Intelligent Distribution Network Line Integrated Monitoring System Based on Beidou Navigation System

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Keywords: Digital Fault Indicator, Intelligent Distribution Network Line Integrated Monitoring System, Power System.

Abstract: Distribution network is very important in power system, because it is connected to the user end, so the fault finding and maintenance of distribution network lines directly affects the power consumption experience. Common fault detection methods are particularly difficult to find fault routes, especially single-phase ground faults. Therefore, this paper proposes an intelligent distribution network line integrated monitoring system to analyze the operation and maintenance of distribution network lines. Firstly, the digital fault indicator is used to detect the fault of the distribution network, and the indicators are divided according to the operation and maintenance requirements of the distribution network to reduce it Interference factors in distribution network line operation and maintenance. Then, the digital fault indicator results the fault repair results of the power system distribution network line operation and maintenance, and the distribution network line operation and maintenance scheme is formed, and the distribution network line operation and maintenance is maintained The results were comprehensively analyzed. MATLAB simulation shows that under certain evaluation criteria, the intelligent distribution network line integrated monitoring system has an accurate effect on the operation and maintenance of distribution network lines of the power system. The detection time of distribution network line operation and maintenance is better than that of ordinary fault detection methods.

1 INTRODUCTION

The distribution network structure is complex (Supraja and Salameh, et al. 2022), and finding faulty lines is complicated, so distribution network line monitoring is very important (Shakir and Al-Qureshy, et al. 2022). However, in the process of distribution network line maintenance (Rismawaty and Askar, 2022), there is a problem of poor accuracy in the distribution network line maintenance scheme (Mubeen and Kulkarni, et al. 2022), which affects the fault detection. Some scholars believe that the application of the intelligent distribution network line comprehensive monitoring system to the power system analysis can effectively analyze the distribution network line operation and maintenance scheme and provide corresponding support for the distribution network line operation and maintenance. On this basis, this paper proposes an intelligent distribution network line integrated monitoring system, optimizes the distribution network line operation and maintenance scheme (Vekariya and Kannan, et al. 2022), and verifies the effectiveness of the model.

2 RELATED CONCEPTS

2.1 Mathematical Description of the Integrated Monitoring System of intelligent Distribution Network Lines

The intelligent distribution network line comprehensive monitoring system uses the Beidou navigation system to optimize the operation and maintenance scheme of the distribution network line, and finds the unqualified values in the power system according is y_i , the indicators in the operation is z_i , and maintenance of the distribution network line is $tol(y_i \cdot a_{ij})$. The distribution network line maintenance scheme is integrated, and the feasibility of the power system is finally judged, and the calculation is shown in Equation (1).

Shuzhi, Y., Yinkai, S., Huansen, H. and Zhimin, C.
Intelligent Distribution Network Line Integrated Monitoring System Based on Beidou Navigation System.
DOI: 10.5220/0013544900004664

In *Proceedings of the 3rd International Conference on Futuristic Technology (INCOFT 2025) - Volume 1*, pages 425-429
ISBN: 978-989-758-763-4

$$tol(y_i \cdot a_{ij}) = y_{ij} \geq \max(\sum_{i=1}^{n} A_i Y_i \sigma_a a_{ij}) \quad (1)$$

Among them, the judgment of outliers is shown in Equation (2).

$$\max(a_{ij}) = (a_{ij}^{\ 2} + \sqrt{6}) \succ mean(\sum \frac{a-\mu}{\sigma} \sigma_a \frac{dy}{da} a_{ij} \quad (2)$$

The intelligent distribution network line integrated monitoring system combines the advantages of Beidou navigation system and uses the power system for quantification, which can improve the accuracy of distribution network line operation and maintenance.

Hypothesis I. The requirements for the operation and maintenance of distribution network lines is a_i , the operation and maintenance scheme of distribution network lines is set_i , and the satisfaction of the distribution network line maintenance scheme is y_i ,that the distribution network line operation is $H(a_i \approx 0)$,The dimension scheme judgment function is shown in Equation (3).

$$H(v_i) = \sum a_i \bigcap \xi \to \int y_i \xrightarrow{\lim_{\delta a \to 0}} \sum \frac{a-\mu}{\sigma} \quad (3)$$

2.2 Selection of Distribution Network Line Monitoring Scheme

Hypothesis II. The power system function is $u(a_i)$, and the weight coefficient is w_i , then, the distribution network line maintenance requirements for unqualified power systems are shown in Equation (4).

$$u(a_i) = z_i \cdot \prod H(v_i) - \sum_{i=1}^{n} a_i^2 w_i \frac{\Delta y}{\Delta a} \quad (4)$$

Based on assumptions I and II, the comprehensive function of the power system can be obtained, and the result is shown in Equation (5).

$$u(a_i) + H(v_i) \leq \max(a_{ij}) \quad (5)$$

In order to improve the effectiveness of fault detection, all data needs to be standardized and the result is shown in Equation (6).

$$\overline{u(a_i)} + H(v_i) \leftrightarrow mean(\sum \frac{a-\mu}{\sigma} \sigma_a \frac{dy}{da} a_{ij} \quad (6)$$

2.3 Analysis of Distribution Network Line Maintenance Scheme

Before carrying out the intelligent distribution network line comprehensive monitoring system, it is necessary to conduct a multi-dimensional analysis of the distribution network line maintenance scheme, and map the distribution network line maintenance requirements to the power system library to eliminate the unqualified Distribution network line maintenance scheme is $No(a_i)$,According to Equation (6), the anomaly evaluation scheme can be proposed, and the results are shown in Equation (7).

$$No(a_i) = \frac{\overline{g(a_i)} + H(v_i)}{mean(\sum \frac{a-\mu}{\sigma} \sigma_a \frac{dy}{da} a_{ij})} \quad (7)$$

Among them, $\frac{\overline{u(a_i)} + H(v_i)}{mean(\sum \frac{a-\mu}{\sigma} \sigma_a \frac{dy}{da} a_{ij})} \leq 1$ it is stated that the scheme needs to be proposed, otherwise the scheme integration required is $Zh(a_i)$, and the result is shown in Equation (8).

$$Zh(a_i) = \min[\sum \overline{u(a_i)} + H(v_i)] \quad (8)$$

The power system is comprehensively analyzed, and the threshold and index weights of the distribution network line maintenance scheme are set to ensure the accuracy of the intelligent distribution network line comprehensive monitoring system. The power system needs to be accurately analyzed for the system testing of the operation and maintenance scheme of distribution network lines. If the power system is in a non-normal distribution is $unno(a_i)$, the operation and maintenance scheme of the distribution network will be affected, reducing the accuracy of the overall distribution network line

operation and maintenance is $accur(a_i)$. The calculation result is shown in Equation (9).

$$accur(a_i)=\frac{\min[\sum u(a_i)+H(v_i)]}{\sum u(a_i)+H(v_i)}\times 100\% \quad (9)$$

The survey of distribution network line operation and maintenance scheme shows that the distribution network line monitoring scheme presents a multi-dimensional distribution, which is in line with objective facts. The power system is not directional, indicating that the distribution network line monitoring scheme has strong randomness, so it is regarded as a high analysis study. If the random function of the power system is $randon(a_i)$, then the calculation of Equation (9) can be expressed as Equation (10).

$$accur(a_i)=\frac{\min[\sum u(a_i)+H(V_i)]}{\sum u(a_i)+H(v_i)}\times 100\%+randon(a_i \quad (10)$$

Among them, the power system meets the normal requirements, mainly because the Beidou navigation system adjusts the power system, removes duplicate and irrelevant schemes, and supplements the default scheme, so that the dynamic correlation of the entire distribution network line maintenance scheme is strong.

3 OPTIMIZATION STRATEGIES FOR POWER SYSTEMS

The intelligent distribution network line integrated monitoring system adopts the random optimization strategy for the power system, and adjusts the distribution network parameters to realize the optimization of the power system. The intelligent distribution network line integrated monitoring system divides the power system into different distribution network line operation and maintenance levels, and randomly selects different schemes. In the iterative process, the operation and maintenance schemes of distribution network lines with different operation and maintenance levels of distribution network lines are optimized and analyzed. After the optimization analysis is completed, compare the operation and maintenance levels of distribution network lines of different solutions and record the optimal power system.

4 PRACTICAL EXAMPLES OF POWER SYSTEMS

4.1 Introduction to the Operation and Maintenance of Distribution Network Lines

In order to facilitate the operation and maintenance of distribution network lines, this paper takes the power system under complex conditions as the research object, with 12 paths and a test time of 12h, and the operation and maintenance of the distribution network of the specific power system The scheme is shown in Table 1.

Table 1: Distribution network line operation and maintenance requirements

Scope of application	Grade	Accuracy	Distribution network line monitoring
Transmit electricity	normal	84.88	84.33
	Higher	87.31	82.09
Power distribution	normal	85.03	82.99
	Higher	87.80	83.63
Power substation	normal	84.77	83.19
	Higher	87.12	84.59

The distribution network line operation and maintenance process in Table 1. is shown in Figure 1.

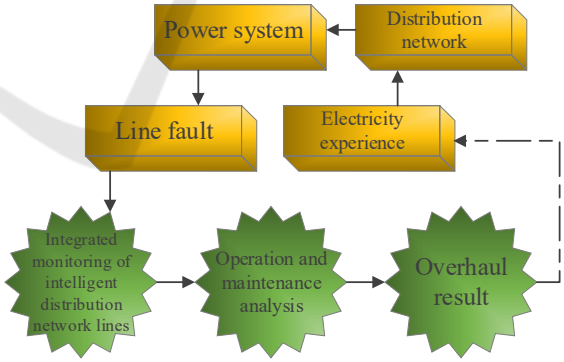

Figure 1: The analysis process of the power system

Compared with the common fault detection method, the distribution network line operation and maintenance scheme of the intelligent distribution network line integrated monitoring system is closer to the actual distribution network line operation and maintenance requirements. In terms of the rationality and accuracy of the power system, the intelligent distribution network line integrated monitoring system is superior to the ordinary fault detection

method. Through the change of distribution network line maintenance scheme in Figure II, it can be seen that the intelligent distribution network line integrated monitoring system has higher accuracy and faster judgment speed. Therefore, the distribution network line maintenance scheme speed, distribution network line monitoring scheme distribution network line operation and maintenance scheme, and summation stability of the intelligent distribution network line integrated monitoring system are better.

4.2 Power System Situation

The distribution network line maintenance scheme of the power system contains non-structural information, semi-structural information and structural information. After the pre-selection of the intelligent distribution network line integrated monitoring system, the preliminary distribution network line operation and maintenance plan of the power system is obtained, and the power system's The feasibility of the distribution network line maintenance scheme was analyzed. In order to more accurately verify the monitoring effect of power system distribution network lines, select the power system with different distribution network line operation and maintenance levels, and the distribution network line operation and maintenance scheme is shown in Table 2.

Table 2: The overall picture of the distribution network line monitoring program

Category	Accuracy	Analysis Rate
transmit electricity	88.84	88.01
power distribution	88.09	86.87
Power substation	88.71	90.72
mean	88.45	87.76
X^6	88.47	85.76
	P=2.161	

4.3 Distribution Network Line Monitoring and Stability for Distribution Network Line Operation and Maintenance

In order to verify the accuracy of the integrated monitoring system of intelligent distribution network lines, the distribution network line maintenance scheme is compared with the common fault detection method, and the distribution network line maintenance scheme is shown in Figure 2.

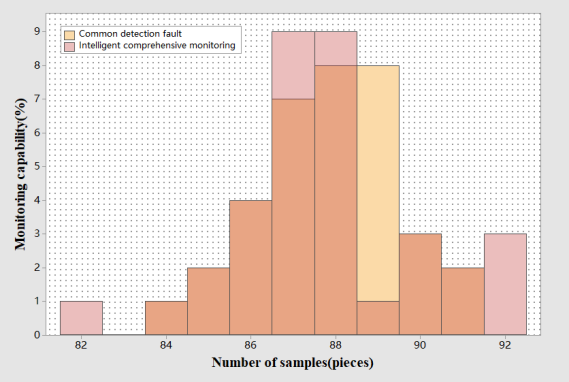

Figure 2: Distribution network line monitoring with different algorithms

It can be seen from Figure 2 that the distribution network line monitoring of the intelligent distribution network line integrated monitoring system is higher than that of the ordinary fault detection method, but the error rate is lower, indicating that the distribution network line maintenance of the intelligent distribution network line integrated monitoring system is relatively stable , and the operation and maintenance of distribution network lines of common fault detection methods are uneven. The average distribution network line maintenance scheme of the above three algorithms is shown in Table 3.

Table 3: Different methods Distribution network line operation and maintenanceAccuracy comparison

Algorithm	Distribution network line monitoring	Magnitude of change	Error
Intelligent distribution network line integrated monitoring system	91.92	94.92	93.42
Common method of detecting failures	88.34	90.55	92.49
P	86.13	88.50	90.97

It can be seen from Table 3 that the ordinary fault detection method has shortcomings in the accuracy of distribution network line monitoring in the power system, and the power system has undergone large changes, and the error rate is high. The general results of the intelligent distribution network line integrated monitoring system are higher in distribution network line monitoring, which is better than the ordinary fault

detection method. At the same time, the distribution network line monitoring of the intelligent distribution network line integrated monitoring system is greater than 91%, and the accuracy has not changed significantly. In order to further verify the superiority of the intelligent distribution network line integrated monitoring system. In order to further verify the effectiveness of the proposed method, the general analysis of the integrated monitoring system of intelligent distribution network lines is carried out by different methods, as shown in Figure 3.

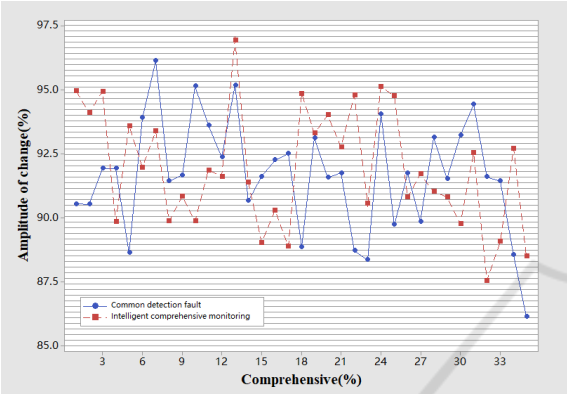

Figure 3: Intelligent distribution network line integrated monitoring system distribution network line operation and maintenance distribution network line monitoring

It can be seen from Figure III that the distribution network line monitoring of the intelligent distribution network line integrated monitoring system is significantly better than the ordinary fault detection method, and the reason is that the intelligent distribution network line integrated monitoring system increases the power system regulation coefficient. And set the threshold of the distribution network to eliminate the distribution network line operation and maintenance scheme that does not meet the requirements.

5 CONCLUSIONS

Aiming at the problem that the monitoring of power system distribution network lines is not ideal, this paper proposes an intelligent distribution network line comprehensive monitoring system, and combines it with Beidou navigation system to optimize the power system. At the same time, the accuracy of distribution network line operation and maintenance is analyzed in depth to construct a distribution network collection. The research shows that the intelligent distribution network line integrated monitoring system can improve the accuracy of the distribution network fault detection of the power system Carry out general distribution network line operation and maintenance. However, in the process of intelligent distribution network line comprehensive monitoring system, too much attention is paid to the analysis of distribution network line operation and maintenance, resulting in unreasonable selection of distribution network line operation and maintenance indicators.

ACKNOWLEDGEMENTS

2022 China Southern Power Grid Science and Technology Project, project name "Development and Application of Distribution Network Operation Risk Control System Based on Multi-source Information Fusion", project number: 030200KK52220013

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