Aeroelastic Analysis for Side-Booms of a Coplanar Twin-Rotor Wind Turbine

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Abstract

As an extension to a previous research made by the authors, this paper represents an aeroelastic analysis for the side-booms supporting the two rotors of a coplanar twin-rotor wind turbine. For a better understanding of the turbine dynamic behavior, the inhouse aeroelastic tool developed by the authors, which is considered as the first approach to study the aeroelasticity of multi-rotor wind turbines, has been extended to model the side-booms and compare three different configurations of the boom size during the analysis. The model is based on deterministic models, where aerodynamic loads are calculated using blade element momentum theory, and virtual work method with a modal approach is used for structure analysis. The three configurations of the side-booms have three different diameters while all other geometrical parameters are kept constant. The bigger the boom diameter, the higher the bending stiffness becomes. It was found that the weight of the rotor is dominant over the fluctuating aerodynamic loads in the in-plane direction, while the deflection is highly affected by the turbulence in the out-of-plane direction. It was also found that the relation between the stiffness and the mean side-boom deflection is of second order, hence, a thorough compromise between weight and strength should be done when designing the side-booms

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