A REVIEW OF TEMPERATURE RISE IN INPUT SIDE BEARING OF TWO STAGE BEVEL GEAR BOX

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ABSTRACT

In today's era, efficiency of any machine is very crucial. Gearbox is a very important component for transmission of power from one shaft to another having short distance between their axis. If efficiency of gearbox is less, then it affects efficiency of whole system. So it is required to improve efficiency of gearbox. In this gearbox, it has been observed that temperature at input side shaft bearing is higher than permissible limit. This paper involves discussion of various research papers related to power losses of bearings.

Keyword :- CFD, MRF, Churning loss, Windage loss

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1. INTRODUCTION :

Generally gearbox is used to transmit power from one shaft to another having short distance. Efficiency is a concern in such systems. Gear power losses are classified into load dependent losses and no-load dependent losses. Gear power loss in a gearbox includes losses among gear, bearing, seal and other auxiliary losses. Gears and bearings conclude load dependent and No-load dependent losses. No-load bearing losses dependent on type, size, arrangement of bearing, lubricant viscosity and oil supply to bearing.

For splash lubrication system, if adequate amount of oil is not supplied to bearing then the power loss in the bearing increases and it causes adverse effect on efficiency of gear boxes. So it is very important to analyse oil flow system. There are many parameters which affect the efficiency of a gear box. Among them one is heat dissipation rate. Heat is generated due to power losses in gear and bearing. In bearing, generally main reason of heat generation is lack of oil supply. The oil film thickness created in bearings also play a major role for heat generation. There are many parameters which directly or indirectly affect the bearing performance. So, for efficient performance of bearing, optimization of all parameter require.

2. LITERATURE REVIEW :

Paper 1 : Optimization of Gear box Efficiency

B. R. Hohn, K. Michaelis, M. Hinterstoiber[1] discuss about various power losses like gear, bearing, seal, auxiliary within gearbox and effect of some parameters on the power losses and efficiency of the gearbox. These parameters are immersion depth of the component, viscosity of oil, additive added in oil, etc. They worked out on influence of design and operating temperature on bearing losses. They concluded that maximum efficiency could be achieved by change of lubricant type, viscosity and supply to the component.

Paper 2 : Investigation of Drag and Churning Losses on Taper Roller Bearings

Jurgen Liebrecht, Xiaojiang Si, Bernd Sauer, Hubert Schwarze[2] discuss about experimental investigation of the drag and churning losses in tapered roller bearing. They also focus on influence of rotational speed, oil viscosity and oil level on the windage and churning loss of the tapered roller bearing. They also work out on CFD

simulation of single phase flow considering the air content and influence of air content on windage and churning loss. So, from this research paper, we can get idea about effect of various parameter on churning loss and minimize their effect on this losses.

Paper 3 :Relating High-Temperature, High-Shear Viscosity to Bearing oil film Thickness Measurements

Serge A. Cryvoff, Asoke K. Deysarkar[3] discuss about method to find bearing oil film thickness. They established a series of reference oils, to measure their bearing oil film thickness. So from this we can measure the oil film thickness for this bearing.

Paper 4 : Analysis of the power losses in geared transmissions- measurements based on open source codes

F. Concli, C. Gorla[4] discuss about influence of operating and geometry parameter on the windage and churning loss of the gears. They conclude that oil level affect more on windage and churning loss of the gear and disc, they also give comparison of two approaches like sliding mesh and Moving Reference Frame (MRF).

Paper 5 : CFD simulation of Splash Losses of a Gearbox

Carlo Gorla and et. al.[5] discuss about CFD simulation for churning losses which occur when simple disc or gear is placed in enclosed geometry filled with oil. They prefer specific meshing method for meshing of the gear and CFD energy model required for this type of geometry. They conclude that error between experimental and CFD analysis is within 5% for this setup.

Paper 6 : Thermal Stress Analysis of a Ball Bearing by Finite Element Method

M. Chandra Sekhar Reddy[6] discuss about meshing condition used for taper roller bearing. It is very useful during meshing section in steady state thermal analysis of taper roller bearing.

Paper 7 : Structural and Thermal Analysis on a Taper Roller Bearing

M. Premkumar and Dr. C. J. Rao[7] discuss about boundary conditions given to the taper roller bearing for steady state thermal analysis. Using this data we can find temperature distribution within the bearing for different oils and flow rates.they discuss about main boundary conditions taken for tapered roller bearing are Conduction, Convection, Heat flow, Radiation.

Paper 8 : Experimental testing and thermal analysis of ball bearings

Jafar Takabi and M. M. Khonsari[8] discuss about thermal network for bearing assembly. They also make mathematical model to solve the problem. They show that temperature of the bearing is increases by using higher viscosity oil. They take three oil samples, SAE 20, SAE 30 and SAE40. Out of these SAE 40 shows higher temperature during operation.

Paper 9 : Temperature influence on Bearing Scufiing Failure

C. Bujoreanu, S. Cretu[9] discuss about scuffing failure in ball bearing. They made temperature distribution model for analysis of scuffing and also give graph between surface temperature and scuffing of ball bearing. So from this research paper we can get idea about affect of scuffing on this bearing.

Paper 10 : Thermal Modelling of Tapered Roller Bearing using Finite Element Analysis

Constantine M. Tarawaneh and et. al.[10] discussed about finite element method for analysis of rail road. They 25 different conditions and conclude that lubricants used in railroad bearings start to degrade when operated at temperatures above 125 ^{0}C for prolonged periods.

Paper 11 : Friction Torque on Cylindrical Roller Thrust Bearings Lubricated with Wind Turbine Gear oil

Carlos Fernandis and et. al.[11] discuss about tribological behaviour of oil have different chemical composition but same grade used in planetary gear box.. They experiment on ESTF, Easter, Mineral , Polyalkleneglycol and

Polialphaolefin lubricants and observed that Mineral oil had highest friction torque comparison to other four oils and ESTF had minimum friction torque comparisons to other lubricants.

Paper 12 : Torque Loss in Thrust Ball Bearings Lubricated with Wind Turbine Gear Oils at Constant Temperature

Carlos Fernandis and et. al.[12] discuss about effect of oil composition on friction torque at constant temperature about 80^0C and two different speed(75 and 1200 rpm). they took six lubricants, ESTF, Easter, Mineral , Polyalkleneglycol, Mineral + PAMA and Polialphaolefin, for the experiment and conclude that as speed increases the friction torque increases.

3. CONCLUSION :

From the review of research papers we conclude that oil type, oil viscosity, oil level in gear box, flow rate of oil are the affecting the power losses and rise in the temperature of the oil apart from other component which are contact with oil. For effective and efficient working of gear boxes, the temperature rise should be minimum. Among these paper no one use ANSYS CFD for simulation of bearing. So, there is scope of using the same for simulation.

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