Review on Design and Fem Analysis of Helical Gear in Gearbox of Induced Draft Fan

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Abstract— This paper presents a failure analysis of a induced draft fan gear box due to fatigue for dulocos conveyors and moulds pvt Ltd, MIDC, Nagpur. The gear is failing prematurely; the life of the gear in the ID fan gear box is less than one month. There is a need to design a gear for fatigue failure as the desired life of gear is 24months. In present study, we create the CAD model of gear box. Then analysis of design will be performed. Then the modifications and analysis of modified design will be performed after that results will be discussed and design will be finalized.

Key words: Modes of Gear failure, gear fatigue

I. INTRODUCTION

A. *Gear Failure*

The role of the industrial power transmission gear drive is to reliably transmit torque and rotary motion at short distance between a prime mover and a driven piece of equipment at certain range of noise, vibration and temperature. When one or more of the preceding operating characteristics exceeds allowable limits, the drive and its application should be examined to determine the cause of the problem. Gear failure can occur in various modes. In this paper details of failure are given. If care is taken during the design stage itself to prevent each of these failures a sound gear design can be evolved.

The failure of the gear takes place in five types they are:

- Wear
- Scoring
- Plastic flow
- Pitting
- Tooth fracture

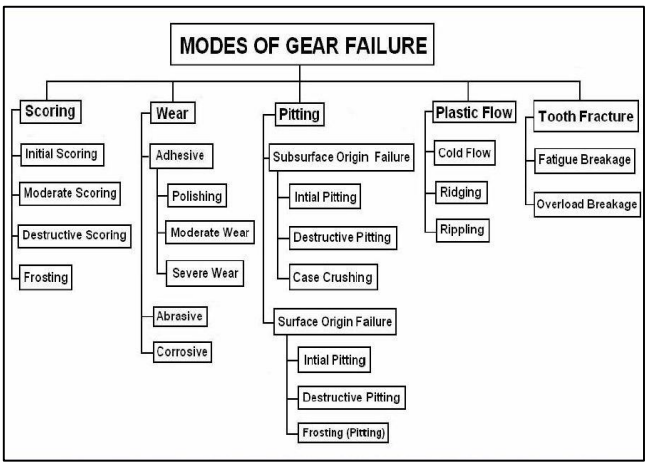

Table 1: modes of gear failure

II. LITERATURE REVIEW

Failure probability of gear teeth wear - Milosav Ognjanovic In extreme gear service conditions some of the tooth damages such as pitting are not the main type of teeth flank failure any more. The hypothesis concerning infinite fatigue endurance of teeth flanks is without support now[1]. Abrasive wear and squeeze at local points of contact eliminate and/or stop pitting from developing. Three types of surface damages (abrasive wear, squeezing and pitting) occur simultaneously and contribute to each other. In that way, teeth flank failure accelerates and gets more intensive and progressive. Infinite flank endurance does not exist. Besides this, the process of simultaneous (progressive) teeth flank damage is stochastic. Statistical approach to failure intensity evaluation is the only possibility. For certain wear limits of teeth flanks, experimental results are presented by statistical parameters. Those statistical models and statistical parameters are suitable for the development of reliability models of gear and gear drives.

Failure analysis of air cooled condenser gearbox. Anand Parey, N.K. Jain, S.C. Koria The failure of gearbox caused losses in terms of cost of gear, down time during replacement and production losses [2]. The gearbox under investigation was used for the driving the axial fan of an air cooled condenser (ACC) of a power plant in a very reputed cement industry in India. The gearbox was expected to have life of 50,000 h continuous running. However, it could not even run for 3000 h which was very intriguing. The unexpected failure of the gearbox led to investigation of the gearbox.

Different types Failure in gears-A Review, Arvind Yadav The objective of this paper to present the recent development in the field of gear failure analysis. By the help of this paper we can know about different types of failure detection and analyzing techniques which is used to reduce these failures from gears [3]. The basic reasons of gear failure misalignment of gear, spalling, pitting etc, follow the reason of gear failure. which is identified from this paper .the intention of this paper is not to provide detailed description of the causes of gear failure but it focused on the different types methodology, that is used by the various researcher in the past recent year to find out causes of failure in gear and what is final result of that to reduce the failure in gear.

Stresses And Deformations In Involute Spur Gears By Finite Element Method Zeping Wei A gearbox as usually used in the transmission system is also called a speed reducer, gear head, gear reducer etc., which consists of a set of gears, shafts and bearings that are factory mounted in an enclosed lubricated housing. Speed reducers are available in a broad range of sizes, capacities and speed ratios [4]. Their job is to convert the input provided by a prime mover (usually an electric motor) into an output with lower speed and correspondingly higher torque. In this thesis, analysis of the characteristics of involute spur gears in a gearbox was studied using nonlinear FEM. Designing highly loaded spur

gears for power transmission systems that are both strong and quiet requires analysis methods that can easily be implemented and also provide information on contact and bending stresses, along with transmission errors.

Stress Analysis of Composite Spur Gear Shanavas S This paper investigates the static stress characteristics of an involute composite spur gear system including bending stresses and contact stresses of gears in mesh and comparing it with the existing involute cast iron spur gear system [5]. The aim is to replace the cast iron spur gear with Carbon fibre epoxy composite spur gear due to its high strength, low weight and damping characteristics. A pair of involute spur gear is modelled in a CAD system (PRO/ ENGINEER) and FEA is done by using finite element software ANSYS 13. The bending stresses in the tooth root and contact stresses were examined using a 3-D FEM model. The bending stress obtained by finite element analysis method is compared with bending stress obtained by Lewis equation and the contact stress obtained by finite element analysis method is compared with contact stress obtained by Hertzian equation.

III. Identified Gaps in the Literature

Most of the researchers have investigated the gears for almost all type of failures like fatigue failure etc.The purpose of this work is to design the gear for Induced draft fan gear box for long fatigue life cycle. Very limited work has been observed on the strength of gear for fatigue life cycle.

IV. Problem formulation

This project is an industrial project related to gear failure in Induced draft fan gear box for Dulocos Conveyors and Moulds Pvt. Ltd, MIDC, Nagpur. During the visit, the problem was discussed. The gear in the ID fan gear box is failing prematurely; the life of the gear is less than one month. The desired life is 24 months.

V. Research methodology

In present study, we collecting problem definition from the industry, to study modes of gear failure and create the hand calculations to require CAD model of gear box. Then analysis of design will be performed. Then the modifications and analysis of modified design willbe performed after that results will be discussed and design will be finalized.

VI. Conclusions

With successful completion of this project, the company Dulocos Conveyors and Moulds Pvt. Ltd will be directly benefited; this solution can reduce the downtime of the ID fan and will significantly increase the reliability of the product. It will also give the project an in-depth knowledge of Metal Fatigue and Gear failure modes, also during the project will get hands on experience on latest Finite element analysis codes.

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