

Research on Application of Intelligent Technology in Automatic Control of Power System

Yan Gao

Jilin Technology College of Electronic Information, Jilin, Jilin, China

646147122@qq.com

Keywords: Automation of Power System, Intelligent Technology, Application

Abstract: Due to the Development and Application of Advanced Technology, Intelligent Technology is Gradually Applied to Power Automation System. the Automation System in the Power Industry Includes a Series of Automation Management Programs and Systems Such as Power Failure Simulation Integrated Program, Power Dispatching Automation and Power Control Automation. as the Main Content of Power System Monitoring, Control, Prevention and Treatment, Intelligent Control Can Not Only Ensure the Efficient Operation of the System, But Also Reduce Energy Transmission Losses, Which Has Become the Focus of Attention. in This Paper, the Application of Intelligent Technology in Power System Automation Will Be Described and Studied in Detail in Order to Provide Useful Experience for the Vast Number of Peers.

1. Introduction

Automation of Power System Includes Automation of Power Production, Transmission and Overall Management. However, the Power System as a Whole is a Very Complex System with Time-Varying and Strong Nonlinearity, and Its Related Parameters Are Not Clear and Constant [1]. on the Other Hand, the Power System is Not Only Built in the Plains, But Also in Some Places Such as Hills and Plateaus. as a Key Technology in Automatic Control, Intelligent Technology Plays a Driving Role in the Realization of the Automation of the Entire Power System. the Introduction of Automation Technology and Intelligent Technology Has Brought a Spring Breeze to Power System Control. with the Gradual Improvement of These Two Technologies, They Have Been Applied to Every Level of Power System Construction and Become an Indispensable Part of Power System Management.

Practical research shows that the reasonable application of intelligent technology in power system automation control can significantly improve the level of power system automation, deal with various problems more scientifically, and optimize the power system to a greater extent [2]. Through power system automation control, the application quality of computer information technology can be effectively improved, the control reliability of power system can be improved, and the effectiveness of system response and adjustment operation can be improved. It has a very good promotion effect on Chinese power development. To this end, the application of intelligent technology in power system automation control can not only improve the degree of power system automation, but also make it develop and stride towards intelligent direction. The research on “functional technology application in power system automation control” has great practical significance.

2. Overview of Automatic Control and Intelligent Technology in Power System

2.1 Automatic Control of Power System

Power system automation control refers to the full application of automatic adjustment and control technology in all parts of the power system to promote the automation level of the power system and enhance the control effect of the power system. The power system automation program automatically adjusts and manages the production, transmission and management of electric energy

to ensure the smoothness of the overall operation of electric power. Among them, power distribution automation, power generation control automation and power grid dispatching automation are the main components of power system automation control technology. Through automatic control of power generation, transmission and other links, real-time automatic monitoring of power equipment can be carried out, scientific dispatching and coordination of power equipment can be carried out, and the goal of safe and stable operation of power system can be achieved. The power system automation realizes the remote or local automatic coordination, control and monitoring of local and overall power systems and various components therein. It uses multifunctional automatic decision-making, detection and control equipment, as well as data transmission system and signal system.

2.2 Intelligent Technology

Intelligent control is a control technology proposed with the development of control theory. Its main function is to help solve control problems that cannot be solved by traditional control methods. It is especially suitable for control systems with high adaptability, uncertainty and strong nonlinearity [3]. In the power system, computers also play an important role. The combination of power system and automation technology has completely changed the working process of power system and greatly improved the stability and safety of power system. If part of the work is in a low state and the traditional control technology cannot play a role, then through the application of intelligent technology, we can comprehensively analyze the surrounding conditions and actual problems, and make scientific responses and decisions in combination with actual needs. It improves the daily operation quality and efficiency of the power system, makes good use of power resources, and improves the quality of life of the people. It plays a very important role in the prosperity and development of Chinese economy. The technology mainly takes physical power system as the research foundation, and implements the optimal allocation of power resources according to sensing measurement technology, communication technology, computer technology, control technology, information technology, etc. to improve the reliability, safety and economy of power system operation.

3. Implementation Scheme and Measures of Intelligent Technology in Power System

Before applying intelligent technology to electric power control system, technicians should plan the implementation plan of its application, check and deal with the problems and defects that may occur in the existing electric power automatic control system on the basis of the original electric power control system. The application of intelligent technology still has various limitations, such as short application time, insufficient system coordination ability, inability to achieve complete sharing of resources, resulting in low automation degree of electric power system, etc. Technical personnel shall formulate relevant application measures and technical application task books according to the determined intelligent technology functions, draw application drawings of intelligent technology according to the requirements in the task books, and formulate corresponding application schemes, so as to provide guarantee for better application of intelligent technology in power automation control. It has greater benefits for enterprises and ensures the efficiency of their production operations. Intelligent technology is the result of modern scientific and technological progress. The application of intelligent technology in power control system will further improve its automation level.

After the implementation plan for the application of intelligent technology is worked out, specific technical application projects shall be carried out according to the plan, and electric power automation control shall be reformed according to the intelligent technical drawings [4]. The power system is a complex and comprehensive management system, which includes many kinds of automation equipment and programs, such as real-time dispatching monitoring, substation automation and load control. In the process of power system automation control, designers should analyze the characteristics of intelligent technologies, and deepen the contents of communication, measurement, equipment, control and support according to the requirements of power system

automation development. In this process, technicians should shoulder their own responsibilities, research and solve some problems that may occur in the application process, and do not arbitrarily change the design drawings, so as to ensure that intelligent technology can play its greatest role in power automation control. With the further development of the electric power industry, the electric power automation system is gradually changing to an intelligent electric power system. This is not only a change from simplification to diversification, but also the only way for the sustainable development of the electric power industry.

4. Application of Intelligent Technology in Automatic Control of Power System

4.1 Fuzzy Theory

Through the application of language variables and logical reasoning theory, the power equipment and power system can achieve the effect of simulation exercises, which is the fuzzy theory [5]. In modern industrial production and operation, due to the complexity of the process, the complexity and uncertainty of the mode formed, the high dimension, time variation, high nonlinearity of the system structure and parameters, as well as the position and uncertainty factors inside the system, lead to the inevitability of fuzzy control system. Fuzzy control simplifies the complexity of system control and facilitates operation by fuzzy logic reasoning and language variables. It is very suitable for control systems with incomplete models, time-varying and strong nonlinearity. In order to effectively and efficiently control the power system, the power industry has introduced a computer control system and used a computer program for braking control. However, it is impossible to effectively control the power system only by compiling a complete computer control program, which requires intelligent power system and manual cooperation. In this case, the technical data can strictly control the logic process according to the rules, that is, through fuzzy theory and logic reasoning, it can simulate the decision-making of human beings, carry out the fuzzy input or intuitive reasoning in the early stage of the power automation system, and make the power automation system complete the decision-making work. It can fundamentally solve the problems of complex variables in the power system and difficult to master real-time system dynamics, etc. It will push the automatic control of the power system to a new height.

4.2 Neural Network Control

The neural network control mentioned here has a long history. Since the early 1940's, neural network control has begun to enter the field of vision and cognition of many researchers. Neural networks are mainly used to simulate the transmission and processing of relevant information. Simple neurons are simulated manually and then connected in a certain standardized way to form [6]. Neural network control scheme has been applied scientifically and reasonably in the automatic control of power system. Artificial intelligence system, mathematical system and computer system are ingeniously combined by neural network control, which makes the framework of energy consumption collection, energy consumption calculation and energy consumption analysis more accurate and intuitive, and improves the working efficiency of the system. A perfect framework for energy consumption collection, energy consumption calculation and energy consumption analysis of the system has been formed, and the energy adjustment and control effects in the power system have been improved. Neural network control through the analysis of neural structure and model. Expert intelligent technology not only includes the relevant theoretical knowledge of power system, but also summarizes the relevant practical experience of power experts. Through improving the knowledge expression and acquisition mode, the diagnosis efficiency of equipment faults in power system has been improved [7]. Different advantageous knowledge can be automatically organized to meet different requirements of information processing. At present, the research on neural network theory is mainly focused on learning algorithm, model, structure and hardware.

4.3 Expert System Control

Expert system control is widely used in power system, and its technology is mature. The expert

control system can distinguish whether the power system is in a warning state or in an emergency state, and propose processing methods so that the power system can quickly return to the control state. This involves many aspects, including not only the recovery of power system performance, the application of emergency processing system, the debugging and switching of various states of the power system, but also the identification of system power supply states, the isolation and removal of faults, and short-term power load warning, etc. Although it has its own advantages, the disadvantage of this method is that it can't carry out heuristic reasoning and synchronous knowledge accumulation. In addition, this method cannot imitate the thinking of experts, has poor learning ability, and cannot analyze and deal with more complex problems. Therefore, when technicians apply the expert system to power automation control, they should pay attention to the problems of knowledge acquisition, effectiveness and combination with other tools of the expert system to improve the expert system.

4.4 Linear Control

Linear control, also known as linear optimal control, is a research form based on optimization theory and an important component of modern control theory [8]. For large units, the optimal excitation control method should be directly used instead of the classical excitation method. In addition, the optimal control theory has also been successfully applied to the optimal time control of hydraulic generator braking resistance. Some studies have proved that using optimal control methods can improve the transmission capacity of power grid for long-distance transmission and improve the transmission quality of transmission lines. The optimal excitation control mainly applies the principle of linear optimal control, compares the measured voltage of the generator with the voltage value of a given voltage, calculates the deviation according to the requirements of PID method, and obtains the control voltage. That is, excitation control in optimal control can further strengthen the transmission capacity of long-distance transmission lines and significantly improve the dynamic quality. Moreover, after long-term and repeated tests, it is concluded that this optimal excitation control method has the best effect when applied to large-scale equipment. Linear optimal controller of power system has been widely used in power production and plays an important role. However, it should be pointed out that since this controller is designed for the local linearization model of the power system, the control effect on large disturbances in a strongly nonlinear power system is not ideal.

4.5 Integrated Intelligent System

For integrated intelligent systems, it not only includes intelligent control methods and intelligent systems, but also involves in-depth cross-linking with power automation systems. On the one hand, modern control methods are combined with intelligent control, such as fuzzy structure control, adaptive neural network control, neural network variable structure control, etc. On the other hand is the cross combination of various intelligent control methods. This is mainly manifested in the cross-use of various intelligent control methods. When studying power systems, expert systems and fuzzy control are often combined, fuzzy control and neural network are often combined, adaptive control, fuzzy control and neural network control are combined, neural network and expert system are combined, etc. Comprehensive intelligent technology not only meets the resource allocation content requirements of power system automation control, but also meets the optimization design objectives of intelligent technology, which has become the inevitable direction of power system automation intelligent technology development.

5. Conclusion

With the rapid development of our country's social economy, the electricity market economy has also made continuous progress. As an important technology of power system, intelligent control technology of power system automation has also received people's expectation and attention. It must develop steadily towards the goal of high quality, high efficiency, stability and safety. In the process of automatic and intelligent control of power system, designers should strengthen the

development and application of intelligent technology. According to the development trend of intelligent technology, reduce the cost of power resources, reduce the energy consumption in the process of system transmission and distribution, and fundamentally improve the quality of economic benefit control. The application of various intelligent and innovative methods in power control system has greatly improved the quality and efficiency of power supply. The wide application of intelligent technology will certainly promote the automation of the entire power system. With the in-depth study of various intelligent controls, the perfection of intelligent schemes for power systems is just around the corner.

References

- [1] Jiang, Wei., Jiang,Wei. (2017). Research on Application of Intelligent Technology in Automation Control of Power System. *Electronic Test*, no. 1, pp. 93-94.
- [2] Li, Ming. (2017). Application of Intelligent Technology in Automation Control of Electric Power System. *Construction Engineering Technology and Design*, no. 8.
- [3] Wang, Qian. (2018). Application of Intelligent Technology in Automation of Electric Power System. *Shandong Industrial Technology*, no. 1, pp. 156-156.
- [4] Zhang, Guangyi. (2019). On the Application of Intelligent Technology in Power System Automation. *Shandong Industrial Technology*, no. 18, pp. 183-183.
- [5] Wang, Yanzhong. (2017). Analysis of power system automation technology and related applications. *Science & Technology Innovation and Application*, no. 9, pp. 202-202.
- [6] Hao, Zhongxiao. (2018). Discussion on Application of Intelligent Technology in Automation Control of Electric Power System. *Internal Combustion Engine and Parts*, no. 1, pp. 206-208.
- [7] Yu, Jian., Qiu, Yanzhuang. (2018). Application of PLC technology in power system automation engineering. *Military-civilian Dual-use Technology and Products*, no. 2, pp. 236-236.
- [8] Wang, Dezhen. (2019). Application of Intelligent Technology in Automation Control of Electric Power System. *South Agricultural Machinery*, no. 15, pp. 181-182.