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A Review Paper on Analysis of Integral Shaft Bearing

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***Abstract*— In this review paper a integral shaft bearing is popular for higher specific load carrying capacity, preventing misalignment defects and eliminating the risk of undesirable distortion of the bearings, rather than Conventional one. Integral Shaft Bearing is used to reduce rotational friction and support radial and axial loads Friction in bearings which cause an increase of the temperature and Stresses inside the bearing. If the heat produced cannot be adequately removed from the bearing, the temperature might exceed a certain limit, and as a result the bearing would fail. To analyze the heat flow, temperature distribution and stresses in a bearing system**

In this study we investigate structural and thermal characteristics performance of Integral Shaft Bearing to Analyze temperature distribution and thermal elongation due to friction also its effect on bearing clearances. Reduce frictional losses due to effect of temperature reduction for the heating parameters.

Key words: Integral Shaft, Modeling, Meshing, Structural & Thermal Analysis.

I. INTRODUCTION:

The term "rolling bearing" includes all forms of roller and ball bearing which permit rotary motion of a shaft. Normally a whole unit of bearing is sold in the market, which includes inner ring, outer ring, rolling element (balls or rollers) and the cage which separates the rolling element from each other.

Rolling bearings are high precision, low cost but commonly used in all kinds of rotary machine. It takes long time for the human being to develop the bearing from the initial idea to the modern rolling bearing.

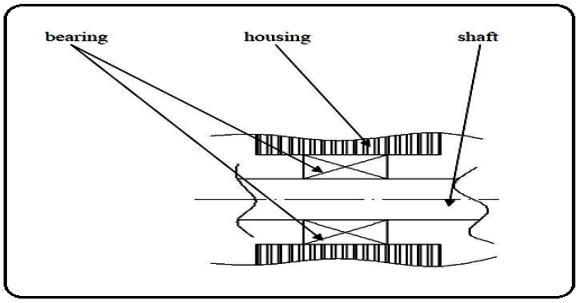

Figure-1. Mechanical System

The reason why bearing is used is that first it can transfer moment or force. Secondly and maybe more important is that it can be interchanged easily and conveniently when it's broken. In the mechanical system shown in Figure-1, it is also possible to amount the shaft directly with housing. However, when this mechanism has some problem, the only possibility to recover the function of this system is to replace the housing or the shaft. From the mechanical engineer point of view, both of them are not only very expensive but also time consuming to manufacture a new housing or shaft with the same parameters.

However when the bearings are used between them, the situation will be different. Normally there is no relative motion between shaft and inner ring or the outer ring with housing. So it has less possibility for the shaft or housing to be worn out. Usually the bearing first cracks and then the shaft or housing is broken. If the above situation happens it is really easy to figure it out: just buy a new bearing from the market with the same parameter and replace it. That's why bearings are so often used.

II. OBJECTIVE OF RESEARCH PROJECT:

The objective of the Research project is to:

a. To Design of Integral Shaft Bearing for Water Pump
b. Modeling & Assembly of bearing components from 2D drawing to 3D model.
c. Stress analysis and temperature distribution for Integral Shaft Bearing
d. Thermal elongation of components in Integral Shaft Bearing at different temperature & its effect on bearing clearances.

III. NEED OF INTEGRAL SHAFT BEARING

Integral Shaft Bearing has two widely spaced rows of rolling element, do not have inner ring but raceways machined directly on the surface of the shaft. As a result there is more space available for the rolling elements, giving higher load carrying capacity with reduced price than conventional single bearings. The use of common outer ring for two rows of rolling elements prevents misalignment defects eliminating the risk of undesirable distortion of bearings.

Integral Shaft bearing provides two internal designs viz. two rows of widely spaced balls and each row of ball and roller which gives broad range of load carrying capacities. The end of shaft normally extends beyond the outer ring on both sides. The length and diameter of these sections are matched

to the specific application. This results in a simple, ready-to-fit bearing unit that is primarily used in water pumps for automobiles.

Since they are not restricted to use in water pumps, also called as Integral Shaft Bearings. Specialty bearing shafts may have flats, knurl, keyways, holes, internal/external threads, splines.

IV. LITERATURE REVIEW:

A. Ambeprasad. S. Kushwaha (2012) Presented paper on *Analysis of the Ball Bearing considering the Thermal (Temperature) and Friction Effects* **[1].** This paper presents the performance of bearing to reduce friction, misalignment defect, and distortion of rolling elements. With this analysis they had been shown that the temperature in this bearing system increases gradually to a steady state temperature. To calculate steady state temperatures only a simple static analysis is necessary, which is far less CPU-time consuming. It is important to know the different conditions that affect how the heat is transferred.

B. Peng Chunjun (2009) Presented paper on *Static Analysis of Rolling Bearings Using Finite Element Method* **[2].** In this he did Static Analysis of Angular Contact Ball Bearing, Contact Analysis and Simulation of Angular Contact Ball Bearing with Simplified Model Using Beam Element. He fined the reasonable reference reaction force from the outer ring to the inner ring by means of FEM simulation. Also, instead of using ball, to simplify the rolling bearing with some other elements between the inner and outer ring. The model mainly used to be discussed is angular contact ball bearing. To do the simulation with the part model of bearing, flexible-flexible model has to be used for the rings and ball. The model with beams between the inner ring and outer ring will be used to simplify the angular contact ball bearing.

C. Takeo Koyama (2009) Presented paper on *Applying FEM to the Design of Automotive Bearings* **[3].** This paper presents the analysis of contact problems by applying FEM to automotive bearing applications such as hub unit bearings and V-ribbed pulleys. FEM is expected to contribute significantly to better bearing models and faster and more reliable evaluations, as well as smoother data exchange with CAD systems. Thus, in many cases, difficult problems will be surmounted more quickly and effectively while securing greater confidence in the stability and reliability of the resultant solution even before an actual prototype is fabricated and tested. He shown that FEA is an effective tool to develop and supply high quality and extremely reliable products to its automotive customers on time. Bearings encounter many contact problems. To make an accurate model of the contact area is a crucial step in FEM. Comparison of actual test data and FEA data contributes to the refinement of the FEM contact model. Contact FEA enables design optimization, weight reduction, and design convergence to boundary and critical conditions. This paper describes the current status of FEA in bearing design and discusses practical applications such as hub unit bearings and V-ribbed pulleys.

D. Prasanna Subbarao Bhamidipati (2006) Presented paper on *FEA Analysis of Novel Design of Cylindrical Roller Bearing* **[4].** This paper focused on studying a roller design which can develop uniform contact-stress distributions by eliminating any edge stress and also recommend a roller bearing design which is easier to fabricate. The roller is relaxed to deflect due to the hollow cavity at the ends of the roller when subject to a compressive contact load, which in turn results in the reduction in contact stress distribution at both ends of the roller.

E. Brian P. Graney (2012), Presented paper on *Rolling Element Bearing Analysis* **[5].** This paper focused on that Bearing failure occurs randomly due to bearing wear and may be accelerated by dynamic forces and lubrication problem. Rolling element bearing require multiple parameters to be monitored and analyzed be effectively assess the bearing condition in order to take corrective action before failure occur. The Purpose of this paper is to briefly discuss how the high frequency natural bearing resonance indicator, discrete frequency indicators (acceleration), acceleration time- waveform characteristics, acceleration time waveform crest factor, and the velocity amplitude of bearing fault frequencies associated with rolling element bearings can be integrated to determine bearing health and risk of catastrophic failure.

F. Jafar Takabi (2012), Presented paper on *Experimental testing and thermal analysis of ball bearings* **[6].** This paper present A comprehensive mathematical model to analyze the thermal behavior of a ball bearing is presented. Considered in conjunction with the transient heat transfer model is the dimensional change of the bearing components due to unequal temperature rise of the bearing components. The model provides a practical tool for evaluation of the transient and steady state characteristics of rolling element bearings owing to the lumped assumption of the bearing components and the finite number of thermal nodes in the heat transfer model of the entire system.

G. Laniado-Jacome Edwin (2011) Presented paper on *Numerical Model to Study of Contact Force in A Cylindrical Roller Bearing with Technical Mechanical Event Simulation* **[7].** This paper focused on The employed modeling technique makes it applicable for a wide range of ball bearing assemblies using the appropriate presented methods to estimate the critical parameters, such as convection coefficients and contact resistances. However, for a given bearing system in practice one needs to consider the appropriate material properties, boundary conditions etc. nevertheless, the approach remains valid.

V. THEORETICAL CONSTRUCTION OF INTEGRAL SHAFT BEARING

Water pump bearings are ready-to-fit bearing units. They comprise a shaft 1 that is supported by means of two rows of rolling elements 2+3 in an outer ring 4. The bearings are greased for life and protected against environmental influences by two sealing rings 5+6. The appropriate material is selected in accordance with the application and the environmental influences; different sealing ring materials can be used on the two sides of the bearing.

a) **Shaft:** The standard material for the shaft is SAE 52100 Steel. Rolling element sets the rolling element sets comprise either two rows of balls or one row of balls and one row of rollers.

b) **Outer ring:** The outer ring 4, is made from SEA 52100 Steel, which having a chemical composition C : 1.05, Mn : 0.35, Si : 0.30, Cr : 1.50.

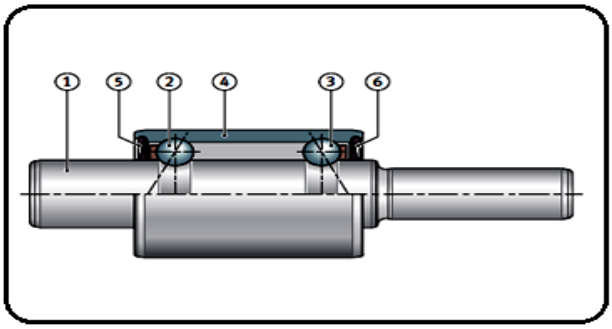

Figure-2. Mechanical water pump Bearing

c) **Sealing rings:** As standard, three different elastomer materials are available for the sealing rings 5 & 6: NBR, HNBR, FPM. The appropriate material is selected in accordance with the application and the environmental influences; different sealing ring materials can be used on the two sides of the bearing.

VI. APPLICATION

Water pump bearings are mainly used in coolant pumps for road vehicles. Due to their versatile design, the ready-to-fit units are suitable for many other applications. They can be used, for example in fans, idler pulleys, vane pumps, angle grinders

VII. CONCLUSION

Today world save energy parameters are use. The most of bearing system is develop the energy but west. Now's day linear transmission system Bearing is part energy saving in the research and develop as the development continuous efficiency and performance benefit invariability increase this will lead increase such tribological concept, bearing mechanism. The bearing profile further development of Integral Shaft Bearing. The liner repeated of the transmission ratio. In any technology with inherent benefits eventually reach fruition the bearing has only just begun to blossom.

VIII. ACKNOWLEDGEMENT:

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