STUDY ON THE EFFECT OF GROOVE PROFILE FOR MAXIMUM LOAD CARRYING CAPACITY AND MISALIGMENT OF HYDRODYNAMIC JOURNAL BERING: A REVIEW

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***Abstract*— In today's era, friction for mechanical driven mechanism is a great problem. So we use bearing as remedy to reduced friction in relative motion. The current project includes the study on hydrodynamic journal bearing with different groove profiles. In the current project author is optimizing groove profile for minimum misalignment, maximum load carrying capacity. Coupled mathematical model of fluid-film and bearing stiffness is generated using MATLAB the simulation of geometric model of bearing with different groove profile is analyzed for fluid structure interaction using ANSYS.**

Keywords—Hydrodynamic journal bearing, friction of motion, fluid structure interaction(FSI) ;

I. INTRODUCTION

Bearings are important parts of rotor systems, and their lubrication behavior affects the reliability of the whole system. Some bearings operate under low rotational speed and heavy load conditions, and the minimum liquid film thickness is on the same order of magnitude as roughness. Influence of journal misalignment on water-lubricated bearings and indicated that the load carrying capacity decreases when journal misalignment angle increases. [1].Hydrodynamic journal bearing is a bearing operating with hydrodynamic lubrication, in which the bearing surface is separated from the journal surface by the lubricant film generated by the journal rotation. Most of engine bearings are hydrodynamic journal bearings. In a hydrodynamic journal bearing if journal rotates in a clockwise direction, Journal rotation causes pumping of the lubricant (oil) flowing around the bearing in the rotation direction. If there is no force applied to the journal its position will remain [2].

II. Theory and measures of Angle of Groove

In this section study about strabuk equation. The nomenclature of a journal bearing is shown in Fig.1 The dimension c is the radial clearance and is the difference in the radii of the bearing and journal. In Fig.1 the center of the journal is at 01 and the center of the bearing at 02. The distance between these centers is the eccentricity and is denoted by e. The minimum oil film thickness is designated by ho, and it occurs at the line of centers. The film thickness at any other point is designated by h. Eccentricity ratio ϵ is define as,

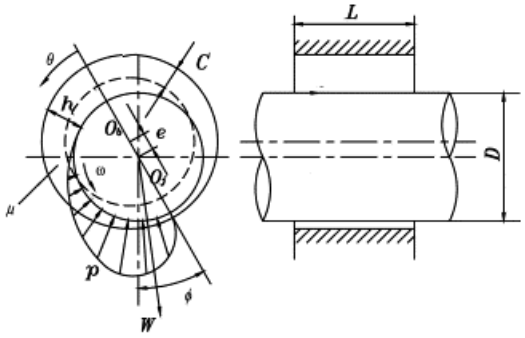

Fig .1 Journal bearing with usual notations

Jun [1] et al. Hydrodynamic lubrication analysis of journal bearing considering misalignment caused by shaft deformation. in this paper using Angle of journal misalignment in bearing hole caused by shaft deformation, Film thickness, Load capacity and attitude angle, End leakage flow-rate. The misalignment has little influence on load capacity, attitude angle, end leakage flow-rate and frictional coefficient. the misalignment moment increases when the value of eccentricity ratio is large.

Fangrui Lv [2] et al.Mixed-lubrication analysis of misaligned bearing considering turbulence. Geometry of misaligned bearing, Numerical model, validation. Under the same external applied load, the turbulence remarkably increases the coefficient of friction, slightly increases the minimum nominal film thickness, and decreases the journal speed at which ML-HL transition occurs. The influence of turbulence on bearing performance is more remarkable when the rotational speed increases.

J. Ghorbanian [3] et al. design predictive tool and optimization of journal bearing using neural network model and multi-objective genetic algorithm. ANN training and prediction quality, ANN development and implementation. Genetic algorithm, results are very encouraging and give a motivation for the use of the proposed optimization methodology,

together with load capacity constraint in IC engine journal bearings. However, this requires a look up table of bearing materials and their load capacity.

Bian Guo**.** [4] et al.Optimal surface texture design of journal bearing with axial grooves. using axial groove, governing equation, Jfo cavitation boundary condition. journal with axial groove have better stability and weaker load carrying capacity. in this paper used cylindrical dimple and spherical dimple. compare a non-texture bearing with the dimple texture journal bearing.

Jun Liu [5] et al.The Effects of Trapezoidal Groove on a Self-Acting Fluid-Lubricated Herringbone Grooves Journal Bearing. Load Capacity, Attitude Angle, and Friction Torque. The characteristics of a self-acting fluid-lubricated herringbone grooves journal bearing with trapezoidal groove. the effects of trapezoidal groove become larger with trapezoidal angle increase.

Lintu Roy [6] et al.Optimum Groove Location of Hydrodynamic Journal Bearing Using Genetic Algorithm. Real-Coded Genetic Algorithm Computational Procedure. In this problem three variables called genes will form a chromosome. inferred that the second groove location is sensitive to the type of objective function whereas the first groove is more or less the same for any objective function. The practice and the notion of convenience of keeping groove positions perpendicular apart need to be thoroughly looked into as the present results show that optimum groove locations are not perpendicular apart for any of the objective functions considered in the present work.

Chin-Cheng Wang [7] et al.Numerical study of a hydrodynamic journal bearing with herringbone grooves for oil leakage reduction. in this paper compare a hydrodynamic journal bearing and a hydrodynamic herringbone-grooved bearing. The continuity and Navies–Stokes equations have been solved using commercial software based on the finite volume method. From the numerical results of a hydrodynamic herringbone-grooved journal bearing, we can see that high-pressure areas occur at the tips of the herringbone grooves without eccentricity this area shaft will be stabilized at low eccentricity ratio. the oil leakage will be reduced with help of herringbone groove.

Lintu Roy.[8] et alEffect of Axial Groove on Steady State and Stability Characteristics of Finite Two-Lobe Hybrid Journal Bearing. in this paper using axial grove hybrid journal bearing in two lobes with steady state and stability condition. use as governing equations, dynamic characteristics, mass parameter and whirl ratio. The bearing load capacity, the lubricant flow rate increases with increases in eccentricity ratio and speed parameter. the bearing having smaller groove angle gives higher load capacity and higher stiffness and damping coefficient magnitude.

A.M.Gad [9] et al.on the optimum groove geometry for herringbone grooved journal bearing. in this paper using different types groove profile for herringbone groove. using beveled step groove profile and compare with rectangular groove profile and circular groove profile with help of groove geometry. beveled step HGJB has higher radial stiffness, higher load carrying capacity, and lower friction torque than rectangular HGJB.

H.Hirani [10] et al.optimization of journal bearing groove geometry using genetic algorithm. in this paper study on location of groove, its configuration and oil feed pressure for optimum performance of cylindrical journal bearing with help of genetic algorithm. the increase in supply pressure from 196kpa to 392 Kpa result is improve in load and speed condition.

Dinesh Dhandeet [11] et al . Analysis of Hydrodynamic Journal Bearing Using Fluid Structure Interaction Approach. in this paper Hydrodynamic journal bearings are analyzed by using Computational fluid dynamics (CFD) and fluid structure interaction (FSI) approach in order to find deformation of the bearing. This technique gives the deformation of the bearing due to action of hydrodynamic forces developed which is important for accurate performance of the bearings operation under severe conditions It is observed that there is substantial amount of deformation of the bearing.

Tushar P. Gundarneeya [12].Evaluation of Load Carrying Capacity of Hydrodynamic Journal Bearing with Nano lubricants. In this work, influence of Nano lubricants on the load carrying capacity of hydrodynamic journal bearing is studied. Increase in viscosity of lubricant oil with nanoparticle as lubricant additives is modeled using different classical model and compared with Kriger-Doughetry viscosity model. Lubricant viscosity due to nanoparticles addition is very accurate by Krieger –Dougherty viscosity model by comparing with experimental results

III. CONCLUSION

The objective of the project work is carried out in different stages namely design and analysis. IN the design stage the hydrodynamic journal bearing has been designed using Ansys software for different L/D ratios and for differenteccentricity ratios. The lubricant film is generated in the CFD module of the software. Further pressure distributionis found by sending the lubricant in between the journaland bearing for different L/D ratios and for differenteccentricity ratios. journal bearing has been conducted usingsequential application of computational fluid dynamics.

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