Comparison of aerodynamic models for Vertical Axis Wind Turbines - DTU Orbit (12/12/2018)

Comparison of aerodynamic models for Vertical Axis Wind Turbines

Multi-megawatt Vertical Axis Wind Turbines (VAWTs) are experiencing an increased interest for floating offshore applications. However, VAWT development is hindered by the lack of fast, accurate and validated simulation models. This work compares six different numerical models for VAWTS: a multiple streamtube model, a double-multiple streamtube model, the actuator cylinder model, a 2D potential flow panel model, a 3D unsteady lifting line model, and a 2D conformal mapping unsteady vortex model. The comparison covers rotor configurations with two NACA0015 blades, for several tip speed ratios, rotor solidity and fixed pitch angle, included heavily loaded rotors, in inviscid flow. The results show that the streamtube models are inaccurate, and that correct predictions of rotor power and rotor thrust are an effect of error cancellation which only occurs at specific configurations. The other four models, which explicitly model the wake as a system of vorticity, show mostly differences due to the instantaneous or time averaged formulation of the loading and flow, for which further research is needed.

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