Fault Diagnosis Method and Improvement Analysis of Complex Automation Control System

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Abstract. With the continuous development of automation technology, it has been widely used in various fields of social production. In order to better apply this technology, automatic control system appears. With its continuous progress and development, the inefficiency of traditional fault diagnosis of such systems has gradually emerged. Therefore, this paper conducts in-depth research and analysis on the fault diagnosis method and improvement of complex automatic control system, and puts forward the improvement method of fault diagnosis for related problems in order to provide certain reference for related research and application.

Introduction

In large-scale social production, complex automation systems will be frequently applied, resulting in various kinds of faults. There are many factors causing the faults. For example, in the process of applying traditional methods, the faults of such systems can not be dynamically analyzed and judged in time, and there is a lack of a relatively complete comparative library [1], which makes it impossible for the relevant staff to make a correct judgment of the system failure in the fastest time, and to effectively apply the relevant data information resources.

Relevant Contents of Fault Diagnosis of Automation System

Related overview. The fault diagnosis of automation system is to acquire, transmit, process, analyze and solve all kinds of faults produced in mechanical manufacturing process or other processes. Fault processing technology mainly includes the use of various physical quantities of sensors, reasonable signal processing and transmission. Through the analysis of the processing results, it can effectively detects the quality of production equipment and the actual work situation, predict the faults that will occur in advance and diagnose them accurately, and can also diagnose the upcoming faults [2].

Current Situation of Fault Diagnosis in Automation Control System. Fault analysis can be applied to integrated manufacturing systems such as data machine tools, automatic production lines and flexible manufacturing units in the process of mechanical production. According to the engineering environment of the system, fault diagnosis methods in different environments can be designed. For example, on the automatic production line, it is basically composed of various auxiliary equipment, process equipment, control system and other aspects, and it can also be called an automated manufacturing system, among which the automatic line is made up of different machine tools. Because of its integration, it is more complex than single equipment. Therefore, it is difficult to find out the cause of failure of complex automatic control system in a short time. In order to better adapt to the automatic line, the corresponding information should be obtained at different locations, and then they should be introduced into an appropriate production model to analyze the causes of the failure [3]. Complex control system will also discover new technology with the complexity of mechanical production process. Because of the combination of diagnostic technology and expert system technology with modern sensor technology, it has strong vitality, which can guarantee the stable development of enterprises, effectively improve the production efficiency of enterprises, and provide strong support for the development of enterprises.

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Diagnosis Method of Complex Automation Control System

Fault Diagnosis Method of Traditional Automation Control. The traditional complex automation control system has some shortcomings and problems in fault diagnosis. Therefore, the complex automation diagnosis methods and improved methods are effectively analyzed. Through practice, it is known that the traditional complex automation control system needs to diagnose the following problems. The first is the parameter estimation method. The second is the state estimation method. The third is the signal processing method. The fourth is the wavelet transform diagnosis method. The fifth is the information checking and diagnosis method.

Problems Existing in Traditional Automatic Control Fault Diagnosis Method. There are some problems in the above fault diagnosis methods. The state estimation method and parameter estimation method are inefficient in diagnosing traditional automatic control systems. The traditional fault diagnostic method does not reasonably set up according to the standard data, all the data results are estimated based on the mobile condition data, which lacks certain accuracy. Repeated signal processing is one of the more accurate diagnostic methods in traditional fault diagnostic methods, however, due to the interference of signal noise, the accuracy of signal is limited.

For the fault diagnosis methods of message checking and wavelet fluctuation, although the above mentioned problems of accuracy rate and signal limitation can be effectively improved, there is an abnormal phenomenon of unified data transformation label in these two diagnostic methods in the process of their operation. The construction of the kernel and the time can simplify the logic relationship of the algorithm, and reasonably optimize it, leading to the unbalance of the accuracy of the diagnostic and analytical data of the system control, and the phenomenon of data collection link breakage.

Improvement Design of Fault Diagnosis Method of Complex Automation Control System

Multi-Factor Baseline Library. In the improved design of system fault diagnosis method, a module for collecting and storing data when a fault occurs is added, which is a multi-factor baseline library. The module mainly collects, collates and analyzes the fault data generated by the complex automated control system. By summarizing the relevant data, the maximum utilization of fault data can be achieved.

Using the method of staggered space design, it is divided into three spaces from top to bottom. The upper layer is the fault feature extraction space. The middle layer is the spatial layer for loading big data schemes. The lower layer is the static storage data space layer. The three spaces are independent of each other, and data can be extracted and exchanged through the staggered channels in the interaction layer. There are some differences between the upper and lower layers. In addition, an independent big data channel should be set up in the loading space of the data scheme, which can ensure the fast and real-time solution of the complex control system when problems arise, and improve the accuracy of the diagnostic automation data control system. Fig.1 shows the working principle of the multi-factor baseline library.

Multi-factor baseline library mainly adopts the way of executing algorithm code to solidify ISP, which can ensure the integrity of code and the stability of the logic of fault data in the process of interaction and storage. The relevant specific code is as follows.

```
include<iostream.h>
include<windows.h>
include<time.h>
include<stdlib.h>
include<conio.h>
Define N 21
  voidgotoxy(int x, int  y)//The function of the position is {C
OORDpos; pos.X=2*x; void  init(int  appl[2]/
```

/ Initialization function(initialize the number of layers and fault characteristics) { i n t i , j ; / / Initialize interactive data i n t w a l l [N + 2] [N + 2 n] = { { 0 } } ; f o r (i = 1 ; i <= N ; i + +). Finally, the improved design of the fault diagnosis method of the complex automatic control information system is completed.

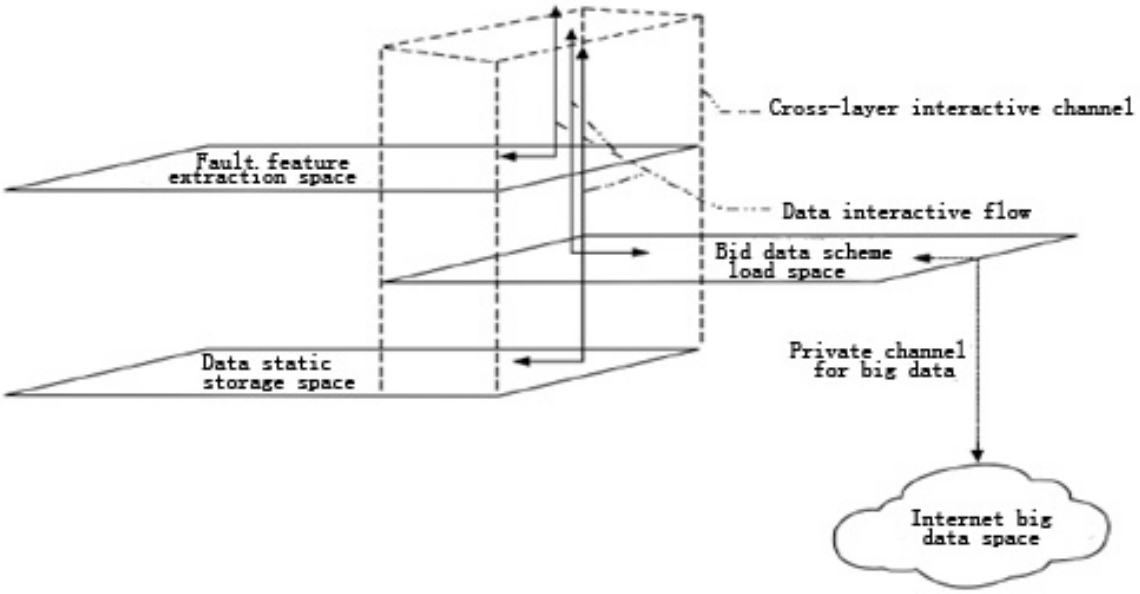

Figure 1 Working principle of multi-factor baseline library

Comparison of Traditional and Improved Diagnostic Methods. Table 1 is a comparison of fault diagnostic methods between traditional automation control system and improved automation control system.

Table 1 Contrast parameters of simulation experiments

Related items	Traditional diagnostic method	Improved diagnostic method
Processing speed of fault diagnosis	68.5/s	21.6s
Accuracy of fault diagnosis	89%	98.8%
Speed of data resources providing fault solutions	0	99.9%
Failure data collection rate	0	100%
Offer rate of data solution	0	100%
Accuracy rate of multiple faults simultaneous diagnosis	71.5%	98.6%
Overhead of operation resources for fault diagnosis	More	Less
The actual condition of a system operating continuously for a long period of time(generally more than 18 hours)	Worse	Better

Advantages of Improving the Design of Diagnostic Methods of Complex Automation Control Systems. Compared with the traditional diagnostic methods, the improved fault diagnostic method has certain advantages. Firstly, the improved method can effectively improve the efficiency of fault diagnosis and improve the accuracy of fault diagnosis. Secondly, it can predict the faults that will occur better, and also has a more accurate judgment function. Thirdly, it can reasonably utilize fault data resources, and can also design solutions for big data. Fourthly, its overall performance is relatively stable and the overhead is relatively small during its operation. From the advantages of complex automatic control system, it can be seen that the improved fault diagnostic method can better diagnose the faults of automatic control system, and can better meet the actual

needs of the complex automatic control system for fault diagnosis.

Conclusions

For the traditional complex automation control system, there are some problems in the fault diagnostic method used. In this paper, the related problems are analyzed and discussed in detail. According to the causes of the problems, the corresponding improved design method is put forward. Finally, through the simulation experiment, it is proved that the fault diagnostic method of complex automatic control system is better than the fault diagnostic method used in traditional automatic control system, and it can meet the basic requirements of design and improvement.

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