

Application of Variable Frequency Speed Regulation Technology in Industrial Electrical Automation Control

Liang Qiao

Survey and Design Institute of China Railway Ninth Bureau Group Co., LTD., Shenyang 110015, China

Abstract:

Before the emergence of frequency conversion speed regulation technology, the industrial electrical automation operation mode has been realized, but in the early operation, the operation mechanism of the automatic control system is relatively simple, that is, according to the unified logic, the start and stop control of electrical equipment, this mode can mainly play a reasonable allocation of electrical equipment operating time and reduce the failure rate of equipment in practical work. However, the simple start-stop control mechanism will affect the capacity level of industrial units, which shows that there are defects in early automation control. So in the context of modern technology, some scholars have proposed the application of frequency conversion speed regulation technology in automatic control, refining the start-stop control mechanism to ensure the "relative maximum production capacity" as much as possible, while taking into account the energy efficiency of reducing the failure rate.

Keywords:

Industrial Electric; Automatic Control; Variable Frequency Speed Regulation Technology

I. The application principle of frequency conversion speed regulation technology

1. Frequency conversion speed regulation energy saving

According to the operation principle of the motor, the speed is proportional to the first square of the flow, and the power and the cube of the speed also show a proportional relationship, when the operating efficiency of the motor is certain, if the flow is reduced, the speed will also decrease in a certain proportion, and the power is reduced in a cubic relationship with it.

2. Power factor compensation

The lower power will cause the electrical equipment to heat up and even increase the line loss. When the power factor of the electrical automation system is reduced, the active power will also be reduced, the loss of electric energy is increased, the use efficiency of the equipment is reduced, bringing serious waste of resources, which is not conducive to saving economic costs, and the device frequency conversion governor can adjust the power factor to the greatest extent and reduce reactive power loss.

3. Soft start energy-saving

The starting method of automatic electrical is generally Y/D or direct start, and the current at the start is equivalent to about 5 times the rated current, which requires the equipment to have a high capacitance, which is also easy to shorten the service life of the motor equipment. Based on the soft start conditions, the frequency converter greatly reduces the starting current, no longer requires a higher capacity, reduces the impact of the grid, and extends the life of the equipment. As far as the general frequency converter is concerned, the internal control system is difficult to meet the automation control needs. In order to facilitate the motor to achieve shutdown or deceleration command in a short time, the inverter speed regulation technology can gradually reduce the output frequency, reduce the speed, and then reduce the power consumption of the motor. At the same time that the motor decelerates, the rotor current is in the opposite phase, causing the motor to produce the corresponding

braking torque. In terms of large and medium-sized capacity frequency converter, in order to achieve the purpose of energy saving and consumption reduction, it is necessary to use the power supply regeneration unit to achieve energy feedback; For small capacity frequency converters, it is necessary to consume the feedback energy of the motor through the brake circuit. In the process of discussing automation technology, frequency conversion speed regulation technology has been paid more and more attention. It is an effective way to promote China's industrial production and ensure the normal operation of the motor to continuously improve the frequency conversion speed regulation technology and give full play to its advantages.

II. The automatic operation structure of frequency conversion speed regulation technology

1. Hardware structure

1) Independent inverter

The independent inverter is to put the rectifier unit and the inverter unit in the same container, and then connect the container to the control equipment. In the application, the independent inverter can convert the frequency of the power frequency power supply of electrical equipment, and convert the power frequency current into alternating current, so as to realize the control of electrical equipment with the help of alternating current frequency. It can be seen that the application mode of independent inverter is relatively simple, so the application rate is the highest in industrial units, but the defect of this inverter is that each independent inverter can only control one electrical equipment, and the function can only control the operating speed of the equipment, and play a load control effect.

2) Common DC bus inverter

Common DC bus frequency converter is a frequency converter that acts on the drive system of multiple electrical equipment and controls multiple electrical equipment. It uses a separate rectifier and feedback device to generate direct current with power in the control system, and then connects the frequency converter with the DC bus of the drive system. At this time, the frequency converter has the ability to absorb the direct current in the bus and enhance the direct current in the bus, so in the control, the operation of the rectifier and feedback device of the frequency converter can realize the current weakening or strengthening, and the corresponding operation frequency of the electrical equipment changes. It can be seen that the application method of common DC bus inverter is relatively complex, so the application rate is relatively small, but its functional performance is good, and it is suitable for large-scale industry.

3) Inverter with energy feedback unit

The inverter with energy feedback unit is a kind of inverter acting in the speed regulation system of electrical equipment, and there is a big difference between it and the above two kinds of inverter, that is, the inverter with energy feedback unit is divided into two structures of inverter with energy feedback unit and inverter, which are independent of each other but maintain a connection. In terms of operation principle, first of all, the frequency converter structure is connected to the power generation power supply of the electrical equipment. At this time, under the power generation conditions, affected by the load moment of inertia, the electrical equipment and the frequency converter will run at the same time, but in a short time, the speed of the motor will be greater than the frequency converter, which means that there is excess electrical energy in the motor, which will be absorbed by the frequency converter. Therefore, the voltage in the inverter will rise rapidly, which is easy to affect the temperature of the equipment, and then through the energy feedback unit, it can obtain the DC bus voltage in the inverter, and the DC voltage is converted into AC voltage through the inverter effect, and then through the multiple noise filtering process, the AC power is fed back to the power grid, and the corresponding energy is consumed. It can be seen that the application steps of inverter with energy feedback unit are relatively complex, but it has good energy saving effect, and it is also favored in practical applications.

2. Software structure

The software structure is the key to realize the automatic operation of variable frequency speed regulation technology,

which has the characteristics of remote control, preset logic, function service and so on. Specifically, the software structure of the automatic operation of frequency conversion speed regulation technology, the first need to use the electronic control unit to control the inverter, the electronic control unit is usually composed of sensors and control circuits, in principle, the sensor can obtain the current state of the electrical equipment, and then the state is sent to the terminal in real time, followed by the terminal in accordance with the automatic logic to identify the current state of the equipment. And according to the manual preset requirements, the state is judged, after the judgment is completed, the control circuit will send a signal to make the inverter operate according to the logic requirements; In terms of preset logic, it refers to the operation mechanism set manually at the terminal in accordance with the work requirements, that is, in the face of different conditions, the terminal will automatically issue the corresponding instructions. In the advanced theory, because there are many practical work requirements, a large number of preset logic is required, so in order to facilitate the selection, each logic mechanism can be packaged into an application through packaging technology to realize the software-based application.

III. The practical application of frequency conversion speed regulation technology in industrial electrical automation control

1. Mine indicator protection

As we all know, the environment in the coal mine is extremely complex, and it is necessary to rely on multiple protection mechanisms to protect the electrical lifting equipment in the work and support the good operation of the electrical equipment. At this time, the depth indicator of electronic equipment is extremely important. During the underground operation of coal mines, if the indicator is difficult to demonstrate its effectiveness, it will cause adverse interference to the overall electrical equipment system, resulting in the normal operation of the system. At present, the frequency conversion speed regulation technology can be used, by adjusting the frequency conversion equipment, the depth indicator is effectively checked, and the working motor is started, the real-time superposition of the encoded pulse in the cycle, the encoder and the pulse are compared, and the equipment can be judged on the basis of good operation. If there is no large difference between the data before and after comparison, it indicates that the depth indicator is defective, and the frequency conversion equipment should be repaired immediately to ensure that the maintenance rate meets the standard.

2. Overspeed control protection in constant velocity range

The use of motor pulling equipment is more frequent, and it is located in the constant velocity range, which should be protected based on frequency conversion speed regulation technology. Its advantage is that it can give early warning for the phenomenon of overload and overspeed of the motor pulling equipment, and monitor whether the mechanical equipment can control the operation speed of the equipment. Generally speaking, the working rate of the motor pulling equipment is often not more than 15% of the equipment operation, if above this value, the operating speed of the frequency conversion system equipment will decrease, the system safety loop is separated, the equipment operating speed is controlled based on the emergency braking equipment, and the equipment overload phenomenon is given an early warning, and the equipment running speed is effectively controlled, so that it does not exceed 10%, and the interval overspeed and overload are controlled.

3. Low-speed control and protection in the deceleration section

When the variable frequency speed regulation technology is suitable for industrial electrical automation control, the deceleration interval control is very important to improve the stability control effect of the equipment. If the system slows down to a critical point of equipment, the corresponding control and protection measures should be selected in time. Synchronous selection of frequency conversion and PLC equipment, effective combination of the two, monitoring speed, and implementing sampling work. And effectively check the data value, safety setting value, etc., so as to ensure that there is no problem with the deceleration section system. If the speed does not match this range, a safety warning can be issued to the center of the system, so as to control the operation of the equipment in real time, so as to ensure that the effect of the system deceleration control adjustment is reflected.

Conclusion

At present, frequency conversion speed regulation technology in electrical automatic control is widely used, and reasonable application of this technology can effectively maintain motor equipment and operating system. In practice, the technical personnel should deeply study the application principle of this technology, understand the application effect of this technology in automatic control, and put forward a series of protective measures to avoid human damage or mechanical failure, and comprehensively supervise the electrical system to always maintain a normal working state, providing conditions for promoting the development of industrial technology.

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