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Large-eddy simulation of flow past wind turbine rotors[1] IMAN BORAZJANI, FOTIS SOTIROPOULOS, St. Anthony Falls Laboratory, University of Minnesota — Understanding the effects of atmospheric turbulence and terrain-specific flow phenomena on the aerodynamic performance of wind turbine rotors is critical perquisite for improving blade designs, developing effective flow control strategies and improving wind farm layouts. We develop a high resolution numerical method capable of carrying out large-eddy simulation of wind turbine flows in arbitrarily complex terrains. The method employs the curvilinear immersed boundary method coupled with overset grids and the governing equations can be solved both in the inertial and non- inertial frames. The method is validated by applying it to simulate the flow for the NREL phase VI wind turbine rotor for various operating points. In addition to LES, inviscid and unsteady RANS simulations are also carried out for all cases. The results from the different models are compared against each other and the experimental data and analyzed to provide turbulence statistics and the 3D flow structure in the rotor wake.

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