

Practice and Discussion on Teaching Reform of Modern Control Theory Course

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Abstract: The rapid development of knowledge economy poses a challenge to higher education. To cultivate high-quality innovative talents, colleges and universities must carry out educational reforms and improve teaching quality. Modern control theory is the core course of automation major. In view of the characteristics of this course, such as its strong theory and relatively abstract nature, this paper focuses on teaching structure, teaching system, teaching content, teaching methods, bilingual teaching and the construction of teaching materials, and the author optimizes teaching content. And the selection of teaching materials, the reform of teaching methods, the strengthening of the connection with practical problems, the addition of experimental links, the reform of examination methods, and the combination of teaching and scientific research to discuss the reform ideas of this course.

Keywords: Teaching Reform, Modern Control Theory, Practice and Discussion

1. INTRODUCTION

Modern control theory is one of the compulsory courses for undergraduate majors in automation. It is a follow-up course following automatic control theory. It is also the basis for graduate students to study courses such as optimal control, robust control, and linear system theory. It is very important in teaching reform. The modern control theory course expresses the actual system in the form of a mathematical model, and then analyzes and processes the system parameters and motion trajectory according to the mathematical model. The concepts are relatively abstract and difficult for students to grasp.

To allow students to better grasp the knowledge of this course and cultivate students' innovative consciousness, innovative ability and comprehensive quality, the course is optimized from the content of teaching and the selection of teaching materials, the reform of teaching methods, the strengthening of the connection with practical problems, the increase of experimental links, the reform of examination methods, teaching and scientific research are discussed. In addition, the content of the course must be systematic and a complete system, including the whole process of control system analysis and synthesis. All the content is a part of the system, so that students can understand the status and function of the internal subject taught by the teacher. Forming a systematic knowledge system is not only conducive to memory, but also conducive to cultivating a systematic way of thinking.

The stability theory in modern control theory belongs to the content of ordinary differential equations, so the relevant theories of ordinary differential equations should be properly supplemented while teaching. In the whole teaching process, while teaching the course content, strengthen the training and training of students' logical thinking ability in a purposeful and targeted manner. research on control issues. Teachers should actively guide students to master the inner connection between knowledge points, not just stay on the surface. Under the limitation of only 32 class hours of teaching, it is difficult for teachers to instill textbooks into students "completely" and "extremely delicate".

We must "reduce the branches and strengthen the poles", select the teaching content, emphasize the basic theory, and

highlight the teaching points in accordance with the requirements of the teaching syllabus stipulated by the "Automation Major Teaching Guidance Sub-Committee in Colleges and Universities". For example, for the chapter "state space model", its most basic content state, state space, state space description of linear time-invariant system, establishment of state space model of physical system, relationship between state space description and transfer function (matrix). Transformation relations, linear changes, etc. should be explained thoroughly, and some cumbersome and impractical content can be appropriately reduced. Highlight the basic theories, basic laws, and content that are beneficial to engineering practice, because they are the essence, the core, and have a long-term effect.

Due to the large number of matrix operations in modern control theory, it is easy to cover up the engineering background of its state-space method, and it is easy to lead students to think that this course is only to solve mathematical problems, and has nothing to do with system control, so they lose interest in learning. Currently, the teacher is required to introduce the relevant engineering background while explaining the concept of physics. For example, use MATLAB simulation software to simulate the control process of the system, verify the physical concepts in the teaching process, combine theory with practical problems, activate the classroom atmosphere, improve students' interest in learning, and let students understand the importance of learning this course. After the teaching content is optimized and designed, an effective teaching method is needed to guarantee the teaching content. There are various modern teaching methods, and it is very important to find a teaching method that suits the needs of teaching content, is popular with students, and has good teaching effects.

2. THE PROPOSED METHODOLOGY

2.1 Reform the teaching structure and improve the teaching system.

In terms of teaching methods, according to the arrangement of the course content, the author adopts a variety of teaching methods such as the combination of multimedia and traditional blackboard teaching, inspiration and discussion, teacher-student communication, and exercise guidance to

improve students' enthusiasm and initiative in learning and improve teaching effects. For the key content, such as how to transform the given state space expression into the form of Jordan canonical form, how to calculate the state transition matrix by various methods, how to judge the controllability and observability of the given system, how to systematize into energy the standard type of controllability and observability, how to decompose the system according to the controllability and observability, the concept of stability and the method of discrimination, the conditions and specific methods of pole configuration, and the design method of the full-dimensional state observer are taught in detail.

The teaching method that stimulates students' thinking ability is adopted, so that students can explore the correct answer to the question and find the inevitable result of logic. For example, in the section on the definition and analysis of controllability and observability of a control system, in general textbooks, the abstract definition is first given directly in a mathematical way, and then its criterion is explained. We believe that it is difficult for students to memorize and accept the concepts of controllability and observability given by pure mathematics. Because modern control theory only includes the basic concepts and methods of control theory, it does not introduce the latest research trends and research directions of control theory. Therefore, when teaching, the latest research trends at home and abroad are combined with teaching content to introduce to students and improve students' interest in learning. And deepen the understanding of control theory, and properly introduce academic conferences in domestic and foreign control circles to students, such as CDC, CCDC, etc., which not only improves students' scientific research knowledge Enthusiasm broadens knowledge.

With the modernization of school teaching equipment, multimedia teaching methods have emerged. Multimedia teaching has the characteristics of intuition, vividness, and image. It can use slides or animations to teach some content that is difficult to describe in language in the classroom, which not only improves the efficiency, but also strengthens students' understanding and memory of the teaching content. For courses with a lot of theory and formulas, it is necessary to pay attention to the organic combination of multimedia teaching and traditional blackboard teaching in the teaching process, to give full play to their respective advantages and improve the teaching effect.

In terms of teaching methods, we must pay attention to intuitive teaching and actively apply modern teaching methods such as multimedia courseware and audio-visual teaching. Because these modern teaching methods have the characteristics of combining pictures and texts, sound, and image, and have vivid appeal, they can stimulate students' interest in learning modern control theory, mobilize students' initiative in learning, and thus achieve good teaching results. Using modern teaching media to make abstract concepts semi-concrete and concrete things semi-abstract makes teaching and learning easier. It is easy to turn to concrete visualization and abstract conceptualization. Therefore, we introduce the MATLAB software tool of control system analysis and synthesis in time to make it serve CAI teaching.

2.2 Using Negative Feedback Ideas in Teaching Methods to Achieve Teaching Objectives and Improve Teaching Effects

For example, for system synthesis based on the state-space method, general textbooks only explain how to design controllers, and do not verify the control effects. The use of

multimedia teaching can make up for this defect. Class teachers can conduct classroom discussions on a practical engineering problem. This kind of discussion-based learning can stimulate students to think proactively, and it is also an integral part of grades, allowing students to actively participate in it. In addition, students who are diligent in thinking and love scientific research can participate in the scientific research work of teachers, cultivate students' scientific research ability, and lay the foundation for future graduation design work. In the process of lesson preparation, according to the content of the course and combined with your own scientific research practice, carefully design problems, consider possible solutions and the advantages and disadvantages of each solution.

Firstly, the questions are given, and then the students are inspired to think independently and propose their own solutions. Group by scheme. Similar plans are divided into groups. Members in the group conduct in-depth discussions and further refine their own solutions. Then each group arranges a representative to give a speech. Finally, the teacher summarizes and improves theoretically, pointing out the problem. The theoretical knowledge involved, and its application methods will answer the questions raised by the students. To achieve the goal of quality education and guide students to participate in scientific research-based learning, reform attempts should be made to the assessment methods of modern control theory, and the proportion of scientific research-based learning assessment should be increased. For example, the overall evaluation score of the assessment is 100 points in total. Among them, the final exam focuses on the flexible use of the basic concepts and basic theories of the textbook, and the test paper score accounts for 40% of the overall evaluation score.

We not only pay attention to the quality of classroom teaching, but also pay attention to many links such as experimental guidance, homework correction, exercise classes, extracurricular Q&A, etc., and adjust the teaching syllabus and determine the teaching plan. In the classroom teaching, students should not be instilled unilaterally, and students should not just accept passively. Teachers and students should fully interact. And according to the learning effect of students, the teaching plan and classroom teaching are revised in time or the teaching syllabus is fine-tuned, to realize the tracking of teaching goals and finally improve the teaching quality. "Modern Control Theory" is not only strong in theory, but also strong in practice. Only through practice can students deepen their understanding of theoretical knowledge, truly master the methods of control system analysis and design, and cultivate analysis, problem-solving abilities, and innovative thinking ability.

The author explores the course practice through the combination of experiment and scientific research training. In terms of experiment, it mainly sets up open experiments. Students are required to independently design experimental plans according to the contents of the experimental course and carry out experimental operations. The experiment does not require completion within the specified time. Students can constantly modify and improve the experimental plan according to their own understanding. In this way, the enthusiasm and initiative of students can be stimulated, their creativity can be brought into play, and talents with real innovative practical ability can be cultivated. Classroom and daily grades mainly examine students' homework (accounting for 10% of the total score), attendance (accounting for 10% of the total score), and classroom learning (accounting for 10%

of the total score), which account for 30% of the total score; The assessment results account for 30%, 5 of the total assessment results.

3. CONCLUSION

At present, the level of automation is changing with each passing day, so that control theory has been greatly developed in production and life, and higher requirements are put forward for further improving the effect of system automatic control. Therefore, how to strengthen the teaching effect of "Modern Control Theory" in the teaching process, letting students use what they have learned has become a major issue. Focusing on the teaching structure, teaching system, teaching content, teaching methods, student performance evaluation mechanism, bilingual teaching, and teaching material construction, etc., this paper conducts extensive and in-depth research and discussion on improving the teaching quality of the "Modern Control Theory" course effective education reform measures.

4. REFERENCES

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