Reconstruction of Information Technology Curriculum—From Empirical Selection to Projection of Thought

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Abstract: After 30 years of development, China's information technology curriculum is greatly changed. However, facing to new challenges, information technology curriculum hasn't shown up sufficient confidence yet. It is necessary to construct the curriculum with the projection of subject thought and build the curriculum structure of "thought—activity—thinking".

1. Introduction

An upstream subject is turned into the course with the abundant ideological details through curriculum transformation. It is necessary to study the essence of the upstream subject knowledge to complete the specific curriculum design with projection of thought and can solve the problem of core value in a curriculum.

2. Reconstruction of information technology curriculum with projection of thought

2.1 Teaching content design

Electronic technique is a broad major. Generally speaking, studying electronic technique inevitably will contact with analog electronics technique, digital electronic technique, electronic design automation (EDA), electronic technique simulation analysis, and electronic technology. Table 1 shows main practice training contents used by these curriculums.

Table 1 Main Practice Training Contents of Each Curriculum

Curriculums	Currently used practice training contents
Analog electronics technique	Amplifying circuit test, waveform generator, power circuit design and debugging
Digital electronic technique	Simple frequency meter design, digital clock design and simple combinational circuit design(e.g. voter)
EDA	Schematic diagram drawing and PCB design
Electronic engineering technology	Radio installation and debugging, multimeter assembly, and adjustable stabilized voltage supply installation
SCM technology course	Software design, including verification practice for verification of command function, arithmetic and logic instruction, memory unit control, timing, interruption and interface circuit, e.g. simple digital clock design

It can be observed from Table 1 that these curriculums are professional foundations and professional curriculums of the electronic technique major. They have the practice training process to some extent. As what mentioned before, it exactly is lack of correlation.

The selective principles of teaching contents are shown as follows: (1) stand out application and regard electronic products as carriers; (2) focus on foundation and support the study of subsequent curriculums; (3) refine knowledge and meet work requirements of occupations; (4) update contents and support contents of skill certificate assessment. 7 teaching project modules are set up, as shown in Table 2. Based on the design of application circuit→PCB layout design→PCB production→device detection→assembly→welding→static and dynamic debugging→performance test, students finally

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complete the design and productive process mode of a real electronic product.

Table 2 Projects, Carriers, Skills and Knowledge Points of Analog Electronic Technique

No	Items	Carrier circuit	Skills and quality	Knowledge points
1	Semiconductor diode	Simple parallel DC power supply with indicator light	①Use the bread board and connect with circuits ② Identify, detect and screen out common diode ③Use common electronic instruments	①Common and special diode ②Rectification, filtering and voltage stabilization
2	Audion and its amplifying circuit	Construction of single-tube multistage amplifier	①Identify and detect audion ②Learn the test of main performance indexes for the amplifying circuit ③Master the troubleshooting method of electronic circuit faults ④Apply Multisim simulation software	①DC amplification of audion ②Field effect transistor ③ Amplifying circuit performance index ④Frequency characteristics
3	Feedback and application	Reversed feedback amplifier	①Judge various feedback types ② General principles of introducing negative feedback to circuits ④Test methods of Multisim simulation software	①Negative feedback ② Influences of negative feedback on amplifying circuit performance
4	Integrated operational amplifier and its application	Electronic alarm	①Connect with integrated operational amplifier ② Apply voltage comparator ③Master troubleshooting methods of electronic circuit faults ④Test methods of Multisim simulation software	① Application of integrated operational amplifier ② Filter ③ Voltage comparator ④Features and transformation of practical engineering signals
5	LF power amplifier	Integrated circuit power	①Drive of actual loads ② Test main performance index of power amplifier ③Improve distortion	① OCL\OTL\BTL power amplifier ②Crossover distortion
6	DC stabilized power supply	DC adjustable voltage regulator power supply	① Design, install and debug DC stabilized power supply ② Familiar with requirement instructions of electronic circuits for work power	①Rectification, filtering and steady pressure ② Three-end integrated voltage stabilizer
7	Comprehensive course design and production	OTL discrete small power audio amplifier	①Master design, productive process and technical process of general electronic products ② Apply Protel199SE software for PCB design and production ③Power amplifier design, installation and dynamic and static debugging ④Engineering drawing and drawing of component lists	① Power amplifier design ②PCB design ③ Code requirements of engineering drawing ④Safe operation and process specification

The practice of making a subjective choice by experience should be abandoned, while social experience orientation of course contents should be considered from two aspects.

2.2 Curriculum system constructed by electronic information engineering technology

According to difficulty of typical work tasks, curriculums of electronic information engineering technology are integrated to form relevant occupational capacity field and define the action field. The curriculum system constructed is shown in Table 3.

Table 3 Professional Curriculum System of Electronic Information Engineering Technology

Post name	Typical work tasks	Action fields	Learning fields
Electronic product assemblers	Component identification and test; welding and assembly of electronic products	Electronic production	Circuit analysis, analog electronic technology, digital electronic technique, quality management and control, electronic product detection, electronic product maintenance, PLC control system design and operation
Electronic product testers	Test of unit circuits; test of combinational circuits; testing of complete machine equipment		
Quality controllers	Formulate and maintain inspection standards; and control product quality		
Equipment maintenance technicians	Daily maintenance of productive equipment; operation and maintenance of electronic equipment		
Electronic product sales engineers	Pre-sales scheme compilation of electronic products, product demonstration; training users, provide field instruction or other after-sales technical support; promotion and training of technical application	Electronic product services	Circuit analysis, analog electronic technique, digital electronic technique, sensor technology and application, high-frequency electronic technology and application, electronic product marketing, electronic product maintenance, communication and protocol
Electronic product maintenance engineers	Detection of basic circuits and parameters; circuitry analysis; fault detection and exclusion		
PCB design engineers	Schematic circuit diagram; circuit simulation; PCB layout wiring design; production of PCB	Electronic product design	Circuit analysis, analog electronic technique, digital electronic technique, sensor technology and application, electronic product drawing and plating, small-scale smart system design and drawing, PLC control system design and operation
Electronic design engineers	Hardware circuit design; software programming and debugging; prototype production and debugging		

2.3 Hardware circuit design of object experiment system

In the traditional analog electronic technique experiment, users construct the experimental circuit, modify component parameters, and observe experimental results on the experimental field. Table 4 lists the difference between the traditional analog electronics and remote analog electronics experiment.

Table 4 Comparison between the Traditional Analog Electronics Experiment and Remote Analog Electronics Experiment

	Traditional analog electronics experiment	Remote analog electronics experiment
Experimental field	Lab field	Without specific limitation, need a computer to connect into the network
Experimental mode	Manual construction of experimental circuits	Construct a circuit through remote control
Experimental circuit selection	Manual selection	Realize control circuit switch
Experimental component parameter adjustment	Manual replacement of components or adjustment of component parameters	Remote control of circuit component parameters
Experimental result lookup	Field instrument equipment	Video monitoring of remote instrument equipment

2.3.1 Analog experiment circuit design

Object experiment circuit scale is limited. It is hard to realize the large-scale parameter regulation like virtual simulation experiment. It can constitute in common-emitter, cobase and cointegration on the basis of classical analog experiment circuit.

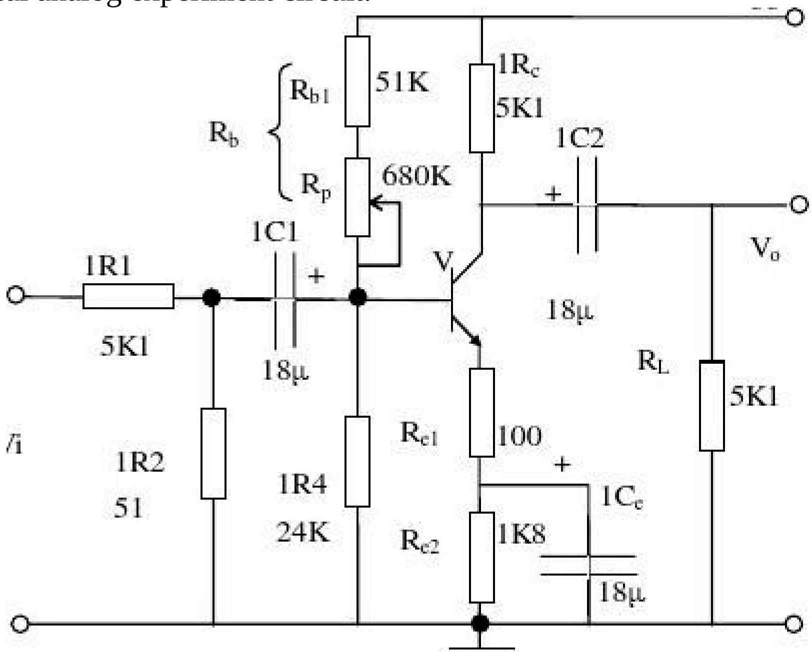

Fig.1 Common-emitter amplifier circuit

2.3.2 Negative feedback amplifier circuit

In the electronic circuit, a part or all of output(output voltage or current) can act on the input circuit through the circuit form. And this process is called as feedback.

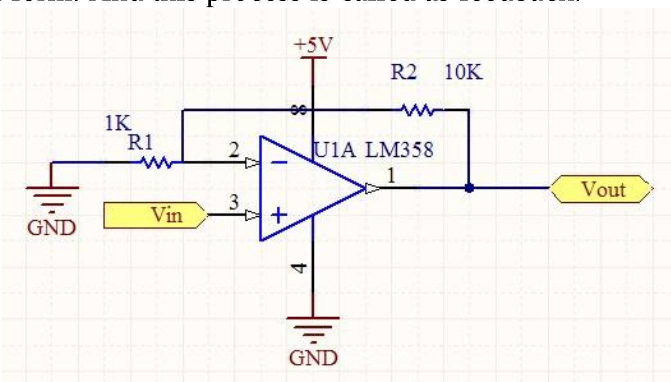

Fig.2 Negative Feedback Amplifier Circuit

2.3.3 Integral circuit

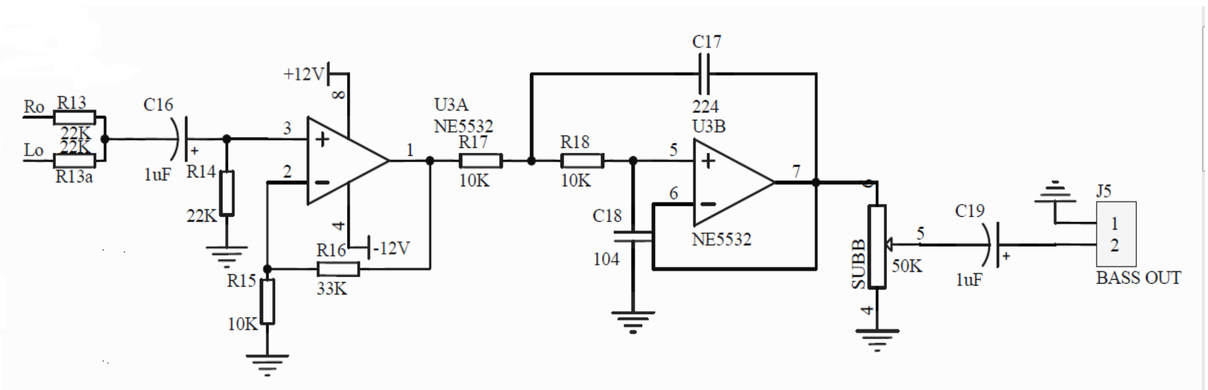

Fig.3 Integral circuit

Integral circuit design realizes the comparison with common amplifying circuit. It realizes the waveform conversion function under the different input signal conditions. The circuit is shown in Figure 3

2.3.4 Sine wave oscillating circuit

The sine wave oscillating circuit is the amplifying circuit with the frequency selective network and regenerative feedback. The oscillating condition means that the loop gain is 1, namely AF=1. A is the magnification times of the amplifying circuit. F is the reaction coefficient. In order to start oscillation for the circuit, loop gain AF should be slightly greater than 1. By adjusting different circuit parameters, the start-oscillation conditions of the oscillating circuit can be studied. Wein Bridge RC oscillating circuit is designed, as shown in Figure 4-5. An adjustable resistance zU2 is added in the circuit.zR1, zC1, zR2 and zC2 constitute in the regenerative feedback frequency selection network, obtaining zR1=zR2, zC1=zC2.

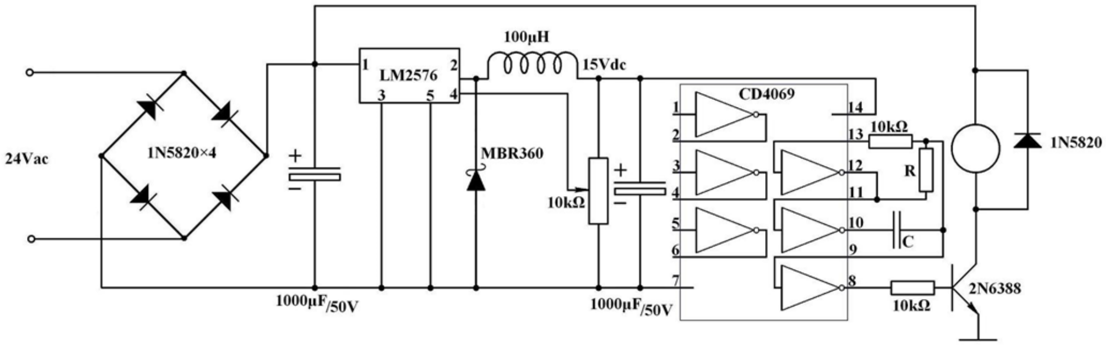

Fig.4 Sine Wave Oscillating Circuit

2.3.5 The experimental circuit needs the bipolar signal source. The unipolarity is turned into the bipolar circuit, as shown in Figure 5. This circuit is composed of two-stage operational amplifier. The first stage is the amplifying circuit of reverse proportion. Voltage gain is 1. The second stage is the summing circuit of invert proportion.

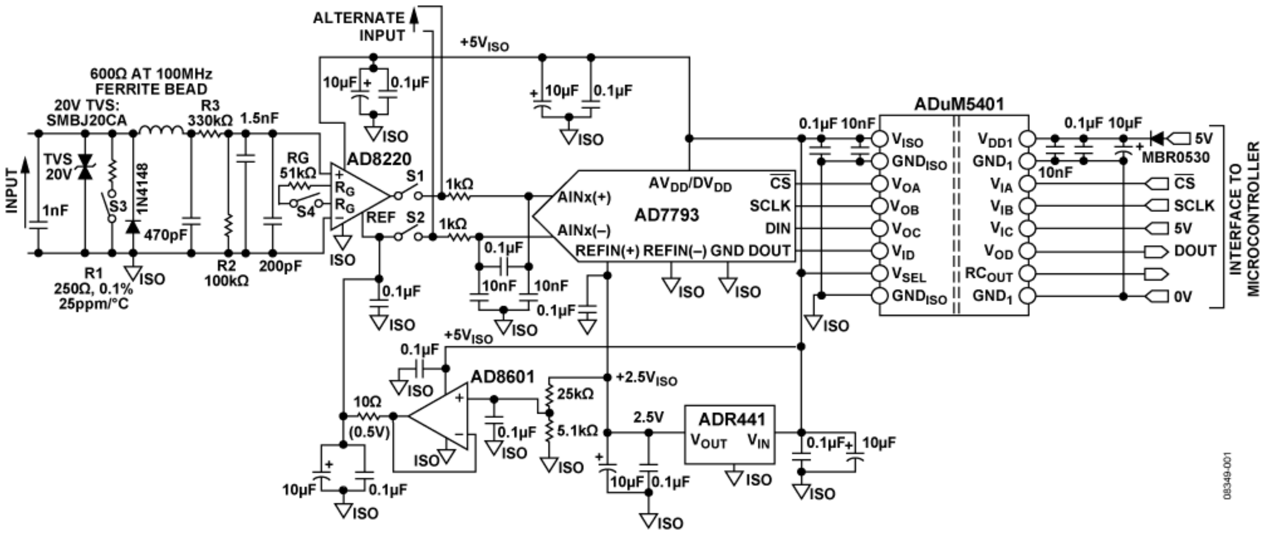

Fig.5 Unipolar to Bipolar Circuit

DAC1 of STM32 generates the unipolar signal source with the amplitude of Vi. When the signal source passes through the first stage operational amplifier circuit, signal output is –Vi—Vol=-Vi. DAC2 of STM32 outputs the fixed voltage that is the same with the signal source value. It is connected to the summing circuit of reverse proportion. When the signal source passes through the second stage operational amplifier circuit, the output signal Vo gains the following value through the formula(1):

$$V_O = -(Vi' \times \frac{R_{11}}{R_{10}} + V_{OL} \times \frac{R_{11}}{R_{10}}) \quad (1)$$

Designing R10=R11=3K, R9=1.5K, the precision resistance is selected to simplify the formula. Vo is obtained through the formula (2):

$$V_O = -Vi' + 2Vi) \quad \text{Formula (2)}$$

3. Conclusions

Information technology curriculum is the course with the abundant thought. Continuous transformation of curriculums will transfer the wisdom to more students. Projection of thought exactly embodies the course value. It tries to realize the organic unification of social experience tool value and internal subject thought value and injects more content confidence and value mission to the information technology curriculum.

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