Research on the Control Courses Reform of Automation Specialty under the Background of New Engineering

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Abstract. In-depth analyzing and researching on the construction of new engineering and the new requirements of the development of intelligent industry for the reform and development of automation specialty, aiming at the urgent need of automation specialty for the intelligent reform of control courses, combining intelligent technology with control technology, focusing on teaching concept, curriculum system and experimental practice, the control curriculum with intelligent control system technology is put forward in this paper. These are the core of teaching and reforming of engineering teaching. Explore the teaching reform mode of control courses in local undergraduate colleges and universities facing the needs of traditional specialty development and new engineering specialty construction, so as to deepen the reform of engineering education and promote the construction and development of new engineering.

Introduction

The construction of new engineering is an important action plan to meet the challenges of the new economy and to deepen the reform of engineering education. We should promote the construction of new engineering from the perspective of serving the national strategy, meeting the industrial needs and facing the future development. In order to deepen the reform and innovation of higher engineering education, the Department of Higher Education published the notice on the development of new engineering research and practice [1]. On the one hand, we should actively set up and develop a number of new engineering majors. On the other hand, we should promote the reform and innovation of existing engineering majors.

In the process of promoting the construction of new engineering, local undergraduate colleges and universities should not only optimize the layout of disciplines and specialties and promote the cross-integration of disciplines, but also take the training of applied talents as the purpose, keep up with the industrial development, aim at strategic emerging industries and serve the economic and social development [2]. Focus on the new needs of national strategy and comprehensively promote the reform and innovation of engineering education and teaching in the new era.

The Core of Reform and Upgrading of Automation Specialty

The automation specialty mainly studies the principles and methods of automatic control, automation unit technology and integration technology and their applications in various control systems. Automation specialty education is to carry out relevant courses and practical teaching with automatic control system as the main line [3]. Automation knowledge system takes control theory and control system theory knowledge as its core. As shown in Fig. 1, control course is the main core course of automation specialty. Therefore, the transformation and upgrading of automation specialty focuses on the reform and innovation of automation control course and practical teaching system.

The intelligent automation is the science and technology of automatic, intelligent, autonomous, efficient and safe operation of the artificial system with the technical system of intelligent control system as the core. The traditional automation upgrading to intelligent automation focuses on the reform and upgrade of control courses on the intelligent direction. Therefore, it is necessary to carry
out the intelligent reform of control courses, which builds the control courses and practical teaching system with intelligent control system technology system as the core.

The Reform Method

Based on the analysis of the current situation of automation specialty and the intellectualized demand for control technology in the development of modern industry, the teaching concept of automation control engineering education for the intellectualized industry is established, and the knowledge system of control course teaching adapted to the requirements of the development of intelligent control system is constructed. In order to improve the teaching content, construct the curriculum system of intelligent control system teaching, a multi-level, multi-stage and multi-way practical link is designed. A new concept and new mode of control curriculum and practical teaching personnel training suitable for the education of automatic intelligent control system is gradually formed.

The Engineering Education Concept

Changing the traditional education idea, taking "student-centered + practical innovation ability + career sustainable development" as the teaching goal, the "control theory + control system + engineering knowledge + engineering ability + scientific literacy + humanistic literacy" engineering education concept is created, as shown in Fig. 2. At the basic level, the core is the control theory and system. Through classroom explanation, student lecture and classroom discussion, we can learn engineering examples or engineering problems, and then consolidate the theoretical knowledge of control. In order to improve the engineering ability of students, control theory knowledge and control experience are applied to solve practical engineering problems through simple system design, experimental scheme design and engineering application analysis. At the sublimation level, students' scientific literacy and humanistic literacy can be cultivated by writing scientific research papers and self-study.

The Control Courses System

According to the whole process of machine-human-machine design intelligent system, six progressive hierarchical knowledge systems are established, which are based on modeling, control theory, simulation, controller implementation, control system and control engineering.

According to the professional training orientation of local undergraduate colleges and universities, through reforming the traditional curriculum content and adding new curriculum, the theory and method of complex multivariable system modeling, intelligent control theory, intelligent controller, artificial intelligence technology simulation software system, virtual reality simulation system, intelligent information processing technology are thoroughly analyzed and refined. Machine learning
and artificial intelligence and other related teaching knowledge areas and specific knowledge points, the overall reform of teaching content, constitute a control curriculum system. The relationship matrix between curriculum system and knowledge system is shown in Table 1.

Table 1. The Relationship Matrix between Curriculum System and Knowledge System.

| Course                                      | modeling | control theory | simulation | controller implementation | control system | control engineering |
|---------------------------------------------|----------|----------------|------------|---------------------------|----------------|---------------------|
| 《Mathematical Modeling》                     |          |                |            |                           |                |                     |
| 《Automatic Control Theory》                  |          |                |            |                           |                |                     |
| 《Modern Control Theory》                     |          |                |            |                           |                |                     |
| 《Intelligent control》                       |          |                |            |                           |                |                     |
| 《Computer Simulation》                       |          |                |            |                           |                |                     |
| 《Virtual Reality》                           |          |                |            |                           |                |                     |
| 《Intelligent Chip》                          |          |                |            |                           |                |                     |
| 《Intelligent Information》                   |          |                |            |                           |                |                     |
| 《Machine Learning》                          |          |                |            |                           |                |                     |
| 《Python Programming》                        |          |                |            |                           |                |                     |
| 《Robot Control Theory》                      |          |                |            |                           |                |                     |
| 《Motion Control System》                     |          |                |            |                           |                |                     |
| 《Process Control System》                    |          |                |            |                           |                |                     |
| 《Electric Power Driven》                     |          |                |            |                           |                |                     |
| 《Special Motor》                             |          |                |            |                           |                |                     |
| 《Intelligent Control Project》                |          |                |            |                           |                |                     |

Figure 2. The Concept of Engineering Education for Control Courses.
The Practical Teaching System

Taking the whole life cycle of system "conception, design, realization and operation" as the carrier, three ways of project-driven, virtual simulation and case-based learning are designed, including four levels: basic level, comprehensive level, application level and innovation level, and five kinds of curriculum experiment, curriculum design, practice, scientific research group and subject competition. Form, innovation base, local experiment, long-distance network and enterprise practice are four practical teaching bases. Through the whole process of practical teaching, design activities can be carried out in a cross-spiral way between theoretical teaching and practical teaching. Practical ability can be trained continuously and practical teaching methods can be diversified. Improve students' thinking and decision-making ability, practice and innovation ability, as shown in Fig. 3.

![Figure 3. The Practical Teaching System of Control Courses.](image)

Summary

Under the new economic environment, the traditional automation specialty should construct the new-type development according to the following aspects: forecasting the future talent market demand, upgrading the existing specialty, adjusting and perfecting the construction path of the existing disciplines.

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