Experimental study of ball bearing with vibration analysis using different type oil lubricants

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Abstract - The bearing plays a fundamental role in rotating machines. Bearing failure analysis is mainly studied by creating artificial defects in various bearing elements and analysis is done with a vibration signature tool to monitor their condition. Maintenance of any machine is very important given machine downtime. Bearing industry products are of high value, which leads to bearing life aspects. Experimentation and signal analysis with MATLAB software were done to analyze ball bearing vibration data to find the perfect lubricating oil for applied load like 50N. Detailed analysis using the FFT Methodology is done to find the minimum vibration response. In addition, it performed lubrication analysis using the FFT analyzer for bearings.

Key words: Ball bearing; Vibration analysis; Time series signal, Fast foriour transformation, Lubricants.

1 Introduction

The importance of vibration analysis is used to determine the operation and mechanical condition of equipment. A major advantage is that vibration analysis can identify developing issues before they cause unscheduled downtime. This can be achieved by regularly monitoring the machine vibration at frequent or set intervals. Routine vibration monitoring can detect faulty bearings, mechanical looseness and worn or broken gears. Vibration testing can also detect instability and unbalance before loading. If the shaft is not damaged by these events Rotational rotation measures can detect improper adjustment mechanisms such as misalignment and bearing replacement. Incorrect shaft alignment or incorrect rotor measurements

All rotating machines make noise that is a function of machine power, such as alignment and alignment of rotating parts. Location of bearings or gears and onboard outputs for displaying housings, pumps and other structures Vibration measurement is an efficient and non-interference method of monitoring the condition of the machine during start-up, shutdown and normal operation.

2 Experimental test rig

The ball bearing (6203ZZ), solid shaft, coupling, single phase induction motor with variable speed drive for a shaft-rotor assembly and metallic angle was used to construct the experimental setup. The shaft is supported on self aligning ball bearings (6203ZZ) loaded with 50N in downward direction of test bearing. In these experiments, the three type oil lubricant such as ISO32, ISO46 and ISO68 was used in test bearing for measurement of signal analysis. Digital tachometer for speed measurement of moving solid shaft was used. Digital temperature meter was used for temperature measurement. Digital vibration meter (VB 8205) and data acquisition card was used to measure the digitally vibration data such as displacement (mm) and frequency (Hz).

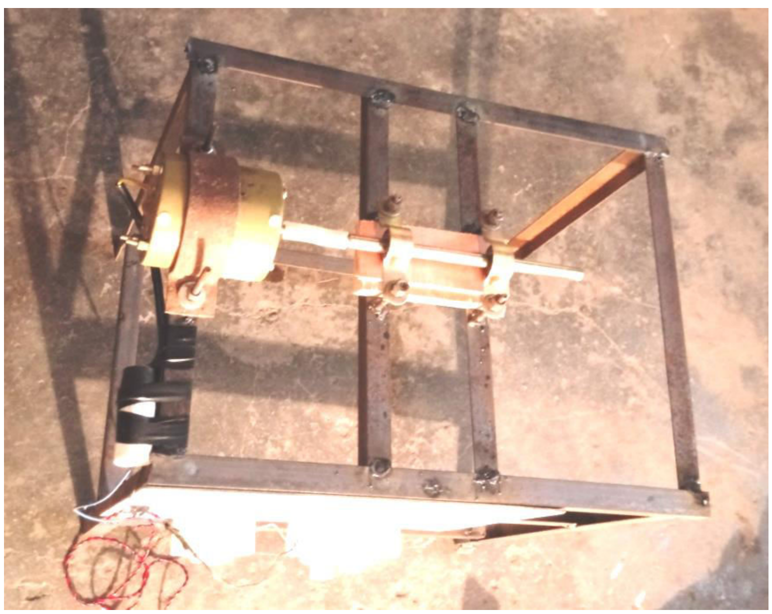

Figure 1 Experimental setup

3 Results and Discussion

It is found that the time series signal of displacement (mm) was minimum (amplitude of -4.507 at 0.09917) and maximum (amplitude of 4.72 at 0.1), fast fourier transformation (FFT) of displacement (mm) was minimum (amplitude of 0.03414 at frequencies of 330.5) and maximum (amplitude of 0.7917 at frequencies of 342.2), using oil lubricant of ISO 32, which are shown in Figures 2-3. It is found that the time series signal of displacement (mm) was minimum (amplitude of -3.983 at 0.1883) and maximum (amplitude of 3.983 at 0.8117), fast fourier transformation (FFT) of displacement (mm) was minimum (amplitude of 0.003865 at frequencies of 304.7) and maximum (amplitude of 0.4221 at frequencies of 247.3), using oil lubricant of ISO 46, which are shown in Figures 4-5. It is found that the time series signal of displacement (mm) was minimum (amplitude of -4.079 at 0.5633) and maximum (amplitude of 4.079 at 0.4367), fast fourier transformation (FFT) of displacement (mm) was minimum (amplitude of 0.008125 at frequencies of 403.1) and maximum (amplitude of 0.9632 at frequencies of 342.2), using oil lubricant of ISO 68, which are shown in Figures 6-7.

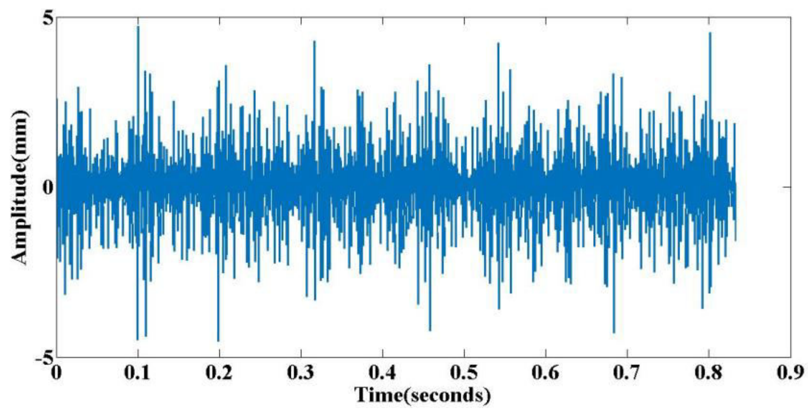

Figure 2 Time series signal of displacement using oil lubricant of ISO 32

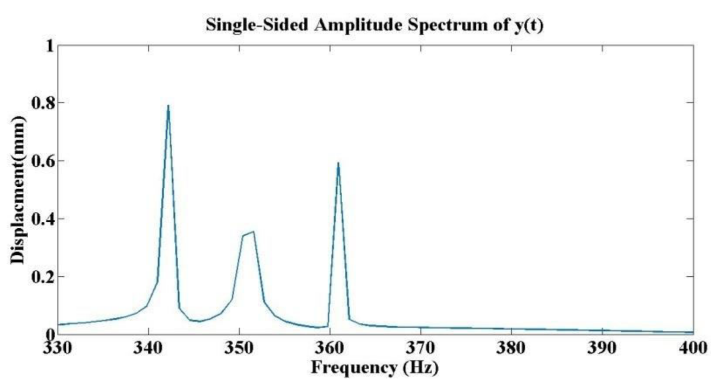

Figure 3 Fast fourier transformation (FFT) of displacement using oil lubricant of ISO 32

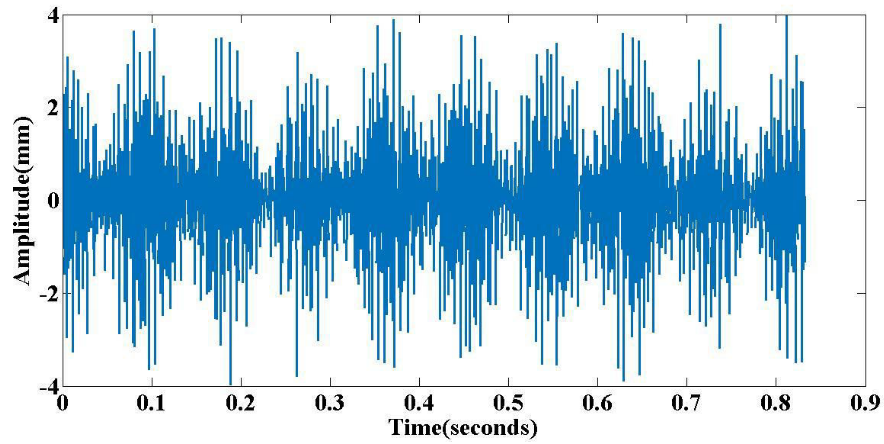

Figure 4 Time series signal of displacement using oil lubricant of ISO 46

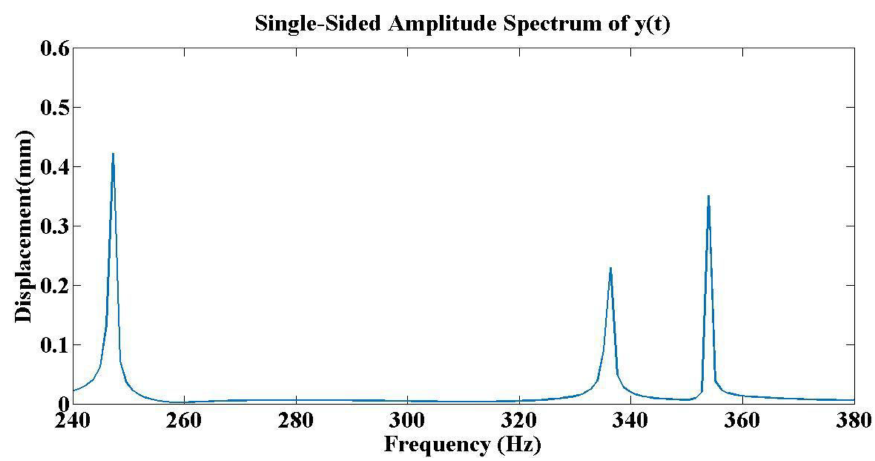

Figure 5 Fast fourier transformation (FFT) of displacement using oil lubricant of ISO 46

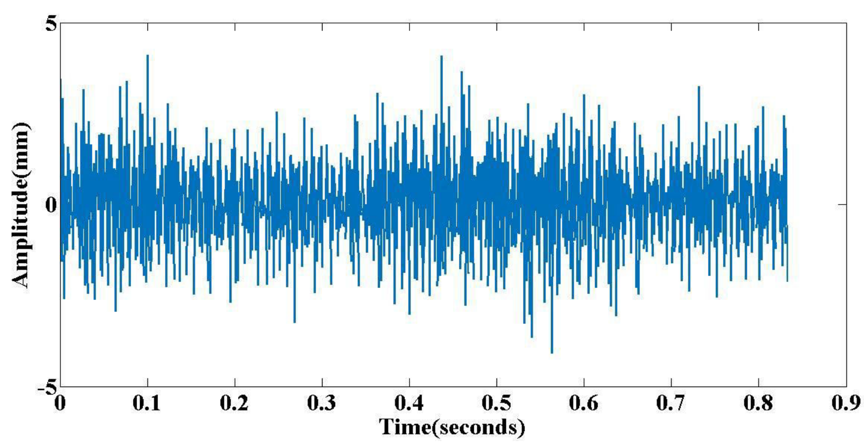

Figure 6 Time series signal of displacement using oil lubricant of ISO 68

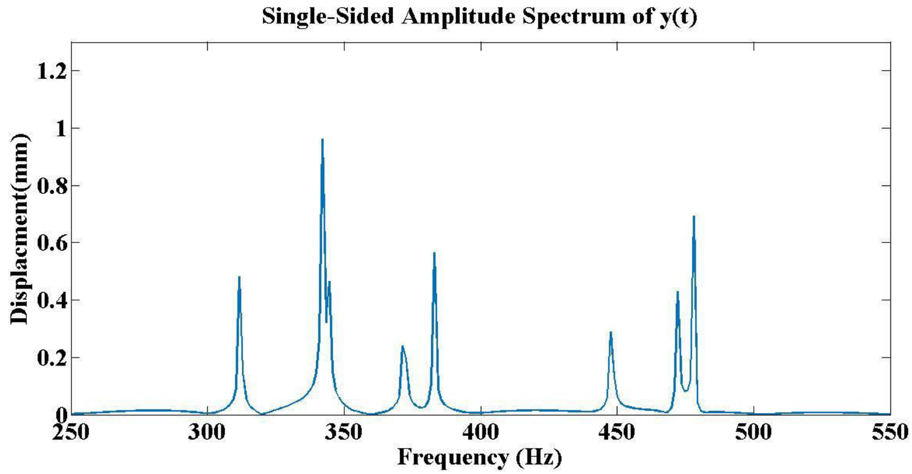

Figure 7 Fast fourier transformation (FFT) of displacement using oil lubricant of ISO 68

4 Conclusions

In this research, the minimum vibration response was obtained using oil lubricant of ISO 46 as compared the other oil lubricant of ISO 32 and ISO 68, oil lubricant of ISO 46 was used to reduce the chance of failure and can increase the life of ball bearing (6203ZZ). In this analysis, the techniques of signal analysis were used as time series signal and fast fourier transformation (FFT). It is obtained that the fast fourier transformation (FFT) of displacement (mm) maximum (amplitude of 0.4221 at frequencies of 247.3), using oil lubricant of ISO 46, which are shown in Figures 5.

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