MSET – MAGNETIC FORCES

Purpose

Measure the attractive and repelling forces generated by a set of permanent magnets located at controlled distances from each other.

Magnets

Magnets are used to either attract or repel other materials. An engineering application using electromagnets is high speed rail transport which levitates and propels the train along a track.

Setup

Results

A pair of magnets, and or magnetized materials will be moved to measureable distances from each other and the resultant repulsion, and or attractive forces will be measured. Equations of force versus distance will be generated and compared to theoretical values.
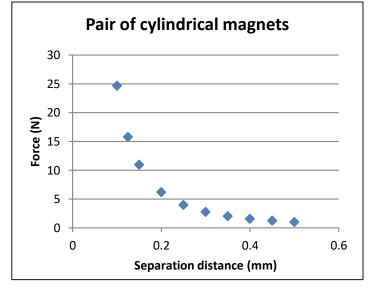
Theory

The force that a pair of permanent magnets can impart on each other is a function of the separation distance "x", geometry, magnetization "M", and free space permeability "U". Common cylindrical magnets of radius "R" and height "H" generate a force "F".

$$F = \frac{\pi \cup}{4} M^2 R^4 \left[\frac{1}{X^2} + \frac{1}{(x+2H)^2} - \frac{2}{(x+H)^2} \right]$$

Pair of cylindrical magnets

Force (N) vs Separation distance (mm)