ELASTIC DEFORMATIONS EFFECT ON HD LUBRICATION OF RADIAL JOURNAL BEARINGS

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Abstract: *The present paper is aimed to study the deformability effect of the bearing surface on the lubrication performance of cylindrical journal bearing with finite length. The bush is coated with thin resilient layer with smooth surface. The steady state EHD problem is investigated under elasticity conditions in accordance with a Vlassov model of an elastic foundation adapted for thin liner. The Reynolds equation is solved numerically by successive over-relaxation technique on a finite difference grid. The converged solutions for the lubricant flow and elastic deformations are obtained. The variety of simulation models of the tribological system is presented. The comparative analysis between the solutions by hydrodynamic (HD) theory and elastohydrodynamic (EHD) theory of bearings lubrications carried out.*

Keywords: *journal bearing, hydrodynamic and elastohydrodynamic lubrication*

1. Introduction

Journal bearings are used extensively throughout the industrialized world, especially in the rotating machines because of their constructive simplicity, low wear, good damping characteristics and high level of the reliability and efficiency. Typical applications include turbines, turbogenerators, large milling systems, aircraft engines and space satellites, medical equipment, military equipment and others [1-3, etc.]. Indeed, it is difficult to think of many types of machines that do not include rotating components with bearings in one form or in another. In plain journal bearings a hydrodynamic (HD) film occurs when at loading point there is a sufficient lubricant between the lubricated surfaces. This lubricant forms a fluid wedge that separates the sliding surfaces.

It is well known that aiming the low wear journal bearing surfaces are sometimes lined with materials that are much softer than the usual bearing metals. The influence of elastic deformation of the bearing liner on the lubricant film geometry results in change of the later; modifies the HD pressure profile; and therefore changes the performance characteristics of the journal bearing. That is why to obtain the optimum design of the considered tribological system the flexibility of bearing liner must also be considered along with the bearing geometric and operating parameters.

The deformations effect of the liners on the bearing sleeve or on the journal on the performance characteristics of cylindrical journal bearing was studied by many investigators [1, 3-13, etc.]; such the current work is further attempt in this respect.

In the relation of above mentioned the aim of the study is to compare solutions by hydrodynamic and elastohydrodynamic (EHD) theory of lubrication for steady-state loaded journal bearing with finite length.

The problem is concerned to a Newtonian incompressible lubricant under isothermal and isoviscous conditions. Under the hypothesis of thin fluid film, it is assumed that the flow is laminar and that inertia is negligible. For the shaft it is assumed to be a rigid; while the bearing shell is covered with a thin resilient liner whose radial displacements are of the same order of magnitude as the film thickness