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# A Review Paper on Study of Various Failure Analysis of Bearings

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**Abstract –** *The purpose of bearings in mechanical systems is to support the load exerted by the shaft and power transmission devices. Bearing life refers to the total number of rotation a bearing can perform efficiently under a given load before deteriorating. When a bearing fails to achieve to its expected life or capability, it can cause the shaft to fail. Fractures, inadequate lubrication and grease application, incompatible environmental conditions, and insufficient shaft bearing stress are all major causes of failure. The main aim of the review paper is to study of various bearing failures and their causes.*

## I- INTRODUCTION

The purpose of the bearing in mechanical systems is to bear the load imposed by the shaft and power transmitting elements. The first sketch of anti friction bearing was proposed by the Lionardo da Vinci. Afterword Timken developed the taper roller bearings and since then various modifications have been occurred in the design. However, the way the ball turns during one rotation is interesting. Because the ball or roller is subjected to a variety of torques during its rotation. This torque includes gyroscopic torque in several planes. The load on the bearing changes constantly as a result of varied torques and forces. As a result, the stress in the bearing's component varies. However, because the internal components of the bearings are subjected to moderate to heavy contact loads, contact stresses are produced. Due to continue inducing the stresses and continuous use of the elements the strength of material becomes weak and the influence of stresses becomes more dominant over a period of time. Therefore the catastrophic failure may occur some times.

## II- DIFFERENT REASONS OF FAILURE IN ANTIFRICTION BEARINGS

### LUBRICATION FAILURE:

Lubrication is the prime issue related to the antifriction bearing. The proper lubrication facilitates the bearing to run smoothly and efficiently. It also helps to separate the metal surfaces at some extent by providing the lubricant layer and thus reduce down the friction. However, continuous use of same lubrication and improper monitoring leads to increases the inside temperature of bearing and thus it leads to move towards its failure. The increased temperature reduces the viscosity of oil which in turn increases the friction and wear and tear in the bearing.

### CORROSIVE FAILURE:

The antifriction bearing which are running in the dusty and humid environment are exposed to dust and moisture content continuously. The dust diluted with the lubricant and abrasion of bearing element has occurred, whilst the moisture content does the chemical reaction with metal surface and produces the corrosion. If proper attention and care are not taken then it leads to permanent failure.

### MISSALIGNMENT FAILURE:

It is speculated that 80% of machine failure is due to improper planning of machine alignment. Therefore, proper and timely commitment of maintenance person is highly required. If the shaft of bearing has misalignment which gives additional load on the races and roller .this load may be cyclic and which leads to increase wear andtear of races and roller too. The increased misalignment induces high contact stress and rapture in material.

**POOR FITTING:**

Proper fitting of the bearing or one may call the proper bearing assembly with the shaft, which is essential to avoid bearing failure. There are two way to fit the bearing namely 1.Manual fitting and 2.Fitting assisted by machine. In manual fitting the wooden log is used to fit the bearing by hammering gently at the bearing is fitting is accomplished. However, this may require experienced person. If the excessive force during hammering action is given, then it may damage the outer race and inner race. This will lead to misalignment in inner parts and sometimes provide excessive clearance. Thus the produced clearance gives excessive vibration and bearing may get failure.

## III - LITERATURE REVIEW

M. Amarnath et.al. in this research paper author said, using experimental test equipment, the wear of roller bearings was investigated. Changes in the micro-geometry of the bearing components were studied using a scanning electron microscope. Large fractures have been observed along the inner raceway. The removal of solid debris from the inner race surface damages the other bearing surfaces much more. Consequently, the lubricating oil is unable to create elastohydrodynamic friction between the inner race and the rollers. Wear rates are modest and stable over time. These characteristics have an impact on bearing component roughness, according to the findings. Wear particles from the inner race enter between operating surfaces, deteriorating contact surfaces.[1]

Hao Guo et.al. In this paper, the failure investigation of the engine water pump shaft bearing included measurements of material composition and quality, observations of macro and micro morphologies, and a theoretical analysis of fatigue failure. The wear behaviour and failure mechanisms have been described, as well as prevention techniques. The principal cause of inconsistent water pump shaft bearing operation was discovered to be failure of the cylinder roller bearing on the power side, rather than the deep groove ball bearing on the impeller side. The wear was mostly caused by the bearing cage fracture and significant wear of the roller and mandrel, including composition, hardness, and microstructures that fulfilled the acceptable standards.[2]

Viktor Gerdun et.al. Two failures of cylindrical roller bearings and axles in freight waggons were described by the author. In the first case, the collapse resulted in the full destruction of the railway line. The material had been deformed and altered by the damage and the high temperatures, making it impossible to trace the source of the failure. The failures were caused by fatigue of the bearing inner rings, according to the research. These had been in place for much too long, and their dynamic strength had finally worn out. As a result, the rings grew larger, allowing the axle to slip through them. As a result of the friction, the bearing began to heat up. Broken rings and jammed rollers also harmed the cages.[3]

Fang Li et.al. Author brief states, by using finite element analysis software to the bearings transient dynamics analysis, the bearing's deformation, pressure, and other properties can be derived. The cage thickness has an impact on bearing performance under pure radial load, radial load, and axial load mixed force, according to the results of the analysis. The data show that the cage thickness has no effect on the bearing's deformation under pure radial stress. When the radial and axial loads are combined, the bearing's radial deformation is minimised compared to when the radial load is applied alone. The deformation is larger when the cage is subjected to a mixed force than when the cage is subjected to a radial load.[4]

R.K. Upadhyay et.al. according to the author, Rolling contact fatigue is caused by cyclic stress generated during performance and mechanisms that cause rolling element bearing fretting failure. When non-rotating rolling element bearing raceways are subjected to vibration or sliding oscillation, false Brinelling occurs. Brinelling is prone to deterioration over time due to voids created on the bearing surface due to a poor bearing surface.[5]

S. N. Satone et.al According to author, this study investigates and analyses the failure of a casting shakeout bearing, which is used in the foundry industry to separate solidified casting and sand from the mould box. The failure of roller spherical bearings used on the central shaft has been observed to cause frequent shakeout breakdown. The most common reason of bearing failure is poor quality, which is prone to deterioration over time due to cavities developed on the bearing surface. Damage to the roller and inner races of the spherical bearing affects the vibrations of the casting shakeout platform.[6]

Marko Nagode et.al. The author said that, for the purpose of testing air springs, a test rig was created. It makes use of the energy that the spring returns during unloading. The springs are loaded by a lever that oscillates at a small angle around its rotation point. Rotation point bearings were discovered to be key components of the test rig during operation. This study examines and illustrates the damage that occurs on bearing ring raceways. Contact pressure and tension under different rolling elements were computed using the finite element method (FEM). It was discovered how damage is created and transmitted. According to study, bearing ring raceways are subjected to material fatigue and spalling.[7]

S. SANKAR et.al. in this research author says, The failure of a bearing in the gearbox of a wind turbine generator is described. To determine the cause of the filter choke alert in the turbine controller, the two-stage filter element and gearbox were checked at the top of the turbine tower, known as the nacelle. To determine the mode of bearing failure, drive train alignment between the asynchronous generator shaft and the gearbox shaft was established. To check for deviations in the material specifications and heat treatment procedure, the failed bearing was subjected to chemical and microstructural examination, as well as hardness measurements. Bearing failure was found to be caused by corrosion, bauxite in the lubricant, and overloading due to continuous high power generation.[8]

## IV - PROBLEM IDENTIFICATION

The bearing failure occurs due to,

1. Improper lubrication and greasing.
2. Inappropriate environmental condition
3. Excessive temperature generation due to friction
4. Initial cracks in bearing
5. Overloading, resulting spalling in bearing

## V - CONCLUSION

The ultimate focus of review study is to understand and be aware of various bearing failures, including their characteristics and causes. The bearing's improper working performance can be used to diagnose rolling element bearing deterioration. Improper lubrication and greasing, overloading, stress, and environmental factors must all be taken into consideration when identifying the source of bearing failure.

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