Static and Dynamic Characteristics of Magnetized Journal Bearings Lubricated with Ferrofluid

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Abstract
This thesis was concerned with a theoretical study of the hydrodynamic journal bearings lubricated with ferrofluids. The study was generalized such that it covered both Newtonian and non-Newtonian behavior of the lubricant. Based on the momentum and continuity equations for ferrofluid under an applied magnetic field, a pressure differential equation has been obtained. Using different magnetic field models, the equation has been solved numerically by the finite difference technique with appropriate iterative technique and pressure distributions have been obtained. The solution renders the bearing performance characteristics namely; load carrying capacity, attitude angle of the journal center, frictional force at the journal surface, friction coefficient and bearing side leakage. By the finite perturbation technique, the eight-oil film stiffness and damping coefficients have been determined. The dynamic coefficients used as an input data for studying the stability characteristics of the rotor-bearing system. The non-Newtonian behavior of the ferro-lubricant under effect of different magnetic models has also been investigated. The results concluded that the magnetic lubrication gives higher load carrying capacity without increase of the friction force if they are compared with conventional lubricated bearing. Axial symmetric applied field, with its sealing magnetic force, has decreasing effect on the side leakage such that the bearing may operate without side leakage by appropriate design of the field and bearing configuration.

Keywords
Magnetic fluid, Hydrodynamic journal bearing, Newtonian,