Effect of Bore Profile on the Static and Dynamic Characteristics of 6-Lobe Journal Bearing

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ABSTRACT

The multilobe journal bearings are applied in the bearing systems of high speed rotating machinery. They allow for stabile operation of rotor and assure very good thermal conditions for the oil film. An example of application of multilobe journal bearings is 6-lobe journal bearing which is used in the bearing system of grinding machine. Larger number operating surfaces causes that the oil film of the bearing shows low temperatures at minimized height of oil film as the multilobe one.

The profile of bearing bush has an effect on the static and dynamic characteristics of bearing. Classic multilobe journal bearings have discontinues bore profile. without smooth transition from one lobe to the next one. In case of pericycloid or so-called "wave" bearing the bore is characterized by continues profile. The radius of bearing operating surface has the origin placed not in the center of circle inscribed in the bearing profile. Pericycloid bearing has the radius with its origin placed in the center of circle inscribed in the bearing bore profile As some investigation show, the pericycloid profile gives lower operating temperatures of oil film and also better stability.

Solution of the basic equations of thermo-hydrodynamic theory of lubrication gives the necessary data on the oil film pressure, temperature distributions, the maximum value of pressure and temperature of oil film, the minimum oil film thickness, oil flow and friction forces, that means the static characteristics determining the input variables for the design of bearing. The static characteristics are required for determination of dynamic characteristics expressed by four stiffness and four damping coefficients applied in calculation of the stability of the rotor-bearing system.

The paper introduces the results of calculation of static and dynamic characteristics of 6-lobe journal bearing with the different bore profile. Reynolds, energy and viscosity equations have been solved on the assumption of adiabatic oil film and at the static equilibrium position of journal. Different length to diameter ratio, lobe relative clearance and pericyloid relative eccentricity and oil supply temperature has been assumed.