

Documents

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Immersed boundary method for flow simulation around horizontal wind turbine

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Abstract

Accurate simulation of wind turbine wakes is critical for the optimization of turbine efficiency and prediction of fatigue loads. These wakes are three-dimensional, complex, unsteady and can evolve in geometrically complex environments. Modeling these flows calls thus for high-quality numerical methods that are able to capture and transport thin vortical structures on an unstructured grid. In this work, an immersed boundary (IB) method for solving fluid flow problems of aligned wind turbines under uniform inflow is shown. A finite element method is used starting from a base mesh which does not represent exactly the blade of the wind turbine (non body-conforming mesh). At each time step, the base mesh is locally modified to provide a new mesh fitting the boundary of the rotor blades. The mesh is also locally improved using edge swapping to enhance the quality of the elements and ensure high accuracy of simulation. The methodology is assessed on two different test cases and validated with experimental results. © Published under licence by IOP Publishing Ltd.

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