PREDICTIVE METHODS TO ANALYSE BEARING FAILURE USING LAB VIEW AND DAQ TECHNIQUE

Asheefali Angadi[1] Pankaj Dhandar[2] Aniket Kadam[3] Abhijit Kadam[4]
[1] *Asst Professor Mechanical Engg Dept.PGMCOE Maharastra,India*
[2] *Asst Professor Mechanical Engg Dept.PGMCOE Maharastra,India*
[3] *Asst Professor Mechanical Engg Dept.PGMCOE Maharastra,India*
[4] *Asst Professor Mechanical Engg Dept.PGMCOE Maharastra,India*

ABSTRACT

In any rotating machinery rolling element bearings are one of the vital components. Are found in industri es from agriculture to aerospace, the failure of the bearings will lead to complete shutdown or malfunction of the machinery. This results in economic losses and substantial time .Before the catastrophic consequences it is important to know the health of the bearings and the severity of the defect. This work describes the suitability of the statistical parameters such as kurtosis, crest factor, peak and RMS as the techniques for monitoring defects. The work also describes effect of the speed and the defect size on these parameters. The fundamentals of rolling element bearings are presented in line with different failure modes and relevant monitoring methods in the time domain, the frequency domain, the envelope spectrum and the wavelet analysis. These reviews show that vibration measurements are a proven and widely accepted data source for bearing monitoring of machinery. For the present study, the faults in the bearings are created artificially using Electric Discharge Machine (EDM). Some advantages of standard and portable DAQ Equipment with LabVIEW software also discussed.

Keyword : - *Fault Dagnosis, DAQ,Lab,View,RMS,Crest Factor*

1.INTRODUCTION

Condition Monitoring incorporates into deciding the wellbeing and state of types of gear furthermore the operational condition of machines whose potential disappointment can be identified before they transform into useful disappointments. It is also used for various systems like measuring, checking, observing and analyzing various parameters so that a corrective action can be taken. Condition observing is an inbuilt basic piece of Predictive Maintains (PM) which is comprehensively utilized for the maintenance perspective which known as Condition Based Maintains (CBM). Moving component direction is comprehensively utilized as a part of a bulky portion of the mechanical and residential[1]

applications. In the rotating machinery fault diagnosis is a typical problem in detection of a fault in bearing. If the bearing fault cannot be detect and diagnose well in advances then the bearing failure sometimes cause both personal damage and cost effective loss. Even quite running of the bearings indicates proper functioning of these appliances. The defects of rolling bearing may be caused localized due to faulty installation or inappropriate lubrication, material fatigue. When the rolling element moves over the defect each time an impulse of vibration can be generated. For diagnosis and detection of defects in bearing different methods are used and are broadly classified as, vibration measuring, wear debris

Analysis, temperature measurements and acoustic emission techniques. Among these methodsVibration estimation is the most broadly utilized system. To measure the sound and vibration responses from flawed bearings different techniques such as, frequency domain, shock pulse method, time frequency domain, Vibration Measurement in time domain, sound intensity and sound pressure. Checking vibration and its investigation gives imperative data about irregularity framed inside structure of

2.METHODOLOGY

1. Using wax at bearing housing accelerometer is mounted/fixed.
2. Accelerometer is connected through the cables to the NI-CDAQ 9174 board to a suitable port, to the computer the output of which is connected.
3. The PC contains pertinent equipment and programming (LabVIEW-2012) to obtain the information, store it and presentation the sign on front board as wave chart and numerical marker.
4. Block diagram window contains the circuit connection diagram for acquiring accelerations, apparatus. Diagnostics based on vibration signature mainly associated with feature extraction which relates health (good or defective state) of a component. For experimentation NU-63052 (NRB) ball roller bearing is used. Vibration signature analysis carried in Lab VIEW environment. Defect free and line defect of size 0.5mm and 1mm on the inner race compared. Vibration analysis is carried only for time domain.
5. Now the test rig is started and the program/circuit is made to run and the data is collected for idle (i.e. no load) condition, as well as for loading of 5psi(34.4737KN),10psi(68.9475KN),15psi(103.4212KN), and load at 250 rpm, 500 rpm and 7500rpm.[2]
6. The program/circuit is stopped and real time acceleration data are exported directly from the wave graph to the Excel sheet.
7. Every time the wave graph pictures are copied for references.
8. Finally estimating the various statistical parameters for condition monitoring

Fig 1:*Accelerometer mounted on bearing housing*

Fig2:*Data Acquisition System*

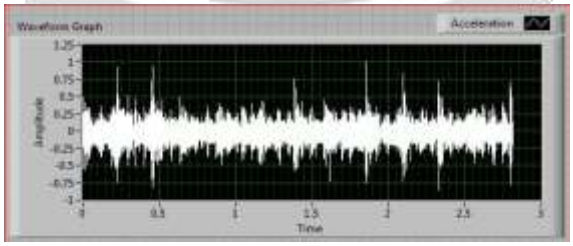

Fig 3 :*Example of time domain graphs*

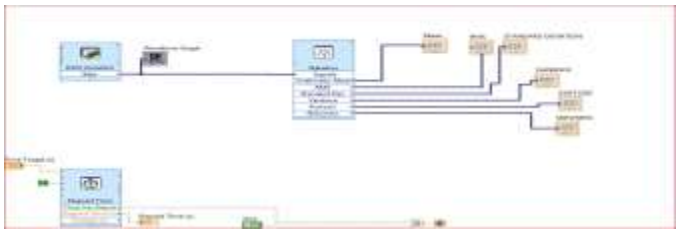

Fig 4:*LabVIEW circuit used to get the statistical values*

3. RESULTS AND DISCUSSION

The various graph obtained for different factors by the lab view software as shown below for Time- domain is performed.

3.1Defect free Bearing

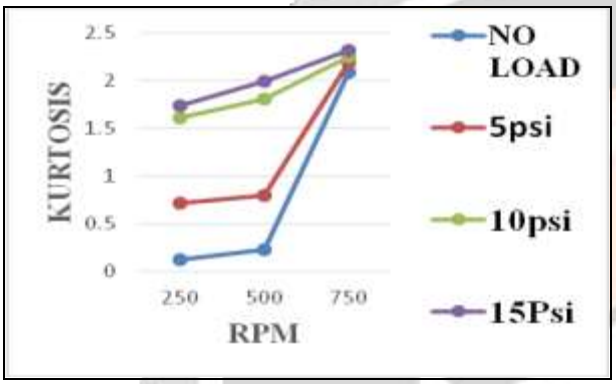

Fig5: Kurtosis Vs Speed plot

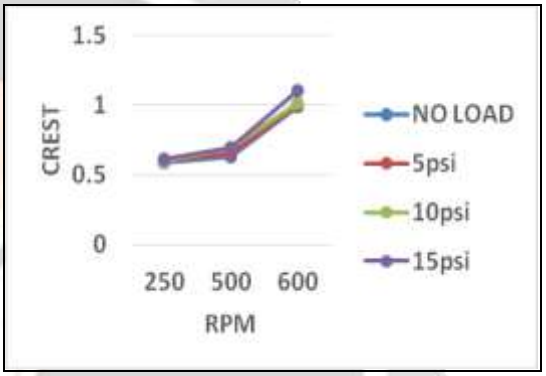

Fig 6: Crest Vs Speed plot

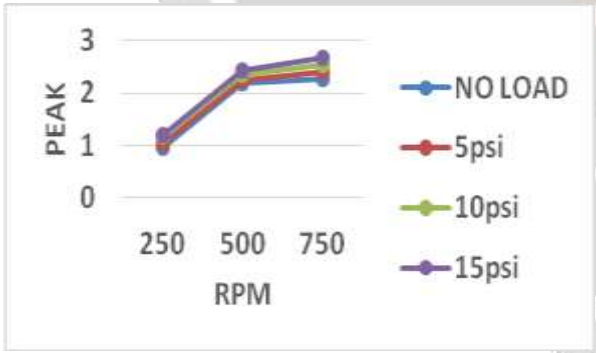

Fig 7: PeakVs Speed plot

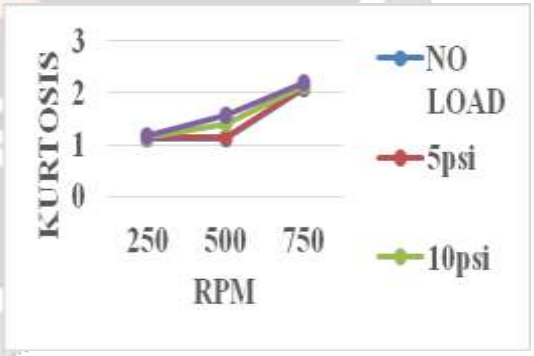

Fig 8:Kurtosisvs Speed plot

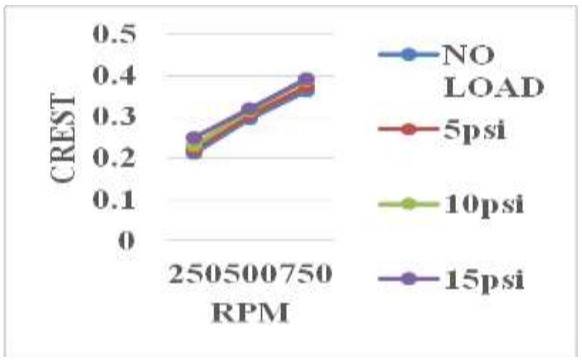

Fig 9:Crest Factor vs Speed plot

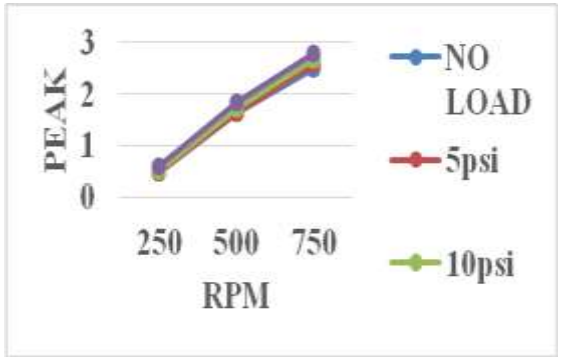

Fig 10: Peak Vs Speed plot

Kurtosis, crest factor and peak were determined for all the three bearings. The figures 5,6 &7 show the variation of the kurtosis value for the five bearings (defect-free, defect of 0.5 mm, 1mm on inner race respectively) for no load, 5psi(KN) load, 10 psi(KN) load and15psi(KN)load. The figures 8,9&10 show the variation of the crest factor for the three bearings (defect-free, defect of 0.5 mm, 1mm respectively) for no load, 5 psi (34.4737KN) load, 10psi(68.9475KN)load and 15psi(103.4212KN)load. The figures 11,12&13 show the variation of the peak value for the five bearings (defect-free, defect of 0.5 mm, 1mm on inner race respectively) for no load, 5 psi(34.4737KN) load 10psi(68.9475KN)and 15psi(103.4212KN) load. The rise in kurtosis, crest factor and peak is observed when the defect free bearing is replaced by the bearing with defect of 0.5 mm and 1 mm on the inner race. Sometimes it may happen that the values of these parameters reduce. This may due to the fact that with increase in defect size the impulse force reduces. Kurtosis, crest factor and peak increase from a speed of 250 rpm to 750 rpm and from no load, 5 psi (34.4737KN), 10 psi(68.9475KN) and 15psi(103.4212KN)load. As the speed increases, the time for the impacts is reflected in the variation in the kurtosis, crest factor and peak values.

4 CONCLUSION

By monitoring vibration level it is possible to obtain information about a machine condition. The level of vibration amplitude is different for different speeds and loads. The level of amplitude of vibration depends on the magnitude of load applied and increases as the load and speed increases for every bearing. When the standard deviation is minimum the kurtosis and crest factor value is always found to be higher. Kurtosis though indicates state of the bearing; it cannot detect the location of fault. The signal corrupted by noise, the kurtosis and crest factor may mislead by indicating the defect in the bearing even if it is not the case. This can be used to trend the variation, which will help to take the corrective action before a catastrophic failure. There by replacing the roller bearing element.Therefore by comparing the values obtained by different vibration analysis Techniques it is possible to understand the vibration severity and suitable remedial action can be initiated at appropriate time. At long last from every one of the experimentations we finish up that the abundance of vibration relies on upon the measure of the imperfection on bearing and the extent of burden connected. Along these lines the vibration observing application can be utilized industries for successful upkeep administration and for exploration.

5.REFERENCES

[1] Yanxe Wang, Ming "identification of multiple transient faults based on the adoptive spectral kurtosis method" *sciencedirect volume 331,2012*

[2] YanxueWang, RichardMarkert **"**spectral kurtosis for fault detection diagnosis and prognostics of rotating machines". *Sciencedirect volume 66-67january2016*

[3] Applied Mechanics and Materials *(*2013) Design of a LabVIEW System Applied to Predictive Maintenance

[4] X.J.Yu et al "Time-frequency Analysis System of Rolling Element BearingBased on Virtual Instrument" *applied mechanics and material vols278-280,pp844-847-2013*

[5] Lili Kang, ZeZhanga, JianmingYu "Data Acquisition and Vibration Analysis Based on LabVIEW."*Applied mechanics and materials,Vols239-240,pp.468-472,2013*