Situation Analysis and Reform Discussion of Analog Electronic Technology Teaching

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Abstract: Analog electronic technology is a basic professional course for engineering students, which is closely related to practice. Due to the abstraction of the physical concept of the course, as well as the boring curriculum, students generally complain about the difficulty in the introduction in learning. In view of this, this paper introduces how to improve the quality of classroom teaching and emphasizes the small projects of experimental teaching. Through simple experimental projects, students can understand the semiconductor devices intuitively and connect the knowledge points in series, which is helpful to guide them to get started and stimulate their interests in learning.

1. Introduction

Analog electronic technology is a basic professional course for engineering students. On the one hand, it lays a foundation for follow-up courses, such as *Digital Electronic Technology* and *High-frequency Electronic Circuits*. On the other hand, it can also solve the problem of application of simple circuits in real life. However, due to the fact that the course has various points of knowledge, the physical concept is more abstract and the engineering features are prominent, which makes the students generally complain about the difficulty in the introduction and in the learning. So, how to improve classroom teaching efficiency and improve the teaching effect of the curriculum has become the hot spot and a problem in the analog electronic teaching in recent years. For this reason, the authors of this paper focus on experimental teaching methods for small projects in the field of practical teaching reform, and receive significant results.

2. Classroom Teaching Reform

At the beginning of teaching, students should have a correct understanding of this course, so students can recognize the importance of this course and the characteristics of the course. For example, it involves many types of circuits, abstract theoretical knowledge, and the idea of using engineering approximation to solve problems. At the same time, the students cannot be made have a fear for hardship or feel scared before learning. So it is important to inspire students' interests in learning, leading them to value it ideologically despite various difficulties.

In view of the fact that there are various knowledge points, conceptual terms and forms of circuits in this course, the introduction of block diagram learning method can help students clarify the context of knowledge, have a clear mind and not be confused in learning, gasp key difficulties and achieve targeted results, for example, multistage amplifier circuit block diagram, the input stage and the middle stage to achieve small signal amplification, the driving stage and the output stage is the power amplifier circuit, which can be seen clearly through a block diagram. In addition, by explaining the block diagram of the single-tube amplification circuit, the block diagram of the feedback amplification circuit, and the composition diagram of the integrated operational amplifier,

it is possible to help students grasp the content of the course from a macroscopic point of view so as to avoid the situation where they are unable to start or feel clueless.

3. Practice Teaching Reform - Introducing Small Projects Experimental Teaching

In the analog electronic technology courses, related experimental courses were also set up. However, most of these experiments were done using laboratory boxes or using simulation software Multisim, which means that students did not really touch the components during the experiment, such as diodes, triodes, they just saw the circuit symbols in the textbook. After the experiment, the students were still unfamiliar with the triodes. Some students had not even seen the actual triodes. Even if they did the experiment, they still did not have an intuitive understanding of the semiconductor devices, which made the analog electronics learning like the castle in the air. In view of this, while the students are learning theoretical lessons, some small experiments can be introduced to guide students to do a few small practical circuits. On the one hand, students' interest in learning can be stimulated to acquire a sense of accomplishment. On the other hand, students can improve their comprehensive practical ability, innovation ability and circuit design ability. In fact, it is significant to guide the students to carry out the circuit analysis, as shown in Figure 1.

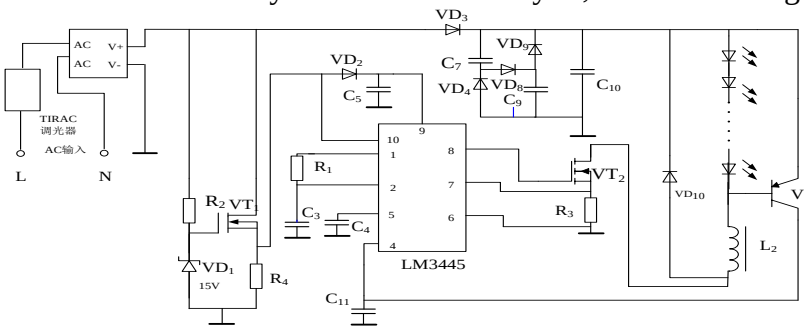

Fig. 1 TRIAC dimming off-line LED driver circuit composed of LM3445

The LED driver circuit mainly includes five parts, namely a TRIAC dimmer, a bridge rectifier BR1, a rectifier circuit and a dimming decoder circuit, a passive power factor correction circuit, and a buck DC/DC converter circuit. The system is based on the LM3445. The TRIAC dimmer is connected to the input of the AC line. Through the dimmer circuit of the LM3445, the current of the LED string can be controlled to achieve brightness control. The TRIAC dimming decoding circuit consists of three parts: a rectifying circuit, a TRIAC conduction angle detecting circuit, and a dimming decoder circuit. (1) Line voltage detection. (2) Angle detection and dimming decoder. Capacitors C7, C9 and diodes VD4, VD8, VD9 form part of the filter valley-filled passive (passive) PFC circuit. Substituting a traditional large-capacity filter capacitor can improve the line power factor. Capacitors C10 (10nF), C7, and C9 can attenuate voltage ripple. The passive PFC circuit outputs the voltage Vbuck as the DC bus voltage of the buck converter. Without TRIAC dimmer access, when the AC line voltage is higher than 1/2 of its peak, VD3 and VD8 would turn on, VD4 and VD9 would turn off, capacitors C7 and C9 are charged in series, and current flows in load. When the AC line is lower than 1/2 of its peak, VD3 and VD8 are reverse biased, while VD4 and VD9 are forward biased, C7 and C9 are discharged in parallel, and the current flows into the load. Controller LM3445, Power MOSFET (VT2), Inductor L2, Diode VD10, Resistor R3 and other off-type DC/DC buck converters are used to drive LED strings. When the PWM signal VT2 on the GATE pin of the LM3445 turns on, the current through the I2 and LED string increases linearly and is detected by R3. When the voltage on R3 is equal to the reference voltage of pin FLTR2, VT2 turns off, L2 releases energy storage, VD10 turns on, and the current passes through the LED string and linearly decreases from its peak value. By learning circuits in this way, students will achieve good results.

4. Assessment method reform

In order to fully assess the students' theoretical knowledge and practical ability during the semester, the credit record system is adopted. The end-of-term assessment methods are divided into volume one and volume two. Volume one has objective questions with a score of 100. It mainly examines the students' mastery of the basic knowledge of this course, students can get credit by passing the exam. Volume 2 has subjective questions with a score of 100. It mainly examines students' comprehensive knowledge of the course, and their performance accounts for 60% of the comprehensive score. The small projects of experiment give the students practical scores by testing the actual hands-on operation of the them, which accounts for 25% of the comprehensive performance. The usual homework conditions, class assignments, and unit tests account for 15% of the overall grade. Students can obtain corresponding achievement by passing the comprehensive score. Practice has proved that the credit record system is suitable for teaching under the cultivation of applied talents.

5. Conclusion

Analog electronic technology course is practical, students can have an intuitive understanding of diodes and triodes through the small projects of experimental teaching mentioned above. Through the application of these two semiconductor devices, students can be guided to get started and their interests in learning can be stimulated. Therefore, students can get a sense of accomplishment, have fun in analog electronic, and dedicate to studying.

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