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Teaching Analysis and Improvement Measures of Power Electronic technology in Robot Engineering Specialty

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Abstract

Power electronics technology is one of the required courses for the major of robot engineering, and it plays a crucial role in the study of the core courses of subsequent majors. Due to its deep principles and high requirements for circuits, electronic technology and advanced mathematics, students do not have a deep grasp of the knowledge points. Based on this phenomenon and combined with their own teaching practice, this paper Various problems encountered in the teaching of power electronic technology in robot engineering are analyzed in detail, and the corresponding solutions are given. The research results of this paper can provide certain theoretical support for the formulation of talent training programs for similar majors and the teaching of professional courses.

Keywords

Power electronics technology; Engineering of robotics; Reform of teaching.

1. Introduction

Industrial robots are the key supporting equipment of advanced manufacturing industry, an important symbol of technological innovation and high-end manufacturing level of a country or region, and also represent the core competitiveness of economic development.In recent years, the state has introduced new policies to support the development of industrial robot industry.In December 2013, the Ministry of Industry and Information Technology issued the Guiding Opinions on Promoting the Development of Industrial Robot Industry;In May 2015, The State Council issued "Made in China 2025", which calls for breakthroughs in key areas, focusing on the development of high-end CNC machine tools and industrial robots.In December 2021, 15 departments including the Ministry of Industry and Information Technology, the National Development and Reform Commission, and the Ministry of Science and Technology jointly issued the 14th Five-Year Plan for the Development of Robot Industry. Since the 13th Five-Year Plan, the integrated application has been greatly expanded. In 2020, the density of manufacturing robots has reached 246 units / 10,000 people, nearly twice the global average level.It is expected that by 2025, the density of robots in manufacturing will double, and by 2035, the overall strength of China's robot industry will reach the international leading level. Robots will become an important part of economic development, people's livelihood and social governance.The robot industry is facing an unprecedented opportunity for development. According to the development plan of the Ministry of Industry and Information Technology, the installed amount of industrial robots will reach 1 million by 2020, and 200,000 engineering and technical talents related to the application of industrial robots will be needed, which means that more than 30,000 engineering and technical talents of industrial robots will be trained every year in the future. Compared with the rapidly growing demand for industrial robot related talents, the training of industrial robot professionals is in a relatively backward state.At present, the robot related talents cultivated by Chinese undergraduate college and university, mostly for the close professional training, its training goal, curriculum and so on have not been professionalized and systematized, can not well meet the needs of the robot industry.In order

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to better serve the national development strategy, especially the transformation and upgrading of traditional industries led by intelligentization and the development needs of strategic emerging industries, the Ministry of Education approved Southeast University to set up the undergraduate major of Robot Engineering for the first time in 2016, and approved Chongqing University of Arts and Science and other 25 universities to set up the major in 2017. On this basis, in 2018 and 2019, 80 and 101 universities were newly approved to offer the major of robot engineering, making the number of universities offering the major of robot engineering reach 207, hoping to speed up the training of a group of robot engineering professional and technical talents urgently needed by the intelligent manufacturing industry[1].

Power electronics technology is a required professional course based on circuit, electronic technology and advanced mathematics, and it is also a basic course of the core courses of electrical and automation majors. As a major related to automation, it is necessary to open the course of power electronics technology for robot engineering.However, because the qualitative analysis of this course is difficult, the quantitative calculation is more, it is related to strong electricity, and has certain risks. In addition, it has high requirements on the circuit, electronic technology and advanced mathematics of the preceding course, so the teaching effect is not good in the actual teaching process, which causes a certain degree of trouble for the study of the subsequent courses. Based on the above problems and combined with my own teaching practice, this paper, Various problems of power electronics technology in the teaching of robot engineering are analyzed, and corresponding measures are given.

2. Problems existing in power electronics teaching

2.1. Delayed updating of curriculum capacity

Power electronics technology is a rapidly developing subject, which is closely related to the development of The Times.As a result, the teaching content needs to be adjusted constantly, and the teaching content and training objectives need to be adjusted timely according to the development requirements of the country in related fields.For example, in the major of robot engineering, power electronics technology can appropriately add some special contents of the major, but in the traditional teaching, due to the limitation of the teaching syllabus setting, the limited number of class hours and the emphasis of assessment methods, the content update is limited, which is reflected in the following aspects:

(1) Excessive theoretical derivation and a lot of waveform analysis;

(2) There are a variety of power electronic devices simple list, lack of application explanation;

(3) The course content does not reflect the characteristics of the robot engineering major;

(4) Teaching design lacks the ability to use power electronic devices.

2.2. Introduction of specialized Basic courses

The pre-course of power electronics technology includes electrical technology, electronic technology and college physics. These three courses are more computation-intensive and more difficult. Some schools attach more importance to the application of training objectives, so the difficulty and class hours of some courses are adjusted accordingly.Electrical technology and electronic technology are basic courses for electricity-related majors, but for the major of robot engineering, they lack certain pertinancy in practice. For example, this course is usually taught by teachers who are not majoring in robot engineering, and the content of the lecture is universal to a certain extent, and even the content of this course is basically the same as that of electrical engineering and its automation major and automation major. The lack of application examples of robot engineering and the lack of close integration with the professional practical engineering environment.It is suggested that the backbone teacher of the robot engineering major should be the main lecturer of the basic course of the specialty, and the basic course of

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the specialty should be closely combined with the teaching of the robot engineering major, so as to improve the pertinency of the teaching and effectively achieve the good effect that the basic course of the specialty serves the core course of the specialty[2].

2.3. Teaching model of specialized courses

Single teaching method and low participation of students.The course content of "Power Electronic Technology" is numerous and miscellaneous, the knowledge point is abstract, and the teaching time is very limited.Such as thyristor rectifier circuit, AC voltage regulating circuit, inverter circuit and other current and voltage waveform analysis is difficult.In order to impart a wide range of knowledge points to students in the limited teaching hours, some teachers often adopt the one-way and single teaching method which focuses on classroom teaching and is passively accepted by students.To be specific, teachers usually teach knowledge points as the main line of teaching in class, and students become the objects of "cramming" and passive acceptance of theoretical knowledge[3]. As a result, teachers lack targeted guidance in the explanation, analysis and application of important knowledge points, which makes it difficult for students to improve their interest in learning and low enthusiasm to participate in classroom teaching, resulting in poor overall teaching effect.

2.4. Experimental teaching link

The whole experiment of power electronics experiment teaching is mainly demonstration and verification experiment, the whole experiment teaching content needs to be adjusted and optimized.The combination of strong and weak electricity in the training platform of power electronics technology, frequent operation and incorrect use by students, makes the experimental platform unable to meet the teaching requirements, with the following problems;

(1) Some modules are frequently used, and the failure rate is high, and the experiment process of students is blocked.

(2) The number of experimental platforms is small, the number of each group is large, and some students' participation is not high.

(3) The error between the theoretical value and the actual value is large, which affects the experimental effect of students

3. Teaching reform and measures

3.1. Update of teaching content

Power electronics technology is a rapidly developing subject, which is closely related to the development of The Times.As a result, the teaching content needs to be adjusted constantly, and the teaching content and training objectives need to be adjusted timely according to the development requirements of the country in related fields.However, in traditional teaching, due to the limitation of syllabus setting, limited class hours and the emphasis of assessment methods, the content update is limited.At the same time, the solution to the long-standing problem of "valuing theory over application" is not ideal.In spite of the continuous local adjustment in this respect, the actual effect is still not ideal, and this problem needs to be further solved in the teaching reform[4].

The development of power electronics and power semiconductor devices in the course content of "Power Electronics Technology" is very rapid. Teachers need to combine the current research hot spots and related technologies of science and technology frontier when preparing the course content.For example, when preparing the teaching content of power electronic devices, new power electronic devices such as SiC and GaN can also be added to the teaching content. With the support of mobile phones and electric vehicles, new power electronic devices will be more and more widely used.Fast charging of mobile phones, wireless charging and

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charging of electric vehicles are the new growth engines.Finally, in the course of teaching, a complete teaching material of power electronic devices is presented to the students.At the same time, the power electronic converter composed of SiC and GaN and its control application technology need research and research papers, teachers download and read the latest published high-level academic papers and use them as teaching reference materials to update and supplement the teaching content[5].

3.2. The difficulty analysis of the course

The teaching method of this course has been improved for many times, from step-by-step infusing education in accordance with the designated textbook, to multimedia integrated teaching, and to the application of flipped classroom, which can enable students to achieve good learning results in some knowledge points with clear theoretical structure and easy to understand, but has little effect in teaching difficult knowledge points.There has been a knowledge point changed a variety of teaching methods, students are difficult to master the dilemma.This has an impact on both students and teachers. In the aspect of students, it leads to the decrease of students' learning interest and subjective motivation.Teachers, produce frustration, reduce the enthusiasm of teaching.In order to make students better accept, we need more effective teaching methods to attract students with more vivid teaching content.For example, teachers can adjust the teaching content appropriately, minimize the long and large theoretical analysis, and give more examples of applications or applications with high relevance to the robot engineering major.Guide students to pay attention to the most cutting-edge technology, stimulate students' enthusiasm for learning.

3.3. Problems of examination mode

The traditional course assessment form is based on the written test results, combined with the experimental results and regular results to determine the final score.This assessment method is relatively reasonable, but with standardized test questions, it is easy to make the learning mode and teaching mode become "exam-oriented". Too flexible, it will make it difficult for students to grasp the direction, greatly increase the amount of memory and difficulty, and make students spend more energy on memorization, which is not conducive to improving the application ability and creativity.Therefore, the development of a new assessment system suitable for the course is one of the ways to reflect the focus of the course, but also enable students to further clarify the learning direction, understand the essence of the course, to achieve the teaching purpose.These are the common problems encountered since the course was launched.In the process of teaching reform, the teachers' team has been committed to trying a variety of excellent teaching models and effective assessment methods to improve the teaching effect, and really help students to apply what they learn and master knowledge flexibly, so as to cultivate talents in line with the needs of the society.

3.4. Reform of experimental teaching model

(1) Retain necessary confirmatory experiments to help students better understand basic concepts.

In the early stage of the power electronics experiment, students are not familiar with the experimental operating platform. They can introduce the experimental platform first, simply let students operate it and get familiar with the experimental equipment. At the same time, they should also emphasize the importance of safe use of electricity and standardized operation in the strong electric experiment.According to the main points of the course syllabus, with the existing laboratory equipment and experimental course characteristics, to determine the types of confirmatory experiments.The principle and wiring of this kind of experiment are not complicated, the key lies in the operation and the corresponding debugging after the completion of wiring, Many students are unable to draw corresponding conclusions and

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parameters.The reason is that the theoretical knowledge is not enough, there is no discovery of problems, after the discovery of the problem can not analyze, let alone solve the problem.Therefore, theory must be connected with practice, and practice is the only criterion for testing truth.

(2) Introduce MATLAB/SIMULINK into experimental teaching to stimulate students' interest in learning.

The experimental teaching of "Power Electronic Technology" course is carried out by relying on the experimental platform, which is basically demonstrative or verification experiments. Students have few opportunities to design, build and debug circuits by hand, which will limit the cultivation of students' hands-on ability and innovative ability, and also greatly weaken the effect of teaching experiments.The MATLAB computer simulation technology is introduced into "electric power

Electronic technology "course experimental teaching, on the basis of the traditional physical experiment, using MATLAB/SIMULINK simulation virtual experiment, students through the establishment of a model, get the experiment corresponding waveform, compare the simulation waveform and experimental waveform, draw the corresponding conclusion, if there is a difference in the waveform, analyze the reason for the difference, A more intuitive understanding of basic power electronic circuits and improve the experimental efficiency.

4. Conclusion

As one of the professional courses of the robot engineering major, the course of power electronics technology plays a connecting role and provides an essential theoretical basis for the study of the core courses of the subsequent major. Combining with its own teaching practice, this paper analyzes various problems encountered in the teaching of power electronics technology in the robot engineering major in detail, and gives corresponding solutions.

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