Development and Analysis of Electronic and Electrical Experiment Simulation Technology

Liuning Zhu, Chuanwu Liu*
Maanshan Technical College, Maanshan, Anhui, China 243000
*Corresponding author e-mail: Liu2364287@sina.com

Abstract. The development of electronic and electrical technology is based on the tedious experiment of electronic and electrical engineering, which is operated by electronic working platform. EWB (electronic workbench) is a kind of electronic circuit simulation software developed by Canadian interactive image technology company in 1988. The software design function is perfect, the operation interface is friendly, the image is very easy to master. The software core of EWB is Spice3f5, which enhances its simulation ability in digital and analog mixed signals. The development of EWB not only solves the problem of time-consuming, laborious and expensive in electronic circuit design, but also brings great convenience and benefits to electronic product designers. They can use computer-aided design to carry out circuit simulation, which can effectively save development time and cost. Only through continuous experiments can we verify the reliability of the circuit and improve the circuit design, but in the specific experimental operation, some factors often lead to the failure of the experiment, which not only increases the cost of the electronic and electrical experiment, but also destroys the original equipment, and also has certain risks. Therefore, to solve this problem, the simulation technology has been widely used in the electronic and electrical experiment. Moreover, the convenient operation mode of EWB, the intuitive circuit diagram and the display form of simulation analysis results are also very suitable for the auxiliary teaching of electronic course, which is conducive to improving students' understanding and mastery of theoretical knowledge and cultivating students' innovation ability. Therefore, many universities in the world have brought EWB into the teaching of electronic courses. This paper mainly describes the application value and specific application mode of simulation technology in electronic and electrical experiment, in order to further expand the application scope of simulation technology in electronic and electrical experiment. The component library of EWB provides thousands of circuit components, including passive components and active components, analog components and digital components, discrete components and integrated components, as well as new or expanded existing component libraries. EWB also provides a complete set of virtual instruments, such as oscilloscope, signal generator, multimeter, baud chart instrument, spectrum analyzer and logic analyzer. Using these components and instruments to simulate electronic circuits is just like doing experiments in a laboratory. It is very real. Moreover, it is not necessary to worry about damaging the instruments and components, or to be at a loss for outdated instruments and insufficient measurement accuracy. This paper first analyzes the advantages of simulation technology in the application of electronic and electrical experiment teaching, and then analyzes the experimental means and application practice of simulation technology in detail[1].
1. Basic concepts of simulation technology applied in electronic and electrical experiment

Experiments play an important role in the development of the electronic and electrical industry, but in the traditional experimental platform, due to the level of operators, the limitations of experimental equipment, many experiments cannot be successfully completed. Simulation technology was born in Canada and has been widely used in the early 20th century. To build a simulation platform in the computer only needs about 10m of internal storage space. This kind of virtual electronic laboratory has the advantages of small space and high production efficiency. Compared with other products, the user interface is highly concise and intuitive. In actual operation, the staff only need to occupy 10 meters of internal storage space. It is necessary to input the original picture information into the system of simulation technology, and then the goal of all-round simulation circuit parameters can be easily realized. In the electronic and electrical experiment, the simulation technology is used to simulate the real experimental environment. Relying on the network technology, the experiment process is presented on the network platform. The virtual electronic laboratory (EWB) integrates a wealth of components. The components and instruments needed in the experiment can be found on the EWB, and the design interface is relatively simple. The experimenter only needs to input the relevant instruction information to complete the circuit diagram simulation. On the one hand, the experimenters can directly see the whole experimental process, and check the designed circuit according to the experimental results, and optimize the circuit design. On the other hand, the application of simulation technology will move the real experiment to the network platform, which not only increases the safety of the experiment, but also saves the experimental materials. In addition, in the electrical and electronic experiment of construction machinery, the relevant staff can also connect the electronic measurement equipment such as ammeter, multimeter, oscilloscope, spectrum analyzer, function generator into the simulation technology, as to obtain more real and accurate experimental data. The application of simulation technology in electronic and electrical experiment teaching can not only effectively reduce the risk of experiment, but also play an important role in reducing the teaching cost, improving the efficiency of the experiment and completing the experiment that cannot be completed in the actual experiment. At the same time, thanks to the four sets of scanning analysis tools, 14 kinds of analysis tools and more than 80000 component models carried in the simulation technology, the technology can effectively solve the problems of complex equipment and low efficiency in traditional engineering machinery electronic and electrical experiments.

| Vp          | Vn                      | Vo          |
|-------------|-------------------------|-------------|
| Rise        | Grounded or stable level| Rise        |
| Decline     | Grounded or stable level| Decline     |

2. Application value of simulation technology in electronic and electrical experiment

It can reduce the cost of electronic and electrical experiments. In the traditional electronic and electrical experiments, the experimenters buy all kinds of experimental equipment and materials produced by manufacturers to build experimental modules. It provides a strong guarantee for the safety of construction machinery electronic and electrical experiment. With the help of simulation technology, the electronic and electrical experiment of construction machinery can be simulated comprehensively and truly in the computer. Through the data collection and analysis in the simulation experiment, the results of the electronic and electrical experiment of construction machinery can be presented accurately and intuitively. First of all, the consumption of these experimental equipment and materials is a huge expense; secondly, the integrity of the experimental circuit built by multiple modules has certain limitations, which may lead to inaccurate experimental results; finally, the use function of these experimental equipment is relatively single, and the chance of reuse is small, which will lead to the waste of a large number of components. After the application of simulation technology, the experimental personnel save the cost of purchasing experimental equipment and materials, and directly complete the experimental circuit design in EWB according to the instructions of the
components provided in the software. In this way, the designed circuit will be more consistent with the actual circuit, and the repeated debugging process of module construction is omitted, and the cost of electronic and electrical experiment is reduced. Improve the safety of electronic and electrical experiment. In addition, because the simulation technology is to put the traditional construction machinery electronic and electrical experiments in the virtual environment, so in the simulation environment, the staff, experimental equipment and experimental data will not be disturbed by the external environment, which makes the feasibility of the mechanical electronic and electrical experiment greatly increased, and the experimental efficiency improved rapidly. In the electronic and electrical experiments, it is necessary to carry out the electrified experiment. The high-strength voltage and current have certain danger. If the circuit design is wrong or the operation is wrong, the experimenter may have the risk of electric shock. In addition, in the logic circuit experiment, if the experimenter put the chip in the wrong position, it may lead to the temperature rise of the chip and cause a fire. Therefore, it can be said that the traditional electronic and electrical experiments are dangerous, especially for the new people who have just started to do experiments. The application of simulation technology can make the experimenters complete the experiment operation on EWB, which can not only effectively avoid the danger of traditional experiment, but also give the experimenters some opportunities to try and error on the simulation platform, so that they can realize the significance of the experiment. In the actual operation of the simulation of the construction machinery electronic and electrical experiment, the staff can convert the original conceptualized and non concrete things into intuitive and vivid images, so as to deepen the image of the staff in the experiment, and bring great convenience for the follow-up experiment of the construction machinery electronic and electrical engineering. In the actual electronic and electrical experiment, in order to ensure the accuracy of the experiment, it is necessary to buy a large number of components and instruments. However, the quantity and specifications of the components and instruments that can be provided in the laboratory are limited, that is to say, there are some components or equipment that are not available and need to be replaced to complete the experiment, which will lead to the experimental results not being satisfactory It's accurate enough. In addition, many of the circuits are built manually by the experimenters, so it is difficult to ensure that there is no error as long as it is manually operated, which will also lead to the distortion of experimental data. With the use of simulation technology, the experimenters can choose the components or instruments they want in the software to construct the experimental circuit. Some experiments, which cannot be completed in reality, can be completed in the virtual laboratory. At the same time, the simulation of construction machinery electronic and electrical experiments in the computer can greatly reduce the working state of the staff in contact with strong current, and put an end to the risk operation such as solder, component installation, electrical measurement, and finally effectively reduce the risk coefficient in the construction machinery electronic and electrical experiment[3].

![Operational Amplifier Circuit Icon](image)

Figure 1. Operational Amplifier Circuit Icon.

3. **Application of simulation technology in practice**

In EWB to complete the experimental circuit design, we need to analyze the experimental data and design the relevant parameters in advance, so that when using the simulation software to design the circuit, we can input the parameters directly. In the simulation experiment of electronic and electrical
experiment, a lot of data need to be input, such as voltage, current and the value of instrument panel. These parameters not only need to consider the reliability of the experiment, but also need to consider the convenience of human-computer interaction, so the analysis of circuit experiment data is very important. In higher vocational colleges, simulation technology has been widely used and popularized in electronic and electrical experiment teaching. Because students have a high enthusiasm for this new technology, coupled with the high degree of similarity of analog components and equipment itself, it is very convenient for students to observe and learn directly. The first is to do the theoretical analysis of experimental data, according to the parameters designed in advance, combined with the characteristics of simulation technology to analyze the feasibility of the circuit; the second is to optimize these data, the parameters designed in advance are not necessarily the best, so it is necessary to optimize through communication, so that all components can be kept in a certain stable state. In addition, most schools are equipped with multi-media classrooms and other teaching facilities, so the introduction of simulation technology in the experimental teaching of electronic and electrical engineering in higher vocational colleges is more practical. It is inevitable that there are some differences between the real circuit information and the analog circuit information, but we need to find out the reasons for these differences, so as to adjust and optimize, and ensure the accuracy of the experimental results. We can use simulation technology to try many times. For example, in the power amplification, the choice of each static point is very important. In order to ensure the rationality of the static point, we must use the amplifier to let the experimenter see the image of each node. In this way, it is convenient for the experimenter to compare the difference between the real experiment and the virtual experiment, and find the improvement direction, so as to enhance the accuracy of the virtual experiment. EWB can analyze the power performance and simulation. The experimenter can use spice program in the component library to build a circuit diagram. After pressing the power switch, the detected data information in the circuit can be seen on the oscilloscope[4]. If there is a big difference between the detected data and the predicted information, the experimenter can change the input data to detect again, so as to get an ideal result. In the process of practice, teachers can directly demonstrate and explain to students in the form of multimedia. By means of man-machine dialogue, each student can really participate in the simulation experiment, operate by themselves, install components and set parameters by themselves in the whole process. In fact, in the simulation experiment, what the computer creates is not a circuit, but an expression. By changing the value in the expression, different experimental results can be obtained, which makes it easier for the experimenter to adjust the circuit. In addition, through the power performance and simulation analysis, the experimental personnel can have a more accurate understanding of their own circuit and experimental results. If the experimental results are not ideal, the experimenters can make improvements according to the simulation results. If the experimental results are ideal, it can also give the experimenters more research motivation and make them have more sense of achievement.

4. Deficiencies in computer application technology
In the current electronic and electrical industry, the electronic and electrical experiment is an indispensable research measure. The simulation technology is applied in the electronic electrical experiment, which creates conditions for the further development of the electronic electrical experiment, and effectively makes up for the shortcomings of the traditional electronic and electrical experiment. The construction of electronic and electrical experiment platform based on simulation technology can effectively improve the experimental efficiency, avoid the occurrence of security risks, and cultivate the innovation ability of experimental personnel. Therefore, the simulation technology provides technical support for the electronic and electrical industry to move forward[5].

5. Conclusion
Simulation technology in the application of electronic and electrical experiments has obvious advantages, it can not only effectively reduce the cost of electronic and electrical experiments, improve the safety of electronic and electrical experiments, but also can ensure the accuracy of
experimental results, make up for the shortcomings of traditional electronic and electrical experiments. Simulation technology provides a wide operating space for electronic and electrical experiment teaching, and can provide students with more opportunities to play imagination and choose different experimental ideas. But this technology as a new technology, its application and promotion still need a certain time, experiment, personnel must master the necessary computer application technology to be able to skillfully apply this technology, for the development of electronic and electrical industry into new vitality It is helpful for students' comprehensive analysis, development and design as well as the overall improvement of innovation ability, so it can be widely applied.

Acknowledgment
Support Plan for Outstanding Young Talents in University of Anhui fund. Serial number: gxyq2017245

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