Performance Evaluation of Hybrid Vertical Axis Wind Turbine

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ABSTRACT

Since Savonius wind turbine is known by its self-starting ability at a low wind speed while Darrieus characterized by its high efficiency, the present study aims to combine the favor characteristics of Savonius and Darrieus turbine by producing a hybrid vertical axis wind turbine and evaluate its performance. A numerical model was built up by using ANSYS Fluent 17.1 software to simulate the flow over the wind turbine blades. The model was based on 3-dimentional, incompressible and unsteady assumptions. This numerical model was validated by comparing its results with a previous published experimental work for other researchers. The validated model was used to evaluate the performance of the hybrid turbine. Three different configurations of Savonius, Darrieus and combination of them (hybrid turbine) were compared. The simulation results showed that vertical axis hybrid turbine which its Savonius rotor is located inside Darrieus rotor hybrid VAWT can achieve a higher starting torque than that of a conventional Darrieus, Savonius type VAWT. Besides at high Tip Speed Ratio (TSR) the hybrid take advantage of its drag type blades as a guide for the flow to Darrieus blades.

Keywords: Vertical axis wind turbines; CFD; Hybrid Turbine; Numerical simulation.