

Exploration of the Teaching Reform and the Establishment of the Curriculum Group of Signal and Information Processing

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Abstract—“Signals and Systems” course and “Digital Signal Processing” course are important basic courses in majors such as communication Engineering, electronic Engineering and electrical Engineering. Along with “DSP technology and application” course, they constitute the curriculum group of Signal and Information Processing. Aiming to construct the curriculum group of Signal and Information Processing, the system structure and the construction scheme was discussed in this paper. The curriculum group construction not only optimizes the curriculum system and makes students easily know the basic theory and method, but also improves the effectiveness of education.

Keywords- Curriculum group construction; Signal and System; Digital signal processing; DSP technology and application

I. INTRODUCTION

“Signals and Systems” course and “Digital Signal Processing” course are very important basic courses in majors such as communication Engineering. They have the important positions and roles in the course of undergraduate and postgraduate teaching^[1-8].

However, in my school 's teaching practices of undergraduate, MSC, PhD, we have found some problems: (1) parts of the course content overlap, such as " signal and system " course and " digital signal processing " course both use a larger space on the Z transform and sampling theorem, which causes the hours waste and makes students feel very boring^[9-12]; (2) in such courses the theoretical derivation is more, but application examples is less, which allow students to doubt the courses' application prospect and reduce their learning enthusiasm; (3) For part of the graduate, the basic knowledge of signal analysis and processing is lacking, which is not good for the subsequent academic study. Based on the above reasons, it is necessary to optimize the curriculum system, establish the Curriculum Group of Signal and Information Processing, and improve teaching methods to promote students to form a complete knowledge system.

II. THE SYSTEM STRUCTURE OF THE CURRICULUM GROUP OF SIGNAL AND INFORMATION PROCESSING

Curriculum group is a structural rational curriculum system which aims to the same or different professional personnel training objectives and requirements, makes the modern education thought and theory as the guide, integrate

three or more contents interconnected or deepen gradually courses^[13-20].

According to the definition and meaning of curriculum group, the content of three courses was designed. In these courses, the repeated parts were eliminated, and the Curriculum Group of Signal and Information Processing was constructed. In the Curriculum Group of Signal and Information Processing, the “digital signal processing” course was the core. In the horizontal construction of undergraduate education, the “signal and system”, “digital signal processing”, “DSP technology and Application” three courses were integrated, a new teaching system was established, and the corresponding teaching method were formed, which allow students understand deeply the wide basic knowledge about signal analysis and processing, master easily analysis and design methods, and train students the ability to acquire new knowledge and apply new knowledge; in the longitudinal curriculum construction of the undergraduate and postgraduate teaching, the “digital signal processing” course (undergraduate), “digital signal processing” course(Master), “modern digital signal processing”(PhD) course were reformed and constructed, which make students' knowledge system to develop in depth and train high-end talents. The Curriculum Group of Signal and Information Processing's structure diagram was shown in figure 1.

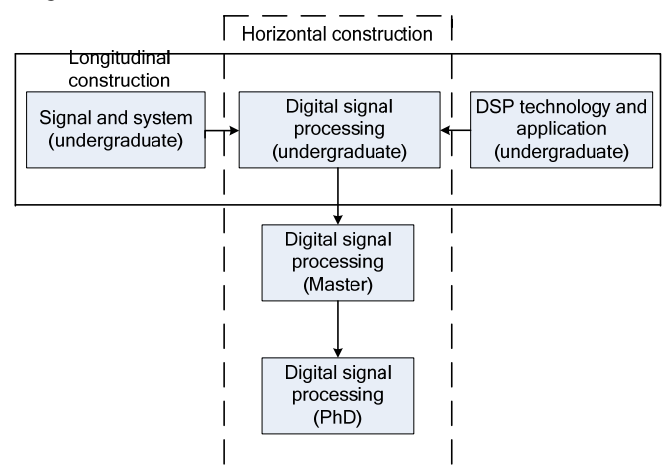


Figure 1. The structure diagram of the Curriculum Group of Signal and Information Processing

In the horizontal construction of undergraduate education, the curriculum group includes "signal and system", "digital signal processing", and "DSP technology and application" three courses. The "Signal and system" course is the leading course of the "digital signal processing" course and the important foundation course which connects the theory and application in the information processing field. The "digital signal processing" course was the important part of information science and the core of curriculum group. The "DSP technology and application" introduce the hardware and software development of digital signal processors, and belongs to the practice and application course. The three courses formed the complete system from the theoretical study to the practical application.

In the longitudinal direction, the modern digital signal processing is a rapidly developing frontier and cross discipline. It is the further expansion for classical digital signal processing theory and algorithm, its basic content in general can be divided into two stages of teaching. In the first stage, the teaching contents include least squares filter, an adaptive filter, power spectrum estimation, which contents of the part as the master stage of "digital signal processing" course content. In the second stage of the doctor, the main contents of the digital signal processing course include the high order spectrum estimation, short-time Fourier transform, wavelet transform, Wiener distribution and multi rate signal processing.

III. THE EXPLORATION OF THE TEACHING REFORM ABOUT CURRICULUM GROUP

A. *Optimizing courses' teaching content*

In our college, the teaching undergraduate object of the Curriculum Group of Signal and Information Processing has two categories: one kind is the students of communication Engineering and electronic Engineering, another kind is the students of electrical Engineering. According to the different teaching object, the targeted curriculum systems were developed.

The main study target of communication Engineering and electronic Engineering's students were the weak signals; they have more deeply requirements about the theories of the signal analysis and processing. So the "signal and system" course (70 hours) and "digital signal processing" course (50 hours) were introduced for them. The courses focus on the theory calculation algorithm and increase some application in the field of communication, radar and other traditional signal, which widen students' knowledge. "DSP technology and application" course makes TI Company's C5000 chip as the object and introduce the application of the speech signal processing.

Electrical major belongs to strong electric specialty. The signal processing was the interdisciplinary study, and the theories about the signal analysis and processing were required slightly. So the major has not opened the "signal and system" course, but expanded the "digital signal processing" course to 60 hours. It supplements students the relevant basic knowledge about signal and system analysis,

decreases the theory depth of this knowledge, and focus on the practical application of this knowledge.

B. *Implementing bilingual teaching*

Bilingual teaching is a teaching pattern of our school advocates, and it is the inevitable trend of development of education reform. Bilingual teaching should not make the teaching complex. The key of Bilingual teaching lies in helping the students to learn professional knowledge better.

"Signals and systems" and "Digital signal processing" courses have congenital advantage of bilingual teaching. As the basic course of information science, the formation and perfection of the theories in these courses were done by classic English textbooks. Most of the domestic textbooks were finished by absorption and reorganization of the English textbooks, so the domestic textbooks lag behind foreign textbooks in the matter of updating the knowledge. Because of the personal professional background and difference of understanding, the expounding differences among the domestic textbooks can easily cause confusion. So reading the original directly is the best way to grasp the knowledge.

In the process of implementation of bilingual teaching, we use the "Signals and systems" and "Discrete-Time signal processing" textbooks edited by Alan V. Oppenheim, which keep same step with the foreign elite university teaching and cultivate students' global vision. In the implementation, we use the English PPT and speak English or Chinese in the classroom, and by this way we implement of bilingual teaching.

C. *Constructing the experimental system of the curriculum group*

Based on the global construction plan of the Curriculum Group of Signal and Information Processing, the laboratory of information processing was built in our college, which forms the experimental platform in which the experiments of "signal and system", "digital signal processing" and "DSP technology and Application" courses were integrated, and the lecture and experimental guide book of the "signal analysis and processing" were compiled. The experimental system achieves the organic combination of the basic principle and the engineering application and the organic combination of the software simulation and the hardware implementation.

Based on Matlab software simulation platform, the Software test mainly complete the "signal and system" and "digital signal processing" course experiment contents, which focus on the simulation of the signal processing algorithm to cultivate students' ability of signal analysis and processing.

Based on TI's TMS320C5x hardware development platform, the hardware experiment mainly complete the "DSP technology and Application" course experiment contents, which focus on use DSPs' system resource to realize the real-time signal analysis and processing to cultivate students' ability of development the digital signal processing system.

D. Building the network teaching platform

Relying on our internal campus network, we completed the construction of "signal and system" and "digital signal processing" network courses. The two network courses have rich teaching contents. In the network courses, the contents were organized on the basis of the modules, and the division of the module is relatively independent. Each module has the learning objectives, teaching content, exercise, test, referenced teaching resources, lesson planning, learning process and other content. The network courses not only have the function of Online Autonomous Learning, also have the function of online self testing and online discussions. The practice shows these networks teaching platform can help students study more easily.

E. Building up the excellent teaching team

Teaching philosophy and goals must be achieved by the teachers' classroom teaching, so teachers' teaching ability was very important. The construction of teaching team of the Curriculum Group of Signal and Information Processing make discipline construction as the guidance, make personnel training as the objective, and eventually realize the sharing of resources, gathering advantage force, forming a certain influential teaching team^[4,5]. The Curriculum group teaching team consists of the responsible person and course teachers. The responsible person is mainly responsible for the overall planning, design and optimization of the teaching staff deployment, and being competent for the task of teaching of many courses; the course teachers should understand all the basic content of courses in the Curriculum Group, and assume at least one course teaching task. In the respect of teacher training, every young teacher was assigned a old teacher with rich teaching experience to help him. The teachers of the teaching team were encouraged to actively carry out the teaching research and scientific research, declare the subjects of scientific research, and publish the articles related to teaching and research to achieve the harmonious development between the teaching and scientific research.

F. Improving the course test mode

The test is one of the important ways to check the teaching effect, evaluate the teaching quality, and measure whether to achieve the purpose of teaching. The course test can take a variety of forms of examination. The proportion of daily study should be increased. The students' achievement of daily learning and research should be reckoned in the total score. The usual assessment can be made by the classroom discussions, report, open course assignments and other forms. The disposable examination form was changed to test form of the whole process, to examine students in each phases of knowledge, which can reflect the real results and comprehensive ability of students. Actual teaching effect shows it was very effective.

IV. CONCLUSION

In view of the problems of contents overlapping, more theoretical derivation and few application examples in "signal and system", "digital signal processing" courses, the

system structure of the Curriculum Group of Signal and Information Processing was explored. The courses teaching content and teaching method reforming were discussed too. The actual teaching effect shows: the construction of the Curriculum Group of the Signal and Information Processing can promote the optimization of the curriculum system, improve the quality of teaching, and achieved good teaching results.

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