Application of Ferrofluid in Radial Bearings for Low-Friction Systems

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20% of total energy consumption is used to merely overcome friction (Holmberg and Erdemir, 2017). Friction comes from all places, with new rolling bearings accounting for over 420 terawatt hours of consumption (Bakolas et al). Bearings require proper lubrication to achieve peak performance. Ferrofluid, a colloidal suspension of ferromagnetic particles, has been explored as a lubricant due to its ability to be manipulated by magnetic fields but there is very little research in the application of ferrofluid in radial ball bearings. I designed and tested 3 different designs, two of which I replaced some of the bearings with magnets. The introduction of magnets into the system increased friction from 0.076 to 0.083. Using ferrofluid as a lubricant dropped the coefficient of friction from 16 to 18 percent. The introduction of magnets increased friction due to attraction between rolling elements, increasing sliding friction. Estimation of the minimum film thickness revealed a specific film thickness of around 0.3 in the traditional oil lubricated bearings, with PLA surface roughness dominating this equation.

Awards Won: