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Discussion on Item Teaching of Power Switch

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Abstract: ***The switch power supply technology course is the main core course of the electrical engineering specialty. This course comprehensively uses the analog electronic technology, automatic control principle, power electronic technology, electromagnetic field and simulation technology and other course knowledge learned in the early stage to carry out the switch power supply circuit and system design course. It is an important professional practice course of the electrical specialty. This course is very practical, and it is also a course that can comprehensively improve students' practical ability. In the teaching of electronic technology, some of our teachers often neglect the content of switching power supply, which is not in line with the current production and life reality. This paper briefly analyzes the project teaching of power switch.***

Keywords: Power switch; Project teaching; Experimental teaching.

1. INTRODUCTION

Switching power supply and its technology is a professional course for students majoring in electrical engineering and automation. Before learning this course, students must master the relevant contents of the professional basic courses such as circuit basic theory, analog electronic technology, digital electronic technology, automatic control principle, power electronic technology, and learn the relevant knowledge of switching power supply based on these contents. Its main contents include various circuit topologies of switching power supplies and their corresponding working principles, common control modes of switching power supplies, performance indicators, design of magnetic components and design of feedback circuits. The switching power supply has strong application, wide coverage and high difficulty. It is of great significance to study the project teaching of power supply switch.

2. OPERATING PRINCIPLE OF SWITCHING POWER SUPPLY

Switching power supply is to use power semiconductor devices as switching elements (switch tubes). The switching elements are repeatedly switched on and off at a certain time interval. When the switching elements are switched on, the DC power of the rectifier and filter on the input side provides energy to the load through the inverter (switch tubes) and the rectifier and filter circuit on the output side. When the switching elements are disconnected, the energy storage device in the circuit (consisting of inductance, capacitance, etc.) releases the energy stored when the switch is switched on to the load, Make the load obtain continuous and stable energy. According to the DC voltage output by the switching power supply, the error signal reflecting the stability of the output voltage is obtained through sampling, detection, comparison and amplification. It is sent to the control circuit to generate a control signal. After the control signal passes through the drive circuit, the duty cycle of the switching element of the inverter (the ratio of the conduction time to the cycle) is controlled, so that the energy transmitted to the output end is adjusted, that is, the output voltage is adjusted to make it stable.

3. THE NECESSITY OF APPLYING PROJECT TEACHING METHOD

The project teaching method was introduced into the field of education in China at the beginning of the 21st century, mainly applied to vocational education. This teaching method aims at cultivating students' practical skills, and has received better teaching effect compared with traditional teaching. China's vocational college graduates are facing great employment pressure. On the one hand, because of the continuous expansion of enrollment in ordinary colleges and universities, the number of college graduates has increased sharply; On the other hand, because colleges and universities focus on cultivating scientific talents, students lack social ability, practical ability and collaborative ability, and employers are unwilling to accept them. In terms of specialty, the switching power supply industry is very huge, and because its development mainly depends on breakthroughs in semiconductor and other industries, it has been defined as a labor-intensive industry. Most of its production has been transferred to China, and there are many employment opportunities after mastering the power supply technology. In view of this, the author proposes to integrate teaching, experiment with the system and design process used in work and scientific research, and to assist students in extracurricular activities. The management of interest groups ensures that most students learn solid technology, and some have the theoretical basis for further study. Project teaching method is a teaching method derived from constructivism learning theory, which is a teaching activity conducted by teachers and students in the form of implementing a complete project work. The teaching work is guided by the idea of project teaching method, which is divided into three parts: teaching, experiment and extracurricular project group. The two parts of teaching and experiment are implemented for all students to form an organic whole, and four items are formed according to the stages of learning content; The extracurricular project group is an extracurricular group organized by students who have spare power in learning.

4. ORGANIZATION OF CLASSROOM TEACHING CONTENT

Classroom teaching is the focus of teaching and the starting point of other teaching activities. First of all, we should organize the classroom content organically, divide the teaching content into levels according to the needs of mastering, and guide students to learn practical technology in a limited time. The principle of teaching content organization is based on the course orientation, taking into account the foundation and practicality, paying attention to the basic theory and engineering application value, discarding the difficult theory, the minimum/simplest power supply system, completing the most basic functions, and then seeking further teaching. The combination of teaching and experiment mainly ensures that most students do not fall behind.
In the teaching process, it is more important to teach students how to learn than to impart knowledge. Teachers should pay attention to the following issues. First, in the discussion teaching, we should start with asking questions, guide students to think independently, and end with solving problems. Pay attention to putting forward questions based on reality and avoid asking questions for questions. Second, find fun from hands-on practice. "Interest is the best teacher". With interest and fun, you can get twice the result with half the effort. Third, learn to synthesize. Many of the questions about power supply technology can be answered online, but most of the answers are incomplete and require certain screening ability. One of the characteristics of this course is integration, including knowledge integration of multiple courses, and integration of theory and practice. Therefore, we should pay attention to cultivating students' comprehensive ability and problem-solving ability in the course study.

5. DESIGN AND MANAGEMENT OF EXPERIMENTAL TEACHING

The traditional teaching mode, which is based on classroom teaching and supplemented by experiments, is not suitable for this course because it is very practical. If students can't design and make simple power supply after learning this course, it is a failure of teaching. Unlike the general verification experiment, the experimental teaching must be in parallel with the theoretical teaching. For each part of the content in the classroom, there are corresponding experiments to deepen the impression, such as semiconductor diodes and power MOS tubes in the basic device part. Students can find the instructions online by model, find out the typical application circuit in the instructions and the important parameters of the device Values, such as resistance to withstand voltage and current. Learn the identification and detection of components, master the installation and welding skills of perforated components, learn the use methods of multimeter, electronic millivoltmeter and oscilloscope, and extract the experimental waveform that describes the typical characteristics of the device and compare the learned knowledge to form a complete test report.

Through the process from components to circuits, the students not only strengthened the understanding of classroom content, but also personally practiced the whole process of actual product design. In addition to the basic experiment, we designed four comprehensive experiments from the shallow to the deep: (1) The production of W main circuit. The detailed design requirements for the main circuit of the boost circuit are given. Students are required to complete the design of the main circuit, including the selection of switch tubes, output rectifier tubes, and the design of inductance. After two rounds of demonstration and evaluation, the final plan is determined and the production begins. (2) Fabrication of control circuit. The detailed control circuit design requirements for the boost circuit are given. Students are required to complete the design of the control circuit, including the selection of the control chip, the fixed switching frequency pulse generation circuit, the overvoltage and overcurrent protection circuit and the feedback closed-loop circuit. After two rounds of demonstration and evaluation, the final plan is determined and the production begins. (3) Booster circuit fabrication and commissioning. Connect the first two parts of the circuit together for debugging. First, for the closed loop part, observe the waveform of each point through the oscilloscope to see the type of problems currently existing in the system; Change the loop parameters according to the closed-loop debugging method. (4) Manufacture of 40W flyback power supply. The complete design and production of this power supply is relatively heavy, including the contents of the previous three experimental classes, and the transformer design is added. It also needs to be demonstrated and commented before students can start production.

The above experiments are relatively complex, and students can adapt to the actual work if they can master and take up the job. It is required to be able to complete at least the first three under supervision. If it is difficult to complete it, you can repeat the experiment plan of others for one more time, and you must ensure that you pass the test independently.

6. IMPLEMENTATION AND MANAGEMENT OF EXTRACURRICULAR PROJECT TEAM

The source of the project should be combined with the horizontal and vertical projects in hand, including the compilation of textbooks and the design and production of actual products, such as inverters. In order to increase the accumulation of hardware related to your own research, you can also establish a project and make a series of power supplies. The implementation of extracurricular project team is student-centered, and teachers take time to guide. Choose diligence, responsibility and As leaders, motivated students are directly responsible for teachers. The students form three echelons according to their abilities and expertise. The students with lower abilities are responsible for finding components and welding, the students with stronger abilities are responsible for debugging, testing and repairing, and the best ones are responsible for drawing PCB boards and designing. Some of the students are enrolled in the core project group, and some are only to accumulate experience for graduation design and future job hunting. The entry into the project team is mainly based on their ability, diligence and subjective will. Make a time plan for the project and complete it as scheduled. Students' further technical training includes the

application of circuit simulation technology and digital control in power control. In order to achieve the best teaching effect, the project teaching method needs the cooperation of students. The students' salary will give them more motivation to complete the project better, and the students' sense of responsibility will also be stronger. The corresponding hardware conditions of the school are also very important. The laboratory is fully open, and the project team should pay a certain amount of money, so that students' free experiments are not limited by resources and time. The project team needs to form a complete management system, which requires more energy from teachers. The maintenance of the system after completion is also very important.

7. CONCLUSION

Switching power supply is widely used in almost all electronic equipment with the characteristics of small size, light weight and high efficiency. It is an indispensable power supply mode for the rapid development of electronic information industry. With the development and innovation of power electronics technology, switching power supply technology is also constantly innovating. This cost reversal point is increasingly moving towards the low output power end, which provides a broad development space for switching power supply. As a teaching professional of electronic technology, it is necessary to deeply study the teaching content of switching power supply, so that students can truly master this technology and become a comprehensive high-end talent facing society and enterprises.

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