Aerodynamic Analysis for the NREL PHASE II Experimental Wind Turbine

Abstract

Present work conducts numerical calculations with CFD (computational fluid dynamics) software to determine the aerodynamic characteristics of the NREL Phase II experimental wind turbine. In this study, the governing equations, consisting of three-dimensional time-dependent conservation of mass, momentum, and energy, are solved using the SIMPLEC numerical scheme. To treat the turbulence effect, the k-ε two-equation turbulent model is adopted as the turbulence closure. Using an untwist, constant chord length, non-symmetrical airfoil as the design baseline of the NREL Phase II experimental wind turbine, important aerodynamic properties, including \( C_p \) (Pressure Coefficient), Moment, power, are determined under broad ranges of wind speed and pitch angle. Predictions can then readily serve as the input loading conditions for further aeroelastics analysis.

Keywords: NREL Phase II, wind turbine, airfoil, computational fluid dynamics, torque, aerodynamic power.