CONDITION MONITORING VIBRATION ANALYSIS OF DEFAULT SHAFT

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Abstract
Condition Monitoring is an advanced and very useful tool of predictive maintenance techniques. When a machine fails or break down results in catastrophic failure, For this reason early detection, identification and correction of machinery problems is paramount to anyone involved in the maintenance of industrial machinery to insure continued, safe and productive operation. In order to run the machines efficiently condition monitoring of machines is important. Vibrations are found almost everywhere in rotating shaft. Shaft vibrates due to unbalances, misalignments and default in Shaft. The disturbance in shaft will be vibrated using actuator and then the vibratory motion in the shaft is sensed by accelerometer. The accelerometer will send the sensed vibration data to F.F.T Analyser which can change the sensed data by accelerometer to meaningful data shown in the PC, such as; frequency, Amplitude, displacement due to misalignment, defects are compared, so that pre-maintenance can be done. so in this paper shows the behaviour of shaft under normal & defects condition & its effects on its performance is shown.
Keywords: **Condition monitoring, FFT Analyser, Vibration Analysis, accelerometer and so on. In this project experimentation is done and results obtained during vibration of shaft**

1.INTRODUCTION

Condition monitoring is process of monitoring a parameter of condition in machinery by different process.out of various tool vibration analysis is used for fault detection in shaft.[1]

1.1 Study of present condition monitoring techniques

Following are the basic condition monitoring technique:

a. Visual monitoring

b. Contaminant or debris monitoring

c. Sound monitoring.

d. Shock pulse monitoring.

e. Vibration monitoring

1.2 Vibration Monitoring

Vibration monitoring is a well-established method for determining the physical Movements of the machine or structure due to imbalance mounting or misalignment this is the most established and tangible technology is sound and vibration analysis. Almost all the machines vibrate and produce sound, and the link between this sound and the machine condition is both easily measured and the results easily interpreted.. A major benefit of vibration analysis is that different mechanical processes within the machine (e.g. imbalance, Misalignments, shaft faults) will produce energy at different frequencies. The different frequencies are separate from one another through analyser. Shaft components are subjected to difficult operating conditions in high-performance rotating equipment such as compressors, steam and gas turbines, generators, pumps, and engines that are used in process and utility plants. Rotating machines are being designed to operate at higher mechanical efficiencies by decreasing the weight and dimensional tolerances leading to greater operating speeds, power transfer, loads, and stresses. As a consequence, many rotor dynamic systems contain shafts that are susceptible to fatigue failure due to transverse & cross-sectional cracks The fracture shaft due to cracking is a rare event; however, if a cracked in shaft is not detected and it bursts, the consequences leads to accidents. This will effects Personal safety, operating costs, and increases overhaul-time intervals, etc. which motivates to research in cracked shaft detection. Vibration monitoring is one approach for detecting cracks that could be implemented in an automated manner to help alleviate cost and safety issues. The appearance of transverse cracks in overhanging shafts having

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propellers carries with it a greater risk of sudden collapse. Even though the presence of a crack (or cracks) may not lead to sudden failure, it will considerably affect its dynamic behaviour. In the last four decades, many numerical and experimental studies have been carried out to identify the effects of different type of cracks, such as transverse, longitudinal, slant, breathing cracks and notches. Crack on a structural member introduces a local flexibility which is a function of the crack depth. Major characteristics of structures, which undergo change due to presence of crack, are:[5]

a. The natural frequency.

b. The amplitude response due to vibration
c. Mode shape
d. Type of material component.

Computer modelling cannot determine the complete dynamic behaviour of structure because certain properties does not conforms traditional methods of modelling. Here experimentation is done to obtained the structural properties by the theory of modal analysis.[6]

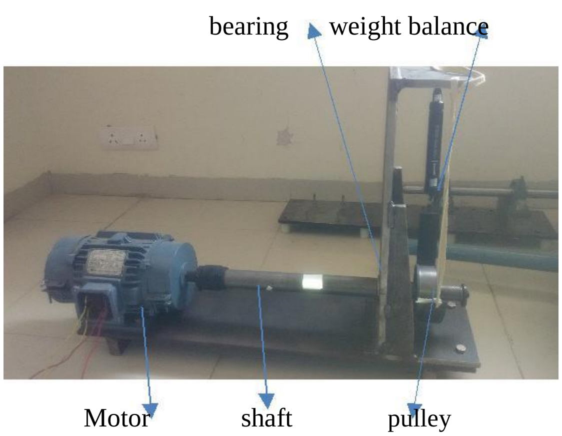

Fig 1 Experimental set up components

Experimental set up and instrumentation:
The accelerometer was connected to F.F.T Analyser. The test rig consists of a shaft of 30 mm diameter 450 mm overall length and supported in a bearing A shaft of diameter 40 mm is fixed at the end of the rotor vertical weighting pan is attached as shown in fig. an dc motor of 0.37 kw is coupled with coupling which drives the shaft.

The setup is run for few minutes to settle down all minor vibrations. Accelerometer along with FFT analyser is used to acquire the vibration signals. The accelerometer is connected to channel no.1 of FFT analyser. The vibration signals are measured at five different speeds namely 350,450, 650, 1000, 1250 Rpm. The speed is measured with digital tachometer. Experimental set up which is going to be used in the current project for obtaining the experimental data contains motor shaft, coupling, bearing & weighting pan.

Fig 2 defective shaft

In this section, the overall R.M.S. acceleration values are compared with speed for different crack's depth for all shafts at motor bearings & crack location The R.M.S. of different location are shown in table. whereas the graph of R.M.S. values versus Speed are shown in below Figs respectively. The above rms values for different speeds in bearing A. It can be seen that for the same amount of speed if rotating speed is increased there is increase in overall R.M.S. Value of vibration acceleration both in 0 mm and 2 mm and 4 mm crack's depth of cracked shaft. We can see that is in below Fig
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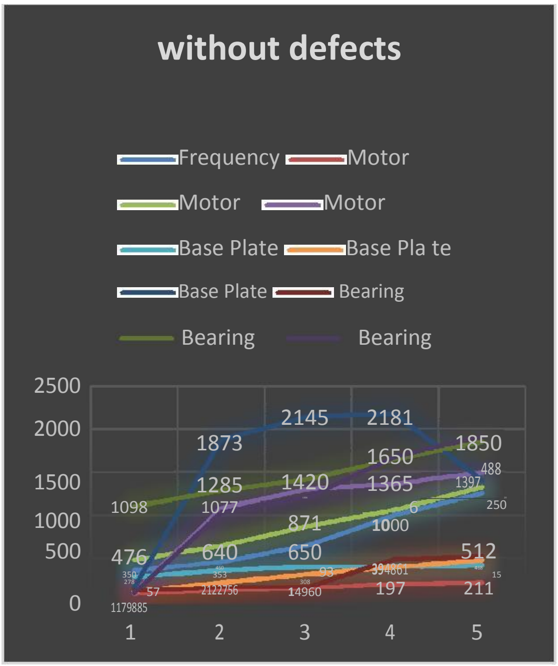

Fig.3 vibration Magnitude (RMS value) µm/s^2 vs. Speed. Without load condition.

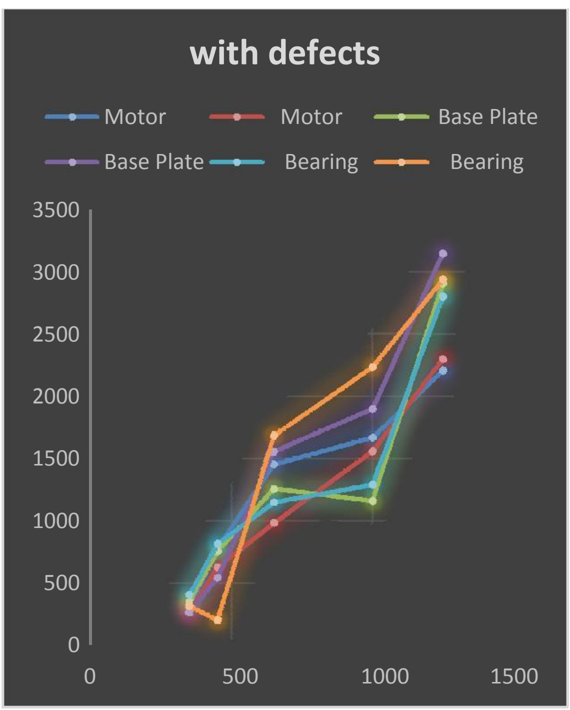

Fig.3 vibration Magnitude (RMS value) µm/s2 Vs. Speed. With load condition.

CONCLUSIO NS

The detection in the fault in shaft has been Studed in adequate number & the relation with respect of faults has been stud ied.from the above results we have concluded that

- If we increser the sp eed then vibration increses in cracked shaft
- Valur of vibration acceleration increases with the distance from r otating shaft.
- Frequency of shaft increases with trhe increase in crack size.
- Position of crack can b e predicted from the deviation of the fundam ental mode.

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