

Teaching Reform and Practice of "Automatic Control Theory"

Mao Yang

School of Electrical Engineering, Northeast Electric Power University, Jilin, 132000, China

Yangmao820@163.com

Keywords: Automatic control theory; Teaching practice; Teaching reform

Abstract. "Automatic Control Principle" is an important professional basic course of electrical information specialty. According to the characteristics of the course, conducted a series of curriculum reforms, such as optimizing teaching content, enriching teaching methods, strengthening practical teaching, focus on the combination of theory and practice, develop student engineering thinking, the students grasp the basic theory of automatic control at the same time, comprehensive analysis of the problem and the ability to solve the problem to further improve. Various teaching feedback results show that the "automatic control theory" of the teaching reform has achieved good teaching results.

Introduction

"Automatic control principle" is an important professional basic course of electrical information specialty, it studies the general laws of automatic control and automatic regulation systems, the research ideas and methods have an important impact on students' follow-up courses and practical problems in engineering. "Automatic Control Theory" comprehensive curriculum, wide coverage of knowledge, it not only requires students to have a solid foundation of engineering mathematics, circuits, motors and drafts, etc. , but also have a strong computing power. At the same time, the content of the course updates fast, theoretical and practical, students feel hard to learn, some teachers find it difficult to teach. Therefore, the reform and construction of the course is the key to comprehensively improving the quality of professional teaching and promoting the development of the subject. Based on the thinking of cultivating comprehensive and innovative talents, the author made some reforms and exploration on the teaching content, teaching methods and experimental teaching of the course. [1, 2]

Course Teaching Features and the Necessity of Teaching Reform

Course Teaching Features. One of the hallmarks of the "Theory of Automatic Control" course is that it involves more theoretical knowledge. In the establishment of the mathematical model of the control system and the application of various knowledge points, there must be physical knowledge such as mechanics, electricity, optics and thermals as well as knowledge of circuits, motors, power electronics, etc. But also have strong modeling skills and the ability to use knowledge to solve practical problems. In addition, a solid mathematical foundation is the basis for learning the course. The basic mathematics calculus, complex variable function theory, matrix theory and other knowledge throughout the entire curriculum. This requires that students have a good math literacy. [3, 4]

The second feature of the "Principles of Automatic Control" course is that it contains more graphics. Such as engineering application schematics, root locus, polar plot and logarithmic plot. Graphics can make teaching more intuitive, but it brings some time-consuming teaching.

Necessity of Curriculum Reform. In view of the above characteristics, if traditional methods are used to teach the "automatic control principle", it is bound to bring the time tight, more content, knowledge difficult and can not achieve the desired teaching effect.

Therefore, in order to make students better grasp the basic principle of "automatic control principle.", lay a solid theoretical foundation for students' postgraduate entrance examination or related work in the future, in order to better solve the problems of teaching and learning, theoretical

study and experimental practice, the teaching reform and practice of "automatic control principle" must be carried out. And teaching reform from the teaching objectives, teaching materials, teaching methods and tools, experimental practices, such as the full implementation of the corresponding measures. [5]

Some Attempts on Teaching Reform

Combining Practical Engineering with Theory and Practice. The course of "Automatic Control Theory" in electrical colleges should reflect the characteristics of electrical automation, some equipment in the lighting and electrical systems such as power supply and distribution, fire control systems, etc. in the electrical engineering and automation major is the knowledge of using the principle of automatic control, and electronic information engineering in the intelligent building automation system is based on the modern control theory of distributed computer control system knowledge. Therefore, the projects of strong and weak electricity all need the principle of automatic control as the foundation. Combining with the actual project, the combination of theory and practice can meet the need of professional development, expand students' horizons and enrich students' practical knowledge.

Rationally Optimize Teaching Content. First of all, select the content of the lectures and strengthen the "three-basis" teaching. The principle of automatic control more content and less time, the contradiction is very prominent, which requires teachers to select teaching content. The key elements stipulated in the syllabus, such as basic concepts, basic principles and basic methods, should be thoroughly explained. In teaching, the contents of classical control theory should be screened. With the rapid development of computer network information technology and the full penetration of this technology into the control field, modern control theory must be increased and enriched, such as reducing the root trajectory part of the teaching time, remove the closed-loop system frequency characteristics analysis, increase the discrete system of lecture content and teaching class, increase the breadth and depth of the system state space analysis. [6]

Second, breaking the constraints of the traditional curriculum architecture. The traditional course system separates the two major parts of the classical control theory and the modern control theory of the control principle, self-contained system, an independent course. From the teaching effect, this way of teaching is not conducive to students to establish the basic framework of the basic theory and method of automatic control disciplines. Therefore, although we are still divided into the two classes of automatic control theory and modern control theory, we completely break the old system constraints in the teaching system of the whole curriculum and integrate the classic and modern control theories teaching. For example, the concept of the system state space is introduced at the same time as the differential equation model and the transfer function model of the control object, and then the mutual conversion between the two system descriptions of the state space and the transfer function is explained. Through such a process, the basic ideas of classical control theory and modern control theory can be organically combined. Practice has proved that the use of this teaching method not only enables students to better understand the control theory of the system structure, but also improve the flexibility and initiative of students to learn, to facilitate students to grasp the entire professional knowledge structure.

Appropriate Reform of Teaching Methods. The author tried some reforms in teaching methods when he taught the "Automatic Control Principles" course. First of all, in view of the weaknesses of the prerequisite courses and the high demands of this course, I try to dilute the derivation in the teaching process. As we all know, "Automatic Control Theory" course has a lot of mathematical deduction, if you blindly teach the derivation process will make students hear boring, thinking can not keep up, leading to not understand, and tired of learning. The author tried to minimize some of the derivation, such as the content of the Laplace transform, so that students can remember several common and commonly used Laplace transform results, and there is no need to spend a lot of time and effort on the process of derivation. [7]

Use of Modern Teaching Methods. In view of MATLAB powerful graphical display function, we also introduce it into the teaching of automatic control theory. For example, it is often necessary

to draw a step response curve for analysis in the time domain analysis method of automatic control principle, the root locus method needs to draw the root locus graph, the frequency domain analysis method needs to draw the Bode plots and the polar plots. These graphs need to analyze, calculate, tracing and other processes, often spend a lot of time, and the results are not very accurate. Using MATLAB language, you can get the corresponding graphics immediately with a few simple instructions. At the same time, it is very convenient to observe the influence of the parameter changes on the stability and dynamic characteristics of the control system. But also to avoid the traditional theory of teaching teachers in blackboard drawing time-consuming and inaccurate hand-painted. [8]

Conclusion

In many years of teaching practice, the author through continuous exploration and improvement, the above methods have been implemented. The teaching practice shows that by changing the teaching mode, the contradictions between the slow changes in teaching ideas and the rapid changes in the overall quality of students after college enrollment expansion are effectively improved. Through the optimization and integration of teaching content, the contradiction between unchanged teaching content and time compression can be alleviated. Through the reform of teaching methods, the conflicts between the prerequisite courses and the high demands of this course can be alleviated. Through the introduction of advanced teaching methods, the contradiction between the single mode of teaching and the large amount of teaching information can be solved. In the future teaching practice, the author will continue to pay attention to the development of disciplines with more sense of responsibility and mission, continue to strengthen the study of teaching and research methods, capture advanced teaching modes and teaching methods, actively for the provincial quality courses "Automatic Control Theory" course to make unremitting efforts.

References

- [1] C. P. Li, P. J. Cao, J. H. Li and B. Zhao: Journal Of Northeast Electric Power University, Vol. 37 (2017) No. 2, p. 82.
- [2] B. Liu, Z. J. He and H. Jin: Journal Of Northeast Electric Power University, Vol. 36 (2016) No. 2, p. 7.
- [3] T. S. Feng and F. Liu: Journal Of Northeast Electric Power University, Vol. 36 (2016) No. 3, p. 11.
- [4] X. P. Meng, L. Kou, Q. D. Yuan and Y. Z. Pi: Journal Of Northeast Electric Power University, Vol. 36 (2016) No. 5, p. 86.
- [5] W. N. Zhou and H. R. Shi: Research in Teaching, Vol. 33 (2010) No. 1, p. 63.
- [6] S. Z. Sheng, F. C. Ye and C. W. Sun: Journal Of Eee, Vol. 39 (2017) No. 1, p. 131.
- [7] B. Li, J. M. Huang, Z. L. Xie and X. Yang: Journal Of Eee, Vol. 38 (2016) No. 3, p. 41.
- [8] J. P. Xia and Y. Wang: Experimental Technology and Management, Vol. 33 (2016) No. 2, p. 159.