Turbulence Modeling Effect on Aerodynamic Performance Prediction of Vertical Axis Wind Turbine Type Darrieus-H

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Abstract

This paper presents a study of the turbulence models effect on aerodynamic performance prediction of a vertical axis wind turbine Darrieus –H. A numerical investigation of two-dimensional unsteady flow around the rotor of a vertical axis wind turbine type Darrieus was made. The Detached Eddy Simulation (DES) approach with two different turbulence models k-ω SST and Spalart Allmaras is used. The model of turbine used (VAWT) has three blades with a symmetric airfoil NACA 0021. The flow field around the rotor is investigated for several values of the tip speed ratio (TSR) and this for each turbulence model proposed.

For different values of the tip speed ratio, dynamic quantities, such as torque and rotor power, are presented and analyzed. Comparing the flow field, the DES approch with Spalart Allmaras is found to be able to capture more vortices after the flow separations. Of the same, the results showed that the power coefficients predicted by the same turbulence model are closer to the experimental data than those by the shear stress transport k-ω model.

Keywords

Wind turbine, Darrieus CFD, DDES, Turbulence.