ELASTOHYDRODYNAMIC LUBRICATION OF PLAIN JOURNAL BEARINGS - SQUEEZE FILM EFFECT

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Abstract: *The study is performed using a designed and verified model of a dynamically loaded journal bearing with finite length. The bearing sleeve is covered with a thin elastic coating whose radial distortions are of the same order of magnitude as the film thickness. The elastic part of problem is investigated in accordance with the Vlassov model of an elastic foundation. The Reynolds equation for 2-D non-steady state problem is derived. The numerical solution is done by FDM with over-relaxation procedure. The presented results are obtained for prescribed loci of the shaft centre which corresponds of squeeze film effect.*

Keywords: *Elastohydrodynamic (EHD) lubrication, squeeze film effect, journal bearing*

1. Introduction

Nowadays, the need for higher speed and at the same time reliable operation of various types of rotating machinery continues to grow. An important factor in achieving this goal is the ability to accurately predict the dynamic response and stability of the rotor-bearing system [1].

Each rotating machinery supported by one or more bearings, whose role is very important in the system as a whole, because namely the bearings are the components that allow relative movement between the stationary and moving parts. As is well known, there are two main types of bearings which are normally used in applications of the rotor-bearing systems. These are different types of journal bearings and rolling-elements bearings.

Journal bearings are used widely and successfully for thousands of years and may be they are the most used machine element in our civilization [1]. Currently large numbers and various types of sliding bearings are used in countless applications such as small electric motors, hard disk drives, micro-electro-mechanical systems, automotive and aircraft piston engines, large steam turbines for electric power generation, etc.

For dynamically loaded journal bearings are typical the squeeze film and dynamic film effects which play significant role in the dynamic behaviour of the rotor. Since the thin oil film that separates the moving surfaces supports the rotor load, it acts as a spring and provides a damping effect due to the squeeze film effect.

Investigations in this direction have been made by many authors in recent decades [2-7, etc.]. The importance of the problem implies a phenomenon studying in combination with other factors influencing the lubrication process of the hydrodynamic (HD) journal bearings.

It is well-known that elastic deformation of the material of the contact bearing surfaces induced by the HD fluid pressure can significantly change the fluid film profile, modify the pressure distribution and, therefore, alter the performance characteristics of journal bearings [8]. The use of surface coatings (on bush or/and journal) such as white metals and various elastomers can lead to significant deformations of the coated surface which can be about the size of thickness of lubricating