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Conditioning and Monitoring of Ball Bearing using FFT Analyzer

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ABSTRACT

Most machinery and many structures do not operate under constant load and stress. In fact, these loads and stress are changing. The bending stress changes from tension to compression as the axle rotates. This constant change in stress can cause fatigue failure in which the material suddenly fractures. The process that leads to fatigue failure is the initiation and growth of cracks in the material. Fracture occurs when the crack grows so large that the remaining uncracked material can no longer support the applied load. Fatigue may be defined as a cycle time-dependent loading or straining of a material. The change in the loading with respect to time is more common from an engineering perspective and is generally considered to be mechanically induced. The vibrations of defected bearing is much higher ten the vibrations of healthy bearing, this leads to the failure of ball bearing. The failure of ball bearing causes wear, resulting in loss of preload or an increase in radial clearance, due to failure of ball bearing vibrations of ball bearing suddenly increases this increased vibrations passes to the machine components which leads to decrease in life and efficiency of machine and production rate. so the conditioning and monitoring of ball bearing should be done periodically to maintain the production rate and to maintain the life of machine components.

Keywords: Vibration measurement, Ball bearing Fatigue life, FFT Analysis, Failure of bearing.

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I. INTRODUCTION

Rolling bearings are widely used in rotating machinery system such as aero engine rotors system, machine tool spindles, and train wheel set. However, they are the weak links of mechanical because their mechanical properties and operating state have significant impact on precision, reliability, and life of the whole system. The failure of rolling bearings not only affects the performance of mechanical equipment, but also causes serious accident. Thus, fatigue life prediction for rolling bearing has important theoretical significance and practical value. The dynamics behavior of rolling bearings is observably affected by factors such as centrifugal force, gyroscopic moment, friction, thermal deformation, and external load on unconventional conditions like high speed and high accelerated velocity Maintenance cost is one of the major operating costs in manufacturing companies. It involves spare parts cost, breakdown cost and manpower cost. Unexpected breakdowns, replacement and repair expenses from catastrophic failures indulge in loss of output due to machinery downtime. The failure of any single machine rotary component in the process can results in loss of rupees per down time hours. Adoption of predictive and preventive maintenance procedures significantly reduces these losses. This is essential in maintenance management to enhance the product quality.

In order to continue the working machines, it is necessary to monitor the health of machine during its operation, with a view to diagnosis the fault in the machine. Condition based maintenance is preferred in industries now a days. Monitoring of these parameters gives idea about abnormalities in the machine, resulted due to faults like wear, crack, corrosion, fatigue etc. Among the various techniques used for this purpose, vibration analysis technique is very popular now days. In the present work

vibration analysis of ball bearing is done by using FFT analyzer. The data taken up in frequency domain and Time domain for healthy and defective bearing operating under certain load. In order to check the validity of the experimental results with theoretical, feature extraction is done. The analysis of vibration signals is major technique for condition monitoring of bearing in machine components. Vibration based signal analysis is used for the detection of bearing fault. The present work emphasizes the comparison of some vibration parameters to characterize the distributed defects in the bearing.

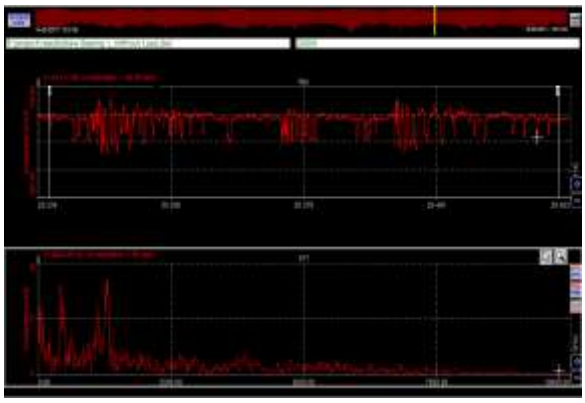
II. METHODOLOGY

Firstly decide the areas where to take readings.
Clean that area with the help of clean cloth.
One end of accelerometer connects to the FFT port.
FFT analyzer then connected to Laptop having Dew soft software installed in it.
Another end of accelerometer mounts on the bearing housing in radial direction.
This set up gives the analysis in the form of time and frequency domain curves.
Wait for 1 minute to achieve accurate graphs.
With the help of all standard results diagnose that what causes take place into each equipment and conclude their remedies for each equipment.

III. RESULT

This experiment was performed by monitoring two of the five bearings mounted on the setup of fatigue testing machine. First we have taken a readings with the healthy bearings and then with the damaged ball bearings. In both of the bearings under different loading conditions, like with no load, with 10kg load and with the 15 kg load.

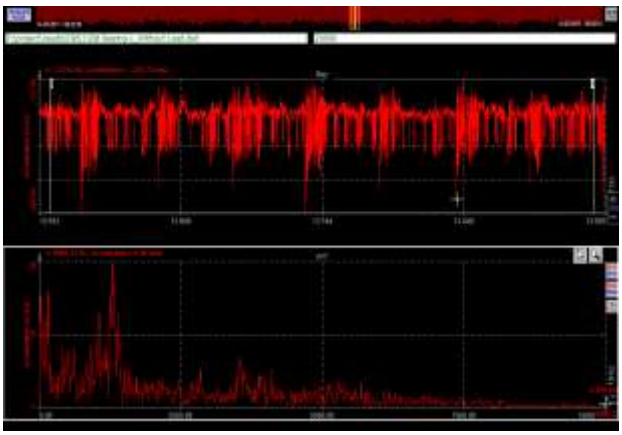
1. Healthy bearing with no load



This is the reading of a healthy bearing with no load condition.

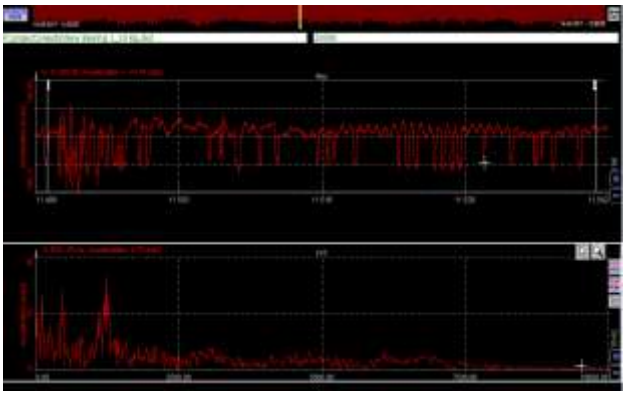
Acceleration 468.8Hz/13.4 m/s^2

2. Old bearing with no load



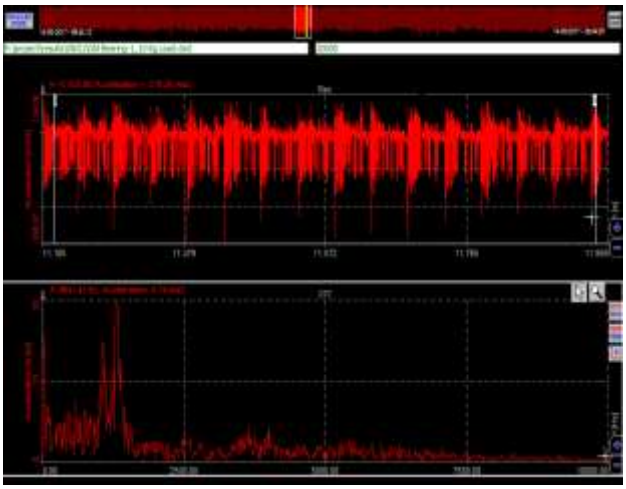
This is the reading of an old bearing with no load condition.
Acceleration 1328.1Hz/17.2 m/s^2

3. Healthy bearing with 10kg



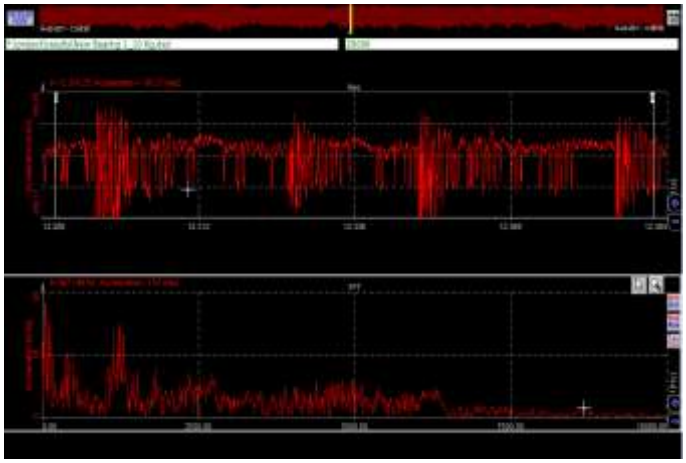
This is the reading of a healthy bearing with no load condition.
Acceleration1130.4Hz/13.5 m/s^2

4. Old bearing with 10kg load



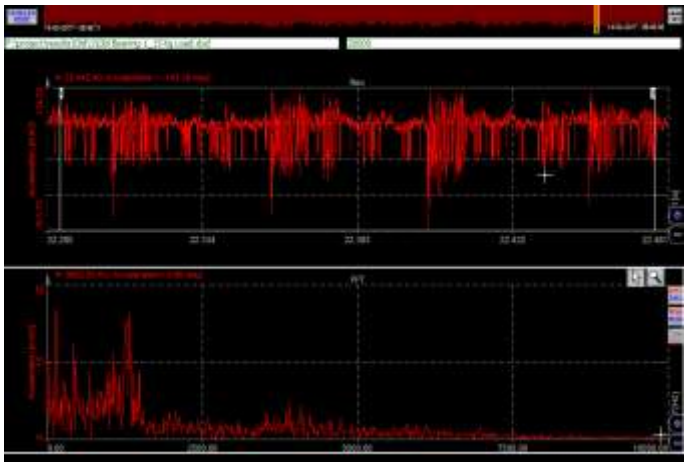
This is the reading of an old bearing with 10kg load condition.
Acceleration 1377.1Hz/15.1 m/s^2

5. Healthy bearing with 15kg load



This is the reading of a healthy bearing with 15kg load condition.
Acceleration 1134.1Hz/15.2 m/s^2

6. Old bearing with 15kg



This is the reading of an old bearing with 15kg load condition.
Acceleration 1328.1Hz/16.5 m/s^2

IV. CONCLUSION

This paper presents a review on the time domain analysis technique for the condition monitoring of the bearing. The time domain analysis was implemented on the bearing data obtained from FFT analyzer.
Thus showing the differentiation between thenormal and defective bearings. The plots also showed a clear distinction among healthy bearing and the defected bearing.
We have seen that as load increases vibrations also increases so as per material used in the machine or in roller bearing we can conclude that conditioning and monitoring is very important factor to avoid damage, accidents to the machine components.

REFERENCES

[1] Lakshmi Pratyusha P. and VPS Naidu, Bearing Health Monitoring – A Review, MSDF Report: 1403, NAL, June 2014

[2] Shanmukhapriya V. and VPS Naidu, Survey on Bearing Health Condition Monitoring, MSDF Report: 1405, NAL, July 2014.

[3] ZekiKiral, Simulation and Analysis of vibration signals generated by rolling element bearings with defects, Tribology International, Vol. 36, Issue 9, pp. 667-687, 2003.

[4] ShyamPatidar and Pradeep Kumar Soni, An overview on Vibration analysis techniques for the diagnosis of rolling element bearing faults, International Journal of Engineering Trends and Technology (IJETT), Vol. 4, Issue 5, pp. 1804-1809, May 2013

[5] Mohamed Boufenar, Said Rechak, and Mohamed Rezig, Time-Frequency Analysis Techniques Review and their Application on Roller Bearings Prognostics, Proceedings of the Second International Conference on Condition Monitoring of Machinery in Non-Stationary operations (CMMNO'2012), published by Springer, pp. 239-246, 2012

[6] Luana Batista, BechirBadri, Robert Sabourin , and Marc Thomas, A classifier fusion system for bearing fault diagnosis, Science Direct, Expert systems with Applications, Vol. 40, pp. 6788-6797, 2013

[7] Adrian I. Cuc, Vibration-Based Techniques for Damage Detection and Health Monitoring of Mechanical Systems, University of South Carolina, 2006 Source: www.me.sc.edu/research/lamss/pdf/dissertations/ms_thesis_cuc.pdf , accessed on 7th August 2014

[8] Yong-Han Kim, Andy C. C. Tan, Joseph Mathew, and Bo-Suk Yang, Condition Monitoring of Low Speed Bearings: A comparative study of the Ultrasound Technique versus Vibration Measurements, WCEAM 2006, Paper 029, pp. 1-10, 2006

[9] Aida Rezaei, Fault Detection and Diagnosis on the Rolling Element Bearing, Carleton University, Ottawa, September 2007 Source: https://curve.carleton.ca/system/files/theses/29994.pdf, accessed on 7th August 2014

[10] Samanta B, Khamis R. Al-Balushi, and SaeedA.Al-Araimi, Bearing Fault Detection Using Artificial Neural Networks and Genetic Algorithm, EURASIP Journal on Applied Signal Processing, Vol. 3, pp. 366-377, 2004

[11] Bearing data; The Case Western Reserve University, Source:http://csegroups.case.edu/bearingdatacenter/pages/download-data-file, accessed on 22nd July 2014.

