Design and Analysis of Helical Wind Turbine Blade

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Abstract: Wind Turbine and testing its performance. Throughout the course of the study, it is proven that the turbine is much more efficient than its predecessors due to the nature of it grasping wind, and harnessing its energy. Conventional sources of power have become very expensive. Common street lights consume a lot of energy; this project aims to use the wasted energy of the wind to produce renewable energy source to produce enough power to light one or more street light. In this project we are going to design and assemble a helical wind turbine and attach it to one or more streetlights. The project will consist of a helical type turbine with an electric generator attached to it dirvia a coupling without the use of a gearbox allowing the system to be simple and applicable on a wide scale. The design of the helical blade it can be rotate continuously any direction of wind. Hence the efficiency of the turbine stress minimized. The output obtained from parameter pressure, velocity, turbulent kinetic energy.The refernce paper related comparison hybride and helical wind turbine blade.tne improve a effecincey helical blade.

KEYWORDS: Helical wind turbine, gear box, turbulent kinetic energy, helical blade

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I.INTRODUCTION

A windmill is a mill that converts the energy of wind into rotational energy by means of vanes called sails or blades. Centuries ago, windmills usually were used to mill grain, pump water, or both. Thus, they often were gristmills, wind pumps, or both. The majority of modern windmills take the form of wind turbines used to generate electricity, or wind pumps used to pump water, either for land drainage or to extract groundwater. A wind turbine is a device that converts kinetic energy from the wind into electrical power. The term appears to have migrated from parallel hydroelectric technology (rotary propeller). The technical description for this type of machine is an airfoil- powered generator.

The two main types of wind turbine are based on the direction/effect of the wind flow:

- Horizontal Axis Wind Turbine (HAWT)
- Vertical Axis Wind turbines (VAWT.)

Fig 1: Different of vertical axis wind turbine

PAPER STRUCTURE

The paper is organized as follows: In Section 1, the introduction of the paper is provided along with the structure, important terms, objectives and overall description. In Section 2 we discuss related work. In Section 3 we have the complete information about Design anslysis Helical wind turbine blade METHODOLOGY. Section 4Results and Finite element analysis helical blades Discussion. Section 6 tells us about the future scope and concludes the paper with references.

DESIGN AND TYPES OF THE HELICAL BLADE WIND TURBINE

Typically, helical wind turbines are designed along a vertical axis. Vertical axis wind turbines are generally gaining popularity for residences and urban settings because they can be placed lower to the ground and on rooftops. Another advantage of the helical wind turbine is that it generally can be used in areas with higher wind speeds where bladed turbines would need to be shut down for safety reasons. In recent years, manufacturers of utility scale horizontal axis bladed wind turbines have come under fire for killing birds especially in migratory paths. Helical wind turbines are also less susceptible to problems with crosswinds than bladed turbines and they require no tail-fan to keep them pointed in the optimal direction.

OBJECTIVES

- Design and analyze helical wind turbine to produce renewable engenry will reduce pollution.
- Cut of cost lighting street especially highways and industrial areas.
- Demand factor for the whole city reduce.
- The cost of the creation of mentioned turbine effective.
- Make it accessible easy to use others.

II.RELATED WORK

Literature review is one of the scope studies. It works as guide to run this analysis. It will give part in order to get the information about wind turbine blade analysis using CFD. From the early stage of the project, various literature studies have been done. Research journals, books, printed or online conference article were the main source in the project guides.

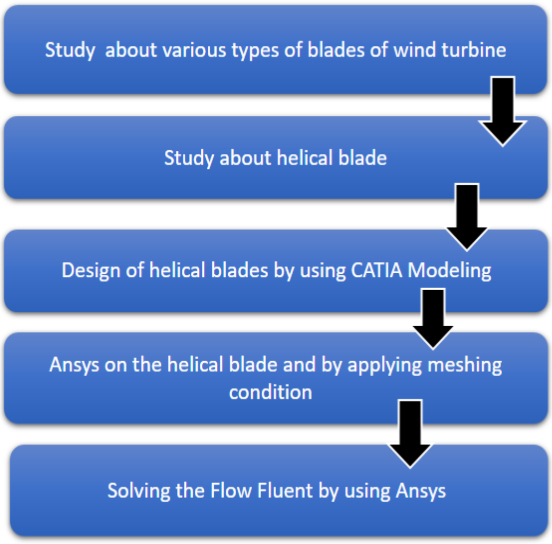
David Hart Wanger et al (2008) has aims to develop a practical engineering methodology for the CFD-based assessment of multiple turbine installations. They are constructs the 2D experimental model of wind turbine which is of NREL S809 aero foil series and compared. Their results with 3D CFD model in Foil 6.3 codes and two ANSYS CFX 11.0 versions. It creates the cylindrical domain whose radius 2L and length 5L where L = turbine radius. For grid generation uses ICEM-CFD (ANSYS) software. In analysis it usek- ω turbulence model. There are two main aims for doing analysis is as under show:

- The primary aim is to predict the lift and drag for 2D experimental wind turbine.

Its secondary aim is to compare the results of Lower CFD Fidelity to Higher CFD Fidelity model. These two aims fulfill with one boundary condition which is use pressure as an inlet condition. The validation of CFD against 2D blade sections showed that the CFD and XFOIL panel code over-predict peak lift and tend to underestimate stalled flow. The 3D results compared well with experiment over four operating conditions. Results from the 3D corresponding calculated torque output showed good agreement with the 3D CFD model and experimental data. However, for high wind cases the actuator model tended to diverge from the CFD results and experiment [7].

III METHODOLOGY

In our project using CATIA V5 for modelling and ANSYS for meshing and Analysis. At present, ANSYS software is widely used Finite Element Analysis, but its pre-process function is so complex that we have must spend too much time and energy, especially for complex model. The comprehensive application of various finite element software can exert their corresponding advantages and makes the analysis more efficient.



Modelling by CATIA

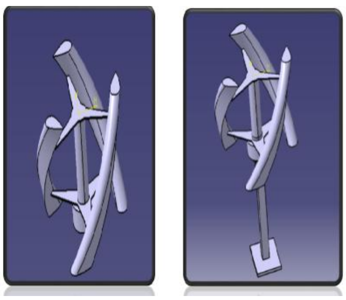


Fig. CAD-model of helical blades

Modelling in CATIA using part design draw a helical blades dimension constraint a diagram after using pad and using different modules and assembling parts more strength- maintain of force on wind. This designed vertical axis helical wind turbine blades safety on.

IV. RESULT

4.1Fluid FLUENT

Here, we are performed both Stator and Rotor on the Helical Blades by applying the obtained from the testing

4.1.1 MESHING apply Stator and rotor

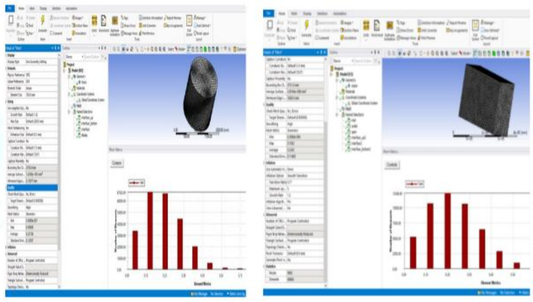
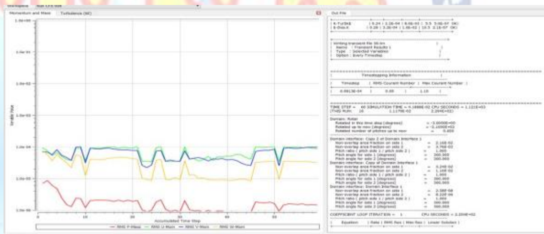


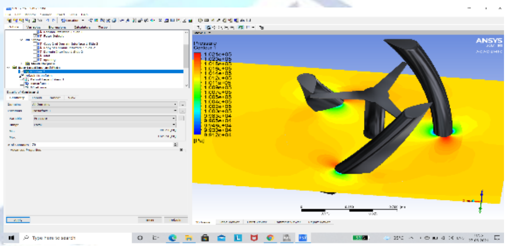
FIG MESHING Helical Blade

4.2 SOLUTION (CFX)



FigSolution CFX Variables values vs Accumulated Time step

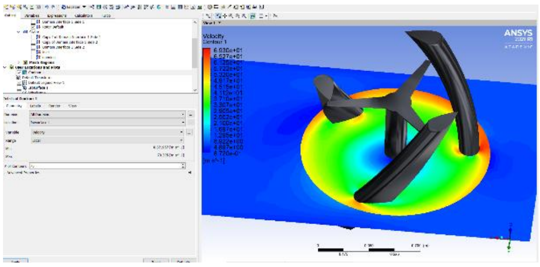
4.3 EXPILICT DYNAMIC BLADES



4.31 PRESURE

IGES format extracts the model in ANSYS workbench. Here, we are chosen HELICAL BLADES apply. There is contour module pressure We found the pressure contour in the body will rotated is 1.021e+05

4.32 VELOCITY



IGES format extracts the model in ANSYS workbench. Here, we are chosen HELICAL BLADES apply. There is contour module pressure We found the pressure contour in the body will rotated is6.930e+01

V.CONCLUSION

We are concluding the CAD-model with Helical wind turbine blade to provide safety for the crew and by providing for high mobility and strength with an attacking mode of design From the Finite element Analysis, we are concluding that:

(1) According to the FLUID FLUENT analysis, Helical blade provides more safety to the crew during the highways and industrial areas

(2) A comprehensive look at blade design has shown that an efficient blade shape is defined by aerodynamic calculations based on chosen parameters and the performance of the selected aero foils. Aesthetics plays only a minor role. The optimum efficient shape is complex consisting of aero foil sections of increasing width, thickness and twist angle towards the hub. This general shape is constrained by physical laws and is unlikely to change. However, aero foil lift and drag performance will determine exact angles of twist and chord lengths for optimum aerodynamic performance

(3) A conclude output determined the parameter's pressure - 1.021e+05, velocity - 6.930e+01.

VI. FUTURE RECOMMENDATIONS

Certain recommendations are to be made after the completion of the project in order to receive better results, and more effective outcomes. The first recommendation is to buy from manufacturers around the country rather than from foreign countries. We experienced difficulties sourcing the generator that we purchased online because there we no company we found that manufactures or imports generators with our specifications, thus we ordered our 64 generators from outside of Saudi

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