

Performance Prediction of a SANDIA 17-m Vertical Axis Wind Turbine Using Improved Double Multiple Streamtube

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Abstract : Different approaches have been used to predict the performance of the vertical axis wind turbines (VAWT), such as experimental, computational fluid dynamics (CFD), and analytical methods. Analytical methods, such as momentum models that use streamtubes, have low computational cost and sufficient accuracy. The double multiple streamtube (DMST) is one of the most commonly used of momentum models, which divide the rotor plane of VAWT into upwind and downwind. In fact, results from the DMST method have shown some discrepancy compared with experiment results; that is because the Darrieus turbine is a complex and aerodynamically unsteady configuration. In this study, analytical-experimental-based corrections, including dynamic stall, streamtube expansion, and finite blade length correction are used to improve the DMST method. Results indicated that using these corrections for a SANDIA 17-m VAWT will lead to improving the results of DMST.

Keywords : vertical axis wind turbine, analytical, double multiple streamtube, streamtube expansion model, dynamic stall model, finite blade length correction

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