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Development of an advanced actuator disk model for Large-Eddy Simulation of wind farms MAUD MOENS, MATTHIEU DUPONCHEEL, GREGOIRE WINCKELMANS, PHILIPPE CHATELAIN, Universite catholique de Louvain (UCL) - Institute of Mechanics, Materials and Civil Engineering (iMMC) — This work aims at improving the fidelity of the wind turbine modelling for Large-Eddy Simulation (LES) of wind farms, in order to accurately predict the loads, the production, and the wake dynamics. In those simulations, the wind turbines are accounted for through actuator disks. i.e. a body-force term acting over the regularised disk swept by the rotor. These forces are computed using the Blade Element theory to estimate the normal and tangential components (based on the local simulated flow and the blade characteristics). The local velocities are modified using the Glauert tip-loss factor in order to account for the finite number of blades; the computation of this correction is here improved thanks to a local estimation of the effective upstream velocity at every point of the disk. These advanced actuator disks are implemented in a 4th order finite difference LES solver and are compared to a classical Blade Element Momentum method and to high fidelity wake simulations performed using a Vortex Particle-Mesh method in uniform and turbulent flows.

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