Application of Gated Pulse Magnetic Neutralization on Magnetic Motion Machines

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Abstract

The application of gated electrical pulses to a combination of various magnetic geometries was tested to see whether any of these configurations resulted in a more efficient motor. In all magnetic motion machines, a problematic area known as the "sticky spot" opposes the motion of the rotor from completing a full rotation. With the use of gated pulses and an optimized, heavy gauge, pulse coil, however, this sticky spot may be overcome with a minimal amount of input power. Using the Finite Elements Methods Magnetics program to calculate and analyze torque, various magnetic track designs were tested, varying parameters such as magnetic track distance, tilt angle, and track length: each inspired from existing designs from the Takahashi motor and Minato wheel. A prototype was built simulating the rotational forces of the magnetic track and the RPM, current, gated pulse width, as well as the voltage input were measured. The results showed that certain magnetic geometries increased the speed of the system and decreased the amount of electricity required, amounting to an overall increase in efficiency. This project succeeded in obtaining three main goals: a successful combination of the motors by Takahashi and Minato, the application of magnetic neutralization, and the maximization of electrical input. With the successful integration of the Minato and Takahashi motors, this study can be used as a foundation for further research in the development of increasingly efficient, next generation, motors.

Introduction

Presently, the world is trying to find a newer and greener alternative energy source. Annually, the world's crude oil supply decreases by 2.1% (Nashawi, 2010). It is only a matter of time before the earth runs out of oil. In this scenario, new alternatives must be found in order to subsidize this lack of oil. Oil may not be the only concern that poses the world; coal is also quickly running out. A recent study indicated that China, a nation whose power is run 80% from coal reserves, may stagnate in economic growth due to coal shortages in the next couple centuries (Shealy & Dorian, 2010). This alternative may be found in magnets, which date back to earth's creation. Not until 600 B.C. did scientists really begin to experiment with magnets; however, its inexplicable power still creates a mystery for scientists today (Beyer, n.d). Even now, scientists are aiming to create more efficient motors such as the axial-flux, brushless DC motor (Yang, Cheung, We, & Wang, 2002). There is mostly one major problem when regarding the use of magnets: in all cases, a sticky spot exists in which electricity must be used to conquer the repulsion forces of the external magnet. Thus, if magnets could be used in a specific orientation to actually conquer this sticky spot, perhaps a new alternative could evolve from this natural material.

Magnets have not been studied thoroughly throughout history. Scientists have failed to explain where magnets acquire their energy from and what possible outlets they can be used for. Alternative energy sources such as solar and wind have fallen short to human societal demands presently and in the future (Thomas, 2008). In wind energy, the blades often kill endangered bird species while the wind does not blow in many areas around the world (Spilsbury, 2008). Perhaps, with a new form of energy, scientists can focus on more fields than just those.

Surprisingly, there are many different types of magnetic motors created. However, each of these motors has flaws; some require mechanical energy to drive them or excess amounts of electricity. Perhaps the major flaw is the fact that in all cases, these motors contain a sticky spot that must be conquered using electrical inputs. In attempts to conquer this sticky spot with as little energy as possible, engineers have attempted to use different techniques to lessen the electrical input. In 2008, Gabrys patented his two air core motors, one of which used a coil with a brushless motor design (Gabrys, 2008a & 2008b). Both of these designs were relatively simple and were rather efficient in his tests. Another simple design by Kohei Minato uses the angle of magnets and the attraction and opposition of magnets to drive a wheel. Described as a jump in Bearden's study, he concluded that such motors

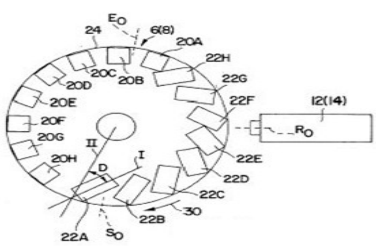

Figure 1: Orientation of magnets around the rotor (includes added counterweights to balance magnets) (Dodd, 2004)

could be the next alternative energy source (Bearden, 2002). In short, the correct degree of these magnets creates a semi-circular formation along the plate's side allowing it to run (Dodd, 2004). As shown in Figure 1, Minato used the specific orientation of magnets along a rotor to create torque. An external magnet must be used to drive the rotor. When this external magnet is present, the disc receives an attraction and repulsion force, causing the disc to propel itself forward. With the correct degree of angles, it is possible to maximize the torque, thus creating a more efficient system. In a previous study done by Chang (2010), he showed that coils could be neutralized in an efficient manner. The information from this experiment will set the basis for further experimentation regarding the application of what was found in Chang's study. When relating the Minato Wheel to comparable motors with the same torque and power, it is estimated that the Minato Wheel will be more efficient. The next test would have to be the connection between the coils electrically and the motor mechanically.

The Minato Wheel is one among thousands of other motor designs. Among others are the Takahashi motor or the Magnetic Wankel motor. This design uses similar principles like Minato to manipulate the torque generated by the magnets. One major difference exists between these two models. The first is that instead of the magnetic track existing on the interior of the rotor, the track actually runs along the exterior, creating a sort of magnetic belt surrounding the motor (Bearden, 2002). Another difference is the fact that distances were incremented; it got further away as it spun around the track (Figure 2). By combining these two designs, perhaps a new type of motor could be generated thus effectively combining the works of two geniuses.

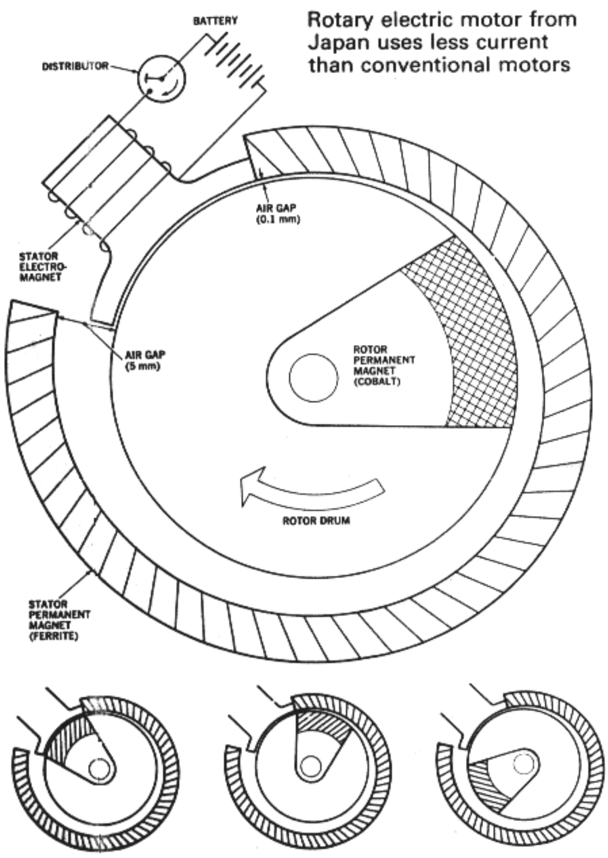

Figure 2: Takahashi motor's 360 degree magnet belt design (http://www.skif.biz/index.php?name=Pages&op=page&pid=97)

All motors generate power. In basic physics, power is measured in Watts. A typical light bulb runs off 25-100 Watts. In motors, the amount of energy generated determines the efficiency of the system. This efficiency is calculated simply using the amount of watts going into the circuit and the amount of watts coming out of the circuit. This measurement is important for it will determine the applicability of magnetic motors in daily use. The power generated would be a variable of constant measure.

The location of electrical input is important to the specific degree. If the input is aligned at the wrong point of the jump, the motor will not run in a smooth fashion. Once tuned to its maximum performance, which sometimes may take a long time to change each specific delay time within the pulse controller, the motor should run in a desired form, taking in as little energy as possible.

Gated pulses could be used instead of direct current. In this case, electrical pulses may reduce the amount of electricity required while conserving energy at the same time. Electrical pulses have been used in many different applications other than motors. It is by far most prevalent in the medical field of science in which pulsing electrical currents treat those with depression (Vieru, 2010). In a study done in 1982, scientists showed that pulsing electricity to create an electromagnet could help in treating ununited fractures in the bone (Basset, Mitchell, & Schink, 1982). It shows that 93% of those treated with electrical pulses healed completely, better than traditional methods of healing. However, scientists have not found a connection with electromagnetic pulsing to magnetic motors. Unlike conventional motors, the Minato Wheel's design enables it to spin 360 degrees before it stops. In this scenario, only at that 360th degree does electricity need to be applied to the coil to neutralize the coil. In order to correctly time each pulse, a measuring device called a Hall Effect sensor was used. This sensor sends a signal to the circuit board every time the first magnet of every rotation runs passed the sensor. By using this method in combination with pulses, much wasted energy is gained in this process.

Both Minato and Takahashi have both discovered their own principles regarding magnetic motion machines. By incorporating their two ideas into one coherent plan, perhaps a new type of motor can be generated. However, not only is this study examining the mixture of these two principles, it is also providing a third principle of pulsing the electrical input. By testing the incorporation of three possibly energy saving principles, a new and better alternative source may be up and coming in the next generation.

Methods

A 16 gauge copper wire was wounded into a coil. Using a magnet wheel generator, different models were created to simulate different designs (Appendix II). There were two main variables when attempting to select the best design: tilt angle and rotation of the magnets. When all possible designs were made, a torque data analysis was run on each model, measuring the torque of an external magnet to the rotor magnets across an increment of 5 degrees (Appendix III). The graphs that produced the best torques were isolated and then ran through another torque analysis to compare the values (Appendix IV). These files were then transferred into an Auto CAD file and readied for the CNC router to cut out the pieces. After this, design of the actual motor began. At first, there was an original design (Appendix I), but as later it proved to be tedious and expensive, it was taken out. Another design was proposed (Appendix I) and later built and constructed with little cost. Materials were gathered and cut into the shapes necessary for the model. After assembly, testing resumed.

The Hall Effect sensor was attached to the plate of the model and adjusted as needed. The circuitry was connected to the coil and the timing was adjusted. When roughly adjusted, the degree and pulse widths were adjusted using the circuit board. Speed was measured in terms of rotations per minute as well as the current of electricity. Finally, the voltage input was also measured. All other data entries including degree and pulse width were also recorded.

This procedure was repeated without the magnet track. The results were recorded and compared to see whether or not the magnets had an ultimate effect on the efficiency of the system.

Results

There were three main goals of this project. The first goal was to successfully combine three distinct principles into one cohesive idea. As to this point, the project was a major success. The combination of these three principles proved to actually work, and the motor ran faster at around a speed of 1500 rpm.

The second goal was to show the application of the neutralization of the magnet. By using the previous study in showing that a magnet could be neutralized, the next question was whether it could be neutralized enough for a motor to actually run. In effect, the neutralization technique found in the previous study was used and applied to the model and showed that this method of running a motor could actually work. In this case, the second goal was also achieved.

The third goal was to show that the specific orientation of magnets help increase the overall efficiency of the system. Given the limited time restraint, the original proposal of comparing the torque of the motor to a standard DC motor was not implemented. Originally the idea was to generate enough torque to actually be able to measure the power entering the motor and the power coming out. In a perfect scenario, this would have been the best option in determining the overall efficiency of the motor. Such desired results were not obtained. However, amperage, voltage, and rotations per minute were measured in substitution for a power measurement. In the end, this proved to support this third goal. Acting as a standard motor, the track of magnets was taken out and the motor's results were recorded. It showed that this control motor ran at 1490 rpm, 0.9 amps and 30 volts, with the gated pulse width at 3000 microseconds. When the track was put in place, it ran at 1506 rpm, 0.9 amps, and 30 voltages, with a gated pulse width also at 3000 microseconds. It is clear that the introduction of the magnet track actually benefited the overall speed of the system. By doing so, it in effect helped it be more efficient. Although the increment was not especially large, at only an increase of 16 rpm, this may be due to the fact that the maximization of the motor's potential was not yet found when measurements were recorded. Although not achieved in the way it first was thought out, it did prove the principle that the use of a track did benefit the overall efficiency.

The last test scenario used was a tangent to what was actually first attempted to test. This last section was the results of using another exterior neodymium magnet and placing it on top of the coil to see if it would positively affect the system. The conclusions were much clearer in this scenario. It was found that the track, although improved the overall speed of the motor, did not have nearly as much effect as an external magnet placed on top of the coil. Running at the same speed, without the neodymium magnet, the coil was drawing energy at 0.9 amps. With the magnet, the amperage was cut almost in half, drawing in energy at only 0.55 amps. Furthermore, the gated pulse widths differed between the two conditions. In the control, the pulse width remained at 3000 microseconds, but in the variable condition, the gated pulse width decreased to only 500 microseconds. This drastic decrease may end up helping engineers constructing a better way of pulsing electronic motors using this external magnet.

Discussion

Because all three main goals were achieved, this project to the magnetic engineering world was a large success in finding the different ways in using magnets to harness energy. As defined above, the first of the three main goals were to combine the three principles of gated pulsing, Takahashi's principle of the magnetic belt and incremental distance, and lastly, Minato's theory of tilted angles. The second goal was to apply the lessons learned from the previous experimentation of neutralizing a magnetic field. And the last goal was to determine whether or not magnets affected the overall efficiency of a motor.

Perhaps the first and foremost item to reconsider is the design of the motor. Although two designs were initially proposed, the final design proved to be both impractical and hard to manage. The rotors were often hard to take off, and the proposition of changing the magnet track proved to be too time consuming in the long run. Thus, because of unnecessary designs, the project proved to be more difficult than on the onset of experimentation. This is an important rule when learning how to engineer a prototype: make sure the model is architecturally and practically sound before construction begins.

As stated above, it is obvious that the actual measurements of torque were not achieved. This mainly was due to the lack of time given to successfully time the circuitry to the rotating rotor magnets. As a future change, the one major problem in this timing process was the fact that the Hall Effect sensor was not fixed properly onto the base of the magnet motor. Although all other instruments were accounted for with detail, this last detail proved to be the singular item that was forgotten on that list. Another important lesson is learned: account for all possible errors and scenarios when experimenting. However, it was not this problem that resulted in inefficient measurements. In the two weeks of actually adjustment of the motor timing, it naturally takes hours upon hours to actually adjust the delay to the right degree. As this natural process takes months to years to finally achieve the maximum efficiency, it was a surprise that the data showed up positive as it did. In short, the data supported the hypothesis that magnets do improve the efficiency of the system overall.

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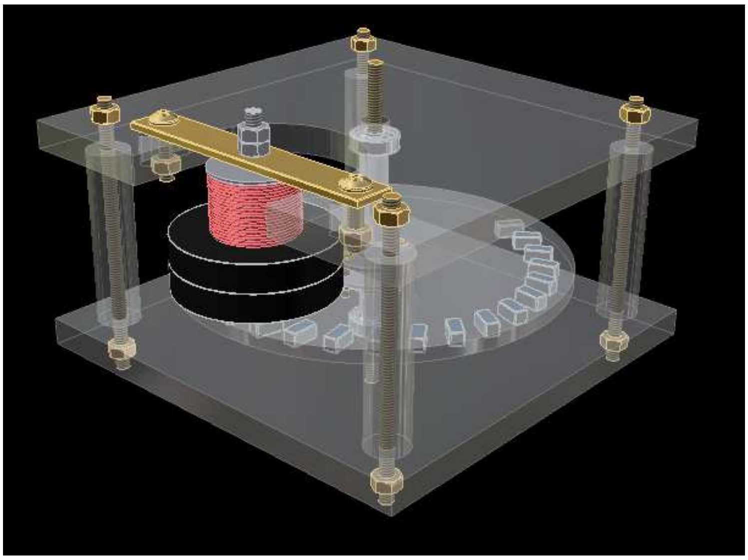
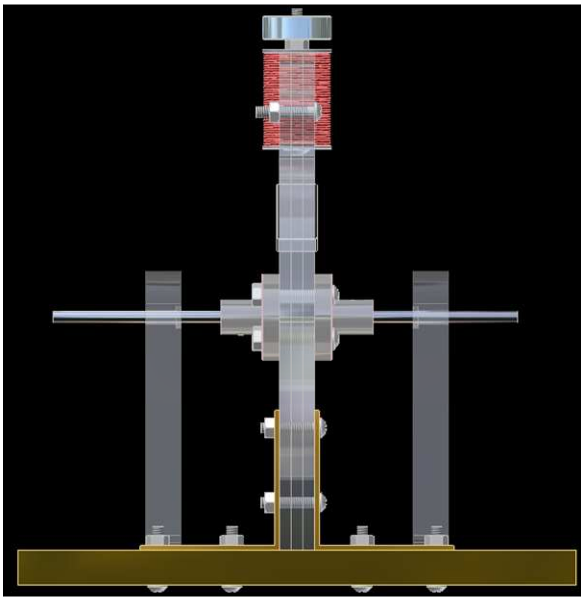
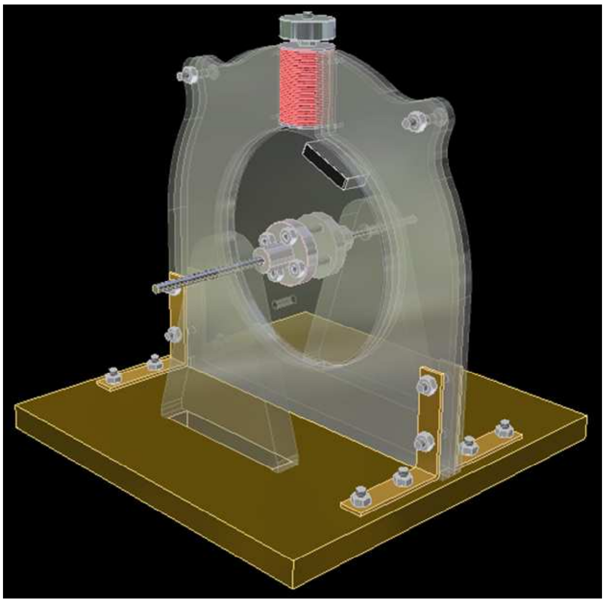
Appendix I

Original Design



Modified New Design





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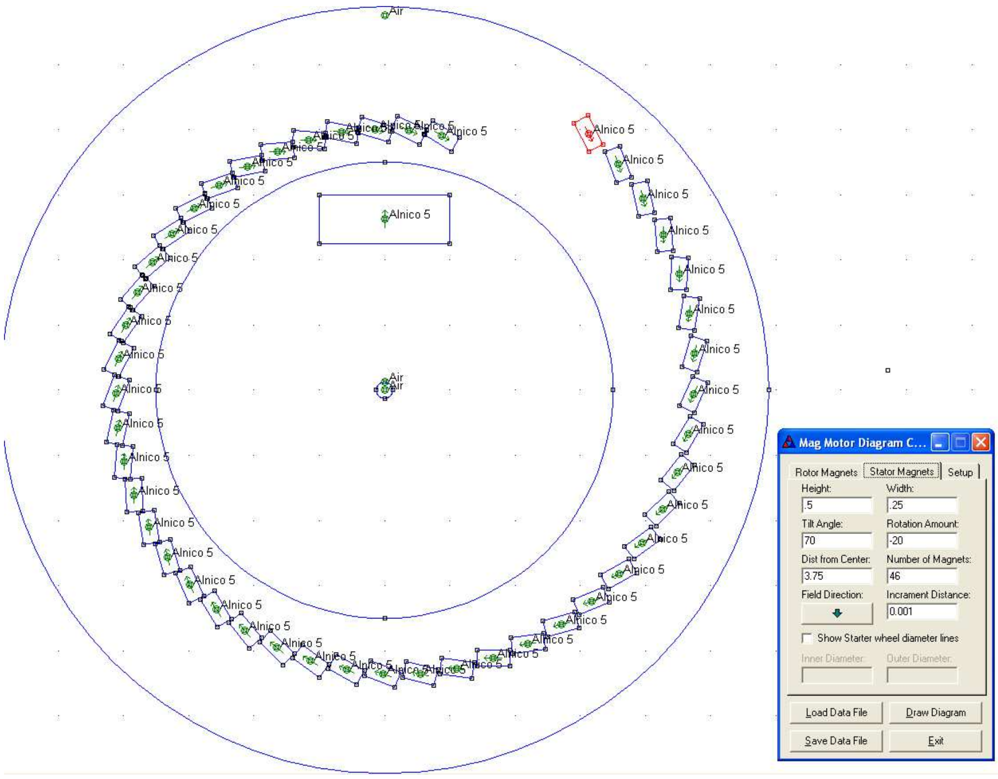
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-20
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Draw Diagram
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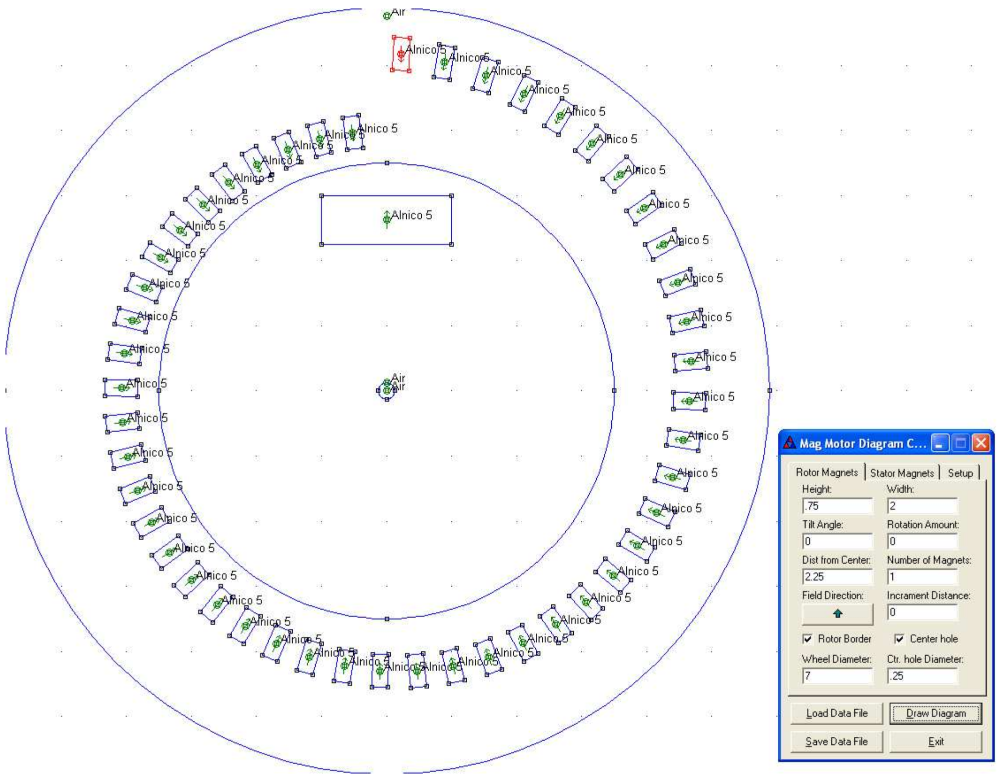
Exit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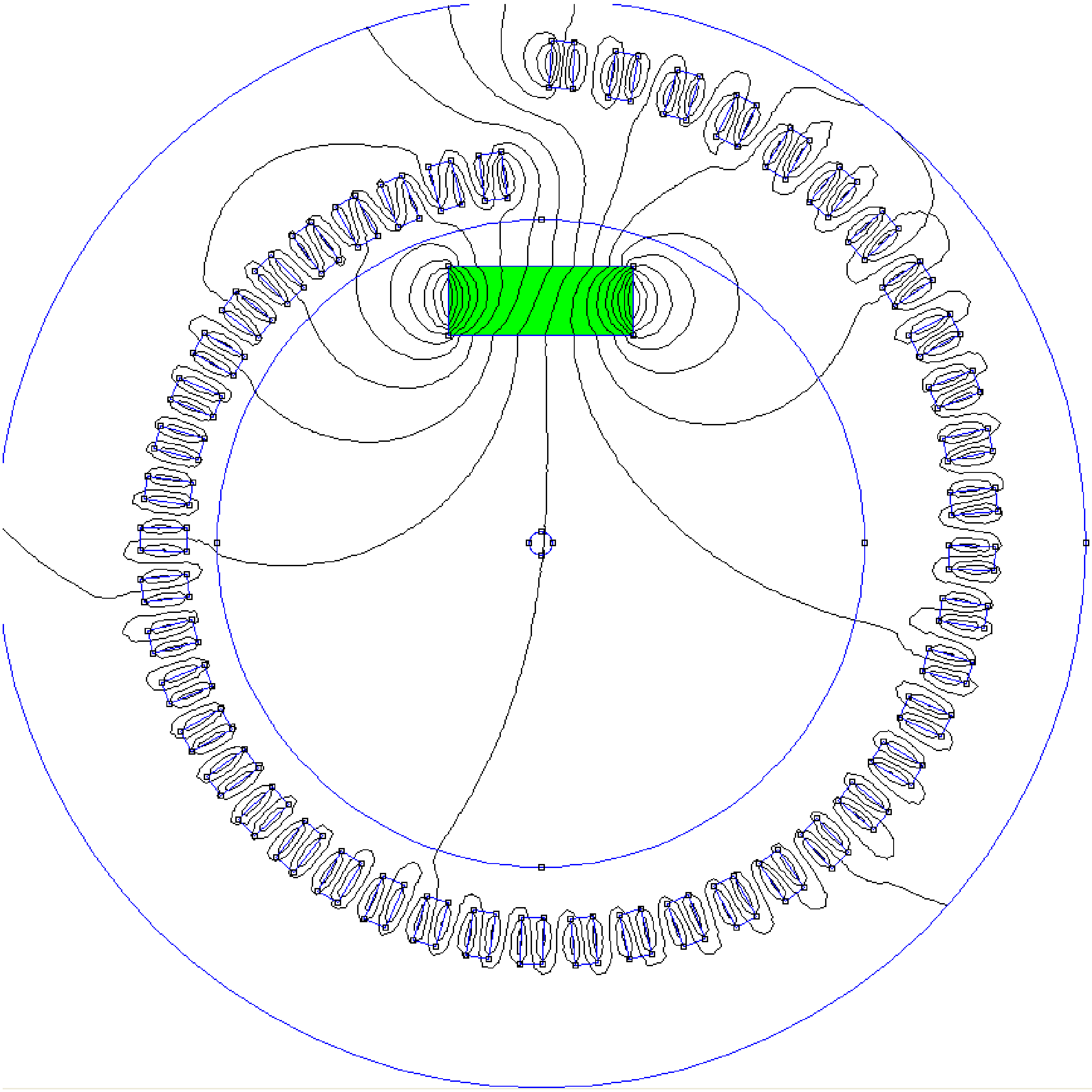

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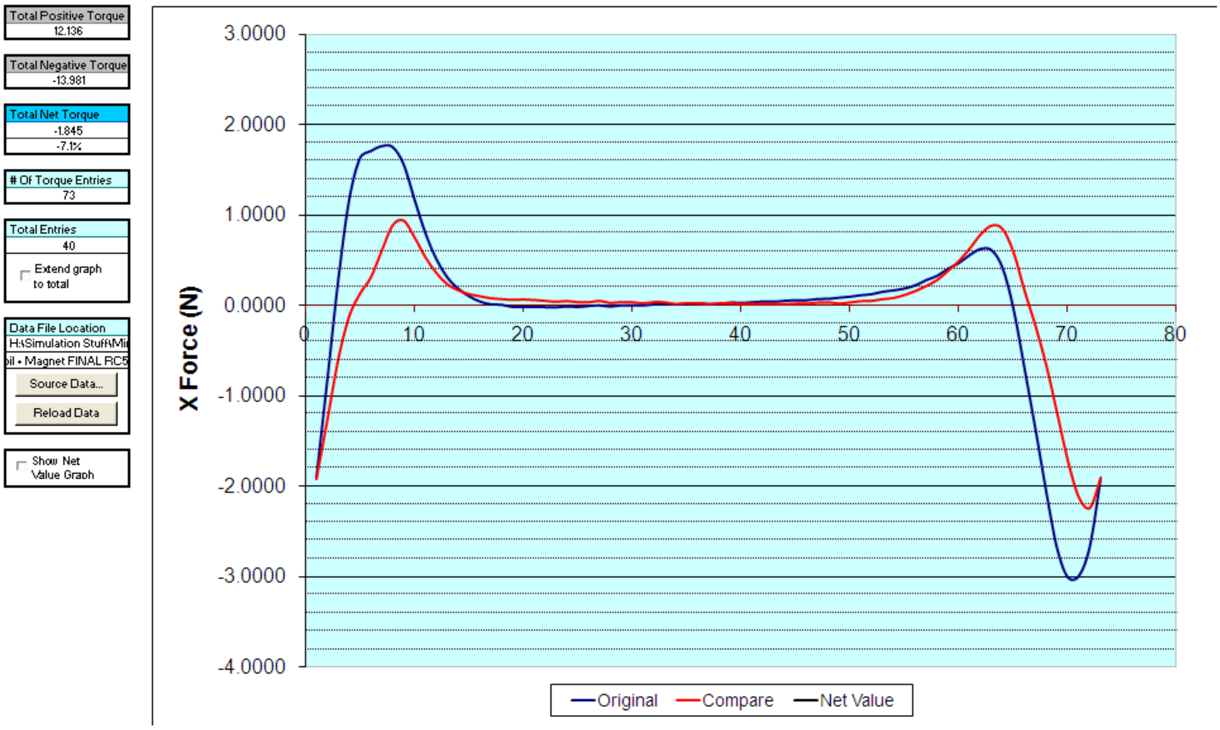
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Total Negative Torque
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Total Net Torque
-1.845
-7.1%
Of Torque Entries
73
Total Entries
40
Extend graph to total
Data File Location
Source Data...
Reload Data
Show Net Value Graph
X Force (N)
3.0000
2.0000
1.0000
0.0000
-1.0000
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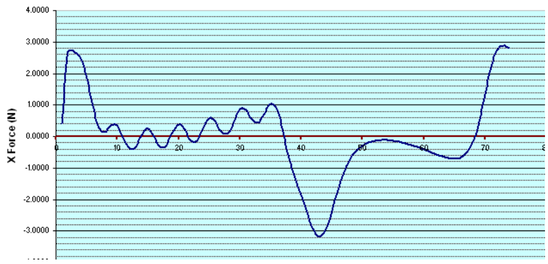
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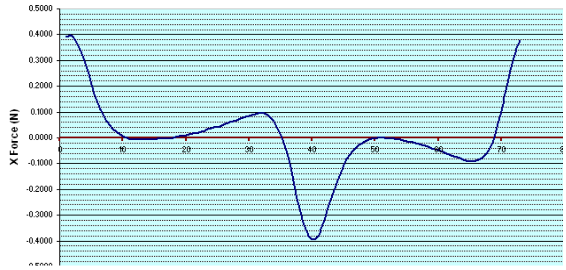
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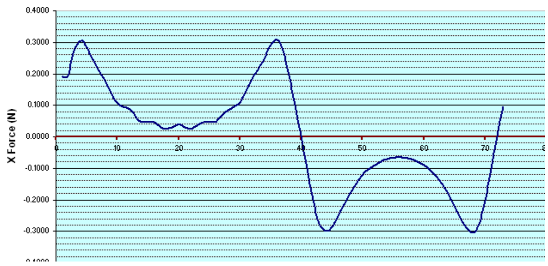
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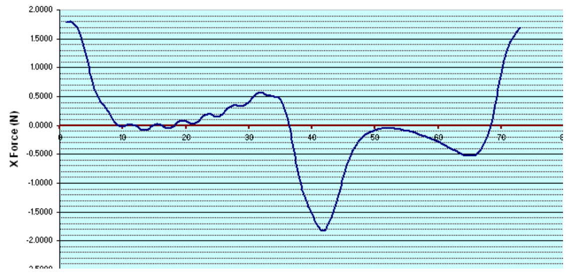
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