Static analysis of partial slip texture slider and journal bearing considering thermal effects

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This paper presents static analysis of slider and journal bearing with partial slip texture considering thermal effects. The one-dimensional modified Reynolds equation is derived for one-dimensional bearing with partial slip texture with thermal effects. The nondimensional pressure and shear stress under static conditions with partial slip texture configuration are derived. Results of load capacity and friction coefficient for slider and journal bearing with partial slip texture under thermal effects are analyzed.

Keywords: slip, texture, friction, bearing; thermal analysis

1. Introduction

The performance characteristics of a slider and journal bearings are influenced by the partial slip texture surface configurations. Spikes [1] analyzed 'half-wetted' bearing which provides good load support due to fluid entrainment low friction. In the 'half-wetted' bearing, no-slip occurs against the moving surface but slip can occur at a critical shear stress against the stationary surface. Salant and Fortier [2] analyzed a slider bearing surface on which slip occurs in certain regions and is absent in others. The load support can be improved as the flow in the bearing can be altered.

The tailored bearing surfaces show an improvement in performance. Tønder [3] introduced the idea of an inlet zone tailored roughness to ease the access of fluid into the device which results in the generation of hydrodynamic pressure. Etsion [4] presented a theoretical and experimental study on the influence of micro-dimples generated using the Laser Surface Texturing (LST) on tribological components.

Cui [5] presented the effect of partial slip on the high-loaded plain journal bearings using thermohydrodynamic analysis. Knight and Barrett [6] presented static and dynamic characteristics of multilobe journal bearings including thermal effects. Singhal and Khonsari [7] investigated the stability of a journal bearing considering inlet viscosity effects. The inlet viscosity has a significant influence on the stiffness coefficients, damping coefficients, and threshold speed.

2. Methods

In this study, slider and journal bearings with partial slip texture surfaces [9] is analyzed taking into consideration of thermal effects based on one-dimensional analysis. The temperatures within the partial slip texture bearing are predicted based on the first order energy equation for an adiabatic film [6]. The viscosity is determined from the temperature.

3. Discussion

The nondimensional load capacity and coefficient of friction of partial slip texture bearing under low load conditions is analyzed considering thermal effects.

4. References

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