Optimum Design of Hydrodynamic Thrust Bearings with profiles based on Rayleigh's pocket shape

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ABSTRACT

The optimization problem of lubricant layer microgeometry was considered for hydrodynamic sector self-aligning acting thrust bearings. The important parameter that characterizes the efficiency of the bearing is the oil wedge load capacity. The aim of this investigation was ensuring the maximum load capacity and in the same time designs the technologically advanced profiles of lubricant layer microgeometry.

Historically the first formulations of the considered problem in one-dimensional case goes back to the work by J.W. Rayleigh published in 1918 [1] and the work by S. Y. Maday published in 1967 [2].

In our investigation we enlarge the results of the previous works in relation to the sector thrust bearings of the reversing and non-reversing types with profiles based on Rayleigh's pocket shape using advanced computing technologies.

During optimization procedure geometrical parameters witch define profile curvature were used as optimization variables and the maximum of pressure integral over the lubricant layer surface was used as objective function. The bearing pressure distribution was determined on the basis of the Navier-Stokes equations using the ANSYS / CFX and the optimization problem was solved using special codes IOSO and modeFrontier.

The dependence of the lift force on a number of selected parameters that fit the profile to the profile giving a global extremum was investigated and the results obtained can be used for optimal design of wide range of bearing profiles in different energy machines and devices.

REFERENCES

[1] Lord Rayleigh. Notes on the theory of lubrication, Phil. Mag.35 (1) (1918),p. 1-12.

[2] C. J. Maday A Bounded Variable Approach to the Optimum Slider Bearing, Trans. ASME. Ser. F. J. Lubr. Technol. 90(1) (1968), p. 240-242