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Application of Medium-voltage High-speed Analog Communication Technology in Distribution Automation

Bin Zhao[1,2], Cheng Gong[1,2], Yifei Li[1,2], Fang Wang[1], Tianle Li[1,2], Hao Ma[1,2], Jun Feng[3,✉]

[1] *State Grid Beijing Electric Power Research Institute, Beijing, 100075, China*

[2] *Beijing Dingcheng Hongan Technology Development Co., Ltd., Beijing, 100075, China*

[3] *North China University of Science and Technology, Tangshan, Hebei, 063210, China*

ABSTRACT

With the rapid development of society, the emergence of society and people's daily life have put forward higher quality requirements for power supply. The original distribution system cannot monitor and control the circuit condition in real time. The power grid operation efficiency is low, and the loss of electric energy in the transmission process is large, resulting in the unstable power supply to users. With the development of smart grid, distribution automation has become the goal of Power System (PS) development. There are many noise data in the process of medium voltage distribution communication. In this paper, the medium voltage high-speed analog Communication Technology (CT) was applied to distribution automation. By modulating the signal and other operations, automatic power distribution can be realized, which can effectively shorten the maintenance time of fault circuits and quickly share power data resources. This paper compared the traditional medium-voltage distribution with the distribution automation based on the medium-voltage high-speed analog CT. The experimental results showed that the average power supply reliability of the traditional medium-voltage distribution and distribution automation was 88.90% and 95.56% respectively in the 10 kV voltage. In the 20 kV voltage, the average power supply reliability of traditional medium-voltage distribution and distribution automation was 90.24% and 97.04% respectively. Therefore, the application of medium-voltage high-speed analog CT in distribution network to distribution automation can effectively improve the reliability of power supply.

Keywords: Distribution Automation, Distribution Network, Medium-voltage High-speed Analog communication technology, Carrier Communication

✉ Corresponding author.
E-mail address: m13587205150@163.com (J. Feng).

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1. Introduction

People also put forward higher requirements for the quality of power consumption, which requires higher power quality and power supply reliability. According to the requirements of China's power grid power supply service, the power supply reliability of the PS to urban areas cannot be lower than 99%, but the traditional power distribution system is easy to cause redundant generation and low power distribution capacity due to the insufficient optimization of the power grid structure. The traditional distribution system can not meet the needs of users. It is necessary to improve the distribution network system, and it is possible to integrate and analyze the data of the distribution network, the power consumption of users and the structure of the power grid, realize the automation of the distribution network, and carry out real-time monitoring, protection and effective control of the operation of the PS. Distribution automation is the key to the development of smart grid. Distribution automation in China is mainly divided into high voltage, medium voltage and low voltage. The high voltage automatic power transmission model has been realized, but the medium and low voltage automatic distribution system has not formed a complete system due to its late development. Due to the relatively low voltage in the medium voltage distribution communication process, there are many channel noises, and the structure of the medium voltage distribution network is complex, which makes it difficult to carry out efficient distribution. The medium-voltage high-speed analog CT is a kind of carrier communication, which can realize the distribution automation management and reduce the outage time when applied to the distribution system. Therefore, this paper has research significance.

With the increasing demand for electricity in society, it is very important to develop smart grid to provide people with high-quality and reliable electricity. The core of smart grid is distribution automation. Many people have studied distribution automation. Among them, Elkadeem M R used the distribution automation system to improve the performance of the underground medium voltage distribution network, and effectively improved the reliability of the distribution network through the distribution automation system [1]. The research of Butt Osama Majeed pointed out that the demand for electric energy in society has increased dramatically, and the increasing demand has increased the requirements for higher reliability, efficiency, safety, and environment and energy sustainability, thus increasing the complexity of the grid. The smart grid can improve the efficiency, reliability and sustainability of the distribution system [2]. Shifeng Ou designed an intelligent closed-loop test system for distribution automation terminals to improve the operation efficiency of power network through distribution automation [3]. Muhammad Munir Azam used the data set method to reconstruct the discrete network, eliminated the computational cost of non-radial combination in the optimization process, and finally obtained the local optimal solution, which effectively improved the performance of the entire power network [4]. Distribution automation can quickly deal with power failures and improve the reliability of power supply by automatically controlling and managing the information of the power network. However, there is a lack of analysis on the automation of medium-voltage distribution network.

The power transmission automation management is divided into high voltage, medium voltage and low voltage. However, there are many branch lines in the medium voltage distribution network, and the attenuation of the lines is obvious. Relevant researchers have applied the medium voltage high-speed analog CT to the distribution automation. Among them, Yan Yu proposed a new type of live working robot structure for distribution network maintenance, which can effectively eliminate or reduce the adverse effect of internal force in the closed chain between the working object and the manipulator under the typical task of 10 kV distribution network, and improve the operation efficiency of the power grid [5]. VC Veera Reddy optimized the layout of renewable resources in the distribution network through the comprehensive power loss index and whale optimization algorithm to improve the efficiency of automatic distribution and transmission of power in the power network [6]. Wang Dan designed a comprehensive energy distribution system, which alleviated the environmental pressure of the regional energy system through comprehensive utilization of multiple energy coupling links [7]. Distribution automation system has been more and more widely used. Power line carrier CT is widely used in distribution automation because of its remarkable characteristics and technical advantages. However, it is not enough to compare the performance changes before and after distribution automation.

With the increasing demand for electricity, the PS needs to develop towards a higher quality and more reliable power grid. Smart grid can realize distribution automation through intelligent technology, and the core of distribution automation is data communication. This paper analyzes the medium-voltage distribution, applies the medium-voltage high-speed analog CT to the distribution automation, realizes the sharing of distribution information through the modulation and other processing of communication data, improves the processing effect of circuit faults, and ensures the stability and reliability of power supply.

2. Methods of Distribution Automation

2.1. Smart Grid

With the rapid development of the economy, people's quality of life is constantly improving. People's life and social production are inseparable from electricity. However, the PS is required to deliver higher quality and economic power. After many reforms, the PS has already achieved high-speed power transmission.

Artificial Intelligence (AI) is a process that simulates the human brain to process complex logical things, and can extend and expand human intelligence theory [8-9]. AI technology has developed rapidly and has been widely used in various fields, promoting the development and progress of society. AI has the ability of optimization analysis, which can be well combined with the power network to form a smart grid and improve the efficient transmission of electric energy.

The smart grid is based on an efficient communication network and provides decision-making analysis for the power grid system through advanced intelligent technology to achieve the economic, safe and reliable development of the power grid, meet the high-quality power demand of users and optimize the distribution form [10-11]. Smart grid can check circuit faults, optimize circuit structure and realize automatic distribution, and promote the development of power grid system. The structural model of smart grid is shown in Figure 1.

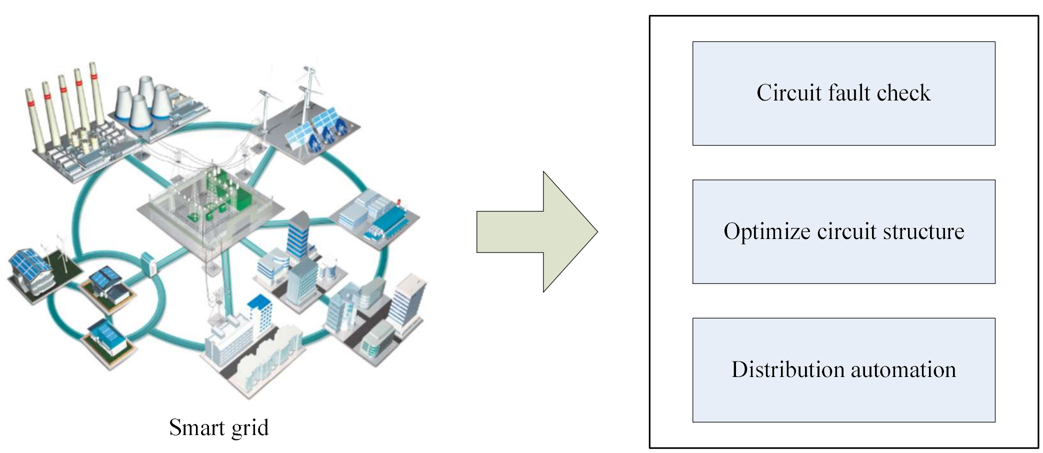


Fig. 1. Structure model of smart grid

In Figure 1, the structure model of smart grid is described. Smart grid is based on the traditional grid by adding intelligent analysis elements to realize circuit optimization and distribution automation, and to meet the power demand of users to the maximum extent.

Artificial neural network realizes intelligent information analysis by simulating biological neurons, and has excellent nonlinear data prediction and analysis ability [12-13]. The artificial neural network can provide information analysis for the smart grid system, making the data set of the smart grid $U=(u_1,u_2,\cdots,u_n)$, such as the data of the grid structure. If the connection weight of artificial neuron and smart grid data is $V=(v_1,v_2,\cdots,v_n)$, the result of artificial neuron processing smart grid data is expressed as:

$$k=\sum_{i=1}^{n} v_i u_i \tag{1}$$

The results of artificial neuron processing are processed by activation function to obtain:

$$y(k)=1/\left(1+e^{-k}\right) \tag{2}$$

The structure of artificial neural network is affected by the arrangement of neurons, and different network structures would have different analysis results. Back-propagation neural network has two-way information transmission mode, which can realize forward data transmission and reverse error adjustment. The application of BP neural network to smart grid can effectively analyze the grid data. The error of back propagation neural network is expressed as:

$$A=\left(\sum_{j}\left(b_j-c_j\right)^2\right)/2 \tag{3}$$

In Formula 3, A represents the error of the back-propagation neural network. Through the analysis of the error, the structure of the network can be adjusted so that the neural network can be better applied to the smart grid.

The criteria that back-propagation neural network can be used for smart grid analysis are:

$$A \le a \tag{4}$$

In Formula 4, a represents the maximum acceptable range of error of back-propagation neural network in smart grid system.

When $A>a$, the neural network structure needs to be adjusted by error A until $A \le a$.

2.2. Distribution Automation

Smart grid optimizes the power transmission process, and distribution automation is an important research direction of smart grid. The main purpose of distribution automation is to improve the power supply efficiency of the distribution network, and reduce distribution faults. In the distribution automation system, power supply enterprises can be monitored in real time. The power grid structure can be optimized, and the labor cost of power personnel can be reduced. The structure model of distribution automation system is shown in Figure 2.

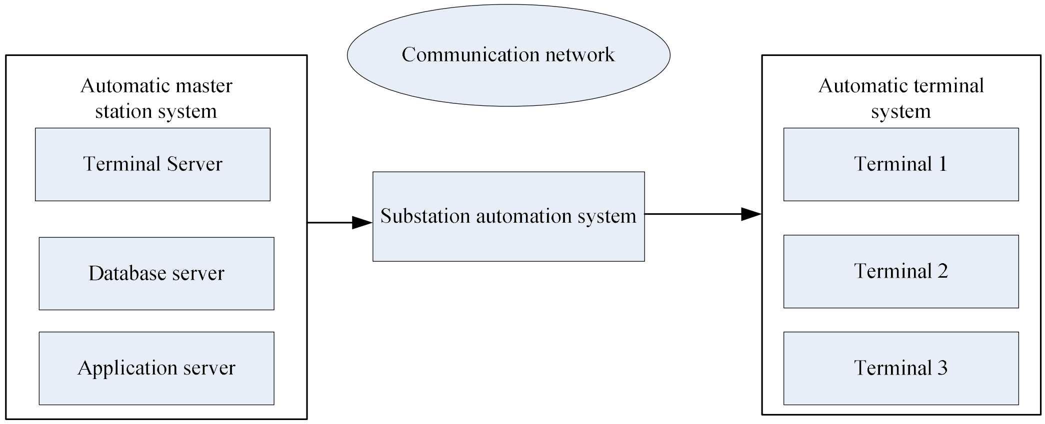


Fig. 2. Structure model of distribution automation system

In Figure 2, the distribution automation system structure model is described. The distribution automation system consists of four parts, namely, the automation master station system, the substation automation system, the communication network and the automation terminal system.

Substation automation system is the reasonable management and monitoring of substation equipment, which is composed of various monitoring and protection devices in the substation. The communication network is the platform for information exchange between the respective automation systems, and can generally communicate through distribution line carrier and radio. The automatic terminal system provides data for the operation monitoring of the distribution system by directly obtaining terminal data, and can accurately execute the commands issued by the master station system to control the terminal equipment.

The distribution automation system plays a huge role in the intelligent operation of the power grid, and can deal with the difficulties encountered by the traditional power grid in a timely manner. The main functions of the distribution automation system can be divided into distribution data acquisition, load management, automatic meter reading, etc. The distribution network automation system has many functions, and each function is connected with each other to jointly promote the development of the PS. In the distribution automation system, the collection of distribution data is the most core function. Through the automation equipment, the power supply of the circuit can be monitored in real time. When the circuit encounters a fault, it can locate the fault location in time, analyze the cause of the fault, and formulate the best solution in time.

The automatic power distribution system promotes the development of the PS and satisfies people's power demand by intelligently analyzing the circuit situation through automatic power distribution. Distribution automation has important application significance. It can effectively improve the reliability of power supply. This is because the traditional circuit fault repair needs to repair the whole circuit after power failure, resulting in regional power failure. The automatic distribution system can locate the fault circuit, repair the circuit fault targeted, and maximize the protection of residential electricity.

The distribution automation system can also optimize the network structure, and reduce the loss of power transmission through line optimization while reducing fault repair. In addition, the distribution automation system can share the resources of the PS, which provides a large number of original power data for the data analysis of the smart grid. Through the analysis of the power data, the response speed to user service and power supply quality can be improved.

In the process of power grid dispatching automation and distribution automation, the communication system is the key to the information transmission of the entire distribution automation system. Because the main station system is far away from the terminal and is affected by environmental factors, the distribution automation communication needs to meet the characteristics of reliability, stability and economy.

The main reason why the communication system should be reliable is that the distribution terminal is exposed to the outside and has been affected by bad weather for a long time, so it needs to be reliable, and continuously provide information exchange services for the distribution automation system. In addition, the communication system needs to transmit information stably for a long time, and the equipment of the communication system needs to ensure that it would not fail. Because the coverage of distribution system is very wide, the communication of distribution automation needs to meet the economy, and the economic cost of maintenance needs to be considered while ensuring the normal communication function.

2.3. Medium-voltage High-speed Analog CT

The distribution network is a safe, reliable and efficient network provided by the secondary step-down substation in the PS to users. It is composed of distribution lines, distribution stations and connected users [14-15]. The voltage standard of high voltage distribution network in China is generally 110 kV or 35 kV, and the distribution voltage in some cities reaches 220 kV. The voltage of medium voltage distribution network is generally 10 kV, and that of low voltage distribution network is 220 V.

High voltage distribution automation technology has been relatively mature, but the automatic distribution of medium and low voltage is still in the development stage, and the medium voltage distribution communication is the difficulty to achieve distribution automation. This is mainly due to the fact that there are many branches in the medium voltage distribution network, and there are many crossover distribution lines in the middle, which leads to the high channel noise and complex network structure of the medium voltage distribution communication.

Due to the relatively low voltage during the medium voltage distribution communication, it is not easy to discharge the transmission line, which makes the random noise generated in the distribution network smaller. However, due to the relatively small voltage, the distance between the user and the power line is relatively close, and the pulse noise generated would seriously interfere with the effect of carrier signal transmission. In addition, due to the very complex structure of the medium-voltage distribution network, there are a large number of node elements in the medium-voltage distribution system, resulting in the impact of signal reflection in the process of transportation.

The medium-voltage high-speed analog CT uses the medium-voltage power line in the power transmission network as the signal transmission medium to transmit power information, and is widely used in the data transmission of the medium-voltage automatic distribution network. It belongs to carrier communication. The working principle of the medium-voltage high-speed analog CT in the automatic distribution network is shown in Figure 3.

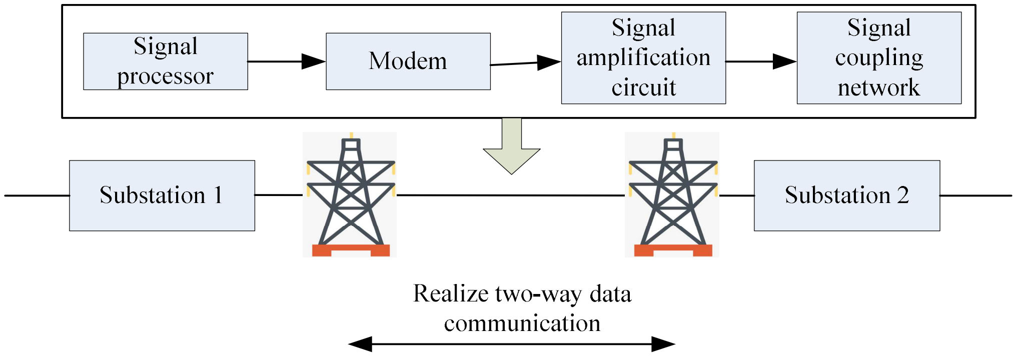


Fig. 3. Working principle of medium-voltage high-speed analog CT

In Figure 3, the working principle of medium-voltage high-speed analog CT is described. The communication signal realizes data communication of medium-voltage distribution line through signal processor, modem, signal amplification circuit and signal coupling network.

The carrier signal is sent and received through the signal processor and the relevant communication data is processed, while the modem adjusts the spectrum of the communication signal to move the spectrum to the appropriate position. Then the modulated signal is amplified by the signal amplification circuit to improve the effect of information communication. Finally, the signal coupling network is used to improve the anti-interference ability in the process of power communication.

The application of medium-voltage high-speed analog CT in distribution network automation can well solve the problems of carrier signal attenuation and signal transmission at nodes. When the medium-voltage high-speed analog CT is used for signal modulation, the modulation methods are divided into three types: amplitude modulation keying, frequency shift keying and phase shift keying. The medium-voltage high-speed analog CT can reduce the attenuation of the signal in the transmission process by reasonably selecting the available frequency of the communication signal, and can reduce the interference of the transmission signal by setting the relay when the communication transmission distance is too large.

3. Experiment of Distribution Automation

3.1. Data Source of Distribution Automation

With the increasing number of power users, distribution automation is an important means to control the transmission of terminal data and information and to collect information. Distribution network is directly oriented to terminal users. The medium-voltage transmission network has a large coverage area and a wide range of applications, mainly including the monitoring of grid faults, centralized meter reading and optimization of circuit structure. The realization of distribution automation is the basis of building a smart grid. The number of information points of distribution automation is large. The distribution equipment is monitored in real time through a large number of information points such as substations and switching stations. Distribution automation is to meet the needs of users for high-quality power consumption, and also has certain requirements for communication speed. It has different requirements for communication rate of different equipment. The communication rate of terminal equipment of distribution automation is shown in Table 1.

Table 1. Communication rate of distribution automation terminal equipment

Serial number	Terminal equipment	Communication rate (bps)
1	Meter reader	30-280
2	Transformer	20-320
3	Transformer substation	1200-9200
4	Power distribution monitoring terminal	200-1100

In Table 1, the communication rate of the distribution automation terminal equipment was described. The maximum communication rate of the substation was 1200-9200bps, and the communication rate of the distribution monitoring terminal was 200-1100bps.

The core of smart grid is distribution automation, which depends on excellent communication network. This paper applied medium-voltage high-speed analog CT to distribution automation, and improved the quality of distribution automation information communication by filtering and amplifying carrier signals. In order to effectively evaluate the application effect of medium-voltage high-speed analog CT in distribution automation, this paper conducted a questionnaire survey on 200 distribution automation communication researchers. The main statistics are indicators that can evaluate the effect of distribution automation. The results of the questionnaire are shown in Table 2.

Table 2. Distribution automation evaluation indicators

Serial number	Index	Number of people	Percentage
1	Communication anti-interference	42	21%
2	Power supply reliability	56	28%
3	Grid operation efficiency	48	24%
4	Power supply stability	54	27%

In Table 2, the evaluation indicators of distribution automation were described. A total of four indicators were listed, including communication anti-interference, power supply reliability, power grid operation efficiency and power supply stability. The highest percentage of power supply reliability index was 28%; the highest percentage of power supply stability index was 27%; the lowest percentage of communication anti-interference index was 21%.

3.2. Experimental Design of Distribution Automation

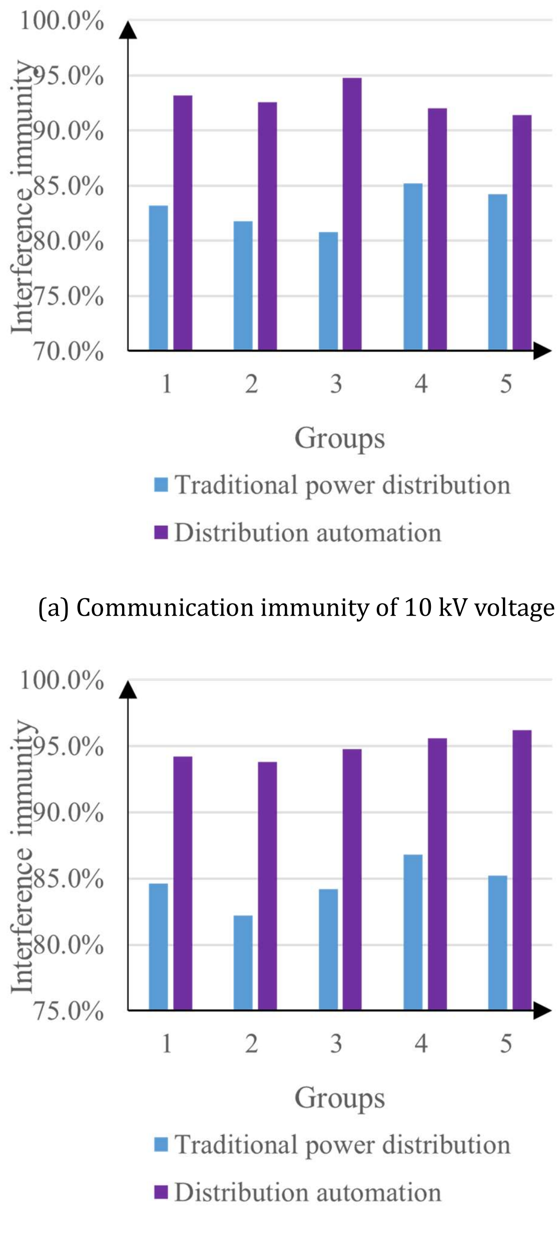
The data communication of distribution automation is an important part of distribution automation. With the development of smart grid, the automation construction of medium-voltage distribution network can provide people with better electricity experience. The communication noise in the medium voltage distribution network is very much and the communication signal decay rate is very fast. Carrier communication was widely used in medium-voltage distribution lines. This paper applied medium-voltage high-speed analog CT to distribution automation.

In this paper, a comparison was made by setting up a control group, in which the control group was traditional medium-voltage distribution, and the experimental group used distribution automation based on medium-voltage high-speed analog CT. This paper made statistics on the data of medium-voltage distribution in China. Since different voltage sizes had different effects on distribution, this paper would set 10 kV voltage and 20 kV voltage for comparative analysis. In order to ensure the accuracy of the data statistics of the medium-voltage distribution network, this paper would carry out multiple data statistics to eliminate the errors caused by human or system. The data comparison points of traditional medium-voltage distribution and distribution automation based on medium-voltage high-speed analog CT are communication anti-interference, power supply reliability, power grid operation efficiency and power supply stability.

4. Results of Distribution Automation

4.1. Communication Anti-interference

Power distribution CT is the core of realizing information exchange of power distribution equipment and monitoring and controlling power distribution. However, the network structure of medium voltage distribution communication is complex due to the many branches of the line, and there are many noise data in the channel. This paper compared the anti-interference performance of distribution communication between traditional medium-voltage distribution and distribution automation based on medium-voltage high-speed analog CT. The comparison results are shown in Figure 4.



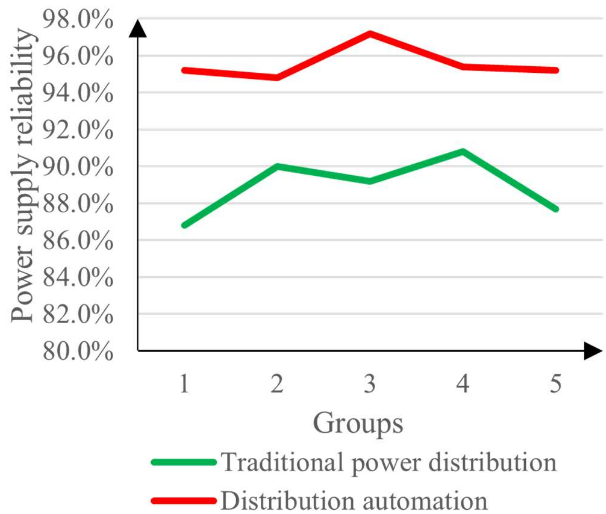
(b) Communication immunity of 20 kV voltage

Fig. 4. Comparison results of communication immunity

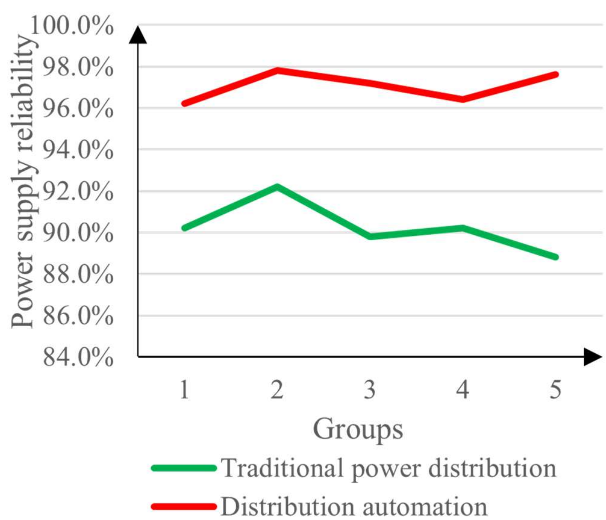
In Figure 4 (a), the comparison results of the communication immunity of the two power distribution modes at 10 kV voltage were described. Among them, the communication immunity of the traditional medium-voltage power distribution reached the lowest of 80.8% in the third group and the highest of 85.2% in the fourth group, with an average of 83.04%. The anti-interference ability of distribution automation communication based on medium-voltage high-speed analog CT was stronger than that of traditional medium-voltage distribution communication in five experimental statistical results. This was because the medium-voltage high-speed analog CT can reduce the interference of noise data by modulating the communication signal. The anti-interference of distribution automation communication based on medium-voltage high-speed analog CT reached the lowest of 91.4% in the fifth time, and the highest of 94.8% in the third time, with an average communication anti-interference of 92.80%. In Figure 4 (b), the comparison results of the communication immunity of the two power distribution modes at 20 kV voltage were described. The communication immunity of the traditional medium-voltage power distribution reached the lowest of 82.2% in the second group and the highest of 86.8% in the fourth group, and the average communication immunity was 84.60%. The anti-interference of distribution automation communication based on medium-voltage high-speed analog CT reached the lowest of 93.8% in the second time, and the highest of 96.2% in the fifth time, with an average communication anti-interference of 94.92%. The communication immunity of the two power distribution modes in 20 kV voltage was higher than that in 10KV voltage. Therefore, distribution automation based on medium-voltage high-speed analog CT can effectively improve communication anti-interference.

4.2. Power Supply Reliability

The purpose of constructing the distribution network is to provide users with higher power quality, reduce power supply failures and restore the power supply effect of the circuit in time to ensure the reliability of power supply. This paper compared the reliability of power supply between traditional medium-voltage distribution and distribution automation based on medium-voltage high-speed analog CT. The comparison results are shown in Figure 5.



(a) Power supply reliability of 10 kV voltage



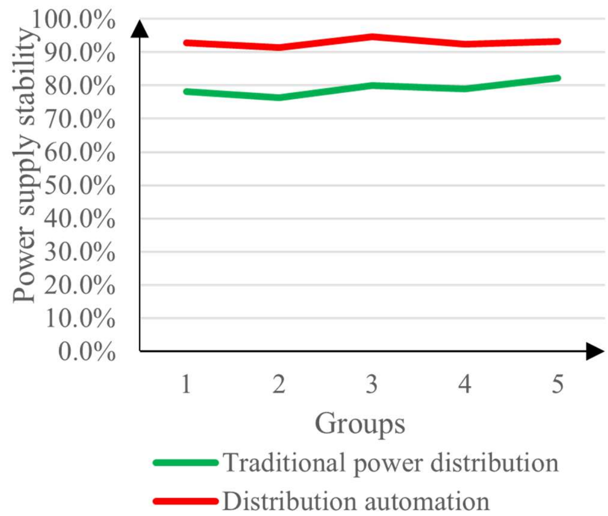
(b) Power supply reliability of 20 kV voltage

Fig. 5. Comparison results of power supply reliability

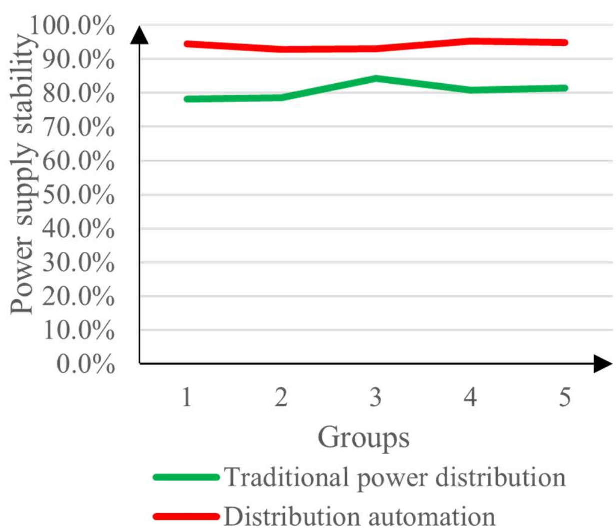
In Figure 5 (a), the comparison results of the power supply reliability of the two power distribution modes at 10 kV voltage were described. The power supply reliability of the traditional medium voltage distribution system reached the lowest of 86.8% in the first group, and the highest of 90.8% in the fourth group, with an average power supply reliability of 88.90%. The power supply reliability of distribution automation based on medium-voltage high-speed analog CT reached the lowest of 94.8% in the second group and the highest of 97.2% in the third group, with an average power supply reliability of 95.56%. The power supply reliability of distribution automation was higher, which was mainly due to the ability to monitor and manage circuit faults in real time, so as to minimize the scope of power failure. In Figure 5 (b), the comparison results of the power supply reliability of the two distribution modes at 20 kV voltage were described. The power supply reliability of the traditional medium-voltage distribution system reached the lowest 88.8% in the fifth group and the highest 92.2% in the second group, and the average power supply reliability was 90.24%. The reliability of distribution automation power supply based on medium-voltage high-speed analog CT reached 96.2% in the first group and 97.8% in the second group, with an average power supply reliability of 97.04%. Therefore, distribution automation using medium-voltage high-speed analog CT can effectively improve the reliability of power supply, repair circuit faults in time, and ensure the quality of users' power consumption.

4.3. Power Supply Stability

Power supply stability of the power grid is also an important indicator to describe the distribution effect. It is mainly reflected in the continuous high-quality power supply, and the power generation and consumption need to reach a balance state. This paper compared the power supply stability between traditional medium-voltage distribution and distribution automation based on medium-voltage high-speed analog CT. The comparison results are shown in Figure 6.



(a) Power supply stability of 10 kV voltage



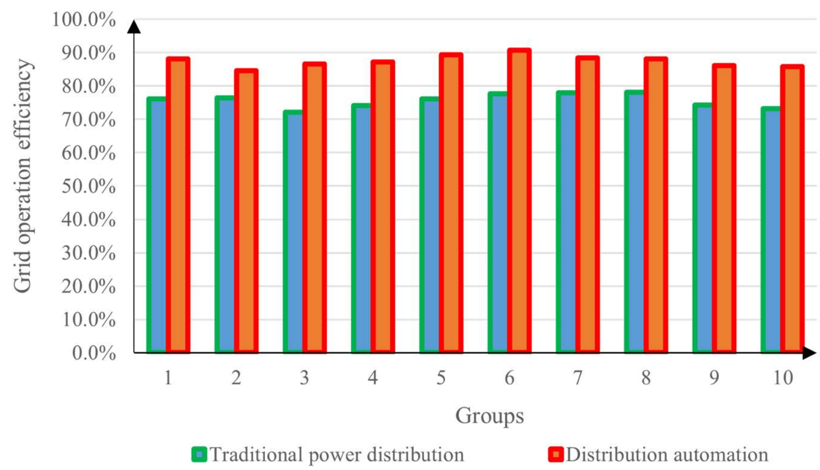
(b) Power supply stability of 20 kV voltage

Fig. 6. Comparison Results of Power Supply Stability

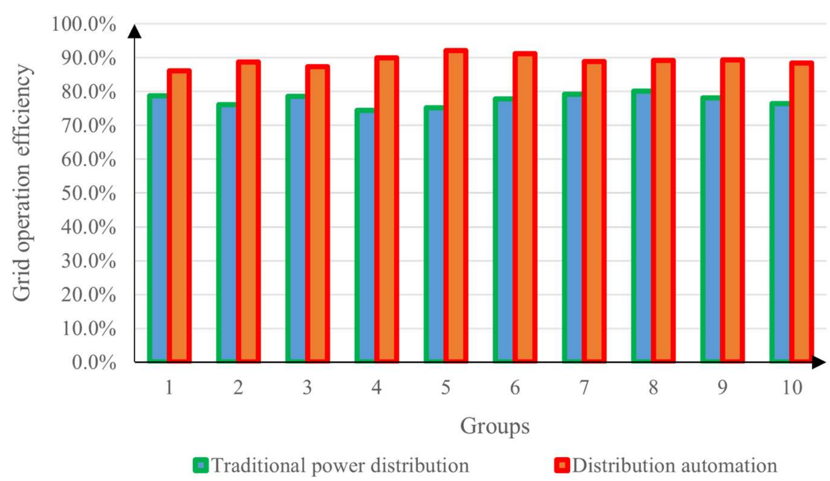
In Figure 6 (a), the comparison results of the power supply stability of the two power distribution modes at 10 kV voltage were described. The power supply stability of the traditional medium voltage distribution system reached the lowest 76.4% in the second group and the highest 82.3% in the fifth group, and the average power supply stability was 79.16%. The power supply stability of distribution automation based on medium-voltage high-speed analog CT was significantly higher than that of traditional medium-voltage distribution. This was mainly because the distribution automation based on medium-voltage high-speed analog CT can optimize the circuit structure, reduce circuit losses, and prevent excessive accumulation of power generation. The power supply stability of distribution automation based on medium-voltage high-speed analog CT reached the minimum of 91.4% in the second group and the maximum of 94.6% in the third group, and the average power supply stability was 92.88%. In Figure 6 (b), the comparison results of the power supply stability of the two distribution modes at 20 kV voltage were described. The power supply stability of the traditional medium-voltage distribution reached 78.2% in the first group and 84.2% in the third group, with an average power supply stability of 80.64%. The average power supply stability of distribution automation based on medium-voltage high-speed analog CT was 94.08%. Therefore, distribution automation using medium-voltage high-speed analog CT can effectively improve power supply stability.

4.4. *Power Grid Operation Efficiency*

The efficiency of power grid operation reflects the level of power grid information and communication, economic benefits, equipment utilization and other aspects, and can analyze the effect of distribution network. This paper compared the efficiency of power grid operation between traditional medium-voltage distribution and distribution automation based on medium-voltage high-speed analog CT. The comparison results are shown in Figure 7.



(a) Power grid operation efficiency at 10 kV voltage



(b) Power grid operation efficiency at 20kV voltage

Fig. 7. Comparison results of grid operation efficiency

In Figure 7 (a), the comparison results of the grid operation efficiency of the two power distribution modes at 10 kV voltage were described. The grid operation efficiency of the traditional medium voltage power distribution reached the lowest of 72.2% in the third group and the highest of 78.2% in the eighth group, with an average grid operation efficiency of 75.65%. The operation efficiency of distribution automation power grid based on medium-voltage high-speed analog CT reached the lowest of 84.6% in the second group and the highest of 90.8% in the sixth group, with an average power grid operation efficiency of 87.54%. The operation efficiency of distribution automation power grid based on medium-voltage high-speed analog CT was higher than that of traditional medium-voltage distribution power grid. This was mainly because distribution automation can quickly share data resources of PS. In Figure 7 (b), the comparison results of the grid operation efficiency of the two distribution modes at 20 kV voltage were described. The grid operation efficiency of the traditional medium-voltage distribution reached the lowest 74.4% in the fourth group and the highest 80.2% in the eighth group, with an average grid operation efficiency of 77.50%. The operation efficiency of distribution automation power grid based on medium-voltage high-speed analog CT reached the lowest of 86.2% in the first group and the highest of 92.2% in the fifth group, with an average power grid operation efficiency of 89.16%. Therefore, distribution automation based on medium-voltage high-speed analog CT can effectively improve the efficiency of power grid operation.

5. Conclusions

With the rapid development of China's economy, China's electric power industry is developing rapidly, and the PS is expanding day by day. People's demand for electricity is also increasing. In order to provide users with efficient and reliable electric energy, smart grid came into being. The quality of service for users has been improved through AI and other technologies. The core of smart grid is distribution automation, but there is a lot of communication noise in medium-voltage distribution communication and the structure of medium-voltage distribution is complex, resulting in the poor effect of traditional distribution. This paper used medium-voltage high-speed analog CT to realize distribution automation by modulating, amplifying and coupling signals. This paper also constructed the evaluation index of distribution automation by means of questionnaire survey, and compared the traditional medium-voltage distribution with the distribution automation based on medium-voltage high-speed analog CT. Multi-group experiments showed that distribution automation can effectively improve communication anti-interference, power supply reliability, power supply stability and power grid operation efficiency. The medium-voltage high-speed analog CT was applied to the distribution automation to effectively realize the monitoring and management of circuit faults. However, when comparing the two distribution methods, this paper only analyzed the medium-voltage distribution.

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