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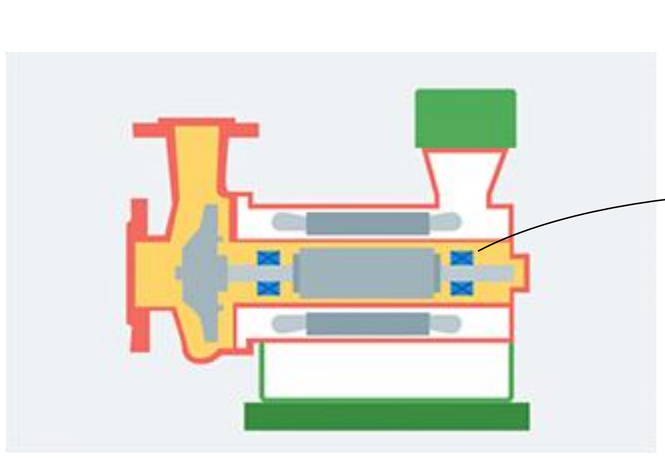
Numerical Study on the Effect of Influent Flow for Film Pressure in a Helical Grooved Plain Bearing of a Canned Motor Pump

Shinichiro EJIRI, PMP, Nikkiso Co., Ltd., Japan shinichiro.ejiri@nikkiso.co.jp

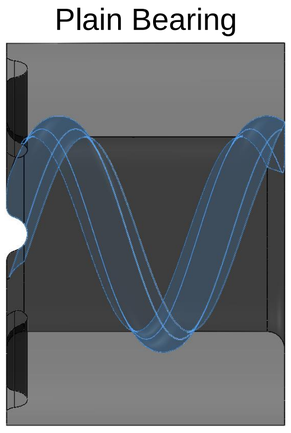
INTRODUCTION & AIM

A canned motor pump is a turbopump with a non-seal structure that integrates the pump and the motor into a single unit. A feature of the structure is that the pumped liquid also serves as the cooling liquid for the motor and the lubricating liquid for the sliding surfaces. In canned motor pumps, helical grooved plain bearings are typically used to provide adequate cooling of the motor. The flow rate of the influent flow to this bearing varies with the internal flow of the pump. Therefore, pumps that operate under a variety of conditions require suitable design for the tribological effects of this change in the flow rate of the influent flow, but the details of this design have not yet been clarified. This study focuses on the film pressure, which is important for the design of helical grooved plain bearings for canned motor pumps. The purpose of the study is to determine the effect of this influent flow on the film pressure by numerical analysis using Computational Fluid Dynamics (CFD).



[1] https://www.nikkiso.co.jp/products/pump/canned.html

Helical Grooved Plain Bearing



METHOD

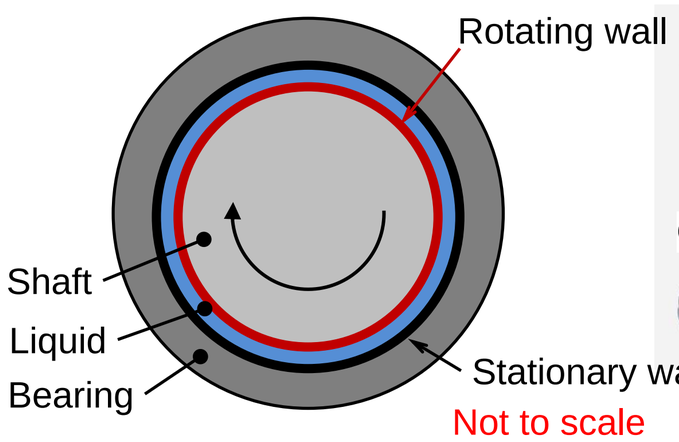
◆ Simulation parameters

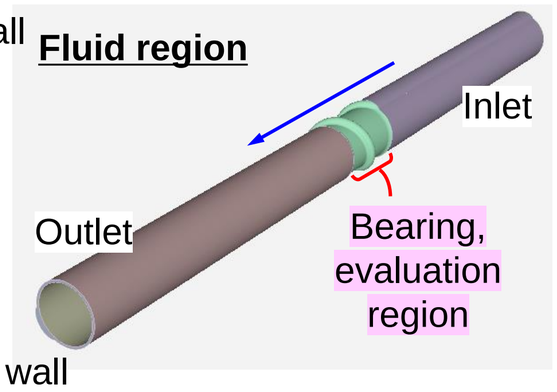
w/ helical groove.	
Bearing diameter [mm]	28.1
Bearing length [mm]	40
Helical groove number	1
Shaft diameter [mm]	28.0
Eccentricity	0.5
Rotational speed [rpm]	3000

◆ Software

- 3D-CAD: SOLIDWORKS 2023SP3
- Mesher: ANSYS Meshing 2022R2
- Prep & Solver: OpenFOAM v1906
- Post: ANSYS Ensight 2022R2

◆ Simulation model



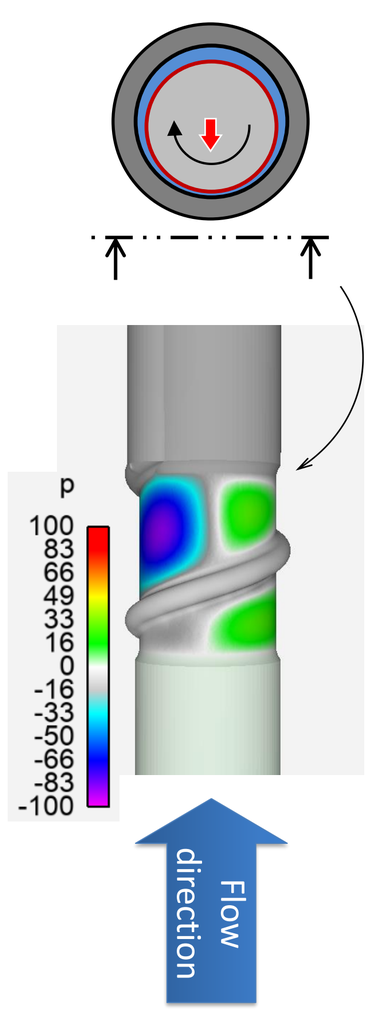


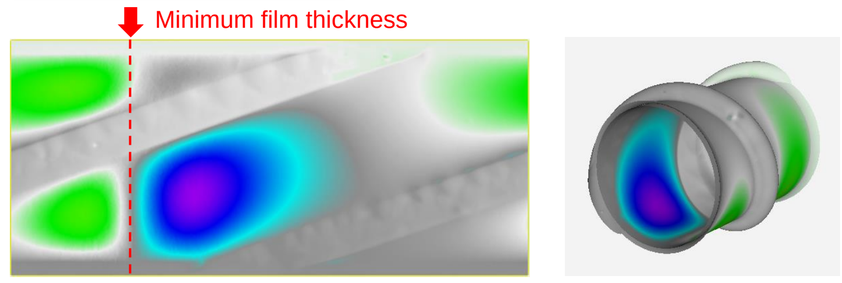
- Inlet condition: pressure, 0
- Outlet condition: flowrate, each
- Laminar flow (Turbulence model not applied)
- Room temperature water

Mesh number

- Inlet region : 70,742
- Bearing region : 1,568,847
- Outlet region : 73,320

RESULTS & DISCUSSION





The inflow of liquid causes changes in the liquid film pressure. The greater the inflow rate, the greater the effect.

For reference:
A result of flowing only liquid without rotating the shaft: 1.0 L/min

CONCLUSION & FUTURE WORK

Calculations under different conditions were performed to analyze the changes in film pressure that occur in the helical grooved plain bearing. Since the influent flow into the bearing affects the film pressure, it is concluded that the design must take into account the pump internal circulation of the pumped liquid, even from a tribological perspective