Application of New Relay Protection Technology in Agricultural Power System

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Abstract: With the continuous development and progress of society, information technology and computer technology have also been highly developed and improved. With the support of technology, new technologies of relay protection system have emerged, which has great significance and role for the effective operation of power system. Especially for the rural power system, the emergence of new relay protection technology has brought many benefits, solved some problems in the rural power system, and guaranteed the effectiveness and security of the rural power system. This paper mainly analyses what is the new technology of relay protection, what specific application of the new technology of relay protection in agricultural power system and the future development trend of the new technology of relay protection.

1. Introduction
The application of new relay protection technology in agricultural power system is of great necessity and significance. With the rapid development of modern relay protection technology, relay protection system has become an important part of the protection system of power plant units and transmission and transformation equipment. It can realize the automatic fault equipment removal in the smallest area in time when the fault or abnormal working conditions occur in the agricultural power system, ensure the stability and safety of the system, reduce the damage of the equipment when the fault occurs, and reduce the impact of the fault on the power supply in the adjacent area. The application of new relay protection technology is the technical guarantee to ensure the safe and effective operation of rural power system. It has an important impact on the development of rural power, ensures the normal operation of rural power system and ensures the smooth progress of villagers’ daily life.

2. New technology of relay protection for agricultural power system

2.1 Information technology
The application of information technology in relay protection of agricultural power system is mainly manifested in two aspects: one is digital signal processing technology. Especially the DSP technology, digital signal processing technology with the development of information technology continues to mature, applied in agricultural power system relay protection equipment, far-reaching impact; second, wavelet transform technology. Wavelet transform refers to the sum of wavelets that divide a signal into different positions and scales. Wavelet transform is a waveform of oscillation, which has a shorter duration, up to several weeks, and has various waveforms. New wavelets or wavelet functions may also be generated. The advantage of wavelet transform is that time-frequency localization analysis has better performance, and some small details in signal or image can be accurately analyzed.
2.2 Adaptive control technology

Adaptive control technology refers to a new relay protection technology which protects the performance or characteristics of agricultural power system by changing the fixed value according to the operation mode of agricultural power system itself and the existing fault state. Fig. 1 is an adaptive control model. The application of adaptive control technology can implement targeted protection measures according to the changes of agricultural power system, greatly improve the protection performance and operation status of agricultural power system, and make the operation of agricultural power system more economical and safe. Adaptive control technology can also weaken the impact of oscillation, fault development, system frequency change and transition resistance in single-phase grounding short circuit on rural power system. Adaptive control technology has good application prospects in transmission line automatic reclosure, distance protection, generator protection and transformer protection.

![Adaptive control model](image1)

Figure1. Adaptive control model

2.3 Artificial neural network technology

Artificial Neural Network (ANN) is a kind of artificial intelligence technology. It can mimic the structure and function of human brain cells, the structure of brain nerves and the way of thinking to enhance the intelligence of this technology. It has complex dynamic characteristics and can deal with problems in parallel. Artificial neural network technology has the functions of memory, learning and association. It has strong adaptability and self-organization ability. It can classify and identify the collected fault samples. Its application in system relay protection mainly embodies in the aspects of non-linear optimization, artificial intelligence, automatic control and information processing. The structure diagram of typical artificial neural network is shown in Fig. 2.

![Structure diagram of typical artificial neural network](image2)

Figure2. Structure diagram of typical artificial neural network

2.4 Fuzzy theory

The application of fuzzy theory in relay protection of agricultural power system is mainly manifested in four aspects: one is to distinguish the synchronous or out-of-step oscillation of multi-mode oscillation. Secondly, the out-of-step oscillations of some complex systems can be distinguished. On this basis, the system can be disaggregated to ensure a more stable and reliable disaggregation. Thirdly,
the basis of feature extraction is wavelet theory, and the basis of distinguishing transformer excitation fault and inrush current is fuzzy set method. That is, when extracting the feature of transformer inrush current discontinuity angle, the feature of wavelet variable maximum sign is taken as the basis. This method of fault identification provides a new and more advanced guiding thought for the researchers of new transformer protection. Fourthly, collect and sort out the relationship between reactive power and reactance components in impedance, and determine the phase selection of asymmetric faults in oscillation. On the basis of correct phase selection, agricultural power system can use distance protection system to remove the asymmetric faults in oscillation in time.

![Figure 3. Membership function of fuzzy scale](image)

There are many scales for converting semantic words into fuzzy numbers, which can also be directly established by decision makers themselves. However, the process will become more complicated. Fuzzy scales can be used to convert them into fuzzy numbers. The functional graph of transforming scales is shown in Figure 3.

### 3. Development trend of new relay protection technology in agricultural power system

The development of relay protection technology is more and more networked. Network is a common communication tool of data and information, and it is the technical pillar and main force of the development of the information age. It has produced an inestimable influence and effect on the development of various industrial fields, and provided convenient and effective means of communication for industrial fields. The specific function of relay protection is not only to cut off the fault components and control the influence area, but also to ensure the normal and stable operation of the whole system. Therefore, every protection unit is required to share the operation and fault data of the whole system. Each protection unit coordinates its actions on the basis of analyzing the shared data to ensure the stable operation of the system.

With the vigorous development of agricultural power industry, the relay protection device in agricultural power system not only has the most basic function of relay protection, but also has the functions of long-term, large-capacity storage of fault information and data, powerful communication function, sharing system data and fast data processing. The realization of these functions requires the support of computer technology, so computerization is the inevitable development of relay protection technology. The development of computerized relay protection technology is of great significance to relay protection technology. It adds many effective and practical functions to relay protection technology and promotes the development and perfection of relay protection technology.

### 4. Conclusions

The new technology of relay protection is mainly developed on the basis of advanced technology such as computer technology, information technology and network technology, which is of great help to the
power system. Especially for the relatively backward system, the agricultural power system which is prone to problems is more helpful. There are many applications of relay protection technology in agricultural power system, which has great popularization. It is believed that with the continuous improvement and development of new relay protection technology, the application of new relay protection technology in agricultural power system will be more and more extensive.

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