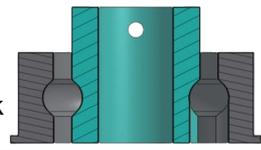


Application of Ferrofluid in Radial Bearings for Low Friction Systems

Christopher Park

Engineering Objectives

- Over 20% of humankind's energy was dedicated to overcoming friction, with over 400 terawatts dedicated lost to newly installed bearings annually.
- Bearings also require consistent lubrication and upkeep.
- Goal: Design a bearing using magnets and ferrofluid to lengthen lifespan and improve performance.



Model created by Chris Park

Data Analysis & Results

Average μ for Bearing Type

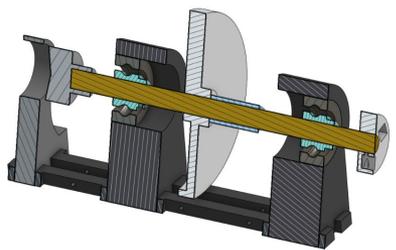
Type	6:2	7:1	8:0
OIL	0.0860	0.0846	0.0770
FF	0.0731	0.0704	0.0741

The magnetic prototype was able to successfully reduce friction when compared to the traditional bearings.

There was a ~8.6% reduction in friction when 1 magnet was used compared to a ~5.1% reduction when using 2 magnets. All data was found to have a $p < 0.001$, ensuring significant results.

A moving average was employed to help filter out noise from the RPM tracker.

Methodology



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- Radial Bearing + Cage
- Vary ratio of steel balls to magnetic balls.
- Test different speeds, loads, and lubricants.
- RPM Measuring with Hall effect sensor.
- Multiple trials and swapping of bearings to ensure consistency.

Interpretation & Conclusions

- This project showed the promising potential of ferrofluidic bearings, with the technology being used in many different environments.
- The 7:1 design and 6:2 designs were both able to outperform their traditional counterparts, performing much better at higher RPM ranges.
- A big point of improvement could be from shifting towards bonded magnets over sintered magnets, increasing load bearing capacity. Custom CNC aluminum bearing races would improve data as well.