Realization of Experiment Platform of the Course "Signals and Systems" Based on MATLAB GUI

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Abstract. Aiming at the weakness of traditional theoretical teaching in the course of "Signals and Systems", MATLAB Graphical User Interface (GUI) is used to convert abstract theoretical knowledge into concrete image simulation. The platform can strengthen students' understanding on important and difficult knowledge points and thus can help to improve teaching quality and efficiency in class.

Introduction

As the students of electronics information major, the course of "Signals and Systems" is a very important professional basic course. In traditional teaching process, teachers focus on the introduction and derivation of formulas, which increases difficulties for students to understand those arcane principles[1]. Then, a majority of students cannot keep up with the class schedule so that they lose the interest of this course[2]. Meanwhile, the experiment equipment of the course is too expensive that a lot of universities can't afford the expense to support of starting experiment. So it is necessary to establish a simulation experiment platform[3].

MATLAB is a high performance, interactive software package used for scientific and engineering computations. It is popular in the control community and offers excellent performance qualities for designing regulation algorithms. This makes it the best candidate for accomplishing the objective we have fostered. GUIDE is a MATLAB graphics user interface (GUI)design environment. It stores GUIs in two files, both of which are generated the first time GUI is saved or run. One file is a .fig file that contains a complete description of the GUI Fig. layout and the components of the GUI. The other file is an .m file that contains the code, which controls the GUI. Calculations and graphical presentations by means of these tools can be displayed in a convenient manner[4]. Therefore, graphs can be directly used to demonstrate the conclusion by teachers. For these characteristics, a simulation experiment platform is realized to help students learn the course easier and better [5].

Realization of Simulation System

Experiments Design of System Platform. The design concept of the system is shown in Fig.1. The system contains two kinds of experiments. Every experiment has its own little items, such as representation of signals, Fourier transform, Laplace transform and so on. These experiments can meet students and teachers' demand of the course and enrich the choice of class teaching modes. It makes the class more vivid and makes the knowledge more acceptable to students.

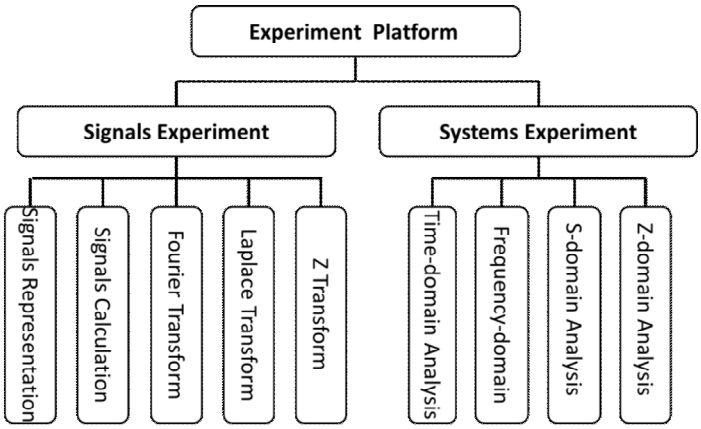

Fig.1 Experiments design of system platform

Design of the Main Interface. The main interface of simulation platform is shown in Fig.2. It can provide choices of different experiments and the introduction of the platform for users. If users want to leave the system, they can click the button called "exist system''. In the system, students can learn the concrete graphs of some common signals, signals analysis and systems analysis. When they click these items, there will be a more detailed interface to show the function and principles of these knowledge points. What's more, students can intuitively see the transformation of signals by inputting different numerical value.

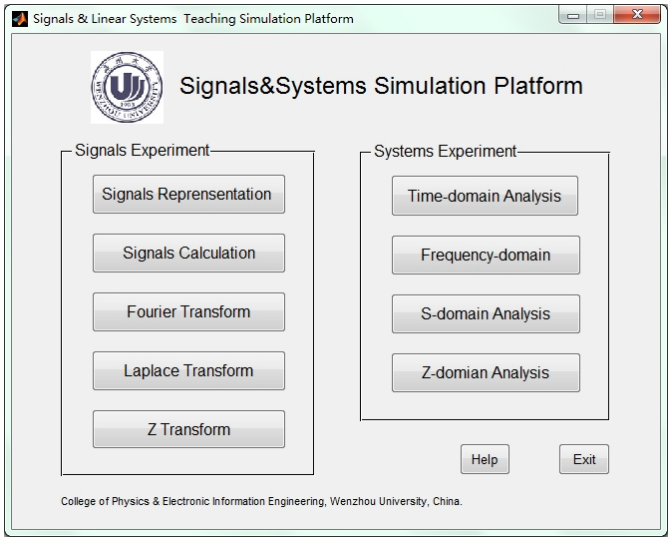

Fig.2 The main interface of experiment simulation platform

The Realization of Fourier series. Fourier series is generally recognized as a difficult point to students. In general, even teacher is also very difficult to explain the principle of Fourier series. So it is complex for students to understand and master. This function is shown in Fig.3.

In the system, the synthetic figure of fundamental component and any N times harmonic component can be displayed. After harmonic component added to fundamental component one by one, the figure will tend to the figure of the original function better and better. The interface is divided into six coordinate pictures to show the effect which is accumulated by N times harmonic that has been inputted. Meanwhile, users can also input value they want into the input field, so the corresponding figure can be displayed. In this way, students are more convenient to memorize and easier to understand the principle. In other way, it can increase students' interest to study by interacting with the platform personally.

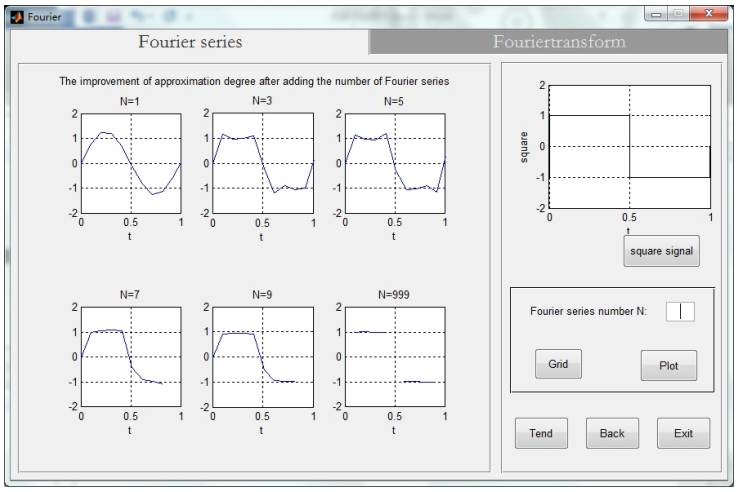

Fig.3 Result of inputting different times harmonic component

The Realization of Fourier transform. As shown in Fig.4, there is an operation interface. Users can see a drop-down window of signals' selection which they can choose needed signals in it. While clicking the plot button on the right, users can complete relevant signals' Fourier transform. And in the part of figure exhibition window on the left, users can see signals' time-domain figure in the part of "function" coordinate axis, signals' Fourier transform figure in the part of "spectrum of function f(t)" and situation of phase in the part of "phase potion".

Absolutely, users can also know the property of Fourier transform from the interface. The characteristics of delay, frequency shift and scaling can be observed directly. Users can input parameters in relevant windows, and then click the "plot" button in the bottom. Finally, there will be relevant change in respective figures.

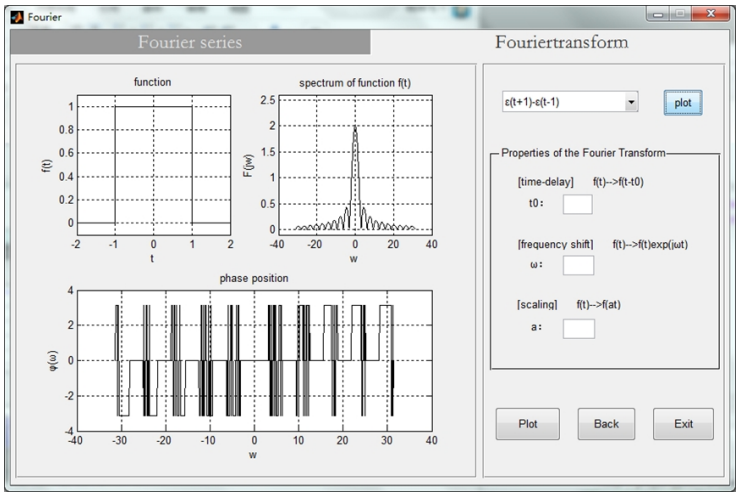

Fig.4 The interface of Fourier transforms

The significance of Teaching

By using the MATLAB simulation platform, the advantage of software experiment which is intuitive display of experiment, real-time, realistic and flexible operation is displayed adequately. The system greatly improves students' experimental interest and plays a better teaching effect. Students can freely modify the parameters and compare the experimental results by using the platform, which can strengthen students to understand content of the course, broaden students' vision of research and analysis, while enhancing the computer application ability of the students.

MATLAB is an open instrument which is easy to learn. Students can meet their additional requirements by programming to simulate the figures on the existing basis. Not only can it strengthen students' understanding of teaching materials, but also develop their manipulative and logic abilities.

Conclusions

MATLAB combined to traditional teaching is a good attempt. It breaks through the weakness of traditional teaching, brings some new teaching perspective. By using simulation platform which is based on MATLAB, students can intuitively learn the principles of those arcane key points and difficult points. It increases students' interest to the course, reduces the difficulty of teaching and improves the quality of teaching significantly [6].

Acknowledgements

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