IJMRT: Volume (5), Issue 6, 2023
International Journal of Multidisciplinary Research Transactions
(*A Peer Reviewed Journal*)
www.ijmrt.in

ISSN (Print):2663-2381
ISSN(Online):2663-4007

Design and Analysis of Vertical Axis Wind Turbine Blade with Booster

Ravi. S[1*], Akash. M[2], Asmitha. M[3], Jaikaanth. T[4], Mohamed Shiek Alaudeen. s[5]

[1]Assistant Professor, Department of Mechanical Engineering, Anjalai Ammal Mahalingam Engineering College. kovilvenni, India.
[2,3,4,5] Student, Department of Mechanical Engineering, Anjalai Ammal MahalingamEngineering College. kovilvenni, India.

[*]Corresponding author

DoI: https://doi.org/10.5281/zenodo.7883100

Abstract

- Wind is used from a very long time as a source of electricity. Lots of efforts have been made to develop the horizontal axis wind turbines but vertical axis wind turbines did not get much attention over the past couple of decades. In the current era of energy crisis, it has acquired more significance. Blade is the most important component of a wind turbine which controls a wind turbines performance and the design of other components that are attached to it. Current work introduces a concept for the design of a twisted symmetrical blade for a small-scale vertical axis wind turbine.
- In our project, we have to analyze the VAWT blade to increase its efficiency. We use the CREO and ANSYS software to draw and analyze the VAWT blade. Already, we have done this design in our design and fabrication project. And, the same design is to be draw in the CREO software and then analyze the design in ANSYS software. By using ANSYS software, we get an output in VAWT design and then it's to calculate the efficiency. And then, we will increase the efficiency by modify the dimension and find the rectified design. It should be better than the previous design. We draw the rectified design in CREO and analyze in the ANSYS software. Then we got the rectified design output in ANSYS software. And the output will be calculated to get the maximum

efficiency. It deals with operate in low wind velocity conditions with the help of a booster. The goal of this project is to increase the efficiency.

Keywords: Vertical Axis Wind Turbine, CREO, ANSYS.

1. Introduction

For thousands of years, people have been using wind energy to do work-from traveling around the world on sailboats to milling grain using windmills. Today, wind is becoming more common as a renewable energy source through the use of wind turbines. Wind turbines have three basic parts–a tower, blades, and a generator. These parts work together to convert energy from the wind into electrical energy. When the wind blows, it pushes against the blades, causing them to spin. As the blades spin, they cause the generator to turn. The turning of the generator generates electricity, which can be used to light a light bulb or play music on your stereo.

The beauty of wind power is that it is derived from a virtually unlimited and inexhaustible resource: the wind. Unlike energy that relies on fossil fuels, wind energy produces far fewer carbon emissions and pollution. In addition, most wind turbines/wind farms, once established, don't have exhausting operational costs. Stay tuned here for the latest news on renewable projects, wind energy and more In future posts, we'll give brief rundowns on other types of renewable clean energy, how they work, various current green energy projects and initiatives, and fun facts about renewable.

VAWT stands for Vertical Axis Wind Turbine. It is a type of wind turbine where the main rotor shaft is oriented vertically, as opposed to a horizontal axis wind turbine (HAWT) where the rotor is positioned horizontally. VAWTs have several advantages over HAWTs, including their ability to operate in turbulent and variable wind conditions, their lower noise levels, and their lower height requirements. Additionally, VAWTs have a smaller footprint, making them more suitable for urban and suburban areas.

However, VAWTs also have some disadvantages, such as lower efficiency and higher costs. Due to their lower efficiency, a larger VAWT is required to produce the same amount of power as a smaller HAWT. Additionally, VAWTs have a limited maximum size due to structural limitations. Overall, VAWTs are a promising technology for small-scale and urban wind power generation, but they are still less efficient than HAWTs for large-scale power generation.

2. CREO Software

2.1. Definition

CREO is a powerful 3D CAD software developed by PTC (Parametric Technology Corporation) that enables engineers to design, analyze, and manufacture products efficiently. It was previously known as Pro/Engineer and was first released in 1988. The software is widely used in industries such as aerospace, automotive, consumer goods, and industrial equipment.

One of the key features of CREO is its parametric modelling capabilities, which enable designers to create complex geometries that can be easily modified and updated throughout the design process. The software also includes advanced simulation tools for analyzing and optimizing product performance, as well as tools for creating technical drawings and animations.

2.2. Modelling Of CREO

CREO is a powerful 3D CAD software used for designing and modelling complex mechanical parts and assemblies. To use the software effectively, it is important to have a strong understanding of its interface, features, and tools. Here are some key steps to modelling in CREO:

- Start by creating a new part file and choosing the appropriate template. This will set up the units, default views, and other settings for your part.
- Use the sketch tools to create 2D profiles for your part. These can include lines, arcs, circles, and other shapes. You can also use constraints to ensure that your sketch is fully defined.
- Extrude your sketch to create a 3D feature. This can be done using the Extrude tool, which allows you to specify the direction and depth of the extrusion.
- Use other features such as Revolve, Sweep, Loft, and Blend to create more complex geometry. These tools allow you to create features such as curved surfaces, fillets, and chamfers.

3. ANSYS Software

3.1. Definition

ANSYS is a suite of engineering simulation software developed by ANSYS, Inc. that enables engineers and designers to analyze and optimize their product designs in a virtual environment. The software is used for a wide range of engineering applications, including structural analysis, fluid dynamics, electromagnetic, and multi physics.

ANSYS software is widely used in industries such as aerospace, automotive, electronics, and manufacturing, among others. The software allows engineers to simulate and analyze complex physical phenomena, such as structural stresses, fluid flow, heat transfer, and electromagnetic fields, among others, to optimize product design, reduce costs, and improve performance.

3.2. Modelling And Simulation

Modelling in ANSYS involves creating a virtual representation of a physical object or system using geometry and material properties. ANSYS provides various geometry modelling tools such as Design Modeler, Space Claim, and ANSYS Discovery Live. These tools allow users to create complex geometries, perform geometric modifications, and prepare models for simulation. Simulation in ANSYS involves defining boundary conditions, loads, and material properties to solve for the behavior of the system. ANSYS offers different solvers for different types of physics problems. Some of the popular solvers in ANSYS are ANSYS Mechanical, ANSYS Fluent, and ANSYS Maxwell. Overall, ANSYS is a versatile and powerful software tool for modelling and simulation. With its comprehensive range of simulation capabilities, ANSYS is an excellent choice for engineers and scientists who need to simulate and analyze complex engineering problems.

3.3. CFD (Computational Fluid Dynamics)

CFD (Computational Fluid Dynamics) analysis is a computational technique used to simulate and analyze the behavior of fluids and gases in a given physical system. CFD analysis is widely used in a variety of fields, including engineering, physics, and aerospace. CFD analysis can be used to optimize the design of systems that involve fluid flow, such as turbines, pumps, and heat exchangers. It can also be used to simulate natural phenomena such as weather patterns, ocean currents, and atmospheric dynamics. The accuracy of CFD analysis depends on a number of factors, including the quality of the input data, the complexity of the system being analyzed, and the choice of numerical method used. However, when used correctly, CFD analysis can provide valuable insights into fluid behavior that are difficult or impossible to obtain through experimental methods alone.

4. Selecting The Blade Material

Selecting the right blade material is crucial for achieving the best performance and durability of a blade. The selection process involves analyzing several factors that impact the blade's performance, including the material's strength, toughness, wear resistance, and corrosion resistance. selecting the right blade material requires careful consideration of several factors, including the application, material properties, manufacturing method, cost, and availability. By analyzing these factors, you can choose the most suitable material for your blade to ensure optimal performance and durability.

4.1. Galvanized Steel

Galvanized steel is a type of steel that has been coated with a layer of zinc through a process known as galvanization. The process of galvanization involves immersing the steel in a bath of molten zinc, which forms a protective coating on the surface of the steel. The zinc coating provides a barrier that helps to prevent rust and corrosion, making galvanized steel ideal for use in outdoor and high-moisture environments. The zinc coating also provides some degree of protection against scratches and abrasions, helping to extend the life of the steel. Galvanized steel is commonly used in a variety of applications, including construction, automotive manufacturing, and the production of household appliances. Overall, galvanized steel is a durable and versatile material that offers excellent protection against rust and corrosion.

References

[1]. V. Rajangam, C.Karthikeyan, Dr. MD.Mohan Gift, K.Naveen.,(2021), "Design and Analysis Of Vertical Axis Wind Turbine Blades (VAWT)", Journal of Emerging Technologies and Innovative Research (JETIR), Volume 8, Issue 4.

[2]. A.J Sriganapathy, S Sudhan , T. Sundarmagalingam, E.Nijilabinash, T.Siva.,(2020), "Design and Analysis of Vertical Axis Wind Turbine Blade", International Research Journal on Advanced Science Hub (IRJASH), Volume 02 Issue 05.

[3]. Andyala Siva, S. AbzalBasha (M.Tech).,(2019), "Design And Analysis Of A Vertical Axis Wind Turbine Blade", International Journal of Research, Volume 06 Issue 08.

[4]. Gosula Suresh, M. Raju, Suraj Kumar Tiwari, D. Sundeep, Syed Javid Pasha.,(2022), " Design and Analysis of Vertical Axis Wind Turbine Blade", International Research Journal of Modernization in Engineering Technology and Science, Volume 04 Issue 07.

[5]. Dr. G. Diwakar Professor, Mechanical Engineering Department.(2017), " Design and Analysis of Vertical Axis Wind Turbine Blade", International Journal of Mechanical Engineering and Technology (IJMET), Volume 8, Issue 5, PP. 504–509.

[6]. Amani I. Altmimi, Mustafa Alaskari, Oday Ibraheem Abdullah, Ahmed Alhamadani, Jenan S. Sherza., (2021),"Design and Optimization of Vertical Axis Wind Turbines Using QBlade", Multidisciplinary Digital Publishing Institute (MDPI), Appl. Syst. Innov. 4, 74.https://doi.org/10.3390/asi4040074.

[7]. Rahul Vaidhye, Prof. Ritesh Banapurkar, Pravin Vasram Jadhav.,(2022), "Design and Analysis of Wind Turbine Blade", International Journal for Research in Applied Science & Engineering Technology (IJRASET), Volume 10 Issue VI.

[8]. S.S.Suprajha, K.Vijayan.,(2016), "Design and Analysis of Helical Blade Wind Turbine", International Journal of Innovative Research in Science, Engineering and Technology, Vol. 5, Issue 5.

[9]. Seungwoo Yoo, Sahuck Oh.,(2021), "Flow analysis and optimization of a vertical axis wind turbine blade with a dimple", Engineering Applications Of Computational Fluid Mechanics, VOL.15,NO.1,1666–1681 https://doi.org/10.1080/19942060.2021.1989041.

[10]. Jai Kumar Sharma, Aman Goyal, Mukesh Pandey, Sateeshkumar.,(2020), "Design and Analysis Of Vertical Axis Wind Turbine Booster At Low Wind Speed", International Journal of Mechanical and Production Engineering Research and Development (IJMPERD), Vol. 10, Issue 3, 13823-13836.

