Aeroelastic Analysis of a Coplanar Twin-Rotor Wind Turbine

AMR MOHAMED METWALLY ISMAIEL ,Shigeo Yoshida

Abstract

Multi-rotor system (MRS) wind turbines can be a competitive alternative to large-scale wind turbines. In order to address the structural behavior of the turbine tower, an in-house aeroelastic tool has been developed to study the dynamic responses of a 2xNREL 5MW twin-rotor configuration wind turbine. The developed tool has been verified by comparing the results of a single-rotor configuration to a FAST analysis for the same simulation conditions. Steady flow and turbulent load cases were investigated for the twin-rotor configuration. Results of the simulations have shown that elasticity of the tower should be considered for studying tower dynamic responses. The tower loads, and deformations are not straightforward with the number of rotors added. For an equivalent tower, an additional rotor will increase the tower-top deflection, and the tower-base bending moment both in the fore-aft direction will be more than doubled. The tower torsional stiffness becomes a crucial factor in the case of a twin-rotor tower to avoid a severe torsional deflection. Tower natural frequencies are dominant over the flow conditions in regards to the loads and deflections.

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