

Design and Implementation of Computer Assisted Instruction for Course of Digital Signal Processing Based on MATLAB

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Abstract

Digital signal processing is the theory and technology that uses the way of numerical calculation to processing signal. Matlab Graphical User Interface(GUI) is devoted to the rapid development of graphical user interface environment. The system combines Matlab GUI and digital signal processing teaching to form a new way of computer teaching demonstration. The presentation mainly includes the following: basic signal generation, basic signal operation, Fourier transform, digital filter design, etc. The system is intuitive, friendly, open, easy for students to understand the theory of knowledge, and greatly improve the effectiveness and efficiency of teaching.

Keywords

Computer assisted instruction; Digital signal processing; Graphical User Interface(GUI).

1. Introduction

Digital signal processing[1-3] is an important course in the electronic information profession, which systematically explains the basic theory and method of digital signal processing. This course covers a wide range of knowledge, including calculus, probability theory, signal and system. Often in the study of the course, the understanding of theoretical knowledge may be more abstract, the basic theory and analytical methods difficult to understand and master. Therefore, we can help solve these problems with MATLAB.It aims to help students understand and master the basic theory and concept analysis methods in digital signal processing, stimulate their interest in learning, improve their sense of innovation and lay a solid foundation for the cultivation of professional interests Foundation.

By demonstrating the simulation, many abstract theoretical knowledge of digital signal processing courses can be expressed in image. Making the original presentation more difficult to observe the phenomenon and the more complex calculations, etc., can be a simple solution, and the form of graphics to show. By providing an image in the classroom and a comprehensive presentation of the picture, you can inspire students' curiosity and interest. It helps students master the theoretical knowledge of digital signal processing courses.

2. Course of Digital signal processing and Matlab GUI

2.1 Course of Digital signal processing

With the rapid development of information technology, digital signal processing curriculum has become an important discipline and an extremely important field of science. The course is a major major in communication engineering, electronic information engineering, and other major in electronics and information.

Digital signal processing is the use of computer or special processing equipment, numerical calculation of the signal acquisition, transformation, synthesis, valuation and identification processing, in order to achieve the purpose of extracting information and easy to use. This course focuses on the basic concepts and basic theories of DSP, including: time domain discrete signal and time domain discrete system, time domain discrete signal and system frequency domain analysis, discrete Fourier transform (DFT), fast Fourier transform (FFT) Time domain discrete system of the basic network structure and analysis, IIR filter design, FIR filter design.

2.2 Matlab Gui

MATLAB is the short name of the Matrix Laboratory, which is a business mathematical software produced by MathWorks Corporation in the United States. Advanced technical computing language and interactive environment for algorithm development, data visualization, data analysis and numerical calculation, including MATLAB and Simulink two parts, and Mathematica, Maple and called the three major mathematical software. It is second to none in numerical applications in mathematical technology applications. MATLAB can perform matrix operations, draw functions and data, implement algorithms, create user interface, connect other programming language programs, mainly used in engineering computing, control design, signal processing and communication, image processing, signal detection, financial modeling design And analysis and other fields.

GUIDE (Graphical User Interface Development Enviroment)[4] is a specialized tool for GUI programming in MATLAB. Through GUIDE, GUIDE can easily design a variety of graphical user interface. Users can follow the prompts to complete the production of new interface, But do not have to understand how the new interface works internally. GUI design can be based on the basic MATLAB program design, you can also use the mouse to use GUID tools to design, you can also combine the above two methods for design.

3. System Flowchart And Design Steps

3.1 System Flowchart

The main features of the demo system are: user interface and graphical output. The system according to the functional requirements of the following main modules: GUI module, the main interface module demonstration, demonstration results and presentation content module[5]. GUI module is a main interface, according to the digital signal processing courses focus and difficulty to select a few typical demo. In the process of developing the interface of the demonstration teaching system, it is necessary to fully understand the function of MATLAB's graphical user interface, including the input of static text, the reading of data, the response of the button, the link of the coordinate axis and so on. System flowchart is shown in Figure 1.

Firstly, enter the GUI main interface, the user can freely choose to want to understand the presentation. If a presentation can be divided into several different types of presentation, the user can enter the corresponding demo interface. The presentation and demonstration results are placed on each sub-presentation window. Users can learn about the presentation content and related theoretical knowledge through the presentation sub-interface, and get different presentation results by entering the parameters. This makes it easy for students to analyze themselves. This demonstration system is conducive to teachers in the classroom teaching, but also for students after school to provide a convenient self-study[6].

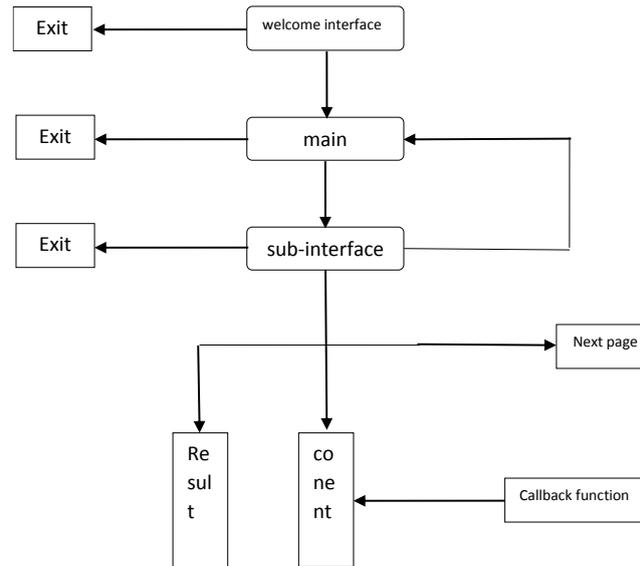


Figure 1. System flowchart

3.2 Design steps of Callback function

In the design of the system, firstly, design the GUI interface, and then design the presentation sub-interface. The interface includes controls such as buttons, axes, text boxes, and so on. After the interface design is complete, only some static images, but no practical significance. It cannot be used for demonstration operations. To achieve the ability to demonstrate presentation and analysis, you must also call a series of programs with the help of the callback function. In the design, the preparation of each callback function is bottom-up. Firstly, write each sub-interface callback function under the procedures, and then write GUI interface callback function under the program.

The specific steps of its design are as follows:

- (1) Design the entire system GUI interface, demonstration of the main interface and the various sub-interface, using the MATLAB graphical user interface development environment GUIDE.
- (2) Write each sub-interface of the control object of the callback function to achieve the control of the corresponding control function.
- (3) Run the GUI interface to check whether the controls are running properly and whether the presentation results are set. And then debug the program according to the results of the demonstration until a satisfactory result is achieved.

4. Conclusion

Nowadays, with the rapid development of social information technology, the emergence of new theories and new technologies, teacher of the digital signal processing courses must keep pace with the times, constantly update teaching methods and deepen the teaching reform. By auxiliary teaching system of digital signal processing courses based on MATLAB, students can intuitively understand and appreciate the textbook abstract content and increase interest in learning. It can also enhance understanding of the nature of the problem, strengthen innovative thinking, and improve the quality of teaching.

Acknowledgements

I would like to express my gratitude to the support of the Fundamental and Advanced Research Project of Henan Province [132300410461], the Doctoral Scientific Funds of Henan polytechnic University [B2012-100] and the Fundamental Research Funds for the Universities of Henan Province [NSFRF140125].

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