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Research of Information System of Monitoring Remote on Distributed Micro-turbine

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Abstract

Aiming at the problems existing in fault diagnosis of Distributed micro gas turbine, a kind of new information system frame of fault Diagnosis on Distributed micro gas turbine is proposed in this paper. The consumers and the manufactures contact with each other through Internet, share the corresponding data of the Distributed Micro-turbine, and diagnose and solve the faults together. Through the study of collecting method of the micro gas turbine generating sets' vibration signals, the technique of gathering reliable vibration signals is designed. The traditional method is revised by this new system, and this can greatly improve the efficiency of Fault Diagnosis, reduce the cost of equipment maintenance, and be in favor of the accumulation and updating of techniques in this field.

Keywords: Fault Diagnose, Distributed Micro-turbine, Monitoring Remote

Compared with the traditional Power station, Distributed Generation refers to the small-scale power generation system locating near the consumers' houses or moving with the consumers. Distributed Generation system is equipped with the advantages like enhancing energy utilization, improving security, avoiding environment pollution and so on. However, when there are faults appearing in the system, the operating crew must detect the state and parameters of the Distributed Micro-turbine on site, and at the same time, the closing down of the Distributed Micro-turbine will bring economic loses to the consumers. Fortunately, with the rapid development of remote telecommunication technology, the increasing abroad application of Internet and the tendency of perfection of CSCW technology, the remote fault diagnose is becoming possible.

1. Remote monitoring information system architecture

Figure 1 shows the system global architecture. Because the location of the Distributed Micro-turbine is scattering, spindle speeding, the natural frequency of rotor, the temperature of axial bearing, the frequency of vibration signals and other data of the Distributed Micro-turbine are collected through intelligent collecting terminal. All these data are sent to the consumer monitoring center by WEB or GPRS while the Distributed Micro-turbine is being monitored. By using the system information management software, we can monitor the Distributed Micro-turbine online and practice the remote fault Distributed Micro-turbine. The manufacturer can contact the consumer monitoring center through Internet, exchange and update the data, and help the consumer to diagnose the faults and repair the system. Both the consumer monitoring center and the manufacturer maintenance center are equipped with three databases. All kinds of data concerning faults are saved in database 1, the dynamitic refreshing data of working condition are save in database 2, and the engineering data of CAD/CAPP applicable to the local Distributed Micro-turbine are saved in database 3.

2. Function of system

By the usage of system information management software through GPRS from long distance, the Distributed Micro-turbine' working condition can be supervised. Usually, only the information of the Distributed Micro-turbine's working condition in the latest three months is stored in the consumer monitoring center, and the information is be continuously updated. Once there is something wrong with one of the Distributed Micro-turbines, the working condition within one week before and after the fault clearance will be stored in the database of the consumer monitoring center. The manufacturer maintenance center and the consumer monitoring center exchange the fault information and update the database periodically. If the engineers for the consumers can not solve the faults, they can ask help from the engineers of the manufacturers and clear the faults jointly. The record of the fault clearance will be added into the database. By using this system, not only the Distributed Micro-turbine can be diagnosed and monitored from a long distance, but the consumers and manufacturers can contact with each other closely and share the data. Thus, the efficiency of fault Distributed Micro-turbine and maintenance can be greatly improved, and the cost of equipment maintenance can also be reduced a lot.

3. Characteristic of system

Because the Distributed Micro-turbines are located separately and their location might be changed continuously, we can supervise them effectively through GSM/GPRS. Bu using GSM/GPRS, we can diagnose and locate the Distributed Micro-turbines with something wrong so as to clear the faults and maintain the equipment conveniently. In addition to this, through the application of control equipment, the Distributed Micro-turbine can be supervised online, and this can not only cut the cost but guarantee the personal security. The consumers and manufacturers can contact with each other through Internet, exchange the corresponding data of the Distributed Micro-turbine, and update and enrich the databases of faults and working condition. And this can be detailed data support for the future fault Distributed Micro-turbine and replacement of the older generation by mew ones of the Distributed Micro-turbine. This system can greatly improve the efficiency of equipment Distributed Micro-turbine and maintenance, reduce the cost of equipment maintenance, and be in favor of the accumulation and updating of techniques in this field. It is a kind of excellent management pattern which can benefit both the consumers and the manufactures.

4. Consumer monitoring center, manufacturer maintenance center & software and hardware configuration

The configuration of the consumer monitoring center and the manufacturer maintenance center is similar. They both need the network environment of Internet, by which the consumer monitoring center and the manufacturer maintenance center can share the audio and video frequencies, examine the files, extract the data and modify the parameters. The Distributed Micro-turbine can be monitored through video frequencies by the CCD cameras, and this is convenient for the remote controlling engineers and those in the manufacturer maintenance centers to observe and diagnose the faults of the Distributed Micro-turbine.

Because the fault Distributed Micro-turbine bears the multi-media characteristics including all kinds of filed data, acoustic data, pictures and so on, databases supporting the multi-media function are required. The databases should also be equipped with the function of unfailing visiting because of the dynamic characteristics of them. In addition to that, the databases are required to have the open interconnect function as the consumers' needs are different. Oracle database can satisfy all the requirement stated above, and is a kind of suitable application database for the consumer monitoring center and the manufacturer maintenance center.

5. Operating mode of the online fault diagnose system

The intelligent collecting terminal collects the working condition of the Distributed Micro-turbine periodically, and all this information is stored in the working condition database of the Distributed Micro-turbine's consumer monitoring center. The working condition within one week before and after the fault clearance will be stored in the database chronically so as to be used as reference when there is anything wrong. The Distributed Micro-turbine methods applicable to this system include the method based on statistics, the method based on expert system and the method

based on the artificial neural network. The manufacturer maintenance center of the Distributed Micro-turbine can transfer the data in the consumer monitoring center under the following two kinds of conditions:

(1) When the local engineers can not solve the faults of the local Distributed Micro-turbine and ask for help to the manufacturer maintenance center, the engineers in the manufacturer maintenance center can have the right to open the consumer's Website and transfer the data of fault and working condition within a certain period of time before and after the occasion.

(2) The manufacturer maintenance center can transfer the new information, successful solving methods and unsuccessful experience in the fault database of the consumers all over the world periodically through the Internet, so as to enrich its own database and provide better service to the consumers.

In the remote service PCs of the local consumer monitoring center, a maintenance expert system is built up and its basic mode is provided by the manufacturer maintenance center. Every consumer can have his own faults memorial and store it in the fault database eternally. After the occurrence of some fault (eg. Iron sick), the frequency of the occurrence of the same kind of fault in the same place or different places will be enhanced a lot. So the memorial will benefit the future maintenance of the local Distributed Micro-turbine, and at the same time, the manufacturer maintenance center will surely encourage the behavior of building the faults memorial because they can get more fault cases from it and the expert system can provide different maintenance scheme aiming at different kinds of faults.

The faults which can be removed quickly by the operators are called as the first kind of faults. Towards this kind of faults, the local expert system will give hints to the operators like closing down the machine, examining the corresponding part and taking necessary measures, eg. tightening the screws, alternating unit and so on.

The faults which are already recorded in the local memorial are called as the second kind of faults. All necessary data, steps of fault clearance and notice points are provide by the expert system, and the local engineers can solve the fault easily with all these abidance.

The faults which can not be solved by the local engineers and already recorded in the manufacturer maintenance center are called as the third kind of faults. The consumer can download the record from the manufacturer maintenance center by inputting his own user name, code and account number (if it is necessary to pay). During the process of fault clearance, the local engineers can seek help from the consumer providing this record as he has the experience of solving this kind of fault. And there are several ways seeking help, like E-mail, telephone, fax, video conference call and so on.

The faults which can not be solved by the local engineers and never recorded in the manufacturer maintenance center are called as the fourth kind of faults. When meeting with this kind of faults, the professional maintenance engineers in the manufacturer maintenance center can transfer the data of working condition and faults, and the data of the local engineers' trying repairing. Through the Internet conference system, the remote engineers and the local engineers can discuss the problems by means of shared whiteboard, discourse, expression, gesticulation and other means and set down the maintenance scheme. If it is necessary, the professors in the corresponding field and the consumers ever experiencing the similar faults can be invited to join the discussion, and the consumers all over the world can take part in the discussion through Internet. When solving the fourth kind of faults, we can take the number of the changed parameters, the time cost in repairing and the time the Distributed Micro-turbine ever operating into account comprehensively to make sure the maintenance cost. Solving a new kind of faults can perfect the database in the manufacturer maintenance center, so the manufacturer should encourage this kind of behavior by low charge.

In addition to that, the manufacturer maintenance center can also provide a hyperlink by which the consumers can visit the manufacturer's engineering database in which the data of CAD/CAPP suitable for the machine tools produced by the manufacturer are stored and these data can be used by the consumers with or without charges. The consumers can get the engineering data either through the PCs of local monitoring center or provided by the engineers of the manufacturer. The manufacturer will update and publicize the engineering data for free periodically, and the long-term friendly relationship between the consumers and the manufacturer will be maintained.

6. Conclusion

In this paper, an information system used for remote fault Distributed Micro-turbine of the Distributed Micro-turbine is provided by combining the telecommunication technique, multi-media technique, the collaborative work technique supported by the computers and Internet together. The traditional method is revised by this new system, and this can greatly improve the efficiency of Distributed Micro-turbine and reduce the cost of equipment maintenance. At the same time, this system can tighten the communication between the consumers and the manufacturer, strengthen the capability of fault diagnosis of Distributed Micro-turbine and clearance for both parts, and be in favor of the accumulation and updating of techniques in this field. By the application of this system, the online monitoring of the Distributed Micro-turbine through GPRS and control module is becoming available.

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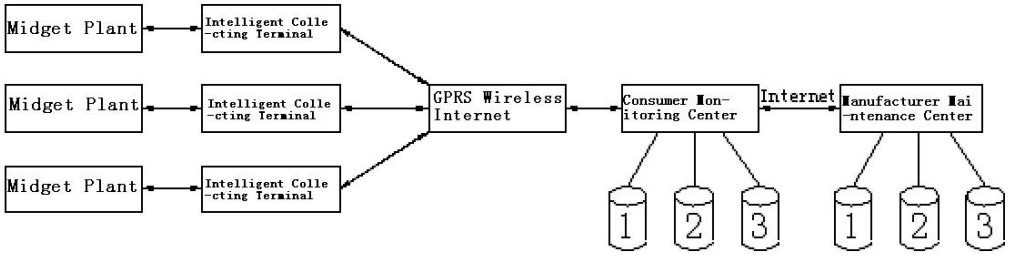

Figure 1. system global architecture