

Application and Research of Electronics and Electrical Technology in Power System

Guojun Ma

Yangzhou Polytechnic College, Yangzhou, Jiangsu, China
yzsmgj@126.com

ABSTRACT. With the continuous development of science and technology, electronics and electrical technology has been increasingly improved and widely used in power system. Electronics and electrical technology is integrated, highly efficient, highly frequent and can be fully controlled. It is mainly applied to four links in electronic system: power generation, power transmission, energy saving and power distribution. The application of electronics and electrical technology can improve the operating efficiency of electronic system and promote the intelligence and mechatronics of the power system. Therefore, this article mainly explores the importance of the application of electronics and electrical technology in power system and the specific methods, so as to offer some reference for the development of power industry.

KEYWORDS: Electronics and electrical technology, Power system, Research and application

1. Introduction

Electronics and electrical technology is developed from the traditional electrical technology and integrated with a new technology. It realizes the efficient integration of traditional electrical technology and electronics technology. Compared with traditional electrical technology, it has many advantages and is widely used in power system. At present, China has made remarkable progress in the application of electronics and electrical technology in power system. By leveraging the advantages of electronics and electrical technology, the operating efficiency and quality of power transmission, power generation, and power distribution in the power generation system can be improved, and the rapid development of China's power industry can be realized.

2. Overview of Electronics and Electrical Technology

2.1 Concept

Electronics and electrical technology is based on computer technology and electrical technology, new theories and scientific technologies are also incorporated, for example, theoretical knowledge and technical principles such as: electronic technology, electrical engineering knowledge, electronic equipment manufacturing, application and maintenance, and power production.

2.2 Features

Electronics and electrical technology has the feature of integration. This feature makes it different from traditional electrical technology. Integration refers to the parallel connection of multiple unit-type devices, and the fully-controlled devices are concentrated on a substrate. The "full control" refers to the replacement of ordinary thyristors with electrical components in the power system. High frequency refers to the higher operating speed of the devices, which means the application of electronics and electrical technology can greatly increase the operating speed of electrical devices. High efficiency can mainly be reflected in the devices and switching technology, which can reduce the conduction loss of electronic devices, ensure the reasonable operating state of the devices and improve the operating efficiency of the power system.

3. The Importance of the Application of Electronics and Electrical Technology in Power System

3.1 Improve the Efficiency of the Power System

With its features of high frequency and high efficiency, the application of electronics and electrical technology can optimize the working efficiency of the power system. "Integration" can make optimal device connection, integrate different devices on the same substrate, optimize the structure of the power system, and improve operating efficiency. "Full control" means in power system, intelligent control and comprehensive automatic control can be realized to make easier overall planning, liberate labor, and improve the overall working efficiency of power system.

3.2 Meet the Development Needs of Power System

In the future, with the intelligence and automation of information technology, the power system also needs to cater to the development of the times and make certain changes. Attentions must be paid to the introduction of intelligent electronic technology to promote the construction and development of mechatronics. In this case, the introduction of electronics and electrical technology can meet the development needs of power system and facilitate the rapid development and normal operation of power system.

4. Specific Applications of Electronics and Electrical Technology in Power System

4.1 In Power Transmission

The application of electronics and electrical technology in power transmission can be seen mainly in aspects such as high voltage direct current transmission technology, flexible alternating current transmission technology and static reactive power compensator. And its application in HVDC transmission technology mainly includes the converter valve thyristors. These devices can effectively reduce the frequency of transformers, ensure the operating efficiency of power transmission equipment, and meanwhile lower the operating costs of power plants as well as improve the competitiveness of power equipment. In flexible AC power transmission, electronics and electrical technology can be found in the combination with mechanical control technology, which can ensure the stability of the power transmission system, maintain high level transmission, and reduce unnecessary losses of the electric power, thereby improving the effectiveness of the power transmission system and making the flexible power transmission equipment more stable and secure.

4.2 In Power Generation

The application of electronics and electrical technology in the power generation can mainly be reflected in four aspects: static excitation, solar energy system, mechanical pump variable frequency and speed regulation, and variable speed constant frequency excitation. The static excitation mainly adopts thyristor rectification and self-shunt excitation, which has high reliability and simple structure, so it has been widely used in power system. Static excitation is mainly used in generating sets of large power plants. The application of electronics and electrical technology can replace traditional exciters, make up for the disadvantages of traditional technology, and improve the operating efficiency of generator sets. In actual operation, the static electromagnetic is mainly divided into two parts: the regulating circuit and the main circuit. The electronics and electrical technology can provide excellent equipment for static excitation power transmission and ensure the stability of operation.

The application of electronics and electrical technology in solar energy systems is mainly in current converters. Current converter is the core of solar power generation, and this core device is constructed based on the electronics and electrical technology. In the solar energy system, electronics and electrical technology can give full play to its characteristics of integration, full control, and high frequency, and convert solar energy into electric energy through a large-scale current converter, so as to realize the automation and high efficiency of the conversion.

In power plants, the power consumption of the fan and water pump accounts for about 65% of the total power consumption of equipment in the thermal power plants. Therefore, the use of frequency conversion and speed regulation of the fan and water pump can realize energy saving. When the power system is conducting mutual conversion of high and low voltage power, the fan and water pump frequency converter can be used to replace the traditional frequency converter to reduce energy consumption and improve the economic benefits of the power system. However, in terms of the current situation, low-voltage inverters have been widely used and the technology is relatively mature, while the high-voltage and large-capacity inverters are still under research and development. Therefore, China should pay more

attention to the design and development of high and low voltage inverters to promote the rapid development of power generation equipment in power system.

Variable speed constant frequency excitation is mainly used in hydraulic and wind power generators. In wind power generation, power generation rate depends on the wind speed, and the maximum wind speed of a windmill varies as the wind speed changes. In hydroelectric power generation, the tools for generating electricity depend on the pressure and flow of the water. When the pressure and flow of the water change, the efficiency of the energy storage machine will also change. When electronics and electrical technology is applied, constant frequency excitation can make appropriate adjustments to the entire power generation system, so that the rotation rate of the system and the frequency of the current can be consistent, thereby ensuring a constant value of the power generation system and improving the operating efficiency of the whole system.

4.3 In Energy Saving

A large amount of energy consumption will be generated in the operation of power system, resulting in the loss of electric energy and low operating efficiency. Therefore, it is particularly important to conduct energy saving research of power system. The application of electronics and electrical technology in power engineering can effectively adjust the speed of motor and improve the performance of motor, so that energy saving can be fully realized. In actual practice, electronics and electrical technology will replace traditional windshield equipment with speed control equipment, which can not only improve the operating efficiency of the motor, but also reduce energy consumption and ensure the economic benefits to achieve the purpose of energy saving. However, this method has some shortcomings, which increases the construction cost of power system, and is not suitable for some small power plants. Therefore, China should attach more importance to the research of energy-saving power system, reduce the energy consumption of the power system as much as possible, improve the energy-saving efficiency of electronics and electrical technology, and ensure the overall energy efficiency of the power system.

4.4 In Power Distribution

With the rapid social development, people have stricter requirements for the quality of power supply. Therefore, electronics and electrical technology can be applied to the power distribution in power system, so that its features and advantages can be fully utilized to effectively improve power distribution system, voltage frequency, asymmetrical conditions and other performances, thereby improving the stability and safety of the power distribution, and ensuring the quality of power distribution to meet people's demand for electric energy.

5. Conclusion

To sum up, over the years, the development of science and technology in China has been more and more mature. Under this situation, the application of electronics and electrical technology has been wider and shows great advantages. Its application in power system can realize the sustainable development and improve the working efficiency of power system. From the analysis of power generation, transmission, power distribution, and energy saving, it can be seen that electronics and electrical technology is superior to traditional electrical technology and it can promote the development of intelligence and automation of power system. And more efforts should be put on the electronics and electrical technology in the future research to make the most of its excellent performances and promote the stable and healthy development of power industry in China.

References

- [1] Ge Aoming. Application and Research of Electronics and Electrical Technology in Power System. China Standardization, No.20, PP.117-118, 2019.
- [2] Du Bolin. Application and Research of Electrics and Electrical Technology in Power System. Scientific and Technological Innovation, No.28, PP.143-144, 2019.
- [3] Wang Lei. Application and Research of Electronics and Electrical Technology in Power System. Encyclopedia Forum Journal Electronic Version, No.9, PP.328, 2019.
- [4] Long Weidong. Application and Research of Electronics and Electrical Technology in Power System. Architectural Engineering Technology and Design, No.2, PP.125, 2019.