

EXPLORATION OF THE TEACHING METHOD OF THE COURSE "CIRCUIT ANALYSIS AND ANALOG CIRCUITS"

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Abstract

The "Circuit Analysis and Analog Circuits" is an important course for electronics majors. The content of the course is the foundation of many senior courses and has a wide range of applications. The theoretical knowledge is usually taught in the classroom, but simulation and practice are completed in the experimental course. This paper attempts to propose some improvement methods which can effectively combine theory with practice, and at the same time, it is more beneficial to the cultivation of students' engineering practice ability.

Keywords: Analog Circuit, curriculum design, simulation, engineering skills.

1. Introduction

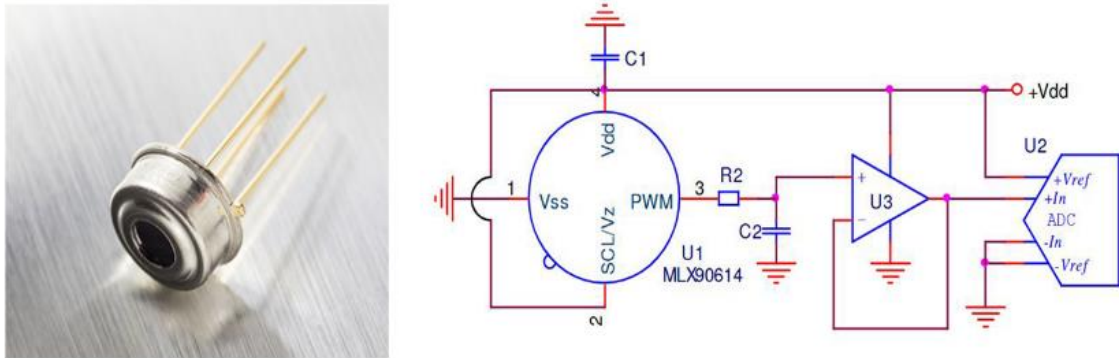
The "Circuit Analysis and Analog Circuits" course for undergraduates is usually difficult to obtain a better teaching effect due to its difficulty, wide range of knowledge, and strong practicality. In the traditional teaching method of this course, the theory teaching is usually carried out first, then the simulation is completed through homework, finally carries out the verification experiment of the circuit function module in another experiment course. This has brought certain difficulties for students to master this course. If we can put theoretical teaching, simulation, and physical verification closer together, it will enhance teaching in engineering practice, improve learning efficiency.

2. Improvement of teaching methods in the classroom

2.1. Preview

"Circuit Analysis and Electronic Circuits" course has many contents and out of practice. When introducing topics, some practical applications close to daily life are usually used to arouse students' interest. Operational Amplifiers (Op-Amp) (Konar, Sahu, and Kundu, 2019) are widely used in analog circuits and can be found in many electronic devices. In the design of integrated circuits, Op Amp, as a necessary basic module, also plays a wide range of roles. It is often integrated into many other chips such as Analog-to-Digital Converters (ADC), etc. For example, before the lecture on "Active low-pass filter composed of Op-Amp (Rong, Yu, and Luo, 2010)", we used the case of the infrared digital thermometer in the tutorial. Due to COVID-19, non-contact temperature measurement has become an effective help to control the spread of the virus. Figure 1 shows an application circuit given in the application manual when using the analog output mode of the Melexis MLX90614 sensor for non-contact temperature measurement. This example can immediately let students understand how the course they are about to learn will change real life.

Figure 1. MLX90614 (left) and its application circuit with LPF (right).



2.2. Perform circuit simulation effectively

In each class, we will select some important circuits for simulation. After explaining how this circuit works, to make it convenient for every student to experience the simulation immediately in the classroom, a new classroom teaching method based on EasyEDA simulation was put into practice. EasyEDA is a circuit design, simulation software that runs in a modern browser without installation.

Figure 2. Run simulation on mobile phone with EasyEDA (Screenshots).

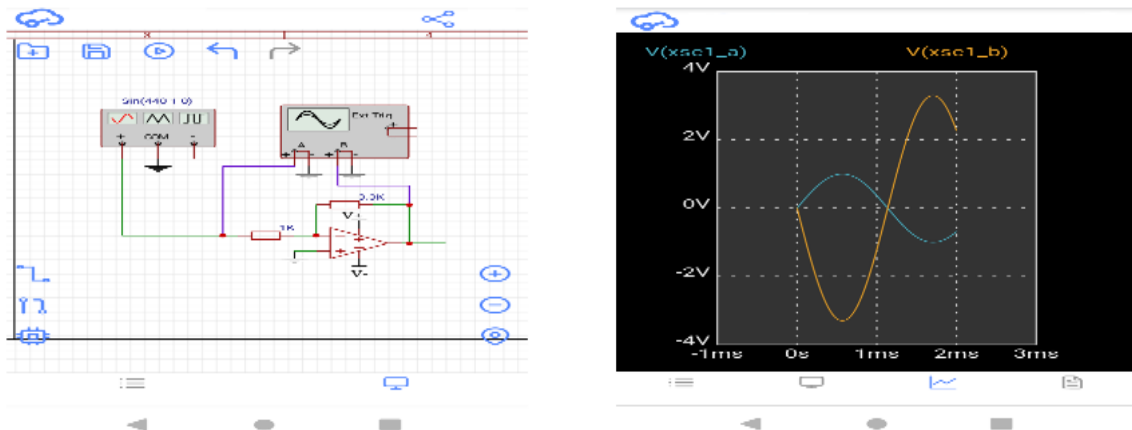


Figure 2 shows the effect of opening a circuit designed by EasyEDA in a mobile browser. This circuit is an amplifier made with an Op-Amp. Compared with playing simulation video on ppt, or just showing simulation by the teacher, this can bring students closer to the circuit, allowing students to understand the circuit as soon as possible through their hands.

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References

- Konar, M., Sahu, R. and Kundu, S. (2019). Improvement of the Gain Accuracy of the Instrumentation Amplifier Using a VeryHigh Gain Operational Amplifier. *2019 Devices for Integrated Circuit (DevIC)*, pp. 408-412.
- Rong, F., Yu, J. and Luo, A. (2010). Reference Current Computation Method Based on Adaptive Low-Pass Filter for Active Power Filter. *2010 International Conference on Measuring Technology and Mechatronics Automation*, pp. 996-999.