CAE DESIGN AND ANALYSIS OF BLADELESS WIND TURBINE

[1]Pratik Kumar Shah, [2]Vishalkumar Jain, [3]Seshadri Subramanian, [4]Sumit Mhaddolkar
[5]Siddique Ahmed

[1,2,3,4]Student, Department of Mechanical Engineering, SIES Graduate School of Technology, University Of Mumbai, Maharashtra, India.
[5]Guide, Department of Mechanical Engineering, SIES Graduate School of Technology University of Mumbai, Maharashtra, India.

ABSTRACT

Access to clean energy is a fundamental need, yet it is difficult to attain by everyone. This paper focuses on an innovative concept to generate clean energy using wind energy which is distributed and flows across the globe. The bladeless wind turbine harnesses the kinetic energy persisting in the wind due to virtue of its motion and converts this energy into electric energy in similar manner to that of conventional windmill. However If you compare a bladeless wind turbine to a conventional wind turbine with similar energy generation, the bladeless wind turbine would cost significantly less, around 45% less Various simulations are done on solidworks to simulate and test various parameters to determine the effect of turbine speed, wind speed on turbine, voltage, power and current produced by the model.

Keywords

Bladeless, Turbine, Design, Analysis, Solidworks

I. INTRODUCTION

Simulations in various mechanical systems using computers is becoming increasing important in many areas of engineering. Elimination of design iterations of the prototype, lab testing and model revision can be achieved through this. Time and money is saved by reduction in hardware construction. Because of this and other benefits afforded by such digital simulation programs, their use is becoming more and more widespread. Objective of this study is to demonstrate the use of modeling and simulation in assessing the performance of the small prototype of bladeless wind turbine using Multi body system software. All the components like mast, spring, base,flange, rack and pinion and frame are designed in solidworks software . simulation under various conditions are done and various parameters are changed and results are obtained.

II. DESIGN SPECIFICATIONS

Components used in this system were designed in solidworks software and following are the design specifications presented below.

2.1 Design of Mast

Fig 1. CAD Design of Mast

Table 1. Specifications of Mast

Parameters	Values
Upper Diameter	100 mm
Lower Diameter	60 mm
Thickness	24 mm
Material Used	PLA Plus

2.2 Design of Rack And Pinion

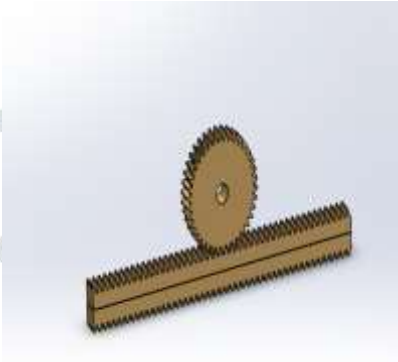

Fig 2. CAD Design of Rack And Pinion

Table 2. Specifications of Rack

Parameters Of Rack	Values
Material	Plastic
Length	220 Mm

Table 3. Specifications of Pinion

Parameters Of Pinion	Values
Pitch Central Diameter	58 Mm
Face Width	12 Mm
Module	1.5

2.3 Design of Pulley

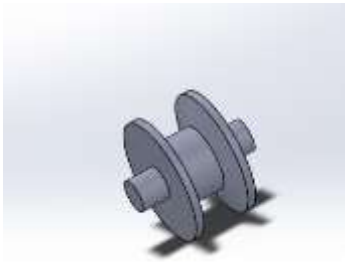

Fig 3. CAD Design of Pulley

Table 4. Specifications of Pulley

Parameters	Values
Material	Plastic
Diameter	50 mm

2.4 Design of Spring

Fig 4. CAD Design of Spring

Table 5. Specifications of Spring

Parameters	Values
Material	Plastic
Stiffness	4 N/Mm
Wire Diameter	2.3 Mm
Coil Diameter	22.5 Mm

III. ASSEMBLY MODEL

Fig 5. Entire Assembly of Proposed System

The fig 5 above represents the assembly model of bladeless wind turbine. As the wind flows around the mast the mast starts swaying due to vorticity, that movement is converted into electricity by means of rack and pinion mechanism, an inextensible chord is attached to the mast which on the other hand is attached to the rack via a pulley. The pinion's shaft is coaxial with the generator's shaft. It is a great way of transmitting energy from a fluid source to a structure.

IV. ANALYSIS AND RESULTS

4.1 Air Flow Simulation

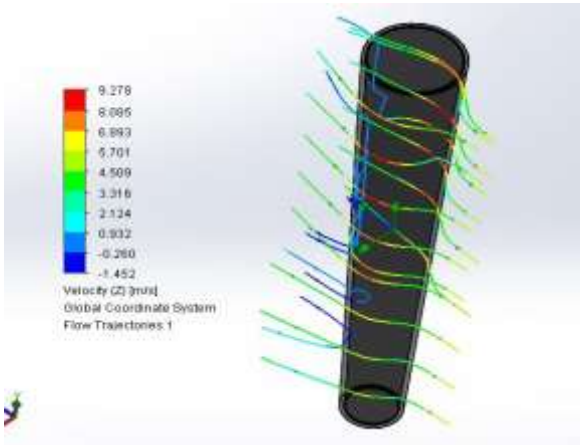

Fig 6. Air Flow Profile

Air flow around the mast was studied and following figure demonstrates the air flow results around mast.

4.2 Structural Analysis

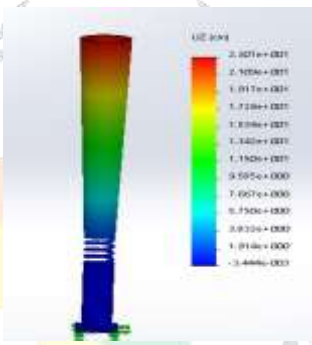

Fig 7. Displacement Analysis of Mast

Structural analysis was done to find out the maximum displacement achieved by the mast at 5m/s velocity and following was the results achieved.

Table 6. Tabular Representation of Results

Parameters	Values
Maximum Displacement	23cm
Maximum Stress Induced In The Spring	7.3mpa
Maximum Voltage Generated	5v

V. CONCLUSION

In this paper study was done on a scaled down model of bladeless wind turbine due to restrictions of student version of the software. However from above analysis and results obtained it can be concluded that bladeless wind turbine can be proven as a better alternative for conventional windmills if installed at large numbers since it can produce outputs even at low wind speeds.

VI. REFERENCES

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