DESIGN, ANALYSIS AND FABRICATION OF MULTI-PURPOSE DUAL ROTOR

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ABSTRACT

Electric power has become a great requirement for today's world globally. And it seems certainly impossible to survive without it as each and every activity of human depends and includes electrical gadgets, appliances and machines. All of these require electricity to run and thus consume a high rate of energy each day. Approximately there is 18,000 TWh consumption of electrical energy per year all over the world. Thus to generate this large amount of energy it requires large amount of natural or artificial resources. Hence the most economical of them are the natural resources that are used to generate energy at comparatively low cost and in large quantity. But the major problem that we are facing is the diminishing natural resources such as petroleum base fuels and coal, minerals such as uranium, caladium, etc.

As a result we are left with the never ending or say renewable resources such as wind, solar and tidal energies to generate the high quantity of electrical energy required. These sources of power generation are the most efficient and economical. With these they are even free of cost and are of no one's authority. This means that they are free to all and in abundance. So as to take great advantage from this and to use the resources in the optimum manner is our main aim.

Thus to generate energy from renewable natural sources such as wind, solar and tidal energy we require a group of mechanisms which converts the kinetic and solar energy of the sources into electrical energy. And for this purpose we are aiming to produce a modern transformation of a wind mill rotor which would generate power more efficiently and effectively.

Keyword: *Dual rotor, Diffuser, Drafted wind turbine*

1. INTRODUCTION

Power has been generated from the wind from more than thousands of years with the help of traditional designs of wind turbine and other mechanism, constructed from wood, cloth and stone for the purpose of pumping water or grinding corn. Later on heavy metallic materials came into application for better performance and efficiency. This brought a revolutionary change in the field of power generation as it was effective form of power production. A greater understanding of aerodynamics and advances in materials, particularly polymers, has led to the return of wind energy extraction in the latter half of the 20th century. Wind power generating devices are now applied in generation of electricity, and are commonly known as wind turbines. The characteristic of the shaft and rotational axis determines the classification of the wind turbine. A turbine with a shaft mounted horizontally parallel to the ground is known as a horizontal axis wind turbine or (HAWT). A vertical axis wind turbine (VAWT) has its shaft normal to the ground.

2. LITERATURE REVIEW

Hongzhi Xu et al[1] In the study, the rubbing fault is simulated by using dynamic model and dual-rotor experimental rig. The experimental results are in accordance with the theoretical simulation results. The results are summarized as follows:(1)The vibration displacement waveforms of rotors exhibit the "waveform cutting" characteristics. The axis trajectory of rotors presents the obvious contraction in rubbing location. Comparing with the dynamic simulation results, the axis trajectory of outer rotor is more stable.The spectrums of vibration displacement under rubbing status not only contain the fundamental frequencies of inner and outer rotor, sometimes difference frequency and superharmonic frequency (such as , , , , and), but also contain combined frequencies of fundamental frequencies of inner and outer rotor, namely, , . However, by comparison, it can be found that the spectrums of experimental results also contain the combined frequency components of outer rotor multiple harmonic components and inner rotor fractional harmonic components, namely, , denotes fractional number).The single or multiple rubbing contact is conducted in rubbing experiments, which is in accordance with the dynamic simulation.

Durmus Uygun [2] This paper proposes a dual-rotor brushless direct-current motor design specifically realized for unmanned underwater vehicles. Brushless DC motors are known for their high torque capacity and power density specs which are also suitable for underwater drive trains known as "thrusters". Proposed brushless DC motor model having double rotor and double stator structure is basically designed by applying typical design procedure including sizing equations followed by detailed parametric analysis approach and coupled circuit model. Design of a dual-rotor brushless DC thruster having foregoing structure utilizes modular concentrated winding, optimized slot-opening and pole/slot ratio, outer and inner diameter and etc. Main output parameters such as rated torque, rated power, rated speed and total loss parameter of each brushless DC motor for different rotor positions are computed and compared. Additionally, a coupled-circuit analysis is employed to show the impact of the proposed design to evaluate rated power and torque capability.

Martin O. L. Hansen and Helge Aagaard Madsen [3] studied the development and description of the aerodynamic models used to estimate the aerodynamic loads on wind turbine constructions. This includes a status of the capabilities of computation fluid dynamics and the need for reliable airfoil data for the simpler engineering models. Also a discussion of the use of passive and active aerodynamic devices is included such as, e.g., Vortex Generators and distributed active flaps. Finally the problem of wakes in wind farms is addressed and a section of the likely future development of aerodynamic models for wind turbines is included.

Ashwin P. Joseph [4] studied magnetic levitation possesses numerous applications in various fields of modern engineering designs and technologies. The focus of this article is primarily to demonstrate magnetic levitation phenomenon in a very simple way to enable science and engineering pedagogy to experimentally realize magnetic levitation and its potential applications. The paper also help the pedagogy to understand various principles and concepts of magnetism experimentally,in addition to the realization of principles behind potential maglev applications such as maglev trains, flying cars, maglev wind turbines and magnetic bearings, thereby, this may hopefully actuate them to pursue research on maglev technologies to meet the magnetic demands of the society at present and also in the future.

N. Tenguria, N.D. Mittal and S. Ahmed [5] The utilization of wind energy is not a new technology but draws on the rediscovery of a long tradition of wind power technology. It is no longer possible now to tell from the remainders of historical wind power plants just how important a role wind power played in the past. In this study a comprehensive review of wind turbine is presented. The objective of this literature is to review available literature for blade design, wind turbine airfoils and rotor wakes, Aerodynamic behavior of wind turbine and fatigue design of wind turbine rotor. Review on optimization is also taken in this work. The article reviews the details of design and optimization aspect of rotor of horizontal axis wind turbines.

F Massouh and I Dobrev[6] The present paper describes a wind tunnel study of flow downstream a small horizontal axis wind turbine (HAWT). The experimental investigations were carried out with the use of particle image velocimetry (PIV). To obtain the flow field in the rotating frame of reference, the phase-locked technique was applied. Explorations were carried out in azimuth planes with different angles. The 3D velocity field was reconstituted by processing the images resulting from the explored azimuth planes. In addition to PIV investigations, hot-wire measurements were also carried out immediately behind the wind turbine rotor at different radial and axial distances. The obtained results are very useful to analyze wind turbine wake and to constitute a reference for CFD computation.

3. CONCLUSION

The compact and small scale wind turbines such as one designed above, with a diffuser around the rotor blade assembly would result in increasing the wind velocity and this would lead to more kinetic energy. More amount of kinetic energy would provide more power generation. Now at due to coaxial rotors of this design there will be comparatively more percentage of power generation from the same quantity of kinetic energy as compared to single rotor turbine.

So the arrangement of this design with a core features such as the duct or diffuser and a coaxial rotor with inversely rotating blades would provide us high quantity of electrical energy from the same wind speed as compared to simple single rotor turbine. Thus adopting the above design would be beneficial in all terms instead of a simple, huge and single rotor turbine.

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F Massouh and I Dobrev Exploration of the vortex wake behind of wind turbine rotor © 2007 IOP Publishing Ltd