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An Immersed Boundary - Adaptive Mesh Refinement solver (IB-AMR) for high fidelity fully resolved wind turbine simulations[1] DIONYSIOS ANGELIDIS, FOTIS SOTIROPOULOS, University of Minnesota — The geometrical details of wind turbines determine the structure of the turbulence in the near and far wake and should be taken in account when performing high fidelity calculations. Multi-resolution simulations coupled with an immersed boundary method constitutes a powerful framework for high-fidelity calculations past wind farms located over complex terrains. We develop a 3D Immersed-Boundary Adaptive Mesh Refinement flow solver (IB-AMR) which enables turbine-resolving LES of wind turbines. The idea of using a hybrid staggered/non-staggered grid layout adopted in the Curvilinear Immersed Boundary Method (CURVIB) has been successfully incorporated on unstructured meshes and the fractional step method has been employed. The overall performance and robustness of the second order accurate, parallel, unstructured solver is evaluated by comparing the numerical simulations against conforming grid calculations and experimental measurements of laminar and turbulent flows over complex geometries. We also present turbine-resolving multi-scale LES considering all the details affecting the induced flow field; including the geometry of the tower, the nacelle and especially the rotor blades of a wind tunnel scale turbine.

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