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THERMAL CHARACTERISTICS OF OIL-LUBRICATED SPIRAL GROOVED JOURNAL BEARINGS

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Oil-Lubricated spiral grooved bearings have lately attracted considerable attention as better substitutions for usual ball bearings, especially in the motor spindles of computer hard disk drive systems. In this paper, thermal characteristics of spiral grooved journal bearings are investigated by applying Thermo-Hydrodynamic Lubrication (THL) analysis because the bearing performances are considerably affected by the raise of oil film temperature. The analytical model consists of three parts: bearing shaft, sleeve and oil film in the bearing clearance and energy equation is applied to the analysis at each region under supposing the raise of temperature is caused only by the shearing force of oil film in the bearing clearance. Thus, the analytical solutions for temperature distribution in the bearing clearance are compared with experimental results under steady/unsteady and concentric/eccentric operating state to confirm the validity of the theoretical model. As to the analysis on eccentric operating state, the effect of cavitation is taken account of. And, theoretical parametric studies on the magnitude of temperature raise of the bearing has been done in detail by changing Peclet number, circumferential bearing number, clearance ratio, heat transfer coefficient and sleeve thickness. The research on steady and concentric operating state indicates that the representative values of dimensionless temperature raise are directly proportional to Peclet number, and inversely proportional to clearance ratio squared or powered by somewhat a less magnitude, and heat transfer coefficient.