

THEORETICAL STUDY OF ECO FRIENDLY PROPULSION SYSTEM

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ABSTRACT

Almost all the engines are propelled by chemical fuels which converts one form of energy to another. Normally, energy from combustion is realized into kinetic energy. But it can also be noted that basic forces in nature like centrifugal force, torque and magnetic repulsion can also be utilized to provide a thrust which propels a system. Here, there is no conversion of energy but the forces which are exerted by the movements of mechanical parts in a specific manner can give a lift to that system. Motion can be controlled by the magnitude of forces acting on it. As spinning body can weigh less than a non spinning body due to its torque and centrifugal force, it is much simpler to provide a thrust for its movement. As there is no combustion of fuels, this is much eco friendly and also a good substitute system. Here, a theoretical propulsion system and its application is presented in a simple way.

General Terms

Propulsion, Flying, Thrust

Keywords

Levitation; centrifugal force; torque; magnetic repulsion; superconductor.

1. INTRODUCTION

The Vimanika shastra written by Maharishi Bharadwaja has a variety designs of air vehicles called Vimana. These vimanas are spacecrafts which appeared in Ramayana and Mahabharata and is found to scientific and possible [1-4]. It uses mercury vortex engine in which superconductive mercury is spinning at great speed creates a field which could shield gravity [5,6].

The airplane uses its aerofoil shaped wings to generate lift by the pressure of air. But as it only uses turbojet engine, it creates noise and less stable for levitation.

Unlike this technique, here, this concept has adopted different technique from different mechanism and levitation principle to make the craft less noise, more stable for levitation in space and efficient.

These are some concepts used in this system, which makes this propulsion a more stable, improved propulsion than current airplane, as it adopts advanced principles from many concepts like levitation, gyroscopic precession and gravitomagnetic field of superconductor and also aerodynamics.

1) Spinning top: When a spinning top or a gyroscope rotates, it gets balanced on a single point, also weighs less

when compared to its rest weight. Thus is due to the introduction of torque in upward direction and centrifugal force [7,8].

2) Magnetic repulsion: Like poles of magnetic fields repels each other. If the sizes or magnitude of field of one is more than other, the smaller is pushed away in greater force. This can be used to make the body move.

3) Electromagnetic Railgun principle of Lorentz force: It is used to add extra force for repel movement. When a free conductor is placed between two parallel current carrying coils, due to production of magnetic field in conductors, Lorentz force is experienced by that free conductor whose direction is given by left hand rule. So if the current is high enough, it is projected away from source with a sufficient velocity [14].

4) Propeller: It is attached to bottom of the body to provide aerodynamic lift just as in helicopter. This adds sufficiently extra lift to the body.

Moreover, it is found that when a superconductor plate is made to rotate about 3000rpm in high pressure in -210°C , it creates a field which can neutralize gravity, above which any object places would lose its weight about 2% [5].

In this model, the system is made to rotate to a required speed so that it gains enough centrifugal force and torque due to which it weighs less when compared with its rest mass. This can be called as a lift. At this stage, magnetic repulsion is used for its next thrust to levitate in space or its movement in a medium.

A superconductor can be installed above the propeller in the suitable conditions for extra reduction of weight.

2. THEORY

- When a body spins, it has a torque whose magnitude is given by radius times force applied and its direction can be given by right hand rule. So, when it is rotated in counter clockwise direction, its torque is upward and its angular momentum is also in the same direction. Due to centrifugal force, the parts inside the outer body is has a tangential force. As it is rotated in very high speed, this force can be used to make gravitational force less effective as magnitude of centrifugal force is made more than gravitational force. It means the tangential force has higher magnitude than downward gravity. It helps to reduce the downward pulling force (gravity). Hence, the tangential forces tries to maintain the body in more stable position and also make body to weigh less. This

is the reason that a spinning top can balance on a single point and its weight is seemed to be low when compared to its rest weight. Hence its weight is seemed to be reduced and so it is easy to propel it to required direction.

- After the rotation, the system has to be propelled further for its movement. This can be given by magnetic repulsion. Magnetic levitation is a technique where a body can be levitated by magnetic forces. It counter acts the gravity better than aerodynamic lift. When an object repels magnetic field, it tries to move away from the field. When the field is very high, the object is strongly pushed away from the field, this momentum can be used for movement of the craft. After the spinning, this repulsive force between the magnets which are placed in upper and bottom is used for maintenance of body in space and for control of the system by changing the position of upper magnet.
- Force experienced by charged particle in electromagnetic field is called Lorentz force. When a conductor projectile is placed between a pair of parallel current carrying coils, it completes the circuit. The magnetic field (produced by electric current given by amperes right hand rule) and electric current interacts and produces electromagnetic Lorentz force. Its direction is given by left hand rule and is directed away from source. When a projectile is projected with required velocity with electromagnetic field, momentum of the projectile can be used for initial thrust. This can help the body initial lift which is very helpful for next propulsion.
- Propellers has aerofoil shaped wing which is rotated about its central axis, due to which air flowing above and below it has lower and higher air pressure respectively due to which it creates lift. The air flows downward, by Newton law, the reaction is upward. This lift can be used for movement of heavy bodies. Helicopters, submarines and ships use this propeller for their movements.
- Superconductors have a special property called Meissner's effect, which is below a certain temperature, superconductor repels magnetic field completely or it does not allow the field to pass through it. So it is possible to levitate an object that is purely dia magnetic using strong magnetic field. Also, a rotating superconductor at lower temperatures produces gravitomagnetic field, which can shield the gravitational force.

Mathematical model is presented below

2.1 Gravitational force of the system

Gravitational force of the system and earth is given by universal gravitational law

$$F = \frac{GMm}{r^2} \dots\dots\dots (1)$$

Velocity of the system with which it must be rotated is given by centrifugal force

$$F = \frac{mv^2}{r} \dots\dots\dots (2)$$

Here, gravitational force and centrifugal forces are considered to be equal because, to propel the body, the

centrifugal force must be equal or greater than gravitational force.

By equation (2), we get

$$v = \left(\frac{Fr}{m}\right)^{0.5} \dots\dots\dots (3)$$

Then the required rpm is obtained by multiplying the values of equation (1) and (3).

$$Rpm = (F \cdot v) \dots\dots\dots (4)$$

Apparent weight loss can also be obtained by substituting $v = \omega r$. In equation (2)

We get,

$$F = m\omega^2 r \dots\dots\dots (5)$$

And wkt, $w = mg$. by substituting $m = \frac{w}{g}$ this in equation (5), and simplifying for weight w , we get

$$w = \frac{gF}{\omega^2 r} \dots\dots\dots (6)$$

2.2 Force on projectile of Railgun

Force on projectile of Railgun is given by

$$F = \frac{U_0}{2 \times 3.14} \ln \frac{w+r}{r} \dots\dots\dots (7)$$

Where w is distance between

Parallel coils and r is radius of coil.

2.3 Force of repulsion

From column law of magnetism, force of repulsion is given by

$$F = \frac{U_0}{4 \times 3.14} \frac{m_1 m_2}{d^2} \dots\dots\dots (8)$$

Where m_1 and m_2 are pole strength known data's.

2.4 Thrust on the propeller

Thrust on the propeller is given by

$$T = 2Av^2 d \dots\dots\dots (9)$$

where its product of area, velocity squared, and density of air.

3. MATERIALS

Materials required for a simple model:

- Outer body should be an insulator to prevent electric shocks, (as inside it uses high electric current) and losses. It should be light, strong and cylindrical in shape(as the coils of Railgun gun should be parallel. The cylindrical shape holds good for all dynamic conditioned.)
- Strong electromagnet of 4T or more and powerful neodymium magnet of 1.4T or more. This are for propulsion for the craft.
- High DC current source for power supply.
- Powerful DC motor of high torque capable of rotating the weight of the body.
- Suitable propeller.

- Conducting wires or coils.
- Conductor rod (projectile).

4. CONSTRUCTION OF THEORETICAL MODEL

Figure 1 shows the theoretical propulsion model. At the bottom side of outer body, electromagnet is fixed powered by the source. The conducting coils are placed throughout inner circumference of the body from bottom to top vertically without being touched each other. Above the electromagnet the conductor projectile to which neodymium magnet is attached, is placed such it can move from bottom to top. On the central axis, DC motor is fixed via shaft and emerges out of the body. Propeller is attached to this shaft below the body.

An aerodynamic shape can be made in upper side to reduce the drag. (superconductor disc can be installed above the propeller if necessary temperature is maintained)

When started, due to Lorentz force and very high repulsion between magnetic fields of neodymium and electromagnets, the conductor hits top side of the body transferring its momentum, so it lifts the whole up and the system starts spinning, so decreasing its weight followed by the magnetic force and thrust by propeller, it can float.

This can also be treated as a single engine and many of these can be applied to propel a large craft.

The power is provided by chemical batteries, large solar panels and also by radioactive decay of elements in space.

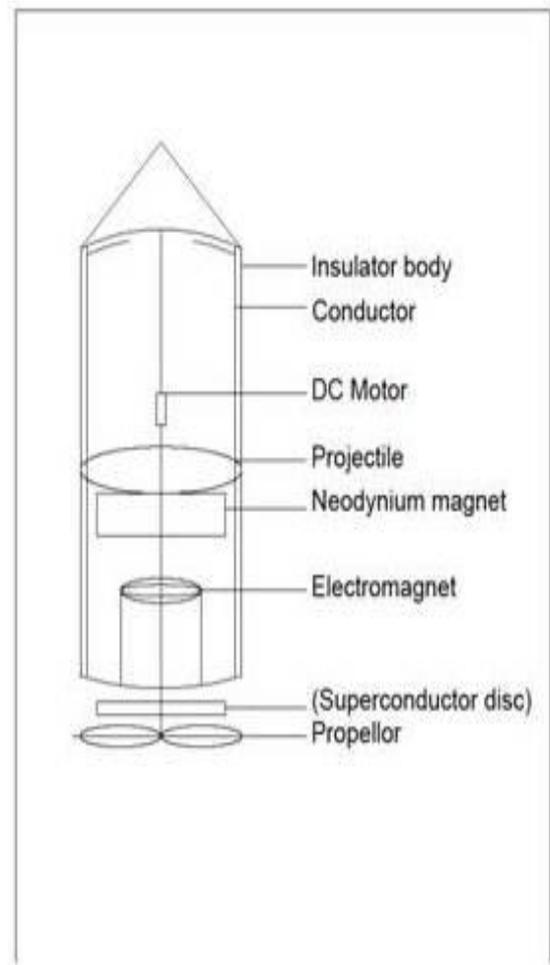


Figure 1: Theoretical propulsion model

5. RESULTS AND DISCUSSION

We have calculated the required velocity (v), rotation per minute (rpm), apparent weight (w) and torque by using the equations (3), (4) and (6). For different masses gravitational forces are thus tabulated in table 1.

Table 1: Torque, apparent weight, rpm, for different masses and gravitational force.

| Mass of the system (Kg) | Gravitational Force F (N) | Radius (m) | V (m/s) | Rpm (F*V) | Apparent weight decrease (10 ⁻⁴ Kg) | Torque (Nm) [1.12*r*(rpm/1000) ²] |
|-------------------------|---------------------------|------------|---------|-----------|--|---|
| 5 | 50 | 2 | 4.5 | 225 | 48.3 | 0.22 |
| | | 4 | 6.4 | 320 | 11.9 | 1.83 |
| | | 6 | 7.74 | 387 | 5.45 | 6.03 |
| | | 8 | 8.9 | 445 | 3.09 | 14.19 |
| | | 10 | 10 | 500 | 1.96 | 28 |
| 10 | 98 | 2 | 4.4 | 431 | 25.8 | 0.83 |
| | | 4 | 6.2 | 608 | 6.49 | 6.62 |
| | | 6 | 7.6 | 744 | 2.89 | 22.31 |
| | | 8 | 8.8 | 863 | 1.61 | 53.38 |
| | | 10 | 9.8 | 960 | 1.04 | 103.21 |

| | | | | | | |
|----|--------|----|------|--------|------|--------|
| 15 | 147 | 2 | 4.4 | 647 | 17.2 | 1.87 |
| | | 4 | 6.2 | 912 | 4.33 | 14.9 |
| | | 6 | 7.6 | 1117 | 1.92 | 50.3 |
| | | 8 | 8.8 | 1294 | 1.07 | 120.02 |
| | | 10 | 9.8 | 1440.6 | 1.10 | 232.43 |
| 20 | 195.83 | 2 | 4.42 | 870 | 12.6 | 3.39 |
| | | 4 | 6.25 | 1225 | 3.10 | 26.89 |
| | | 6 | 7.66 | 1500 | 1.42 | 90.72 |
| | | 8 | 8.85 | 1733 | 0.79 | 215.27 |
| | | 10 | 9.89 | 1937 | 0.51 | 420.22 |

Also, we can calculate the magnetic repulsion by coulombs law of magnetism: If the strength of electromagnet and neodymium magnets are 4T and 1.4T respectively, the distance between is very small then the initial force will be 53N. This force is sufficient for the movement. Railgun

also adds the force depending on the current supplied. The thrust is created by propeller based on its area which is dependent on size of the main body.

The graphs have been plotted by taking rpm, apparent weight decrease and torque as function of radius:

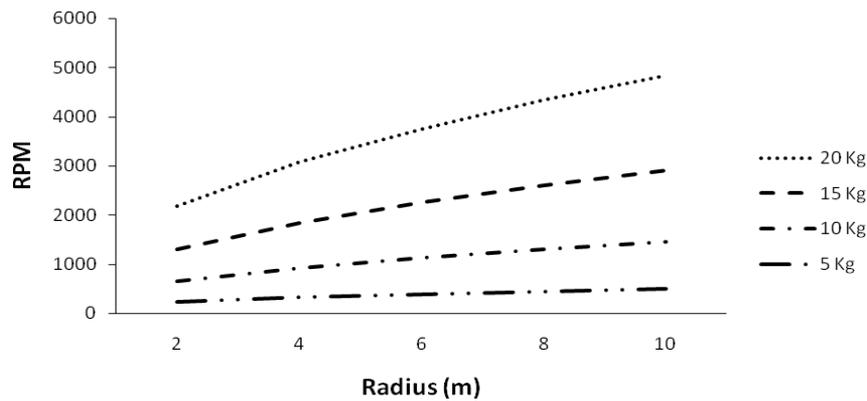


Fig 2: The variation of rpm with radius.

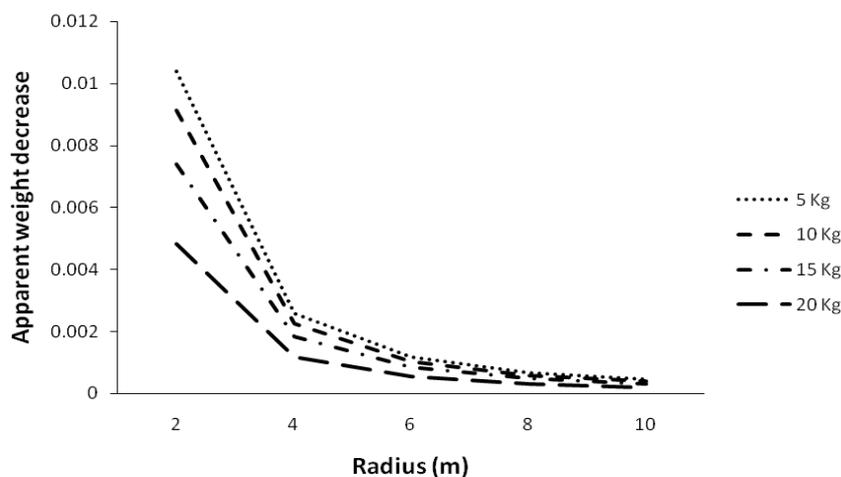


Figure 3: The variation of apparent weight with increase in radius.

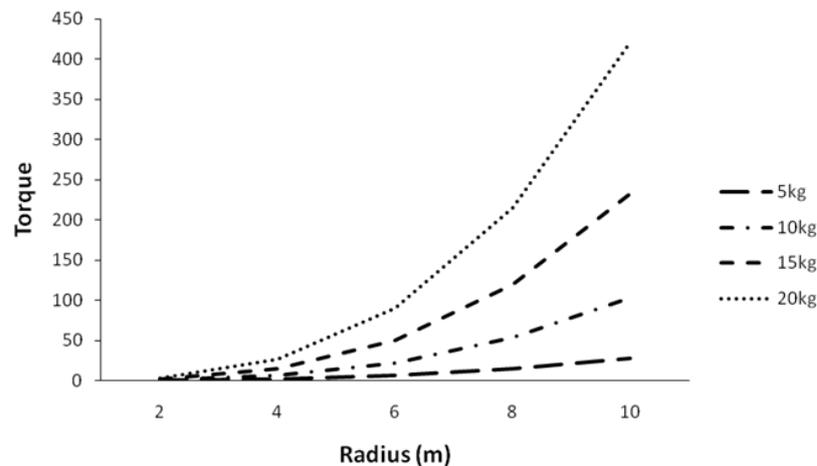


Figure 4: The variation of torque with respect to radius.

The results are to be the floating of the system whose power is proportional to spinning and magnetic force applied. The tables and graphs are plotted to understand the variations of apparent weight, torque and rpm with respect to radius for a constant mass. In all the cases excepted are the outcomes.

The figure 2 shows that, the required rpm increases linearly with radius. It means, when radius is more, its size, volume hence the mass is more. To move this large quantity, more force or rpm is required because to reduce the weight.

From the figure 3, it is found that apparent weight decreases exponentially as the radius increased. The reason can be stated as when radius increases, rpm is increased. By the equation (6), apparent weight is inversely proportional to radius. And also centripetal force is inversely proportional to the radius by equation (2).

From the figure 4, torque increases exponentially with radius. It due to that torque is vector product of radius and force and is directed upwards when rotated in counter clockwise. So as radius increases, torque and angular momentum is increased creating more lift.

6. CONCLUSION

Changes in weight and motion in spinning body is studied and this can be taken as advantage of propulsion. The above model can also taught as an individual machine and a number of these can be combined together to lift or move a heavy craft.

It is also very eco friendly as it does not use any chemical fuel exception of large electric current and also efficient as all parts of this machine are dynamic working parts. It can also be treated as alternative to chemical fuels engine like ion thruster, solar sails and many other propulsion systems. It is more suitable for levitation in any environmental condition as it has adopted many advanced technique for propulsion. As is only uses electricity as power source, it produces very less noise. Also, there may be losses in rotation heating effect of electric current, almost all power is utilized, hence making more efficient. This can be best implemented in outer space for better thrust of the crafts and in rescue places. The power can be provided by chemicals or large solar panels or by radioactive elements. In space

electromagnet may be replaced by neodymium magnet for constant force without electric current.

As it only requires electric current as a major ingredient, it can somehow be supplied and so cost of fossil fuels is minimized and also it is compact.

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