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Project Number
36746

Project Title

What Effect Does the Size of a Magnet Have on its Ability to Serve as a Frictionless Bearing?

Abstract

Objectives/Goals
In this project, the effect of the size of magnets on their ability to serve as frictionless floating bearing was investigated.

Methods/Materials
Magnets (passive type, Neodymium material) of different sizes and shapes were tested for push/pull forces and distances. Magnets having same thickness but different diameters were compared. Magnets having same diameter and different thicknesses were also compared. In addition, identical magnets were stacked up to compare the performance between a multiple magnets grouped together against a single magnet. Using the same number of magnets, many different stacks of different ratios were also assembled to compare their effects on push/pull distance. Also, the same number of identical magnets was tested in different pattern arrangements to see the influence of spacing between magnets (in same group) on push/pull distance. Finally, several different bearing design concepts were built and tested to validate the knowledge obtained.

Results
It was found: for the same magnet thickness, the bigger the diameter, the stronger the push/pull force and larger push/pull distance; and for the same diameter, the thicker the magnets, the stronger the push/pull force and larger push/pull distance. However, this was just a matter of better or poor performance. The most important factor was the arrangement of magnets in the design. If the magnets were placed closed to each other, the combined magnetic force was more focus in one direction. If the magnets were placed far apart, the combined force direction was changing back and forth in opposite directions which could not be utilized in a floating bearing design. . The built floating magnet bearings were also compared with a common type ball bearing and it was observed that the floating bearing could turn longer or faster due to much less friction. The concept was examined in several orientations/configurations to show they all worked. It was also found that the evenness of magnet locations and the uniformity of their magnetic strength are very important. If the magnets have uneven magnetic fields or placed unevenly, it could lead to unbalanced loading and tilting of the parts.

Conclusions/Discussion
Therefore, having bigger and thicker magnets is a good start to have stronger performance, but it is required to have proper magnet location arrangement and stack up to make these magnets serve as a frictionless bearing.

Summary Statement
I showed the size of magnets influenced the performance of a frictionless floating bearing, but the must requirement for the floating bearing to work is not the magnet size but the location arrangement and stack up of these magnets.

Help Received
I designed , built and tested the concepts myself. My teacher reviewed my project.