Torque Analysis of Darrieus Vertical Axis Wind Turbine with Wind Guiding Panels

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ABSTRACT

In this thesis, the rotational torques of several wind turbines used for wind power generation are simulated using different aerodynamic methods. Based on the above results, a new design of a Darrieus vertical axis wind turbine (VAWT) is developed. The proposed new Darrieus VAWT which has movable wind guiding panels can possess lower cut in wind speed and higher rotational speed during operation when compared with the traditional one. The simulation results has shown that the wind guiding panels with slant angles of 5 degree at the location angles of 90, 60, and 30 degrees can increase the average torques by 6.9%, 14.7% and 18.4%, respectively at wind velocity 10 m/s. In experimental study, a scaling down model of the wind turbine determined in a dimensional analysis is fabricated through 3D printing. In the wind tunnel experiment, it has been shown that the wind guiding panels can lower the startup wind velocity by 6.2% in comparison with the original one and raise the rotation speed

13.4% at wind velocity 11 m/s. In testing the mobility of the wind guiding panels, it has been demonstrated that the wind guiding panels with a tail design can always face the incoming wind from any direction.