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Research on Frequency Control Technology in Electrical Automation Control

Yue Peng

Weifang Vocational College, Weifang, Shandong 262737

Abstract: With the continuous improvement of production efficiency, quality and flexibility, electrical automation control technology plays an increasingly important role in industrial production. As the core technology of electrical automation control, frequency conversion speed regulation is of great significance to improve production efficiency, reduce production costs, ensure stable operation of equipment and reduce energy consumption of electrical automation control system. Frequency conversion speed regulation refers to the frequency and voltage adjustment of motor power supply, so as to achieve accurate control of motor speed. The economy of this technology is mainly manifested in its ability to effectively reduce production costs, while its versatility is mainly manifested in its high degree of functional modularity and wide adaptability. Simply put, frequency conversion speed control technology is essential in the electrical automation control system. It reflects the scientific and technological progress of the enterprise, and also plays a decisive role in the enhancement of enterprise benefits. This paper provides a more comprehensive discussion on the application of frequency conversion speed control technology in electrical automation control for relevant personnel.

Keywords: Electrical automation; System control; Variable frequency speed control technology

Introduction

With the rapid development of China's economy, the overall operating of the power system has also made great progress. Relevant departments should do a good job of automation control in the design and management of power systems, master the specific application of frequency conversion speed regulation technology in electrical automation control, and do a good job of integrated management and customization. The analysis of the actual application effect of frequency conversion speed control technology and management needs can achieve a full range of technical innovation and research of frequency conversion speed control technology, so that the function of frequency conversion speed control technology can be maximized, to ensure the practicability of all technologies in application.

1. Principle of frequency conversion speed control technology

Frequency conversion speed control technology is a kind of precision motor speed control strategy, its core concept is to adjust the voltage and frequency in the power system, so as to achieve high-precision control of motor speed. The requirements for motor speed control and advances in power electronics have led to the creation of this technology. Further exploration of the practical applications of variable frequency speed control technology requires a prior understanding of its operating principles.

1.1 Frequency control

The motor operates on the principle of electromagnetic induction. When the frequency of AC power supply changes, the rotating magnetic field in the motor will change, which will have a certain impact on the rotor speed. Using this principle, variable frequency speed regulation technology adjusts the motor speed by changing the power frequency. When the frequency increases, the magnetic field accelerates and the motor speed increases; conversely, when it decreases, it slows down the rotational speed of the magnetic field, which in turn slows down the motor. This method makes the motor speed and frequency into a linear relationship, which lays the foundation for the realization of high-precision speed control.

1.2 Voltage control

In practice, since the torque of the motor is proportional to the square of the voltage, the simple control is not enough to achieve stable operation of the motor. Therefore, the frequency conversion speed control system also needs to be adjusted during the speed control process to ensure that the motor can obtain sufficient torque when the load changes. At low rotational speeds, a higher output torque is required, while at high rotational speeds, the voltage should be adjusted down appropriately to prevent overheating. In this way, the smooth operation of the mo-

tor under various working conditions can be ensured and the normal operation of the motor can also be ensured.

1.3 Current control

The variable frequency speed regulation system will also carry out current control to make the motor run more efficient. By monitoring the working state of the motor and setting the switching mode of the inverter, effective control of the output current wave is realized. This method can not only improve the power factor of the power system, reduce the harmonic of the power system, but also reduce the power loss and improve the efficiency of the motor. Meanwhile, the system also includes dynamic compensation of torque and flow control, which ensures that the motor can still provide stable torque output under various loading conditions.

2. Electrical automation control in the application of frequency conversion speed control technology

2.1 Generator application

The technology also has a great impact on the power output of the generator. When the traditional synchronous generator is running, its speed is very much related to the frequency of the power system. However, due to the wide frequency band and strong adaptive ability of the speed control motor, it has a good application prospect. At the same time, the introduction of frequency conversion speed control technology into wind turbines can make full use of wind turbines to improve the power generation efficiency of the units.

2.2 Motor Drive System Applications

The most common applications of variable frequency speed control technology are in motor-driven devices, such as pumps, fans, and conveyor belts. Precise adjustment of the frequency and voltage of the motor power supply realizes flexible regulation of the output power of the device, enabling it to meet the requirements of various load conditions. For example, in the refrigeration system, the frequency conversion speed control technology is adopted to achieve a constant cooling effect through the adjustment of the speed of the cooling fan. Compared with the conventional constant-speed variable-frequency speed control technology, this method can not only substantially reduce energy consumption, but also effectively prevent engine overloading, thus improving the service life of the equipment.

2.3 Application in CNC machine tools

Frequency conversion speed control technology also plays a key role in precision manufacturing. Frequency conversion speed control technology can enable each processing equipment to quickly switch on different workpieces, so as to improve processing accuracy and reduce energy consumption. For example, in precision drilling, in order to ensure accuracy, the speed can be adjusted very low, while in roughing, in order to achieve faster cutting speed, the speed can be adjusted higher. At the same time, the vibration of the machine tool is reduced by frequency conversion speed control, and the surface quality of the machine tool is improved.

2.4 Application of variable frequency air-conditioning system

The operation of the power system shows that in addition to the use of frequency conversion speed regulation in the above systems, the frequency control system can also be used for air conditioners, especially inverter air conditioning systems. From an overall point of view, the use of frequency conversion control technology to control the air conditioning system is universal and has achieved good results. During operation, it is often necessary to switch on or off the refrigeration unit or the heating unit to better adjust the indoor temperature, which causes a certain amount of energy loss. However, in the process of operating, the inverter is able to adjust in real time as the indoor temperature and load conditions change, thus achieving high energy efficiency. Variable frequency speed control technology enables continuous adjustment of indoor temperature and humidity, greatly improving the comfort and versatility of the entire air-conditioning system. In addition, with the development of modern society, the quality of people's life has improved significantly, and the requirements for air conditioning have become much higher. Frequency conversion speed control technology is used to adjust indoor and outdoor temperatures to make people feel comfortable. We should have a comprehensive understanding of the overall working condition of the frequency conversion speed control technology, analyse the problems that occur in its operation, and improve it based on its working principle to ensure the actual working level of the system.

2.5 Application in industrial automation control

The current development trend of the whole industrial system makes it more important to control the industrial automation system. Technicians need to understand the specific operation mode of the whole industrial system, give full play to the role of frequency conversion speed control technology, and do a good job in the control and management of the whole system. To understand the specific content and needs of the current equipment control, and do a good job of adjusting the motor and hydraulic equipment, it is necessary to carry out in-depth research and discussion of the working mechanism of the air pump and fan, so that the function of frequency conversion speed control technology can

be maximized, and the automation control and management of the entire industrial system can be promoted.

The use of a variety of technologies can effectively improve the actual rate and efficiency of equipment operation, play an effective role in promoting the development of a specific industry, and then achieve the effectiveness and level of specialized production operations. In order to conduct continuous and in-depth research on the application of frequency conversion technology in the current automation control, it is necessary to analyse its working principle, and master its operating specifications to ensure the efficient operation of the overall process.

3. Conclusion

In conclusion, frequency control technology is essential in electrical automation control, which achieves efficient and economical speed control by accurately adjusting the motor frequency and voltage. It improves production efficiency, reduces energy consumption and costs, and ensures stable operation of equipment. It is widely used in many fields such as generators, motor drives, CNC machine tools, air conditioning systems and industrial automation, and promotes the intelligence and efficiency of industrial production. In the future, frequency control technology will continue to develop and bring more innovation to electrical automation control.

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