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The Application of Pump Intelligent Condition Monitoring Technology in Nuclear Power Station

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Liangcai Qi [*], **Xincai Chang and Jishi Guan**

China Nuclear Power Technology Research Institute, Beijing, China.

*Corresponding author e-mail: qiliangcai@cgnpc.com.cn

Abstract. This paper introduces a pump intelligent condition monitoring system, the system monitors the real-time vibration signals of pump, and analysis the operating state of pump. It can monitor the failures such as the bearing failures, imbalance, misalignment and so on. Besides, it can give an advice about the location of potential failures. Proven results show that the system can predict the potential failures, fix the failure location. The system plays an important role in nuclear power station.

1. Introduction

With the develop of internet of things, big data and intelligent manufacturing, equipment management has meets the new challenges [1]. Traditional periodic inspection has a big labor cost, and can't predict failures. The intelligent condition monitoring system can monitor the status of equipment in real time, predict potential failures, and avoid major accident, it reacts the management level of company [2].

In nuclear power station, pumps play an important role, especially primary pump, circulating water pump and so on. Condition monitoring and fault diagnosis can exhibit the pumps performance and possible failure information, which can make sure the nuclear power station is safety [3].

2. Condition monitoring system

2.1. System structure

The whole system consists of sensors, data acquisition equipment, router, data management and monitoring station. Vibration sensors are usually fixed on motors, gear cases and pumps. Data acquisition equipment is used for get the sensors data. data management is used for data manipulating, data analyzing, data storing and alarm management. Data acquisition equipment and data management are connected together via router. As show in Fig. 1
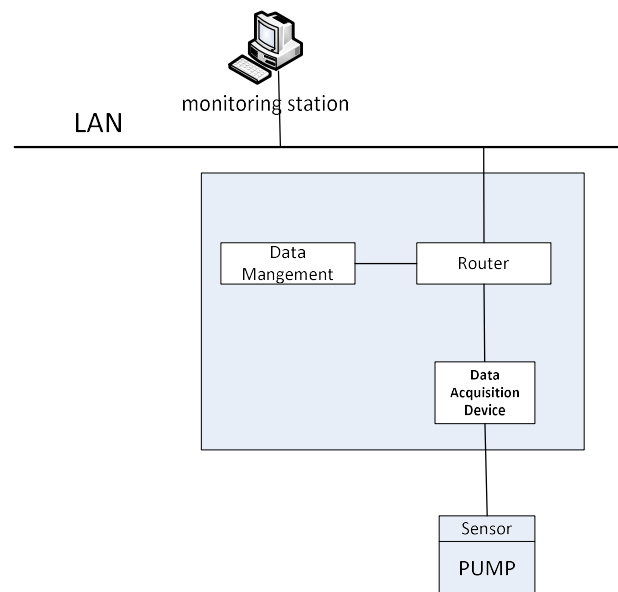
Figure 1. System structure

2.2. Software Function

2.2.1. Analyzing method
(1) General picture

Gestures can supervise all measure points by means of general picture. The atlas can be shown by right-click measure point name, and it can be saved. As show in Fig.2.
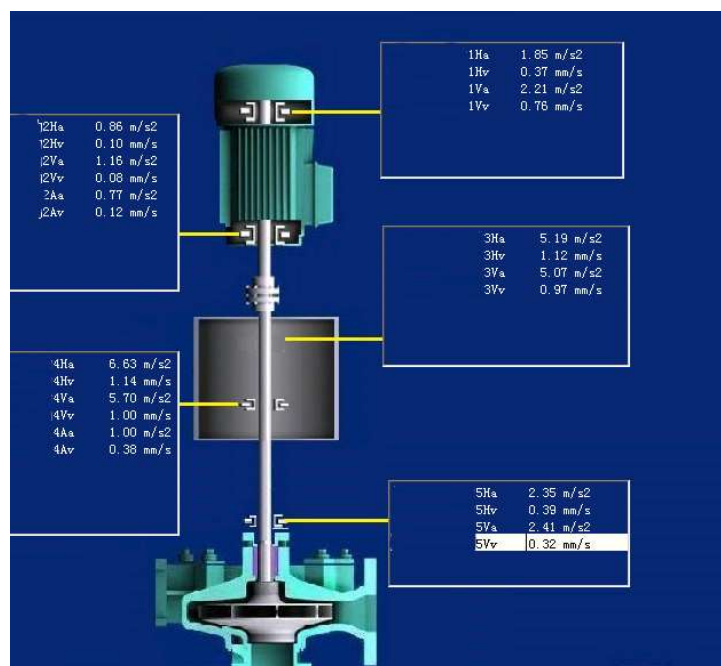

Figure 2. General picture

(2) Trend analysis

This function can monitor all points real-time and historical data, the chart and the spectrogram. As show in Fig.3.

Figure 3. Trend analysis

(3) Alarm management

Alarm management can inquire the historical trend of alarm points. This module can compare the same point at different frequency or different points at the same frequency. At the same time, it can conclude the fault reason. As show in Fig.4.

Figure 4. Alarm management

2.2.2. The typical failure type the system can monitor
1. Bearing loose.
2. Bearing wear.
3. Rolling element, holder and inside and outside circle fault.
4. The coupling is out of alignment, rotor imbalance and so on.
5. Cavitation.

3. Case Study

The system was applied to circulating water pump in nuclear power station. Twelve vibration sensors were fixed on motor, gear case and pump, they can measure the speed, accelerated speed and displacement of equipment.

After a period of time, the motor accelerated speed appeared abnormal data, as shown in Fig.5. According the data, the frequency is similar with characteristic frequency of holder, rolling element, inside and outside circle. We can conclude that there are some fault on that position.
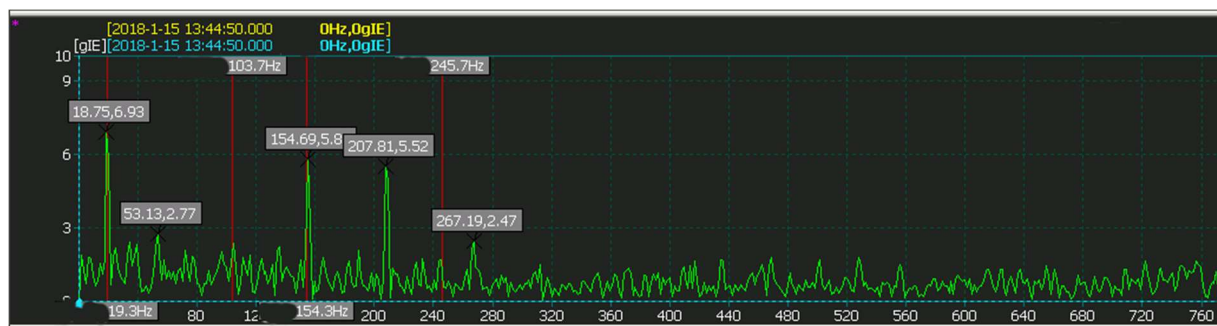

Figure 5. The fault data

After the examination of the device, we found that the rolling elements had some scratch, which validated our conclusion.

4. Conclusion

This paper introduced a kind of intelligent condition monitoring technology about pump. The technology has been applied into nuclear power station.

After a period of time application, the system has monitored some fault which had been proved right. The intelligent condition monitoring can monitor the performance of pumps, predict the potential failures, fix the failure location. It's very important for nuclear power station.

References

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