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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DESIGN ANALYSIS OF BEARING FOR AUTOMOTIVE APPLICATION

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Manufacturing Design) with Honours.

By

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FACULTY OF MANUFACTURING ENGINEERING

2009/2010

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DESIGN ANALYSIS OF BEARING FOR AUTOMOTIVE APPLICATION

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DECLARATION

"I declare this report is on my own work except for summary and quotes that I have mentioned its sources"

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ABSTRACT

The goal of this project is to make a design analysis towards bearing in automotive application This analysis involves bearing theory and the improvement that can be made from the result. There are various methods used in making different specifications of bearings. In order to produce a quality bearing, there are many aspects that should be considered such as the original design of the bearing. Besides, there are also other parameters that is important during the production of bearing. There are several softwares used to analyze the bearing. In this project, MINITAB. ANOVA and R & R is used to analyze this result .

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ABSTRAK

Projek ini bertujuan untukmembuat analisa rekabentuk terhadapgegalas (bearing) pada kenderaan. Analisis ini melibatkan teori gegalas (bearing) dan penambahbaikan yang dapat dibuat hasil daripada keputusan analisa.Terdapat pelbagai kaedah yang digunakan dalam pembikinan pelbagai jenis gegalas (bearing) Untuk menghasilkan bearing yang bermutu, pelbagai aspek perlu diambil kira; contohnya, rekabentuk asal bearing tersebut.. Selain itu terdapat juga beberapa parameter yang perlu diberi perhatian dalam penghasilan gegalas (bearing). Terdapat beberapa "software" yang digunakan untuk menganalisis gegalas (bearing)Dalam projek ini , MINITAB ANOVA dan R&R digunakan untuk menganalisis keputusan yang didapati.

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DEDICATION

This report is dedicated to all my lovely family and thankful to Allah s.w.t

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LIST OF ABBREVIATIONS

OEM (Original Equipment Manufacturer)

ANOVA (Analysis of Variance)

R&r (Repeatability and Reproducibility)

LCV (Light Commercial Vehicle)

MUV (Multi Utility Vehicle)

DGBB (Deep Groove Ball Bearing)

SABB (Self Alignment Ball Bearing)

SRB (Spherical Roller Bearing)

RMS (Root Mean Square)

ISO (International Standard Organization)

WPC (Wave per Circumference)

FFT (Fast Fourier Transform)

AE (Acoustic emission)

NDT (Non Destructive Testing)

PSM (Projek Sarjana Muda)

UTeM (Universiti Teknikal Malaysia)

wpc (Wave Per Circumference)

MEB (Measuring Effect Bearing)

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CHAPTER I
INTRODUCTION

1.1 Introduction

Nowadays, predictive maintenance has become an effective and efficient method for predicting failures of machines. Monitoring defects is a major aspect of predictive maintenance. Manual inspections of defects are not only expensive but also will cause risk of accidentally causing damages when reassembling a machine. For this reason, monitoring process for example predicting bearing defects is very useful in predictive maintenance until the next bearing replacement.

There are many types and specification of bearings. Roller bearing and journal bearing is the most popular and widely used in industry compare with other types. A roller bearing has two types of roller element, a roller type and ball type. In this project, it will be focused to monitor defects in a ball bearing. There are also different method used for monitoring and diagnosis of bearing defects such as vibration, temperature and wear debris measurement analysis. The vibration method is the most widely used in the industry now. But recently, many researchers have found that from **ANOVA** (Analysis of Variation) and **R&r** (repeatability and reproducibility) have many advantages compared with the vibration method. This project will focus on the application of affected on bearing and also monitoring bearing defects.

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Although the development of SKF ball and Roller bearing industry is not quite evitable, it can be said without contradiction that Malaysia has relatively strong base for the manufacture of bearings. Almost all the units have foreign collaboration, the SKF Bearing industry manufactures around 500 types of bearing as against over 30,000 types of bearings being used by the industry in Malaysia. Major products are inputs to areas like fans, electric motors, water pumps. The major of this production go into a huge automotive sector which is being developed in Malaysia for example. In this, automotive segment accounts for 45 percent of the revenues and the remaining 55 percent of revenues are being contributed by industrial demand. In the automotive bearings market, the organized segment manufactures cater to 50 percent of the demand. About 15 percent of the production is by the unorganized segment in Malaysia, and the remaining 35 percent of demand is fulfilled through imports. Out of the total revenues in the automotive segment, 60 percent of the revenues are contributed by the OEMs and the remaining 40 percent is by the demand from the aftermarket. There has been a growth of 15 percent in the aftermarket segment and OEM demand has increased by more than 25 percent from the financial year 2005-06. Though the demand from the aftermarket segment is increasing, the growth rate is declining compared to the year 2005 - 06. In the aftermarket, 6 percent demand is from the engineering applications segment, 5 percent from LCV segment, 4 percent from MUV segment, 8 percent from car segment, 11 percent from tractor segment, and the remaining 15 percent from automotive ancillary segment. Rest of the 50 percent demand is from the Railway sector. [1]

In the automotive industries, can seeing the good competition between the bearing factories manufacturer as the SKF (Sweden), NSK (Japan), KOYO (Japan), Timken (USA) and FAG (Germany). This company always give the good product to the customer. As the user the company want the good bearing to use, in the automotive basically there are choose the high quality of bearing. In this case to evaluate the SKF bearing because is a high quality comparing the others manufacturer. Below has shown the percentage bearing manufacture market on 2007.

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Table 1: Percentage of Bearing Market. [1]

Company	Market share
SKF	28%
NBC	20%
FAG	17%
TATA	8%
TIMKEN	10%
NRB	12%
Others	5%

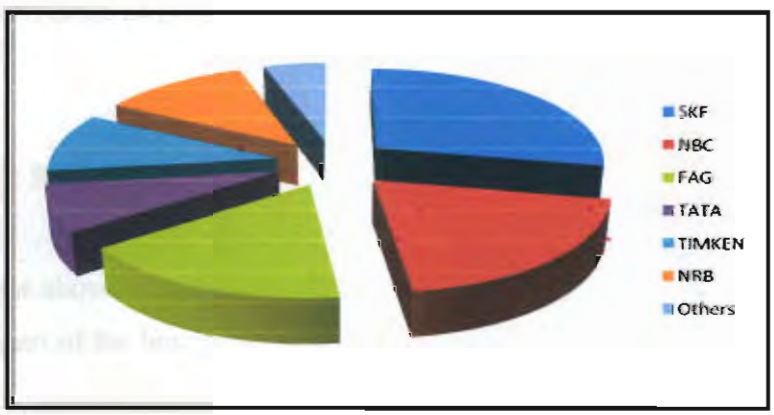

Figure 1: Pie Chart

The fortunes of the bearing industry in Malaysia are linked to the growth of automotive industry. The overall growths in commercial vehicle industry were at 9.7 % in 2007. OEM industries such as two-wheeler, is facing price competition in their own markets and continue to exert price pressure on local bearing suppliers. The growth of Malaysia middle class with increasing purchasing power along with strong growth of economy over the past few years will accelerate demand from the automotive industry and other sectors like steel, power & heavy engineering, thus providing a favorable market environment for the bearing industry.

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Over the last few years, there has been sharp increase in the prices of steel which forms the basic material for bearings and also currently increase in fuel prices which has affected to the demand of automobiles and indirectly to the bearing industry. The overall margins of bearings manufacturer are under severe pressure. The company expects that there will be a risk on its margins on account of intense competition from the unorganized sector in the domestic industry and flow of cheap imports of bearings from china and other low cost countries. To dilute this risk besides any cyclic fluctuations in bearing demand from Automotive or various other industries, the company will focus on technologically advancement and more profitable products/market segments. The company will continue to work in the areas of higher productivity, better efficiency and cost reductions in order to grow. [2]

1.2 Project Background

For this case, the abovementioned problems will be analyzed by using appropriate method. Each part of the bearings will be identified and analyzed as below:

- Analyze the surface roughness on facing bearing,
- Analyze roughness on groove,
- Surface roughness ball/roller
- Cage clamping
- Greasing
- Lubrications
- Materials
- Noise (disable)

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