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RELIABILITY OF WORN COMPLIANT JOURNAL BEARINGS

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ABSTRACT

This work investigates the effect of polymer liner wear on the performance characteristics and reliability of journal bearings. The analysis is based on a thermohydrodynamic model that also includes thermo-mechanical deformations of the bearing. The polymer liner provides enhanced bearing performance but is prone to wear at start-ups. Changes in the bearing geometry caused by wear are considered. The wear scar is located in the lower half of the bearing. Such parameters as hydrodynamic pressure, operating temperature, power losses and film thickness are studied and compared for the unworn and worn bearings. The wear effect on bearing reliability is analysed and discussed.

Keywords: journal bearings, polymers, temperature, power loss.

INTRODUCTION

A constant trend towards higher power densities in rotating machinery calls for better mechanical components capable of carrying higher loads while being the same or smaller in size without sacrificing machine safety. For hydrodynamic bearings it is important that minimum film thickness never drops below a safety limit. Oil film becomes thinner if load increases. This also results in elevated temperatures, which reduce oil viscosity and further decrease oil film thickness. White metal or babbitt is the material of choice for the linings in conventional hydrodynamic bearings. Babbitt provides good conformability and embeddability but loses its strength with rising temperature.

One way to avoid these limitations is to use different materials for bearing linings. It has been shown that load carrying capacity of tilting pad thrust bearings is significantly increased by using PTFE as a substitute for white metal [1, 2]. PTFE can also withstand high temperatures and provide low breakaway friction [3], which makes it an interesting candidate to use in plain journal bearings. Application of PTFE as a bearing lining provides journal bearings with compliant properties.

It has been shown that journal bearing performance is improved due to the compliant properties of the polymer liners [4-6]. The goal of this paper is to investigate and clarify differences in the thermohydrodynamic performance of worn compliant journal bearings in comparison to unworn bearings.

RESULTS AND CONCLUSIONS

The results of this study shows that depending upon the bearing design and operating parameters the wear of the polymer liner may have positive or negative influence of bearing performance and reliability.

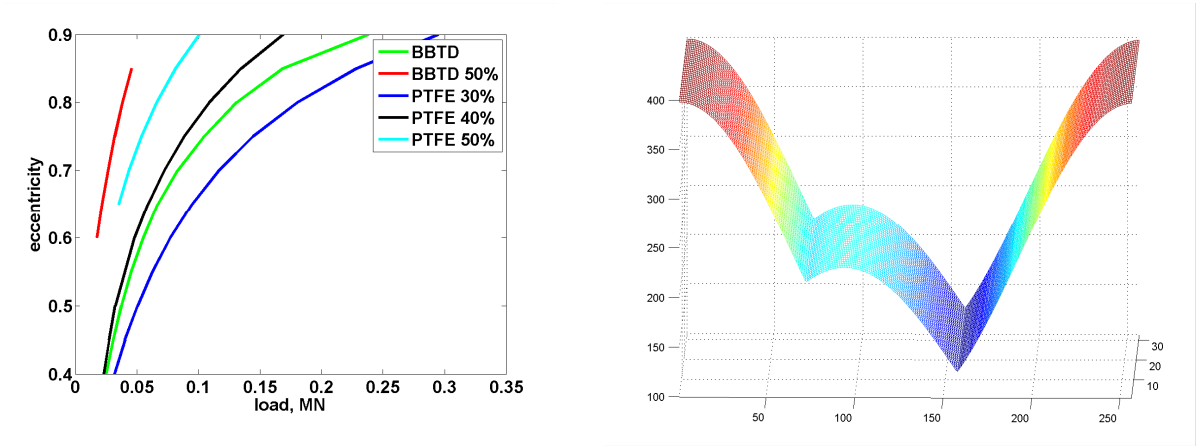

Fig. 1 - Shaft eccentricity and oil film thickness in the worn bearing

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