הטכניון מכון טכנולוגי לישראל TECHNION Israel Institute of Technology

Faculty of Mechanical Engineering הפקולטה להנדסת מכונות

# MECHANICAL ENGINEERING STUDENT SEMINAR

**Thursday, June 23 2022 at 13:00, Online:** https://technion.zoom.us/j/6592575312

## Hydrodynamic Lubrication and Surface Texturing

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Hydrodynamic journal bearings are machine elements that support load with reduced friction between moving parts in a variety of mechanical systems. Better understanding and more accurate prediction of the tribological performance of hydrodynamic bearings require to take more actual lubricant behavior into account. To this end, the method of the 3D computational fluid dynamics (CFD) based on Navier-Stokes equations is used to solve the two phase flow problems of hydrodynamic bearings. Such problems may be complex and hardly addressed with the traditional lubrication theory based on Reynolds equation.

The axial groove is a common lubricant supply method to distribute the lubricant over the axial length of the bearing clearance. In the present study, the oil-air two phase flow in the vicinity of the groove is solved with the CFD method. Initially, the lubricant spread in a system of parallel plates including an inlet tube and axial groove is studied to clarify the realistic lubricant supply boundary conditions (oil spread length) in hydrodynamic bearings. Then, the variation of lubricant distribution across the radial direction of journal bearing is studied to relax the assumption of uniform spread-length along the film thickness in the classical theory of hydrodynamic lubrication. In addition, the effects of axial groove parameters, i.e., length, width, and location, on the performance of journal bearings are studied using modified lubrication theory based on Reynolds equation (Elrod algorithm) to provide the recommendation of groove design that minimizes total power loss without sacrificing minimum film thickness.

For submerged journal bearings, the occurrence of reverse flow near the end of the cavitation region is studied using the CFD method. The experimentally observed "tongue" shaped reverse flow in the film reformation zone at the end of the cavitation is predicted, showing a quasi-cyclic pattern in time with stretching out and drawing back movement. The effects of various design and operational parameters including eccentricity ratio, radial clearance, supply pressure, rotational speed and oil viscosity on the location, length and frequency of the reverse flow are presented and explained.

Finally, some results for the effect of surface texturing of the bearing's surface, on the total power loss and minimum film thickness, are presented.

Note: the seminar will be given in English

Seminars Coordinator: .