TV Acoustic Vibration System Based on Computer Aided Testing

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Abstract. According to the mathematical method of target optimization, the automatic control mathematical model of fault diagnosis and computer program algorithm has been set up, and computer TV sound abnormal noise fault automatic elimination system has been designed.The experiment and computer simulation are carried out on the performance of the computer television fault automatic elimination system, and the frequency automatic fault exclusion curve and the TV vibration stress distribution cloud image have been obtained. Through the frequency diagnostic test of the units, it has been obtained that 4 fault diagnosis frequency distribution table and the vibration distribution map of frequency response.Compared the data obtained from the experiment and computer simulation with the data of the electrical system, it can be found in time that the faults in the electric system, and then corresponding measures can be taken to eliminate the trouble.

Introduction

In the industrial 4.0 industry background, the importance of automation and audio-visual professional needs become to emerge; acoustic vibration system is one of the main problems of TV system frequent accidents. It will cause very serious consequences if not timely taking measures to prevent accidents, especially in the mass production of TV sales to the world, client terminal problems for customers and manufacturers are serious injury of credit degree and cost. Because television systems generally operate 24 hours in a day, it will consume a large amount of manpower and material resources by use of artificial real-time monitoring, and it will greatly improve the detection efficiency and save the cost of labor by use of the automatic control system for real-time fault monitoring.

According to the principle of "solving problem in advance in the processing of design and verification". In this paper, the automatic control system of the computer acoustic system troubleshooting has been designed, and it has been compared that the data of audio-visual voice frequency diagnostic table, frequency response spectrum distribution in the system and unit actual work normally, TV system faults can be obtained in the presence of analysis, fault exclusion measures can be took timely to prevent the occurrence of accidents.

Overview of mechanical and electrical system acoustic vibration automatic detection system

In mechanical and electrical system acoustic vibration abnormal noise fault detection system design, it can be divided into detection system software design and detection system hardware design, which can mainly achieve the fault diagnosis and detection signal input and output interface of the control. The man-machine interface can realize the automation of fault detection, which is shown in Figure 1. The sensor in the graph is used to automatic test fault signals. The sensor is mainly consists of pressure sensor, pink noise signal and frequency signal.

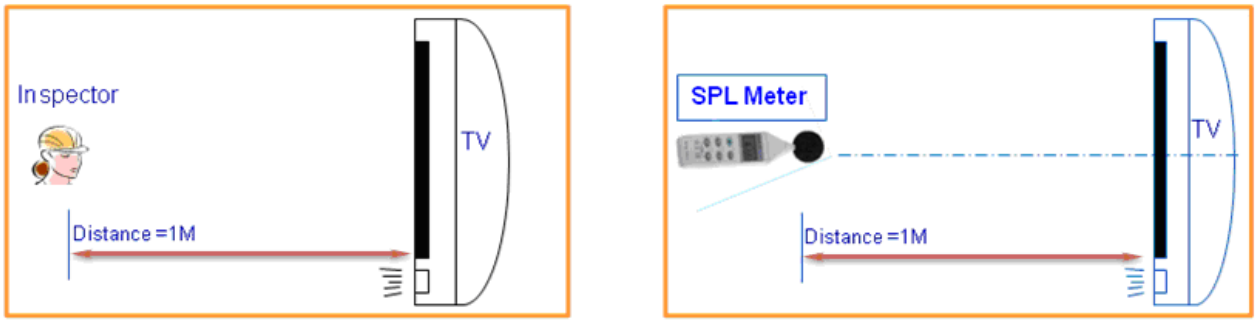


Fig. 1 Schematic diagram of fault automatic detection

The hardware design of the detection system mainly includes the digital automatic control module, the fault diagnosis module, the sound sensor and so on. The fault diagnosis detection board is used to realize the fault detection. In this paper, the fault diagnosis and detection system and TV system are connected with the SPL logic device. Finally, the system is compiled and control signal and data latch. In the mechanical and electrical system TV sound vibration abnormal noise detection system, sound vibration system is very important, the system is the main driver of the sound source.

Mathematical model and algorithm design of automatic detection of TV abnormal noise vibration

Automatic monitoring of TV fault can also by vibration signal acquisition, and the objective function optimization function to optimize the design of function. The function design is mainly related to the objective function and the constraint condition. In accordance with the principle of electro acoustic vibration, and mechanical wave / acoustics principle, the objective function model is shown in Fig.2.

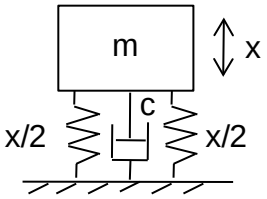


Fig.2 The objective function model

The resulting expression is shown in the formula (1).

$$F \xrightarrow{H(s)} \sum_{i=1}^{N} \frac{\alpha_i}{s^2+2\xi_i\omega_{ni}s+\omega_{ni}^2} \xrightarrow{y} |Y| = |H(s)||F| \quad (1)$$

$$F = c\dot{x} + kx$$

$$F \downarrow H \downarrow \Longrightarrow Y \downarrow$$

This can be a solution to the abnormal signal of vibration. After the input of signal, the output of the vibration form and the main process of data conversion are shown in Figure 3 below.

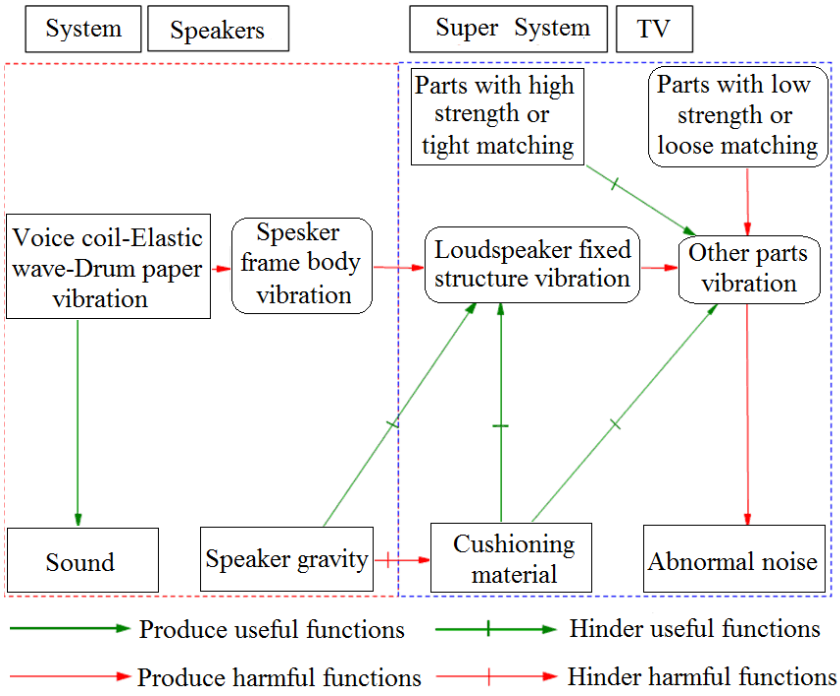


Fig.3 The vibration form and the main process of data conversion

Experimental study of automatic detection of abnormal noise vibration of TV set

In order to verify the validity and reliability of mathematical model and algorithm of the TV sound vibration abnormal noise fault automatic detection, the sound vibration abnormal noise fault automatic removal system has been designed in this paper,, and the system of computer simulation and experiment simulation, the experimental equipment is shown in Fig. 4.

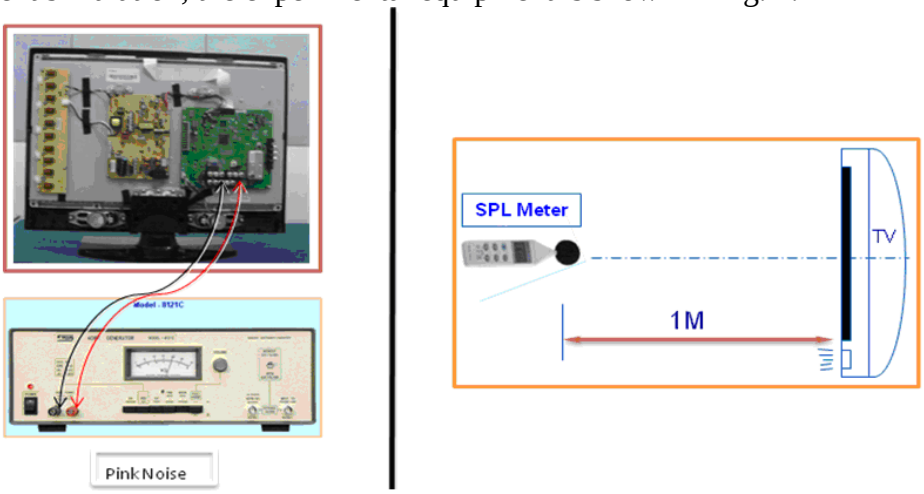


Fig.4 Schematic diagram of automatic detection of sound vibration of TV set

Figure 4 shows the schematic diagram of experimental apparatus, the signal source can be converted by TV and vibration frequency signal, the detection instrument and computer fault analysis system are carried on the port link, by using computer software for automatic control of straight to the point target, and the abnormal point measures exclude.

Figure 5 shows using Lms Test. lab software in the TV to build the physical signal, analog TV in different frequency bands, different frequency and vibration of the audio visual performance, which produces the abnormal signal noise.

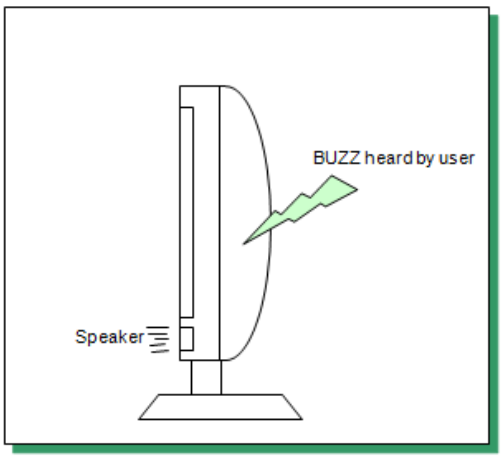


Fig.5 Computer simulation analysis structure

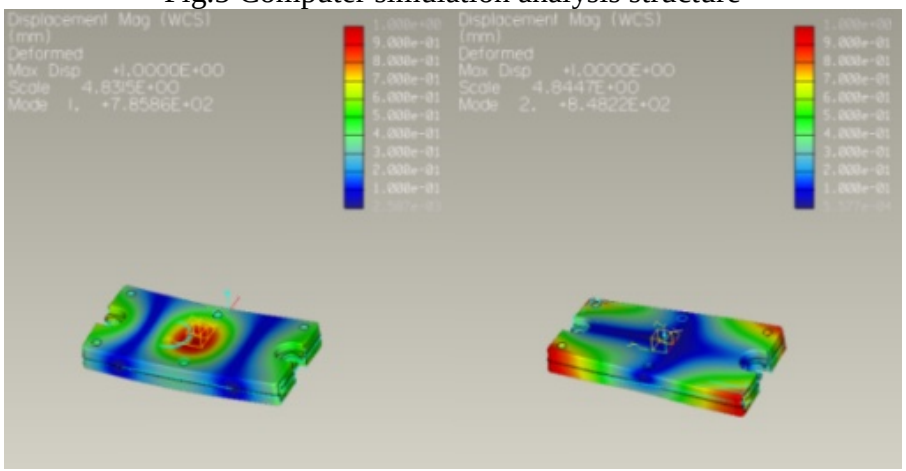


Fig.6 Mechanical and electrical automation TV sound vibration abnormal noise automatic simulation

As Figure 6 shows fault distribution simulation map through TV fault detection, the fault parameters of the television can be timely tested by TV detecting instrument, detected parameters has been simulated by computer automatic fault analysis system, finally fault distribution maps shown as Fig.6 can be got. The red to blue in Fig.6 shows source by the larger small, regional red said relatively large amplitude vibration, focal concentration phenomenon is more serious, which will produce relatively large fatigue failure. Therefore, measures should be taken in time to prevent accidents.

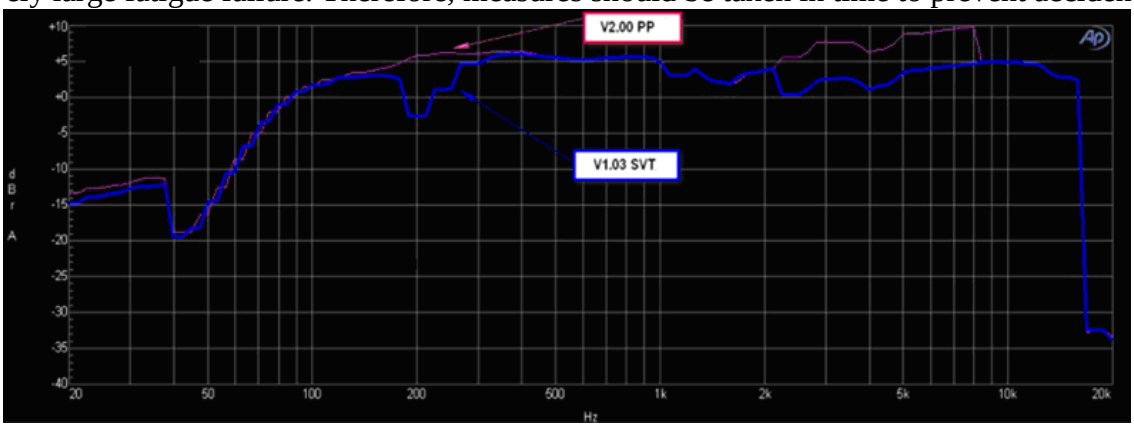


Fig.7 Frequency diagram of sound shift curve

Figure 7 shows the TV voice activity displacement curve obtained by computer automatic testing system simulation of TV system, it can be seen a frequency vibration through the displacement amplitude, if there is a large peak displacement, it shows that there is a risk point in the electrical system, then measures should be taken timely.

Fig.8 Schematic diagram of mechanical and electrical system unit module test

Figure 8 shows the system fault detection of mechanical and electrical systems units, in order to further verify the effectiveness of the model and algorithms for the detection, fault diagnosis has been taken on television system units in this paper, and fault diagnosis frequency has been shown in Table 1 below.

Table 1 natural frequency fault diagnosis

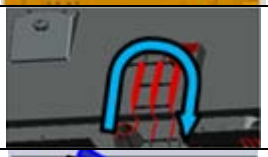
Item	Resonance frequency	Causal analysis	Illustration	Frequency point position
1	90~123Hz	The rear shell wall hanging and the wall hanging column are margin		Wall hanging column (4pcs)
2	138~163Hz	Clearance between rear shell Rib and iron parts 0.5mm		Rear shell support (3pcs)
3	93Hz	Rear shell allowable deformation degree 2mm		Rear shell side IO (4pcs)
4	90~123Hz	Clearance between R/C and IO 1mm		Rear shell IO (2pcs)

Table 1 shows diagnosis frequency table through mechanical and electrical automation fault exclusion detection system, four diagnosis frequency has been detected in Tab.1, and the normal work of each unit of diagnosis frequency and TV equipment mechanical and electrical frequency comparison, if frequency is consistent, mechanical and electrical system work normal, and if not, then there are faults in TV system, troubleshooting measures should be timely taken to guarantee the normal work.

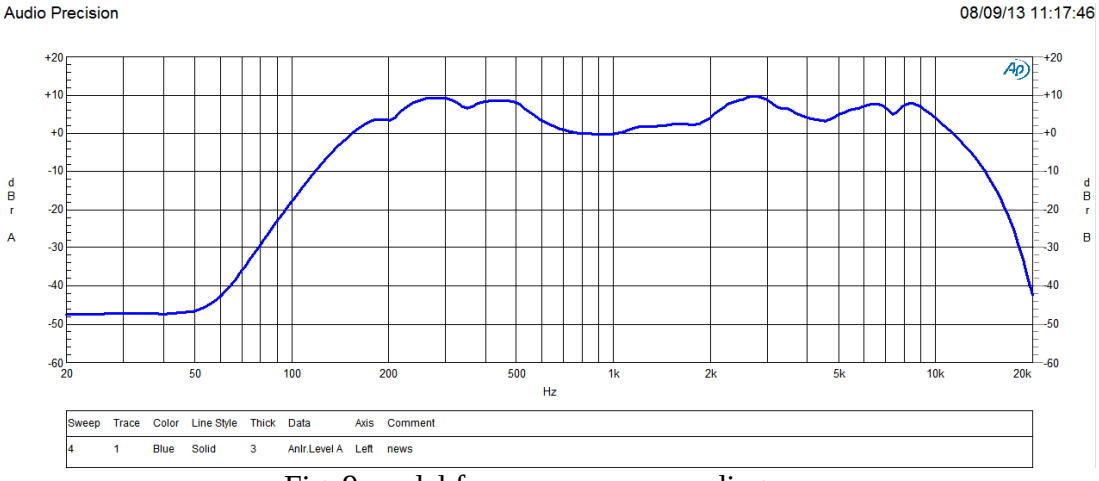


Fig. 9 modal frequency response diagram

Figure 9 shows the television system frequency response spectrum getting by computer analysis system, this diagram can be compared by the units spectrum in normal work, if the spectrums are consistent, TV system normal work, if the spectrums are not consistent with each other, corresponding measures should be taken to ensure normal work of the TV system units.

Conclusion

In this paper, the computer software analysis system has been introduced to the TV instrument fault detection system, acoustic vibration fault diagnosis system based on mechanical and electrical automation has been designed, and the system performance has been experimental studied and computer simulation, the automated detection method and fault exclusion curve has been got, and vibration distribution cloud image of TV acoustic vibration has been got by use of computer simulation. In order to further verify the algorithm's effectiveness, four different units fault diagnosis frequency has been got by frequency diagnostic tests for different units in this paper, and the sound distribution map of frequency response has been drawn, which provides a theoretical reference for the sound and vibration problems study of television system.

Acknowledgments

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Reference

[1] Cui Xuanming. Journal of applied fuzzy logic technique in fault diagnosis of gasoline engine in [J]. Journal of Transport Science and Engineering, 2008, 24 (3):81-83.

[2] Hu Jianrong. Structural damage diagnosis based on modal analysis [D]. Chengdu: Southwest Jiao Tong University, 2006.

[3] Yin Jinghua, Lv Guangjun,Du Bing. A vibration isolation and packaging model for vibration isolation system. Journal of Harbin Institute of Technology.2005, 37(7):983-985.

[4] Ron, Deng Ying, Tu Liangyao. The establishment and frequency correction of the vibration model of electrophonic loudspeaker, Journal of Vibration and Shock, 1998 (2):9-13.

[5] Long Ying, Teng Zhaojin, Zhao Fushui. The status and development trend of finite element modal analysis [J]. Hunan Agricultural Machinery, 2009,36(7):27-28.

[6] Wang Qing. The physical principle and Engineering Technology[M]. National Defense Industry Press, 2008.

[7] Meng Jun, Zhai Liuming. Research on the principle and model about reducing noise[J]. World Sci-Tech R & D, 2008,30(4):472-475.

[8] Zhou Haichao, Zuo Yanyan, Bao Linxiao. Free modal analysis of crankshaft of four cylinder diesel engine [J]. Noise and Vibration Control, 2010, 30 (6):63-66.