Comprehensive Aerodynamic Analysis of a 10 MW Wind Turbine Rotor Using 3D CFD - DTU Orbit (27/04/2019)

This article describes a comprehensive aerodynamic analysis carried out on the DTU 10 MW Reference Wind Turbine (DTU 10MW RWT), in which 3D CFD simulations were used to analyse the rotor performance and derive airfoil aerodynamic characteristics for use in aero-elastic simulation tools. The 3D CFD airfoil data derived using the Azimuthal Averaging Technique (AAT) was compared to airfoil data based on 2D CFD simulations on airfoil sections in combination with an array of 3D-correction engineering models, which indicated that the model by Chaviaropoulos and Hansen was in best agreement with the 3D CFD predictions. BEM simulations on the DTU 10MW RWT using the AAT-based airfoil data were carried out and compared to BEM simulations using the original airfoil data and the 3D CFD results, which showed clear improvements, particularly on the inner part of the rotor. Finally, 3D unsteady Detached Eddy Simulations (DES) were carried out to derive airfoil data for standstill conditions in the range of angles of attack of AOA = [-180, 180] deg. showing distinct differences compared to the baseline data.

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