

Design, Development and Analysis of Combined Darrieus and Savonius Wind Turbine

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Abstract : This report concerns the design, development, and analysis of the combined Darrieus and Savonius wind turbine. Vertical Axis Wind Turbines (VAWT's) are of two type's viz. Darrieus (lift type) and Savonius (drag type). The problem associated with Darrieus is the lack of self-starting while Savonius has low efficiency. There are 3 straight Darrieus blades having the cross-section of NACA(National Advisory Committee of Aeronautics) 0018 placed circumferentially and a helically twisted Savonius blade to get even torque distribution. This unique design allows the use of Savonius as a method of self-starting the wind turbine, which the Darrieus cannot achieve on its own. All the parts of the wind turbine are designed in CAD software, and simulation data were obtained via CFD(Computational Fluid Dynamics) approach. Also, the design was imported to FlashForge Finder to 3D print the wind turbine profile and finally, testing was carried out. The plastic material used for Savonius was ABS(Acrylonitrile Butadiene Styrene) and that for Darrieus was PLA(Polylactic Acid). From the data obtained experimentally, the hybrid VAWT so fabricated has been found to operate at the low cut-in speed of 3 m/s and maximum power output has been found to be 7.5537 watts at the wind speed of 6 m/s. The maximum rpm of the rotor blade is recorded to be 431 rpm(rotation per minute) at the wind velocity of 6 m/s, signifying its potentiality of wind power production. Besides, the data so obtained from both the process when analyzed through graph plots has shown the similar nature slope wise. Also, the difference between the experimental and theoretical data obtained has shown mechanical losses. The objective is to eliminate the need for external motors for self-starting purposes and study the performance of the model. The testing of the model was carried out for different wind velocities.

Keywords : VAWT, Darrieus, Savonius, helical blades, CFD, flash forge finder, ABS, PLA

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