Design and Analysis of Test Rig for Testing of Bearing using Data Acquisition System

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Abstract— Bearings are the most important part in the mechanical system design. They just not reduce the wear but also supports the system by maintaining the concentricity of shafts. The study of bearing comes under the field of tribology. Whenever the bearing failure occurs. It may lead to the catastrophic effect on the power transmission system. So proper design and selection of the bearing type is the most important. In this project we are monitoring the health of bearing so that we can have idea before its failure. This is done with the help of plotting the acceleration v/s time graph. Every bearing has a load rating and life, in this project we are determining the health of bearing. Whether it will work efficiently for its life. In this project we are using the CATIA V5 R20 CAD software to design the systems. The results and conclusions will be drawn accordingly.

Keywords: Data Acquisition System, Bearings, Arduino Uno

I. Introduction

Vibration is one of the major limitations in any machining operation, which causes improper surface finish of the work piece. Vibration arises from numerous sources such as misalignment, imbalance, improper tightening, motor, tool chatter, spindle rotation, improper foundation and dynamics of gearbox. Vibration from any one of these leads to improper surface finish. The surface finish of the work piece also depends upon the feed rate, cutting depth and cutting speed. Surface finish of the work piece depends upon feed rate, depth of cut and rotating speed of the work piece. Due to various machining operation the gearbox is subjected to wide speed ranges and torque variations.

Although vibration studies have received good attention, the present project focuses in on dynamics of high speed gearbox where gear meshing frequency, modal analysis and critical speed are analyzed. In order to solve the vibration analysis problems of a flexible and/or rigid shaft carrying flexible or rigid single or multiple disks, mainly lumped parameter based methods using transfer matrix have been used previously. This way, the problem can be simplified. However, accuracy of the solution is compromised while predicting higher natural frequencies and critical speeds of a shaft-disk system. Srinath et al. solved the vibration equation of a continuous non-rotating shaft carrying a rigid disk. In its simplest form, a geared spindle system is modeled as a couple of disk-spindle system connected by a spring representing the gear mesh. The spring connects the disks tangentially. While the disks are considered to be rigid in most of the cases, the shafts are subject to torsional vibration. However, the lateral vibrations due to flexure may not be neglected if the shafts are compliant enough.

II. Problem Statement

Bearing plays vital role in automobile industry. Therefore, there is a strong demand for their reliable and safe operation. If any fault and failures occur in bearing it can lead to excessive downtimes and generate great losses in terms of revenue and maintenance. Therefore, early fault detection needed for the protection of the transmission system design. In the current scenario, the health monitoring of the bearings are increasing due to its potential to reduce operating costs, enhance the reliability of operation and improve service to the customers.

III. Objectives

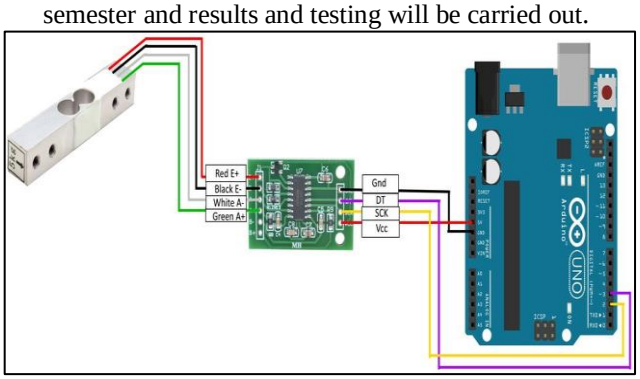
To monitor the bearing health. To obtain acceleration v/s time graph, and analyse it to study the bearing health using accelerometer. To study and use the advanced CATIA model for the development of product. Inspect the bearing to avoid the future failure.

IV. Methodology

We have started working with finding and studying of research papers from different portals like science direct. Then we collected all the topic related data from these research papers and studied them in detailed manner along with the standard reference books and academic books. Then we finalized the working methodology of our prototype and used CATIA to

A. Design the Model

- After finalization of prototype functioning, we have done the calculations and accordingly detailed force analysis is done, where which type of material is used for prototype is finalized.
- After the final analysis and material selection we go out in the market to purchase the required components with required specifications.
- In this purchasing process we approximately estimated the cost required to purchase the components and for machining.
- Finally, our product will be manufactured in second semester and results and testing will be carried out.



B. Arduino Uno

The UNO is the best board to get started with electronics and coding. If this is your first experience tinkering with the platform, the UNO is the most robust board you can start playing with. The UNO is the most used and documented board of the whole Arduino family.

V. COST ESTIMATION

A. Material Cost Estimation

Material cost estimation gives the total amount required to collect the raw material. These materials are divided into two categories.

1) Material for fabrication:
2) Standard purchased parts:

B. Machining Cost Estimation

This cost estimation is an attempt to forecast the total expenses that may include manufacturing apart from material cost.

VI. PROCEDURE FOR CALCULATION OF MATERIAL COST

The general procedure for calculation of material cost estimation is after designing a project,

1) A bill of material is prepared which is divided into two categories.
   a) Fabricated components
   b) Standard purchased components
2) The rates of all standard items are taken and added up.
3) Cost of raw material purchased taken and added up.

SR.NO.	COMPONENTS	COST
1.	Motor	1000
2.	Mild Steel	1000
3.	Frame design	300
4.	Electronic controlling system	3000
5.	Testing	4000

Total Cost Project = Cost of Components + other cost = 10000/-

VII. RESULT

We have successfully designed the bearing health measurement system with the help of CATIA V5 R20 software, the calculations will be done accordingly then materials for components is selected.

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