Numerical Study of the Pressure Distribution in the Internal Gear Motor/Pump

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Abstract: The dynamic response of an internal gear motor/pump is particularly determined by the behavior of its ring gear. Meanwhile, the performance of the ring gear is mostly decided by the oil film. The oil film thickness is very popular in the field of the rotating machinery. Its role is to separate the relative motion between two surfaces. Unlike to the other rotating machinery, for internal gear motor and pump, the working oil is also the lubricant oil, and the operating pressure is also "external load" acting on the ring gear. In other words, internal gear motor/pump is considered as the "self-loadin" and "self - supporting". Pressure distribution in the film thickness is one of the most important factors of oil film thickness. In this paper, finite difference method (FDM) is used to calculate the pressure distribution in the internal gear motor and pump for different geometric configurations with three cases of lubrications: hydrodynamic, hydrostatic, and hybrid. Then the analysis of effects of different parameters on the pressure distribution is studied. The simulation results show that the pressure distribution as well the maximal pressure in film thickness much depends on the operating pressure, the rotating speed, the film thickness, and the position of the oil supporting holes. Moreover, the effect of misalignment of the ring gear on the pressure distribution is also studied. Based on the analysis of the pressure distribution, some new concepts for oil supporting system for the internal gear motor/pump are proposed in order to improve the load capacity of film thickness as well extend the operating area of the internal gear motor/pump to 4 quadrants.

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