment content is displayed. If it is not pressed, it is false. Show experiment introduction content. The design of FIR filter uses window function method. We can select different filter types, lowest stop band, highest stop band, lowest pass band and highest pass band and other parameters. Observe and record the amplitude frequency response

waveform and phase frequency response waveform. Changes between parameters. Figure 2 selects the Flat Top window function, Windowed FIR topology, and the image characteristics after filtering are shown in the figure.

In the "original signal and filtered signal" display control on the front panel, a comparison waveform of the original signal and the filtered signal can be generated. The white curve represents the original signal and the red curve represents the filtered signal, which can be easily judged by the comparison. Whether the signals overlap and whether there is distortion. There is a button for saving the experiment report in the lower right corner, which can save the corresponding data and conclusions in the experiment, which is the key experimental conclusion for students in the process of experimental learning.

4. Conclusion

The experimental teaching through the experimental teaching simulation system overcomes many shortcomings of traditional teaching, and has the function of generating experimental reports, which increases the convenience of students' learning. The virtual digital filter based on LabVIEW has relatively high stability and predictability, and will not cause errors due to environmental influences, such as temperature, humidity, etc., and does not require precision components, and the cost performance is higher than traditional instruments. During the experiment, digital filter can be used to manage and control parameters such as cut-off frequency and stopband attenuation. The transmitted signal can be properly filtered.

References

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