

# Analysis of Electronic and Electrical Technology in Electrical Automation

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**Abstract:** Electronic and electrical technology plays an important role in electrical automation system, including but not limited to circuit design, motor control, sensor application, etc. By analyzing the advantages and limitations of these applications, engineers and researchers can better understand the working principles and optimization methods of electrical automation systems, and provide ideas and methods for system design and control.

**Keywords:** Electrical automation; Electronic and electrical engineering; technical analysis.

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## 1. Introduction

With the continuous development and progress of science and technology, electrical automation technology has also made major breakthroughs and progress. The development of electrical automation can be divided into the following stages:

### 1.1. Manual control stage

In the early stage of electrical automation, people mainly use manual control to control the electrical system. Engineers and operators need to manually operate the control equipment to control and manage the electrical system. This way has the problems of low efficiency and high operational risk.

### 1.2. Timing control stage

With the development of electronic technology, people begin to use timing controllers to achieve automatic control of the electrical system. The timing controller can control the switch and operation of the electrical system according to a predetermined schedule. This method improves the working efficiency, but there are still problems such as low control accuracy and poor adaptability.[1]

### 1.3. Feedback control stage

With the continuous progress of control theory and technology, people begin to use feedback controllers to achieve automatic control of the electrical system. The feedback controller can adjust the output signal of the controller according to the feedback signal of the electrical system to achieve accurate control of the electrical system. This method improves the control precision and stability.

## 2. Application of Electronic and Electrical Technology in Electrical Automation System

### 2.1. Circuit design

An important application of electronic and electrical technology in electrical automation system is circuit design. Circuit design is the basis of electrical automation system, which involves the selection of circuit topology, the selection of components and the calculation of circuit parameters. Electronic and electrical technology provides a wealth of

theoretical knowledge and practical experience for circuit design, which can help engineers design circuits with superior performance, stability and reliability.

The application of electronic and electrical technology in circuit design mainly includes the following aspects: circuit topology design: electronic and electrical technology provides the theoretical basis for various circuit topology structures, such as amplification circuit, filter circuit, regulation circuit, etc. The engineer can select the appropriate circuit topology structure according to the actual needs to achieve the required functions. Component selection: Electronic and electrical technology provides performance parameters and selection methods of various electronic components. In circuit design, engineers need to select appropriate components to meet the performance requirements of circuit design. Electronic and electrical technology helps engineers understand the characteristics and use methods of various components, so as to make correct selection. Circuit parameter calculation: Electronic and electrotechnical technology provides methods and formulas for circuit parameter calculation, such as voltage division calculation, current analysis calculation, etc. Through circuit parameter calculation, engineers can predict the performance and working state of the circuit, providing guidance and reference for circuit design.[2]

### 2.2. Motor control

Another important application of electronic and electrical technology in electrical automation system is motor control. Motor control is the core link in the electrical automation system, which involves the starting, running and stopping of the motor. Electronic and electrical technology provides a wealth of theoretical knowledge and practical experience for motor control, which can help engineers design efficient and accurate motor control systems.

The application of electronic and electrical technology in motor control mainly includes the following aspects: control method selection: electronic and electrical technology provides the theoretical basis for various motor control methods, such as voltage control, frequency control, vector control, etc. Engineers can select appropriate control methods according to the characteristics and actual needs of the motor to achieve accurate motor control. Controller design: Electronic and electrical technology provides various

methods and technologies for controller design, such as PID control, fuzzy control, adaptive control, etc. Engineers can design appropriate controllers according to the requirements of motor control to achieve accurate control of the motor. Sensor application: electronic and electrical technology is widely used in motor control, such as position sensor, speed sensor, current sensor, etc. The sensor can monitor the running state of the motor in real time and feedback it to the control system to achieve closed-loop control and improve the accuracy and stability of motor control.

### 2.3. Sensor application

Another important application of electronic and electrical technology in electrical automation system is sensor application. Sensor is the key equipment in the electrical automation system. It can convert various physical quantities and signals into electrical signals to monitor and control the system. Electronic and electrical technology provides a wealth of theoretical knowledge and practical experience for sensor applications, which can help engineers design high-performance and reliable sensor systems.

## 3. Innovative Application of Electronic and Electrical Technology in Electrical Automation System

In the electrical automation system, the innovative application of electronic and electrical technology is an exciting field. With the development of artificial intelligence, Internet of Things and other emerging technologies, electrical automation systems are facing many new opportunities and challenges. This section will discuss the innovative applications of electronic and electrical technology in electrical automation systems, analyze the advantages and challenges of these applications, and look forward to the development direction of electrical automation systems in the future.

### 3.1. Application of artificial intelligence in electrical automation system

Artificial intelligence (AI) is a technology that simulates human intelligence. Its application has gone deep into various fields, including electrical automation systems. The application of artificial intelligence in electrical automation system is mainly reflected in the following aspects:

#### 3.1.1. Data analysis and prediction

In the electrical automation system, a large number of data need to be analyzed and processed. AI technology can help engineers and researchers better understand these data and extract useful information from them. By using machine learning algorithms and models, the data in the electrical automation system can be predicted and optimized, so as to achieve efficient operation of the system.

#### 3.1.2. Fault diagnosis and maintenance

Fault diagnosis and maintenance in electrical automation system is an important task. Artificial intelligence technology can identify fault causes and provide corresponding maintenance suggestions by analyzing sensor data and system status. For example, machine learning algorithm can be used to monitor the running state of electrical equipment, find faults in time and take corresponding measures to improve the reliability and stability of the system.[3]

#### 3.1.3. Intelligent control and optimization

Artificial intelligence technology can help optimize the control strategy of electrical automation system to improve the performance and efficiency of the system. By using the deep learning algorithm and reinforcement learning method, the system can be intelligently controlled to achieve adaptive adjustment and optimal control. This intelligent control method can automatically adjust the control parameters according to the real-time changes of the system, and improve the response speed and stability of the system.

### 3.2. Application of Internet of Things in electrical automation system

The Internet of Things (IoT) refers to connecting various physical devices with the Internet to achieve interconnection between devices. In the electrical automation system, the application of the Internet of Things can bring many advantages:

#### 3.2.1. Equipment interconnection and remote monitoring

Through the Internet of Things technology, electrical equipment and sensors can be connected to the Internet to achieve interconnection between equipment. In this way, engineers and maintenance personnel can monitor the running status of equipment at any time and anywhere through the remote monitoring system, find problems in time and take corresponding measures.

#### 3.2.2. Data sharing and collaborative work

The Internet of Things can realize data sharing and collaborative work between devices, and improve the overall efficiency of the electrical automation system. Through the Internet of Things technology, different devices can share data in real time and work together according to the shared data to achieve automation and intelligence of the system.

#### 3.2.3. Intelligent perception and decision-making

Internet of Things technology can realize intelligent perception and decision-making of electrical automation system. By connecting sensors and controllers to the Internet, you can collect the operating data of the system in real time and make intelligent decisions based on these data. For example, when the system has abnormal conditions, the Internet of Things technology can send an alarm in time and take corresponding measures to ensure the safe operation of the system.

### 3.3. Advantages and challenges of innovative applications

The innovative application of electronic and electrical technology in the electrical automation system has many advantages, but also faces some challenges.

#### 3.3.1. Advantages

The innovative application can improve the performance and efficiency of the electrical automation system and realize the intellectualization and automation of the system. Through the introduction of artificial intelligence, Internet of Things and other technologies, intelligent perception, adaptive control and remote monitoring of the system can be realized, and the reliability and stability of the system can be improved.

#### 3.3.2. Challenges

Innovative applications also face some challenges. First of all, there is a huge amount of data in the electrical automation system, and the requirements for data analysis and processing are high. Secondly, the new technology needs to be integrated

with traditional electrical equipment and systems, which needs to solve the compatibility and communication problems between different equipment.[4] In addition, the application of new technologies also faces challenges in security and privacy, and relevant security and privacy protection measures need to be strengthened.

#### **4. Conclusion**

By taking these measures, the reliability and stability of the electrical automation system can be improved and the normal operation of the system can be ensured. However, with the continuous development and innovation of the electrical automation system, the electronic and electrical technology is still facing new challenges and needs continuous research and improvement.

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