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Helical vortex-based model of deterministic stresses for Large-Eddy-Simulation of a wind turbine wake[1] MARC BRACONS[2], Environmental Engineering, Ecole Polytechnique Federale de Lausanne, CHARLES MENEVEAU, Mechanical Engineering and CEAFM, Johns Hopkins University, MARC PARLANGE, Environmental Engineering, Ecole Polytechnique Federale de Lausanne — When representing a wind turbine in LES using a drag disk (e.g. A. Jimenez et al. 2007), the periodic effects due to the turbine's rotating elements remain unresolved. The periodic effects on the mean flow can be represented in a simulation using deterministic stresses in the wake. In this work, based on the Biot-Savart law with a helical vortex street and various simplifications, we develop an analytical expression for the deterministic, periodic velocity fluctuations in the wake. Then, the deterministic stress tensor is obtained by the product of the approximated fluctuating components of velocity, and integration over a helical period. The resulting model is implemented within a Large Eddy Simulation of an array of wind turbines, using the scale-dependent Lagrangian dynamic model (Bou-Zeid et al. 2005). The importance of the deterministic stresses on the computed wake structure is examined by varying the strength of the helical vortices.

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