# The Design and Experimental platform of "Control Circuit" Based on Nextboard

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Abstract. "Control Circuit" is the measurement and control technology and instrumentation specialty courses, focuses on the measurement and control circuit circuit commonly used in industrial production and scientific research in a variety of connections and functions. It differs from the electronic circuit, in addition to teaching basic circuit schematic, you also need an object-oriented monitoring and control, to fine, fast, feature indicators to measure and control tasks spirit, so "Control Circuit" experiment in Teaching particularly important. Based on the Global China's Nextboard engineering teaching platform for "Control Circuit" Course design and associated teaching experiments further exploration. Experiments show based Nextboard of "Control Circuit" experiment, enabling the course content and circuit principle clearer, understandable, easy application again experimental program development, high equipment utilization efficiency.

# Introduction

Control Technology and Instrument Specialty affiliated Instrument Science and technology disciplines. The "Control Circuit" is the measurement and control technology and instrumentation specialty courses, it is the undergraduate and control and instrumentation specialty basic course, and can be used as guide and assist in monitoring and control and related engineering fields.

"Control Circuit" This course focuses on the features of the circuit used in measurement and control systems, mainly for the production and practice-oriented monitoring and control tasks. It allows students to master and control circuit used in measurement and control systems. General measurement and control system is composed of three parts sensors, measurement and control circuits, and the implementing agencies thereof. As shown in Figure 1.



Figure 1 Composition Measurement and Control System

Therefore, measurement and control system components forefront of sensor signal acquisition, signal collected are generally weak, and mingled with all kinds of noise, so the role of monitoring and control circuit is to amplify weak signals, eliminating the inclusion of noise, then, measurement and control circuit the effect is amplified effect, remove noise, and signal conversion, etc. the signal actuator. Finally, there is the actuator and control system, according to measurement and control tasks, it is necessary in accordance with the signal will turn actuator operation and control circuit output signal calculations, transformation to adapt the actuator drive signals. According to the above measurement and control tasks and control circuit is divided into the following several important elements and experiment: a variety of operational amplifier circuit design, signal modulation and demodulation circuit, and a signal circuit.

#### **Nextboard Experiment Platform Overview**

Nextboard experimental platform is Global China company dedicated to creating experimental platform for engineering education. The entire platform through innovation and design based on virtual instrument technology base, with the experimental module Pan-and third-party developed through these modules can be completed sensors, analog circuit, control theory, and other Engineering Experiment. On the experimental platform, students can begin to build circuits and modules, not only will more clearly grasp the theoretical knowledge, but also to cultivate students' self-learning ability. Nextboard experimental platform shown in Figure 2.

Nextboard general engineering teaching experiment platform need to connect NI (National Instruments) M, X Series data acquisition card. In the face of different disciplines experiments, additional experimental module equipped with different disciplines. And through NI LabVIEW software company at any time to prepare the corresponding program. Because of this versatility, making Nextboard for teaching laboratories, an innovative multi-disciplinary laboratory construction. Nextboard and offers many different courses according to cooperate experiment module, such as a sensor module for sensor curriculum kits, thermistor experiment module.



Figure 2 Nextboard experiment platform

In order to meet the engineering education teaching, experimental, innovative three directions, as well as ease of use for the user, Pan-China provides the user Nextboard soft panel, shown in Figure 3. Users can complete a variety of experimental learning content directly in the soft panel, and can easily be used with all of the resources on debugging Nextboard.



Figure 3 Nextboard soft panel

#### **Nextsense Experiment Module**

Global China Nextboard and control experimental platform offers a variety of experimental module, it can be convenient, fast and intuitive monitoring and control programs for experiment and demonstration, thermocouple sensor teaching experiment applied experimental series nextsense module, is the main course of the experimental and control circuits. nextsense module shown in Figure 4, is for the sensor teaching, curriculum design and control circuits and other basic teaching experiment module. nextsense series with the Pan-general engineering teaching experiment platform nextboard use, you can complete the course teaching thermocouples, thermistors and other sensors. Courses provide sensors and conditioning circuits, covering sensor characteristics depicted, circuit simulation and actual measurements. Experimental sensor signal acquisition "Control Circuit", for example, application Nextboard sensor teaching experiment series nextsense thermocouple module can be completed experimental demonstration.

## Thermocouple experiment module demo

Experiment Module thermocouple, divided into hardware and software components of two components. Software section, first open nextboard soft panel nextpad, click on the Configure button, select the thermocouple experiment icon nextpad main interface, double-click into the experiment, As shown in Figure 5.



Figure 4 Thermocouple experiment module



Figure 5 Soft thermocouple experiment nextpad panel

Soft thermocouple experimental subject curriculum tab panel, which consists of five parts: a sensor introduction, characteristic curve, experimental content, experimental simulation, measurement

panel. If the thermocouple experiment principle or the content is not particularly aware of it, you can view the description of the corresponding curriculum option card in the sensor introduction, the introduction of the principle of the thermocouple is very clear, for understanding and digest the contents of theoretical study has a very intuitive help. Sensor introduction tab as shown in Figure 6.



Figure 6 Sensor introduction tab

First, the hardware required to connect the circuit, the test module into Nextpad thermocouple experiment panel, as shown in Fig. Experimental module circuit board depicted with dashed lines indicate the need for external resistors alternative resistance, resistance to connect different magnifications are also different. Magnification = Alternate resistance value / 50  $\Omega$ , this experiment choose whether 10  $\Omega$ , therefore Gain = 10K  $\Omega$  / 50  $\Omega$  = 200 times. Click the Run button, you can see the curves and experimental data running in Nextboard panel, shown in Figure 8. So you can see from the graph of the results of experiments run in Theory and "Control Circuit" Course as mentioned completely consistent and clear and understandable. You can also save the data to a computer running the experiment in order to view the data saved results shown in Figure 9. In addition, you can also open tab to view the panel after this experiment LabVIEW program, in order to keep improving or modifying the content of related experiments and Nextboard soft panel settings, shown in Figure 10.



Figure 7 Experimental external thermocouple wires





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Figure 10 After the thermocouple experiment LabVIEW panel program

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## "Control Circuit" Teaching Experiment

Content "Control Circuit" includes function and control circuitry and its main requirements, type, composition and trends; low drift, high performance instrumentation amplifier, isolation and controllable amplification circuit; and through typical thermocouple sensor Nextboard Control experiments designed to find Nextboard platform for measurement and control system is very complete and easy course experiments. According to "Control Circuit" course requirements, can make use of the platform on the basis of Global China Nextboard, further use of NI LabVIEW

software to be designed software programming, design more appropriate "Control Circuit" Course of Experimental soft panel, for students to more in-depth understanding of the content and meaning of good experimental secondary curriculum.

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# References

[1] Chen Yu Lin reform experimental teaching methods, training creative ability [J] research and exploration laboratory studies, 2003, (04): 30-31.

[2] Xu Guoan Deepening Experiment Teaching Reform to focus on training students' ability [J] Experimental Technology and Management, 2003, (02): 112-113.

[3] Guoxiong Control circuit [M] Beijing: Mechanical Industry Press, 2006.130-132.

[4] Liu Ming Electronic Circuits Integrated Design Experiment Course [M] Tianjin: Tianjin University Press, 2008.305-310.

[5] Luqi Rong individual laboratory based on virtual instrument technology to build [M] Beijing: Electronic Industry Press, 2006.240-245.

[6] Levin associated virtual instrument in electronic technology demonstration experiment [J] Laboratory Research and Exploration, 2004, (01): 20-22.

[7] weeks and flat platform virtual instrument teaching experiment in the application of electronic technology Courses [J] Experimental Technology and Management, 2006, (03): 73-75.

[8] Li Peijiang development of university-based measurement and control experiments on LabVIEW [J] Laboratory Science, 2008, (02): 72-74.

[9] Hsieh Su labVIEW based virtual laboratory platform [J] Test Technology and Testing Machine, 2007, (03): 40-43.

[10] LI Ming-phase experiments based on virtual instrument modulation and demodulation [J] Experimental Technology and Management, 2007, (06): 80-83.