



Research on the Practical Application of Virtual Simulation Task Driven Mode in Electronic Technology Course

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Abstract. In view of the problems existing in the current teaching of electronic technology courses, the virtual simulation task driven teaching mode is constructed with the demand as the traction and the students as the center. The mode is applied to the teaching of electronic technology courses, and the specific teaching process and teaching cases are given. Through the instructional design of virtual experiment activities, more opportunities to explore and design experiments are provided to students, so that to broad their knowledge horizons, cultivate their creativity, and comprehensively improve the quality of talent training.

Keywords: Virtual Simulation · Technology Electronic Technology Course · Multisim · DC Regulated Power Supply

1 Introduction

Virtual simulation was first proposed by Professor William Wolf of Virginia University in 1989 [1]. It is a virtual environment with computer technology as the core, assisted by sensor technology, multimedia technology, simulation technology, human-computer interface technology, display technology, image processing and pattern recognition and other technologies. Its core is modeling and simulation. Virtual simulation is a technology for interaction between users and computers and their complex data [2].

Electronic technology courses are important professional basic courses for electronic engineering and information communication majors, mainly provide necessary electronic technology knowledge and basic skills for subsequent professional courses, and play an important role in the talent training system. At present, this kind of courses adopts the traditional teaching mode; the teacher fills the classroom with theories, weakens theoretical deduction, and lets students remember conclusions.

The experimental teacher demonstrates and imitates, usually by inserting circuits in the experimental box and the combined experimental platform, and cooperating with commonly used electronic instruments such as digital multimeter, oscilloscope, spectrometer, etc., to measure the circuit parameters [3–6]. Most of the experiments are confirmatory experiments, and the proportion of design and comprehensive experiments is

small. In the whole knowledge cognition process, students have been passively accepting and memorizing the knowledge. Students rely too much on the experimental instructions in the experiment process, resulting in students "knowing the nature, not knowing the reason" and lack of active learning awareness. Even if they have independent opinions, but they are limited by the opening hours of the laboratory, inadequate instruments and equipment, lack of advanced experimental instruments, etc., make it impossible to carry out experimental verification and design, and students' creativity and enthusiasm could not be effectively stimulated, which also leads to students' ability to analyze and solve problems could not be well improved, making personnel training always stay at a lower level.

2 Teaching Mode of Electronic Technology Courses Driven by Virtual Simulation Task

The virtual simulation task driven teaching mode was based on constructivist learning theory, situational learning theory, and cognitive discovery learning theory and learning by doing teaching theory [10]. After two years of exploration, practice and improvement, according to the training objectives and teaching requirements, in the two dimensions of time (before class, during class and after class) and role (teachers and students), the virtual simulation teaching mode is combined with the task driven teaching mode to build a virtual simulation task driven teaching mode for electronic technology courses. This mode can be summarized as follows: taking tasks as the main line, teachers as the leading role, and students as the main body, by means of virtual simulation technology and physical experiment. In the teaching process, the teaching activities are supposed to be composed of four modules: design task - analysis task - completion task - teaching evaluation. The specific process is shown in Fig. 1

3 Teaching Practice of Electronic Technology Courses Driven by Virtual Simulation Task

Taking the teaching of DC stabilized voltage power supply in electronic technology and application as an example, this paper analyzes the teaching process of "virtual simulation task driven". According to the task requirements, students design the experimental circuit diagram with this function, select and configure component parameters, determine and write the experimental steps, build the experimental circuit with virtual instruments and components, and adjust the settings of virtual instruments and meters. According to the requirements of the indicators, the real experiment process is simulated, and the data are recorded. Finally, the results of the circuit simulation are analyzed.

According to the implementation design scheme, the students used Multism to design and simulate the circuit, which deepened their understanding of the function of DC stabilized voltage power supply. The details are as follows.

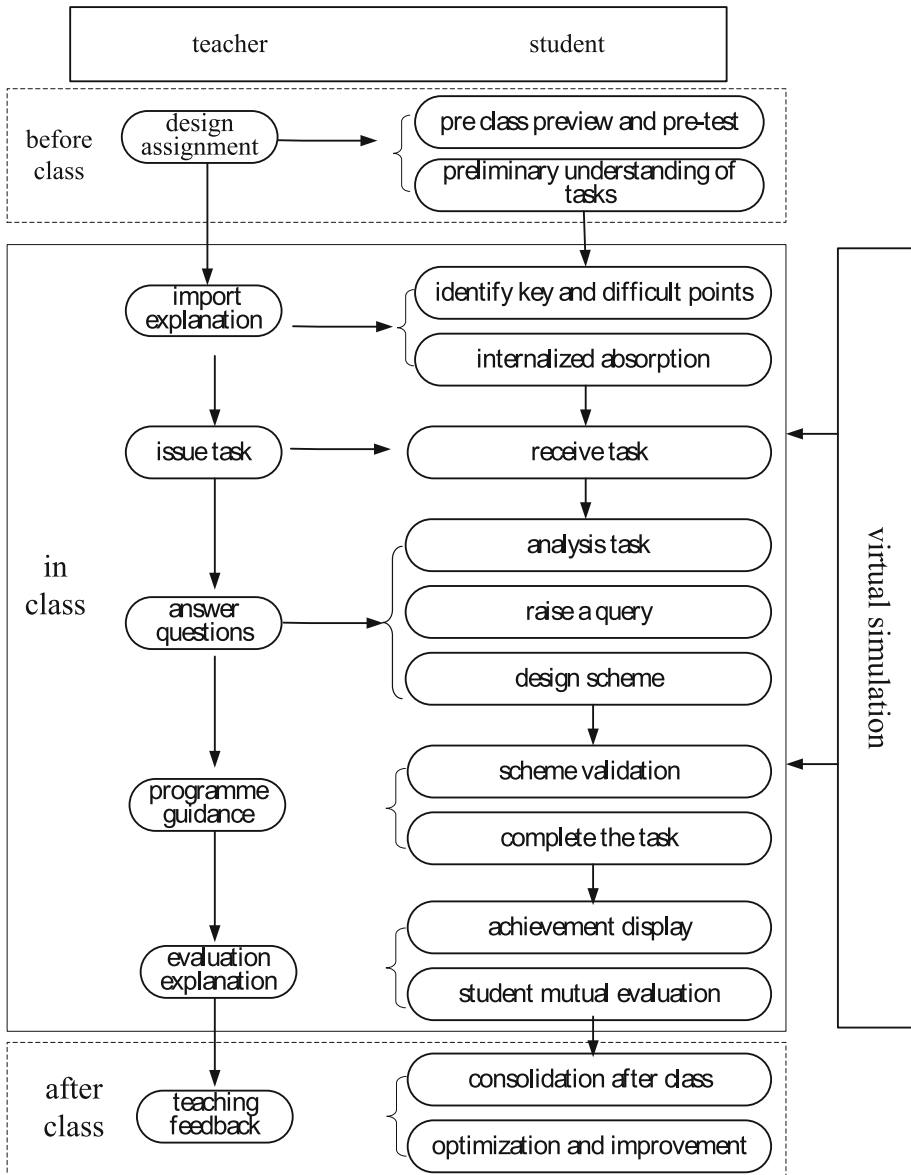


Fig. 1. Virtual simulation task driven teaching mode (owner-draw)

3.1 Transformer Circuit

The power transformer is generally a step-down transformer, which can reduce the 220V mains voltage to the required voltage value. In addition, it can also isolate the mains power to ensure the safety of electricity use. The analog simulation trans-former circuit is

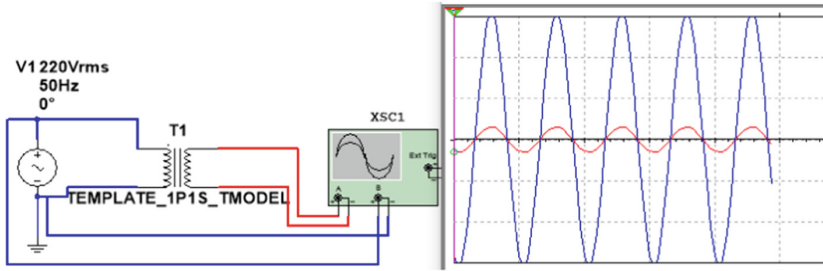


Fig. 2. Transformer circuit (owner-draw)

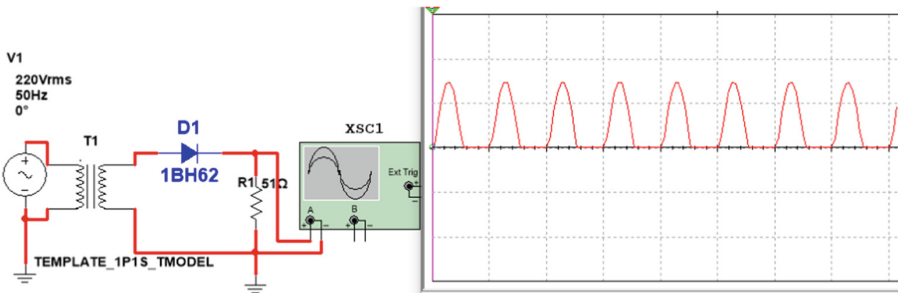


Fig. 3. Half wave rectifier circuit (owner-draw)

shown in Fig. 2. Changing the original and secondary side turns ratio of the transformer will change the output voltage.

3.2 Rectifier Circuit

The rectifier circuit is divided into wave rectifier and full wave rectifier. The current flow direction is always from top to bottom within one cycle of the input signal, and the waveform of the rectifier output is unidirectional pulse waveform. In the process of half wave rectification, it can be seen that the circuit structure is simple and few components are used, but it is only conducted within half a cycle of the power supply, the utilization rate of the power supply is low, the DC voltage component of the output is relatively low, and the pulse of the output waveform is large, as shown in Fig. 3.

The full wave rectifier circuit uses more diodes, but the output DC voltage is large, the ripple voltage is small, the maximum reverse voltage that the transistor bears is low, the power transformer is fully utilized, and the efficiency is improved. As shown in Fig. 4.

3.3 Filter Circuit

Although the direction of the pulsating voltage obtained through the rectifier circuit is unchanged, there is still a large fluctuation. The function of the filter circuit is to filter the AC component of the pulsating voltage, so that the output DC voltage becomes

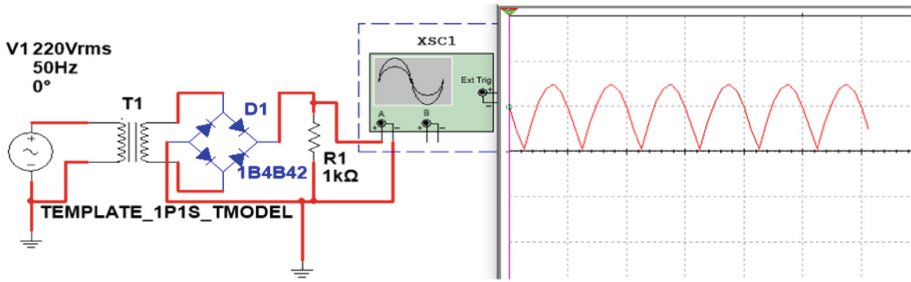


Fig. 4. Full wave rectifier circuit (owner-draw)

smooth. The filter circuit consists of capacitors. It can be seen from the figure that the filtered output voltage is much smoother than the rectified output voltage, and the pulsation component is much reduced. That is, after capacitor filtering, the average value of output voltage increases. As shown in Fig. 5 and Fig. 6.

From the comparison of the above two figures, it can be seen that the larger the capacitance is, the slower the discharge time is, the smoother the curve is, the smaller the pulsation is, and the better the filtering effect is.

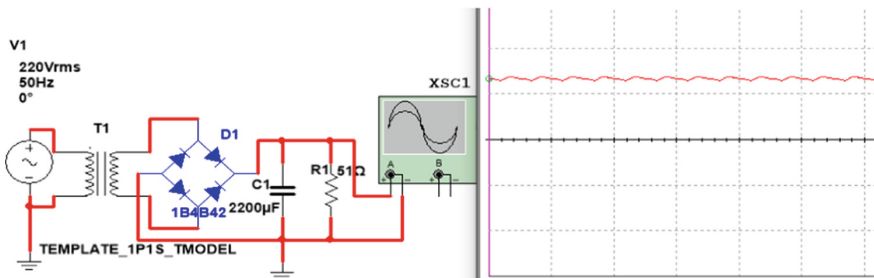


Fig. 5. C = 2200µF filter circuit (owner-draw)

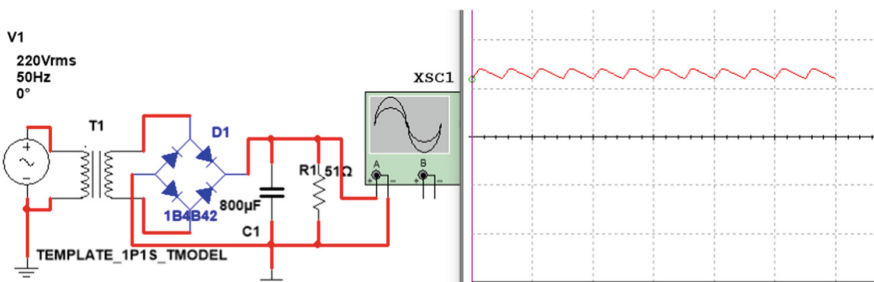


Fig. 6. C = 800µF filter circuit (owner-draw)

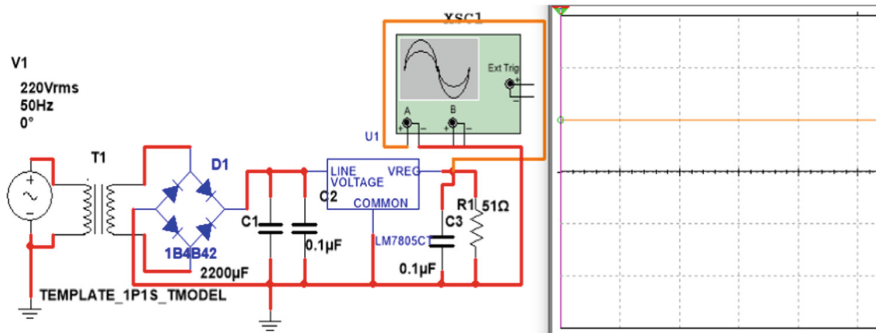


Fig. 7. Voltage stabilizing circuit (owner-draw)

3.4 Voltage Stabilizing Circuit

Using the three terminal fixed output voltage integrated regulator LM7805, we can see that the output voltage of the regulator is 5V. As shown in the figure, change the AC voltage value to increase the input voltage of LM7805. Check the value of the output voltage and the voltage stabilizing characteristics of the regulator. As shown in Fig. 7.

Through the simulation project of DC stabilized voltage power supply, students have effectively improved the utilization of time. By studying and realizing the transmission, conversion, processing and application of current in a limited time, students can not only solve the problems of real experiments, but also set and change experimental parameters by themselves, such as changing the rectification mode, the size of filter capacitor, etc. Previously, students could only measure and obtain experimental results in the laboratory for many times, now students can use the simulation schematic diagram, simulation waveform and simulation data to directly reflect before the experiment.

4 Conclusion

The application of virtual simulation technology has greatly improved the teaching conditions of electronic experimental courses, broadened the models and methods of theoretical and experimental teaching, solved the problems in traditional teaching, broken through the limitations of teaching content, and improved students' understanding and application of electronic course knowledge. In different links such as teaching and learning, learning and using, teachers can analyze the characteristics of various circuits in simple terms, as well as the impact of parameter changes on the circuit, and use the most intuitive output waveform to explain, which is more convincing. The difficulties and key points in the course teaching are simulated dynamically in real time, so that the theory can be applied to practice intuitively and vividly. The students' interest in learning is effectively stimulated, their practical ability is greatly improved, and the teaching effect is greatly improved. It is an inevitable trend of teaching development to integrate virtual simulation technology into electronic technology courses, which is conducive to training high-quality professional application-oriented talents.

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