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Coefficient of a Rolling Motion Bearing Drive

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Abstract

On the basis of the Darcy's equations which define the lubrication flow in porous layers, and the Reynolds's modified equation, we solve the problem of an unsteady movement of viscous incompressible lubrication in the clearance of a porous damper. The peculiarity of this solution is a simultaneous account of dependence of lubrication viscosity and permeability of porous barrel.
As a result, we have found the field of pressure in a porous and lubricant layer, analytical dependences for forces in the oily film as well as the equations describing non-stationary and stationary movement of the shaft center have been obtained. Besides, the module of unbalance transmitted force and also stationary and non-stationary drive factors have been established. It is proved, that taking into consideration a simultaneous account of dependence of the lubrication viscosity and permeability of the porous barrel, the damper works more steadily.
The received specified analytical models have allowed establishing of the influence of some additional factors, and also making the comparative analysis of newly received results and already available ones. It has confirmed the great connection of a new model with a real practice.

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Keywords: hydrodynamics; radial bearing of finite length; damper; dependence of the porous barrel permeability and lubrication viscosity on pressure, non-stationary drive factor.

1. Introduction

Under certain conditions of operation [1-4] the use of dampers with a compressed oily film can increase efficiency of usage of both plain bearers, and rolling bearings. Dampers can lower the level of fluctuations and the load forces transmitted by bearings on bearing parts, but stability of the rotors leaning against liquid bearing units

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thus decreases. The rotor disbalance can cause a resonance of all supporting surface or rotor fluctuations at critical speeds. In this connection it is reasonable to lower disbalance influence drive to the case to a great extent. Reduction of such influence can be reached by adjusting of the radial bearing of finite length and appropriate amount of the designed dampers with the compressed oily film, supplied with a ring from porous bearing composite.

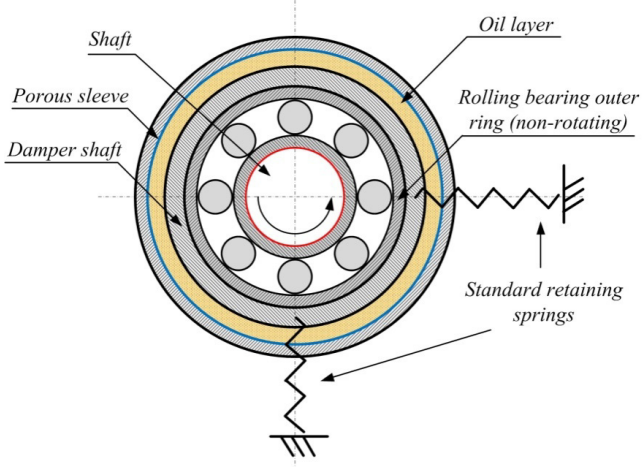

Fig. 1. The scheme of a damper with a compressed oil layer and porous race

The majority of the published papers devoted to calculation of porous triboelements take into consideration either infinitely long bearings or bearings operating in a stationary mode of friction [5-14]. In papers [15-17] the following factor scores are given: adjustment of the radial bearing of finite length in the damper with a compressed single-layer or two-layer porous race on reduction of fluctuations; influence of disbalance on supporting surface of the bearing (Fig. 1) taking into consideration permeability anisotropy of porous layers and a source of lubrication feeding in circumferential and radial directions.

The essential drawback of the analytical models suggested in these papers is that influence of hydrodynamic pressure on lubrication viscosity and permeability of porous layers is not taken into consideration. Fig. 2 and 3 show the scheme of loading of the radial damper with the compressed oily film and with a porous layer; they also show the forces operating in the damper with the compressed oily film and a porous race.

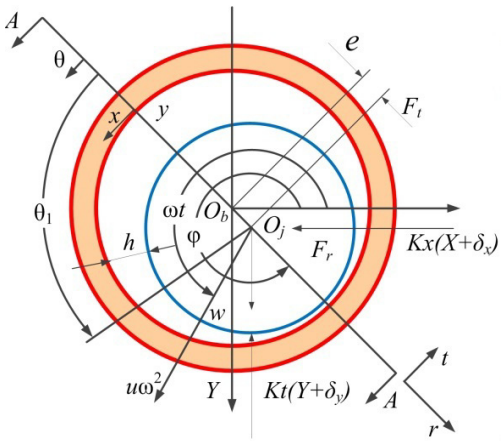

Fig. 2.The forces acting on the shaft in the damper with a compressed oily film