

Thinking about the Key Technology of Digital Circuit Breaker

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Abstract

With the rapid development of social economy and the continuous improvement of living standards, people have become more and more dependent on electricity, and put forward higher requirements for power supply reliability. In order to meet the demand of power network lean management and ensure the reliability of power supply as far as possible, digital circuit breaker is rapidly popularized in distribution network. Based on this, the key technology of digital circuit breaker is studied deeply in this paper.

Keywords

Digital Circuit Breaker; Distribution Network; The Key Technology.

1. Introduction

Digital circuit breaker is the key protection device of distribution network, is to protect electrical equipment and distribution network from over/under voltage, overload, overcurrent, short circuit and other factors affecting the switch electrical equipment, in electrical equipment plays an extremely important role in protection. With the further improvement of the degree of industrial automation, the function of digital circuit breaker is also having higher and higher requirements, only can complete the trip control circuit breaker, has been unable to meet the needs of the development of The Times.

2. The Structure and Characteristics of Digital Circuit Breaker

From the point of view of industrial application, according to the different voltage grade can be divided into high voltage and low voltage circuit breaker, often 3kV as a cut-off point, lower than 3kV is low voltage circuit breaker, higher than 3kV is high voltage circuit breaker. Digital circuit breaker, with communication, control and measurement and many other functions, coupled with the increasing innovation of microcontroller technology, makes the function of digital circuit breaker greatly enriched. Intelligent control unit is the key technology of digital circuit breaker, its performance has a decisive influence on the quality of digital circuit breaker. As early as in the 1970s, intelligent controller has been born, with the continuous development and extensive use of communication technology, computer technology and intelligent chip, make circuit breaker control and intelligent monitoring technology in industrial water has been widely used. Compared with the traditional circuit breaker, the digital circuit breaker combines sensor technology, network technology and micro-electronic technology to replace the previous mechanical structure of relay combination and auxiliary switch. Digital circuit breaker can collect operation data separately, excavate faults, and transmit fault signals in real time to avoid safety accidents. On the premise of traditional circuit breaker, digital circuit breaker adds intelligent control unit, which is mainly composed of intelligent identification module, data acquisition module, adjusting device and other parts.

3. Key Technology of Digital Circuit Breaker

3.1 Signal Acquisition

Digital circuit breaker in the process of work, will appear all kinds of physical changes, such as force, heat, displacement, vibration and electrical volume. Select corresponding physical quantities

according to different monitoring requirements, which can reflect the current working condition of the device. For example: in the static state of the digital circuit breaker, the circuit breaker contact temperature monitoring, monitoring the current size, according to the previous temperature value, can be static contact, the contact condition of the first to judge.

3.2 Signal Processing

The collected signal is the original signal, which may contain interference and may not be the most essential quantity reflecting the working state. The corresponding intrinsic quantity is extracted from the original signal to filter out interference and noise in the signal, which is signal processing. When extracting characteristic quantities, experts should give full play to their role.

3.3 State Recognition

With the help of human grasp of the professional theory of digital circuit breaker, the processing of the signal and digital circuit breaker working state and service life related to the characteristic quantity to be compared, and then judge the digital circuit breaker is currently in the working state, this is completely similar to the current expert system used. The intelligent diagnosis of digital circuit breaker depends more on the understanding and mastery of this kind of professional theory. For the self-perfection and self-learning ability of intelligent system, it can not be considered for the time being.

3.4 Diagnostic Decisions

Based on the current actual operation of the digital circuit breaker, so as to determine what kind of action the digital circuit breaker adopts. For example: to give diagnostic reports, determine the subsequent application of digital circuit breakers, for the service life of digital circuit breakers, fault analysis, whether to repair the relevant opinions. If a diagnosis reveals a very serious fault, adjustments or actions can be taken to prevent more serious damage. For example, SF₆ air pressure can not meet the requirements of the design description, so it is dangerous to operate at this time, and the locking command must be issued and executed.

3.5 On-line Monitoring

The open and close control of the digital circuit breaker is usually completed under the action of the electromagnetic force formed by the circuit. The fault detection of the digital circuit breaker can be realized by analyzing the operation characteristics of the switch moving contact and the current fluctuation of the control coil circuit. According to the current waveform obtained from the analysis, the starting time of the mechanism operation, the coil energized time and the rod movement time can be calculated. However, according to the parameter category corresponding to the digital circuit breaker, the current operating state of the operating mechanism is judged. For the same type of digital circuit breaker in good condition, the current waveform of its opening and closing coil is similar, and the time characteristic parameter changes constantly in a certain range. Therefore, the open and close current waveform can be used as a practical reference to compare the open and close current waveform during the operation of digital circuit breaker, so as to achieve the goal of fault detection. The relation between the moving contact stroke of digital circuit breaker and the moving spindle rod stroke is close to the linear characteristic, the contact stroke time characteristic curve can reflect whether there is mechanical vibration fault. Through the addition of acceleration sensor, linear displacement sensor, angular displacement sensor and so on can get the contact motion characteristic signal, in order to determine the digital circuit breaker state is abnormal or not.

3.6 Solid-state Circuit Breaker

In recent years, silicon carbide materials have become a strategic industry facing the main economic battlefield and facing the major national needs, mainly used in new energy, smart grid, rail transit, information and communication and other fields. Doping is the most basic method to give different electrical properties to silicon carbide, among which p-type doping is the "short board" of silicon carbide. Because it is difficult to reduce the resistivity of p-type silicon carbide substrate, it seriously

restricts the development of high-power power electronic devices. So, how do you solve this difficult problem? The first is to find the "crux", which is the main research content of Huang Yuanchao in the science and technology innovation center. -- explores the main reasons for limiting silicon carbide p-type doping and realizes the preparation of p-type silicon carbide substrate with low resistivity. In the study, Huang Yuanchao found the main reasons for restricting THE p-type doping of silicon carbide and proposed the corresponding improvement method, that is, reducing the ionization energy of Al through the "aluminum + titanium" co-incorporation method and entering hydrogen doping into silicon carbide under non-thermodynamic equilibrium to eliminate the compensation effect of carbon vacancy on holes. At present, the circuit breaker industry is in urgent need of a change, and silicon carbide will certainly become an important academic part of the research and development of solid-state circuit breaker.

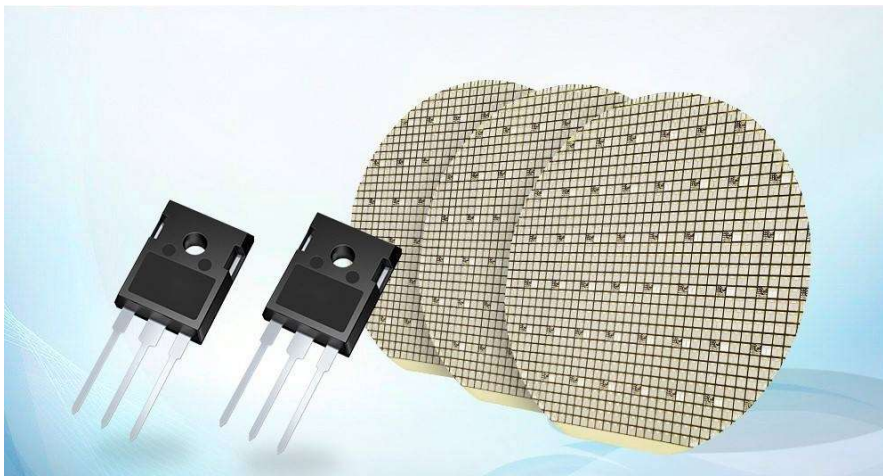


Figure 1. Silicon carbide mos tube

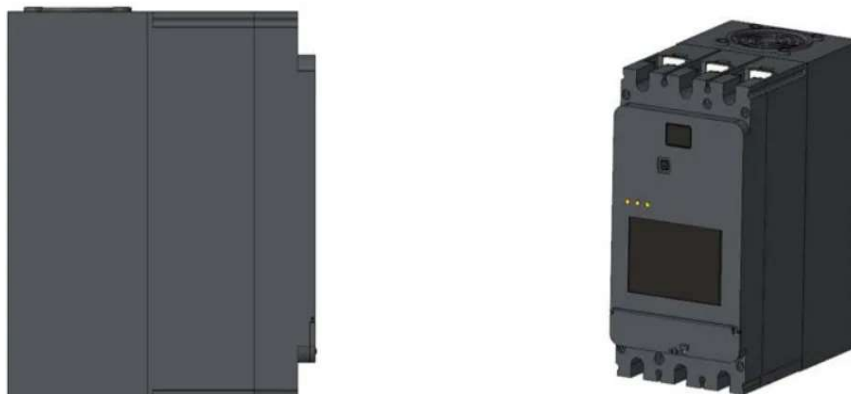


Figure 2. Solid-state circuit breaker

4. Conclusion

To sum up, as a key component of distribution network, digital circuit breaker plays a very important role. Compared with the traditional circuit breaker, digital circuit breaker has its unique structure and characteristics. At present, the key technologies of digital circuit breaker mainly include signal acquisition, signal processing, status identification, diagnosis and decision, online monitoring and other technologies, which support the efficient and stable operation of digital circuit breaker.

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