

Effect of Surface Roughness on the Lubrication of Step Bearings with Ferrofluid

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Abstract

The main purpose of this study is to discuss the affections of ferrofluid combined with surface roughness to the infinite long two step bearing. To consider the influences of ferrofluid to the two step bearing, the Shah's theoretical model is adopted, and the modified item of ferrofluid characteristic, $\mu_0 M (\partial H / \partial x) + (16\pi\mu_0 r^3 \chi M) / 9(l+2)^3 (\partial H / \partial x)$, proposed by Shah is included. On the basis of the Christensen's stochastic model, the longitudinal or transverse one dimensional roughness effects to the two step bearing due to surface finishing are explored. The pressure distribution and load carry capacity of the bearing system can be expressed as function of magnetic parameter, roughness parameter and shape parameter. According to the results, the two step bearing lubricated with ferrofluid can enhance the pressure distribution and improve the load carry capacity. When the bearing system is lubricated with magnetic ferrofluid, whether the system subjected to external magnetic field or not, the performance characteristics have significant affections. If the two step bearing possessed with transverse one dimensional roughness, lubricated with ferrofluid and subjected to external magnetic field, the lubrication performances of the two step bearing can be highly improved.

Keyword : ferrofluid, surface roughness, two step bearing