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Fault Diagnosis in Gears using Vibration Analysis

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Abstract – In gearboxes, load fluctuations on the gearbox and gear defects are two major sources of vibration. Further, at times, measurement of vibration in the gearbox is not easy because of the inaccessibility in mounting the vibration transducers. For detecting different type of gear tooth faults an experimental data is taken from single stage gearboxset up. Vibration analysis techniques are used for detection of fault in gear system, fluctuation in gear load. A method for detecting the evolution of gear faults based on time-amplitude analysis through LabVIEW. By comparing Signals of defective condition with healthy condition through vibration analyzer in which, analysis is carried out with the signal to trace of vibration. The validation is done successfully by taking input signalfrom accelerometer to LabVIEW program. It is for calculating effective statistical parameters in defective condition for time & amplitude domain analysis. The actual position in angle of rotation for one tooth missing in gearbox is also investigated by using LabVIEW program. It is also helpful tool for health monitoring of gears in different conditions.

Key Words: Gearbox, Vibration Analysis, Accelerometer

1.INTRODUCTION

In a machinery serve the fundamental purpose of transmitting power or rotary motion between shafts while maintaining the desired angular velocity ratio, ensuring smooth motion transfer and high efficiency. These criteria are typically metunless a gear is defective. When a fault affects one or more gear teeth, it undermines the performance of the gear system, leading to deviations from the intended motion transfer.Gear failure, stemming from various reasons, can impact either a few teeth or theentire gear set. Different failure modes such as scuffing, pitting, abrasive wear, and bending fatigue cracks are associated with tooth surface failures, often caused by excessive stress and inadequate lubricationEnsuring precision in gear inspection necessitates specialized machinery, often requiring dedicated installation space.

1.1 2. Objectives

To determine faults in gear pair using vibration signals
To check composite errors by measuring the vibrations

Problem Definition

Advancements in technology have spurred the development of new production methods, enabling the manufacturing of products on a large scale at low costs. With this mass production comes the necessity for precise fitting of component parts, ensuring that any randomly selected part seamlessly integrates with others. Traditional gear test rigs have limitations, often requiring different rigs for different types of gears and lacking sufficient accuracy in composite error checking. To address these issues, a new gear test rig design has been proposed

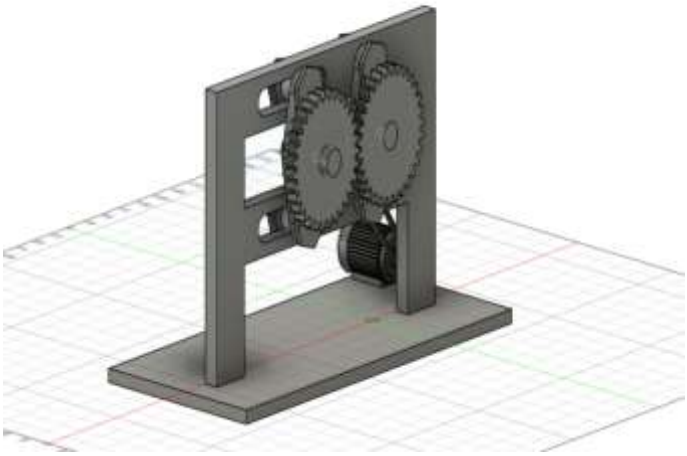


Fig -1: Figure

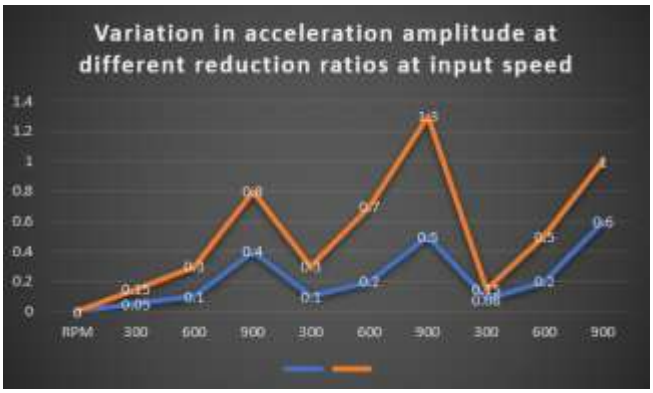
RESULT

Table 4.1 Amplitude at different speeds (Standard Gears)

Speed Ratio	300 rpm	600 rpm	900 rpm
1:26	0.05	0.1	0.4
1:52	0.1	0.2	0.5
1:78	0.08	0.2	0.6

Table 4.2 Amplitude at different speeds (Gears with defect)

Speed Ratio	300 rpm	600 rpm	900 rpm
1:26	0.15	0.3	0.8
1:52	0.3	0.7	1.3
1:78	0.15	0.5	1



CONCLUSIONS

The development and implementation FAULT DIAGNOSIS IN GEARS USING VIBRATION ANALYSIS After analyzing these all graphs, we got dynamic vibration amplitude values fordifferent faults. So after these result we conclude that this whole system was a modernphenomenon to get defect in a gearbox. Now days this kind of modern system is usedby industrial purpose. As a result we get for standard gears of 1:3 gear ratio amplitude of 2.8 where as for same gear ratio with faults in gears gives amplitude of 7.9 this shows the condition of gears with faults. By comparing the vibration response of a new faulty gearbox to that of a gearbox with a known fault, we can predict the fault or defect without the need for complete disassembly. This approach offers significantadvantages, as it allows for direct identification of the fault upon opening the system, streamlining the repair process and reducing overall downtime. So this becomes a less time consuming process to repair a faulty system

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