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Review Paper of Wear on Journal Bearing

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Abstract: ***Journal Bearing is used to bear the load and confine the rotation of the shaft. A loaded rotating journal (Shaft) is supported by circular bushing (sleeve or bearing), the diameter of bearing is slightly more than diameter of journal, to provide the clearance so proper supply of lubrication oil is possible, which can enhance the performance characteristics of journal bearing. Journal bearing are mostly used to carry the radial loads of shafts working in dry and lubrication conditions. Journal bearing is used in various applications like sugar mill bearing, cement industry and turbine etc. The hole or groove is provided on bearing for the supply of lubricant. Journal bearings are most suitable for low temperature applications with slow speed. The common reasons for failure of journal bearing are the wear and temperature of journal bearing. The bearing is worn out and leading to wear particles in lubricants, heavy vibrations may be cause by rubbing oil whirl***.
Keywords: Wear; Temperature; Lubrication.

I. INTRODUCTION

Tribology is the branch of science which deals the study of physics, chemistry and mechanics of rubbing surfaces which contain friction wear and lubrication of materials. Friction and wear properties are always observed in various material which used for the transmission of the power from one shaft to another, friction and wear are always affect the efficiency. Bearings are assemblies which consist of rolling elements (inner & outer races) which are used for rotating and linear shaft applications. There are various types of bearings, includes ball & roller bearings, linear bearings & mounted versions that may use either rolling element bearings or plain bearings. The journal bearing geometry is shown in fig 1.

A. Nomenclature of Journal Bearing

Center of journal at O, Center of bearing at O', Eccentricity e, Minimum film thickness h0 occurs at line of centers, Film thickness anywhere is h, Eccentricity ratio $\in = \frac{e}{c}$.

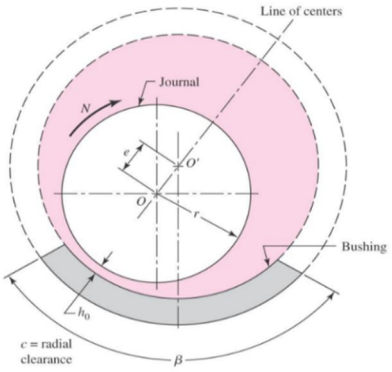


Fig. 1: Journal Bearing

B. Classification of Wear

Wear is a process of slow removal of a material from part of solids subject to sliding and contact or in relative motion.
There are following types of wear:

1) *Rubbing Wear:* Rubbing wear occurs when there is surface and sliding contact in machine.
2) *Cutting Wear:* This is abnormal wear produced when two surfaces penetrate to one another.
3) *Rolling and Sliding Wear:* The wear produce due to rolling and sliding of the machine parts.

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4) *Chemical Wear:* Corrosive wear is frequently called as fretting corrosion, erosion, stress fatigue, etc.
5) *Abrasive Wear:* Abrasive wear is occurs when material removed from one surface by another harder Material and that time leaving hard particles of fragments between the two surfaces. It is also being called gouging, scratching or scoring.
6) *Adhesive Wear:* Adhesive wear occurs due to the contact and interaction of asperities on two surfaces having strong adhesive force.

II. LITERATURE REVIEW

Several researchers have been performed remarkable work on journal bearings.

1) Shyam Bahadur [1] has been observed that the transfer films are formed in sliding between polymer and metal. Inorganic particulate materials used as the fillers in polymers may be increase or decrease its wear resistance. Wear depends upon the cohesion of transfer film, adhesion of transfer film to the counter face, and the protection of rubbing polymer surface from metal asperities by transfer film.
2) Dumbre Omkar and Khillari Shubham [2] concluded that the material like lead base Babbitt, tin base brass shows good properties like less wear, less corrosiveness, So that it is suitable material for the journal bearing. It is also identified that wear rate increases when normal load and sliding velocity increases for both copper and aluminum. At ideal condition, wear rate of copper lower than that of aluminum for the observed range of normal load and sliding velocity.
3) Erol Feyzullahog˘lu and Nehir Sakirog˘lu [3] Aluminum-based alloys nowadays are developed to be used in high performance engine bearings. He study, new Al-based bearing alloys, which produced by metal mould casting, were developed; tribological properties of these alloys under lubrication were analyzed experimentally. Four different aluminum alloys were carried out on pin on disc wear tester for that purpose. SAE 1040 steel was used as the disc material in the wear tester. The results show that friction and wear behavior of the alloys changed according to sliding conditions. As a result of the evaluations conducted, Al–Sn and Al–Si alloys, which include Si and Sn, can be preferred, among the aluminum alloys that will work under lubrication, as the bearing material.
4) Gengyuan Gao et al [4] aims for provide references to designing water-lubricated plain journal bearings. Considering the differences between the physical properties of the oil and water, the effects of eccentricity ratio on pressure distribution of water film analysed by computational fluid dynamics (CFD). Then numerical analysis of journal bearings having different dimensions is carried under different rotational speeds. Based on this analysis, reference is produced for selecting the initial dimension of diameter which is used to design efficient water-lubricated plain bearing under the specified load and speed.
5) Emiliano Mucchi et al [5] for the examination of the lubrication regime and wear between the pressure ring and vanes in variable displacement vane pumps, an experimental method is provided. By minimizing wear, boosting volumetric efficiency, and lowering maintenance costs, understanding the lubrication regime is crucial for improving the performance of vane pumps. In order to identify the optimal material in terms of wear and friction, tests employing pressure rings made of various materials were conducted.
6) E.N. Santos et al [6] performed a hydrodynamic lubrication evaluation on radial journal bearings. The Reynolds equation was solved in order to use the Generalized Integral Transform Technique (GITT) to get at a hybrid numerical-analytical solution. In order to check the study results, as well as to show the consistency of the outcomes and the ability of the GITT technique to address journal bearing issues, comparisons with results reported in the literature were also made.
7) Peng Liang, Changhou Lu [7] the concept of dynamic pressure ratio (γ) was proposed in this article to measure hydrodynamic effects on bearing land. Reynolds equations and flow continuity equations were solved using finite difference, over-relaxation and under-relaxation methods. Using the example of a capillary-compensated hydrostatic plain bearing with four pockets, we study the variation of dynamic pressure ratio (γ) with eccentricity ratio (ε) and speed (N).
8) N.B. Naduvinamani et al [8] describes a theoretical investigation of how surface roughness affects porous step-slider bearings' hydrodynamic lubrication. A stochastic random variable with non-zero mean, variance, and skewness can be used to numerically represent a more general type of surface roughness. The findings of the numerical calculations show that the negatively skewed surface roughness pattern increases load carrying capacity and decreases coefficient of friction, but the negatively skewed surface roughness pattern has negative effects.
9) J. D. Bressana et al [9] claims that when the hardness gap between the pin and disc grows, disc wear becomes more severe. It is clear that a reduction in pin hardness results in a reduction in the pin wear resistance distance; the trends of the pin wear rate curves with sliding distance are approximately linear and constant. However, some pins have the ability to reduce the rate of wear in the final stage. This is brought on by a decreasing in real contact pressure when the pin contact area and/or disc track hardness increase.

10) Priyanka Tiwari et al [10] gives an overview of significant publications that analyse numerous theories, equations, and methods for calculating the hydrodynamic journal bearing's temperature distribution, minimum oil layer thickness, friction loss, and load carrying capability. The design of hydrodynamic journal bearings depends heavily on the predictions of these characteristics. The main focus of the current study is on a variety of elements that have a significant impact on how well a hydrodynamic journal bearing functions.

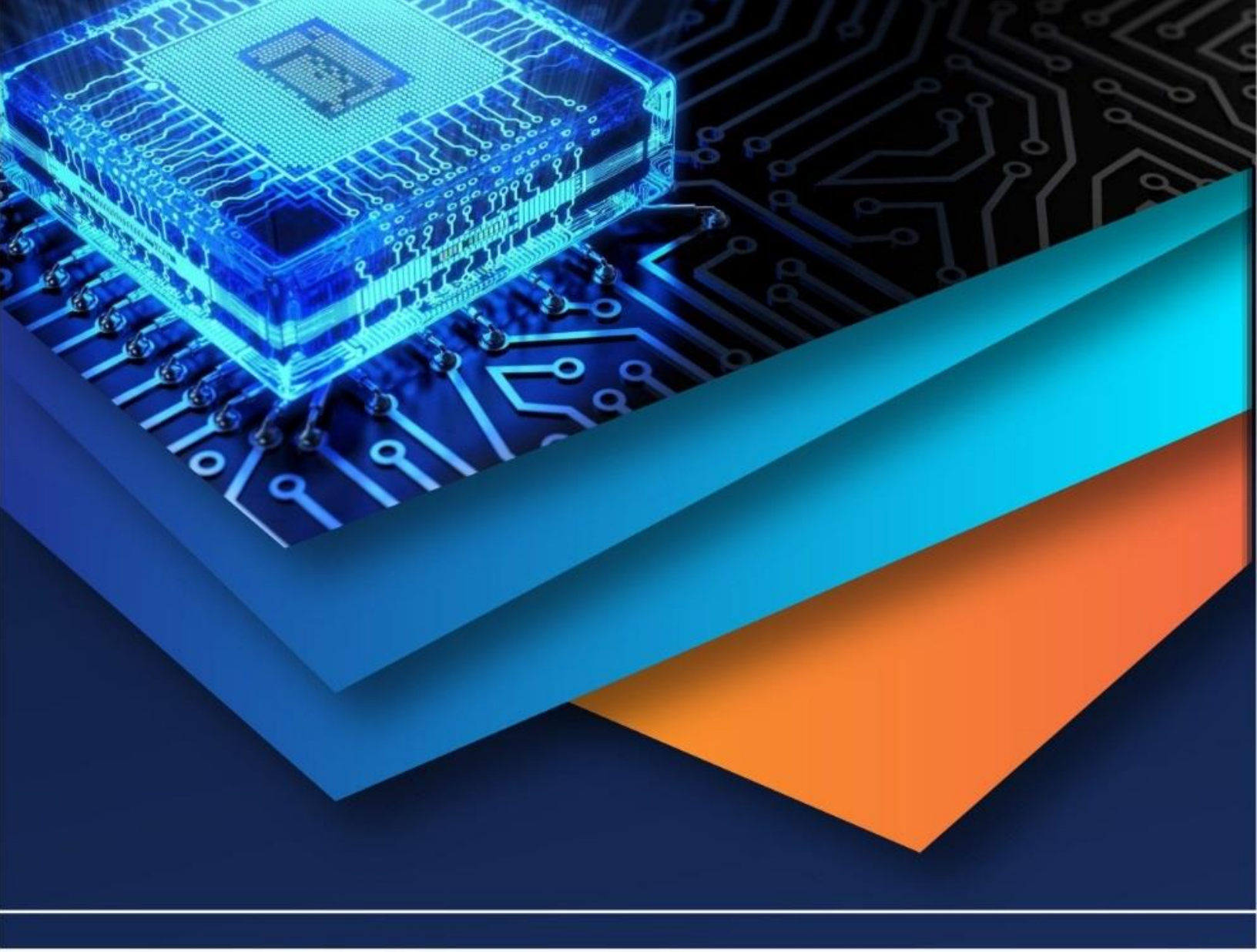
III. CONCLUSION

According to the examination of the literature, wear is a crucial consideration when choosing the material for journal bearings. When selecting a material, consideration must be given to factors including wear rate, coefficient of friction, time of use, and environment in which journal bearings are operated. In dry and lubricated conditions, wear is observable and is influenced by speed, load, temperature, and operating time. Analyzing wear rates on various materials and under various circumstances is possible. The primary circumstances in which various lubricants can be employed are dry and lubricated situations.

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