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POWER GENERATED BY USING MAGLEV SPEED

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ABSTRACT

Maglev is the combination of magnetic and levitation. Maglev train uses electromagnets for both propulsion and levitate purpose. The pros of maglev train is the speed which usually ranges between 500-600 km/h and the cons of maglev train is the requirement of continuous supply of electricity. Basically the electricity is further converted into mechanical to support the propulsion phenomena. For that among the various forms of energy wind energy is the best form to use in the present situation. This paper is the study of the idea of generating electricity by using the wind energy created by the speed of the train. The device preferably uses horizontally or vertically mounted helical turbine type rotor attached to electrical generator in order to capture the wind and produce electrical energy. This paper also includes the study of helix angle and working principle of helical turbine.

KEYWORDS: Wind Energy, Electromagnets, Helical Turbine, Helix Angle.

This paper relates to the study of the idea of utilizing the high wind speed generated due to the high speed maglev train. Maglev technology is the most innovative technology of the era. The only drawback of maglev is continuous requirement of electricity .This requirement can be fulfilled by deploying wind turbines.

To capture and convert large amount of energy from wind currently requires specific structure to be constructed. The conventional form of wind turbines are not suitable for the present invention. The most suitable type of wind turbine which can be used in present state is savonius type or helical turbine type. This paper further includes the selection of material for the most suitable situation and its durability.

SAVONIUS TURBINE

Savonius wind turbine type having a rotatable member extending along a longitudinal axis and a plurality of blades extending radially outwards from the rotatable member and spaced apart around the circumference.

Following are some of the examples of savonius turbine study:

1. US patent No. 1,766,765, which discloses a savonius or vertical wind rotor with oppositely curved or arranged vanes.
2. US patent No. 4,784,568 provides vertical axis savonius rotor with a fantail that may be used with high speed winds. The rotor is used with a single speed control mechanism attached to the bottom of the rotor assembly.
3. US patent No. 4,890,976 describes a wind driven turbine including a rotor and a plurality of vanes that are vertically mounted for capturing wind and forming a venturi.
4. US patent No. 4,926,061 is an example of prior art, discussing a wind trap energy system having a rotary shaft and a series of wind traps with vanes for capturing wind energy. The system may be in a vertical or horizontal position. Kinetic energy of wind is transmitted through the shaft and flywheel to turn multiple generators and produce electricity.

DESIGN OF SAVONIUS TURBINE

Helix Angle

This study is aiming the performance of helical savonius wind turbine at varying twist angles or helix angle.

The power coefficient at different tip speed ratio (TSR) and torque coefficient at different azimuths when helical angle of blade is 0̊, 45̊, 90̊ and 135̊ were investigated in a condition that projection area and aspect ratio are consistently maintained. The flow characteristics were examined at every 1̊ from 0̊ to360̊. In a result, the highest maximum power coefficient occurred at helical angle of 45̊.

Regarding the variation of torque coefficient at different shape models as helical angle increase, the phase different of torque coefficient became smaller.

TIP Speed Ratio

The coefficient used for evaluating the performance of wind rotor are as follows, C (power coefficient), c◦ (Torque coefficient) and TSR (tip speed ratio).

TSR is a coefficient used for presenting the window rotor performance. TSR is a coefficient used for presenting the window rotor performance.TSR is defined as the ratio of the blade tip linear speed to the wind speed.

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TSR, denoted by λ, can be expressed as equation (1), where R denotes the rotor radius, N is in RPM and V means free stream wind speed (m/s).

$\lambda = \omega R / V$ (1)

The power coefficient denoted by C, is a ratio of the power produced by the wind rotor to the power produced by the wind rotor to the power available at a specific wind speed.

$C = T\omega / 0.5 þAV^3$ (2)

MATERIAL USED IN SAVONIUS TURBINE

In this section we are going to consider material for the different parts of turbine. So, that turbine will be able to bear all the pressure and speed of wind without any destruction.

From the paper "Design of a Savonius wind turbine" following data is Collected. The condition that have been set were:

Blast of wind at 27m/s.

Steady wind Direction, steady end velocity.

Temp 293k,Pressure 101.325kpa.

The following table 1 & 2 will consist the various Properties of different materials.

Table 1: Properties of material

	Mechanical Characteristics	**Parts of Use**
Steel C45	Tensile Strength: 600-800 MPa	Axis
	Yield Strength: 340-400 MPa	Support rings
	Shear Stress: 450-600 MPa	Supporters of the base
	Tensile Modulus: 190-210 GPa	Side to side cylinder
	Poisson's Ratio: 0.27-0.30	Bases

Table 2: Properties of material

	Mechanical Characteristics	**Parts of Use**
Aluminum Alloy 3105	Tensile Strength: 150 MPa	Blades
	Yield Strength: 130 MPa	Top cap
	Shear Stress: 97 MPa	Bottom cap
	Tensile Modulus: 70- 80 GPa	Thin joints (wires)
	Poisson's Ratio: 0.33	Base cover

CALCULATION

Let us consider the material for blade will be aluminum alloy 3105 with tensile strength of 150MPa. Now, with the help of experiment performed by the researchers, we have some value of forces and area for both positive and negative blades. Here the positive blade is active blade and negative blade is inactive blade.

For Positive Blade

[F1] FORCE = 1726613141N

[A1] AREA = 217431092m^2

Pressure exerted on the blades

P1=F/A

= 1726613141/217431092

P1= 7.94N/m^2

This pressure is much less then 150Mpa or 1500N/m^2. Therefore, our design is safe.

For Negative Blade

[F2]FORCE= 857649137N

[A2] AREA = 217431092m^2

Pressure exerted on the blades

P2= F/A

= 857649137/217431092

P2= 3.944N/m^2

This pressure is much less then 150Mpa or 1500N/m^2. Therefore, our design is safe.

POWER CALCULATION

The Results of measurement of the two velocities can be found in table 3. The last column shows the actual power of the wind turbine.

Therefore these are some of the experimental values of wind which will produces the following power.

Table 3: Velocity Measurement

Wind Velocity *u*	Velocities *V1,V0*	Coefficient *α=(V1-V0)/V1*	Coefficient *Cp*	Actual Power *P=0,5* A *Cp *p *u*^{3}
4 m/s	V1 = 4 m/s V=1,0320 m/s	0,742	0,197	1,84 Watt
6 m/s	V1 = 6 m/s V=1,5060 m/s	0,749	0,188	5,80 Watt
8 m/s	V1 = 8 m/s V=1,9080 m/s	0,752	0,185	13,86 Watt
10 m/s	V1 = 10 m/s V=2,4120 m/s	0,758	0,177	25,90 Watt
12 m/s	V1 = 12 m/s V=2,8840 m/s	0,759	0,176	44,51 Watt
14 m/s	V1 = 14 m/s V=3,3950 m/s	0,757	0,178	71,49 Watt
16 m/s	V1 = 16 m/s V=3,8940 m/s	0,755	0,181	108,80 Watt

CONCLUSION

Wind has a lot of potential in it and if properly harnessed then it can help solve the energy crises in the world. The study of wind turbine and its characteristics showed that how it can be properly designed and used to get the maximum power output. Although the speed of maglev is very high and for such speed the blades of turbine should be strong. Thus the material selected for the blades in this study will be able to bear the high pressure without any damages. This paper shows the appropriate helix angle and the other coefficients which will be designed properly so that it will not create any problem to the blades even in such high speed condition. And the idea of using Savonius turbines around the maglev train can be implemented.

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