

The Application and Discussion of Virtual Simulation Technology in Basic Electricity Courses

Zi Li, Yuling Chen

Shenyang Institute of Technology, Fushun 113122, China

Abstract

Virtual simulation technology is a novel technology in the development of electrical related professions. Virtual simulation technology enables the simulation of real life and allows people to experience a more realistic effect through the situations and scenarios created. As a technical course in higher education, the basic electricity course provides a guarantee for the employment as well as the development of students. Teachers should raise awareness of virtual simulation technology and use it proficiently in the process of student learning, so that theoretical knowledge can be applied in practice and students' understanding of theoretical knowledge can be improved.

Keywords

Virtual Simulation Technology; Basic Electricity Course; Application.

1. Overview of Virtual Simulation Technology and the Current State of Application of Virtual Simulation Technology

Virtual simulation technology is often called simulation technology, and is mainly based on the actual situation to build experimental models, with the assistance of simulation type software, to simulate the environment of the circuit and the actual condition of the circuit operation, so as to be able to visualise the circuit environment. In the process of teaching in higher education institutions, teachers often use virtual simulation to build models in order to ensure that students can truly understand the theoretical knowledge, due to the complexity of the content of some basic electrical courses and the limited teaching conditions. At this stage, virtual simulation technology has begun to be widely used in a variety of different fields, playing an increasingly important role.

Shenyang Institute of Technology, School of Information and Control of the electrical classes mainly include circuits, analog electronics and digital electronics, the practical nature of the course are relatively strong, most of the traditional experiments are for students to build a certain model through the experimental equipment, but sometimes due to student design errors lead to the damage of the integrated chip in the experimental operating platform. Virtual simulation technology is mainly through the computer software, combined with the actual situation of the circuit to create the corresponding experimental scenarios and experimental equipment, the abstract and complex experimental principles continue to simplify, so that students intuitive observation and analysis. At the same time, teachers and students can adjust the experimental data according to the actual situation during the operation of the model, thus improving the realism of the model. It can be said that virtual simulation technology has greatly improved the effectiveness of teaching and research. In the teaching of basic electrical classes, teachers commonly use virtual simulation software such as Multisim, Proteus, Matlab, EWB and labVIEW. Multisim software can help the experimenter to reasonably debug the experimental data and give feedback on the problems in the experimental line, so as to achieve continuous improvement of the model. The software is simple to use and can be operated by the students themselves, and the EWB simulation software has a high degree of simulation effect, imitating

the operation of the circuit. The software is also compatible and can be used by teachers in the teaching process.

2. Strategies for the Application of Virtual Simulation Technology in the Teaching of Technology in Basic Electrical Classes

2.1. Virtual Technology is Introduced into the Classroom to Stimulate Students' Interest in Learning

The actual content of the electrical fundamentals course is abstract and difficult for students in higher education to learn. Most of the theoretical knowledge involved in the course is interlinked, and the complexity of the knowledge is relatively high, making it difficult for students to learn and remember. In the traditional teaching process, teachers follow the logic of the textbook knowledge and explain it in a rigid manner, which makes it difficult for students to understand the content and does not achieve the expected learning effect. The introduction of virtual machine simulation technology can help teachers to establish real models, and through the demonstration of the model, students can truly experience the string of knowledge and can remember the knowledge points faster. The virtual simulation model stimulates students' interest in learning, increases the activity of the classroom and effectively improves students' learning efficiency.

2.2. Build a Virtual Experiment Platform to Improve Students' Learning Efficiency

The practical nature of the electrical foundation course is strong. In the process of learning, students must constantly memorise knowledge points and apply them to practical work, and put theoretical knowledge into practice in order to ensure the efficiency of learning. In the past, students only listened to the theoretical knowledge explained by teachers and did not understand it thoroughly enough, so they could not apply it in practice. In addition, many institutions of higher education have limited economic conditions and do not have sufficient funds to purchase experimental equipment and equipment, which leads to poor hands-on skills. At the same time, there are more problems with electrocution due to the low safety awareness of students during the experiment. The emergence of virtual simulation technology has effectively solved these problems. Teachers can build virtual experimental platforms and guide students to connect circuits through simulation software, which can not only eliminate electricity safety hazards but also improve students' learning efficiency.

Teachers in higher education institutions should build virtual experimental platforms according to the actual situation of students and the arrangement of basic electrical courses, so as to provide students with more opportunities for practice. Through personal experiments, students can truly understand the theoretical knowledge and effectively improve their learning efficiency. For example, when studying three types of amplification circuits, teachers can help students differentiate between them by showing them three types of amplification circuits and pointing out the similarities and differences between them through the virtual technology platform.

2.3. Application of Matlab Simulation Software in Teaching Basic Electrical Classes

Matlab simulation software is one of the most popular software programs used by higher education teachers to improve the teaching effectiveness of basic electrical courses.

In general, teachers can make use of two forms of simulation with Matlab simulation software in a comprehensive design context. Firstly, the Simulink simulation platform can be used to simulate the test images. This simulation platform can effectively simulate the integrated

environment, has a good practical performance and is relatively inexpensive to use, which can reduce the teaching pressure of higher education institutions. Secondly, the simulation mode of writing code files. This mode is relatively little used in the teaching of basic electricity courses. The first simulation mode is more often used in the teaching of basic electricity courses in higher education institutions, which can help students improve their learning efficiency. In the process of teaching, teachers choose to use two different modes of teaching in combination with the actual arrangement of the course, so as to ensure that the simulation effect is more intuitive. Matlab simulation software can be used to simplify complex situations, for example, when teachers explain waveforms, by building models that allow students to understand them intuitively. For example, when explaining waveforms, the teacher can model the waveforms to give students an intuitive understanding of the waveforms.

2.4. Application of EWB Simulation Software in Teaching Basic Electrical Classes

The EWB simulation software is used in practice to simplify circuits by means of graphics. The simulation software makes it possible to connect components and instruments in an efficient way, thus making complex circuits simpler and enabling the testing of circuit components and the connection of instruments. The EWB simulation software has a fault setting function, which allows students to set up open, short or broken circuits in the model according to the actual situation, thus allowing them to observe the operation of the circuit intuitively and to understand how the circuit operates in the presence of a fault. The EWB simulation software enables the analysis of the circuit function and provides students with a comprehensive understanding of the circuit's function for the actual situation of the simulated circuit. The simulation software can point out the wrong operation of the experimenter and make adjustments to the problems in the circuit, which can provide certain tips and help for teachers and students. Among the circuit analysis functions, the EWB software includes common circuit analysis methods such as transient and steady-state, noise and distortion, in addition to time and frequency domains, and the poles and zeros of the circuit, which can be used to assist the experimental operator. The use of virtual simulation software can be used as an aid to the experimental teaching process for students to solve the pre-experimental verification work, it reduces a lot of experimental costs and experimental losses. EWB software can be used for most experimental operations in the teaching of basic electrical classes, such as the verification of the superposition theorem and the polyharmonic oscillator composed of 555 timers, etc. In the process of using EWB software, we can learn about the simulation function of using its analogue and digital circuits, and also be able to store test point data in a timely manner. the use of EWB software can make complex electronic principles Simplifying and thus explaining them in a simulated page helps students to master the course.

2.5. Application of Multisim Simulation Software in Teaching Basic Electrical Classes

The Multisim simulation software is used to show the user the simulation components and the interface in a graphical way and to show the desired results of the original circuit in a simpler way. In addition to its use in normal experimental courses, in normal theory courses, in order to achieve a better integration of the practical aspects of the course, lecturers also use Multisim simulation software to show students some course-related teaching examples in the course of theory teaching. For example, in the digital electronics course, in order to better show students the application of the 555 timer, Multisim simulation software can be used to build an intermittent alarm circuit for students to visually demonstrate the application of the 555 timer in the form of graphics and sound, as shown in Figure 1.

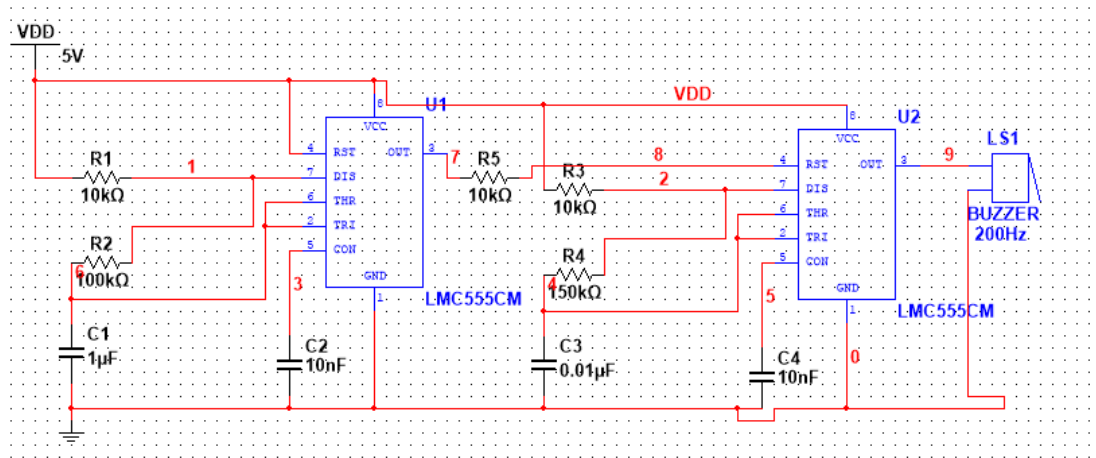


Fig 1. Intermittent Alarm Circuit with 555 Timer

3. Summary

All in all, virtual simulation software has a good teaching effect in the process of teaching basic electrical classes. The application of this technology can concretise complex theories and present the course content in a more vivid way. At the same time, the flexibility of the application of virtual simulation technology is relatively high, which can effectively improve the teaching effect.

References

- [1] Ma Jian, He Yuan, Li Xin. Research on online teaching system of university experiments based on virtual simulation technology [J]. Modern Electronic Technology. Vol. 45 (2022) No. 11, p. 125-130.
- [2] Nie YT, Wang P. Research on the application of virtual reality technology in online practical teaching of vocational education [J]. Agricultural Machinery Use and Maintenance. Vol. 05 (2022) No. 05, p. 148-150.
- [3] Zhang Xiangqun, Ning Huina, Qin Huiling. Application and practice of virtual simulation technology in the course of "circuit and electronics" in the context of new engineering [J]. Science and Technology. Vol. 10 (2022) No. 10, p. 128-130.
- [4] Hu Mengying, Duan Jiandong, Yuan Yao. Application and reflection of virtual simulation technology in the experimental teaching of electrical class [J]. China Education Informatization, 2022, 28 (03): 113-118. Vol. 28 (2022) No. 03, p. 113-118.