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Large-eddy simulations of a single vertical axis wind turbine MAHSA RAHROMOSTAQIM, ANTONIO POSA, ELIAS BALARAS, MEGAN LEFTWICH, The George Washington University — Recently vertical axis wind turbines (VAWTs) have been receiving increased attention due to various potential advantages over the more common horizontal axis wind turbines. They can be placed for example in urban areas where space is limited, since they are moderately sized and virtually silent. In this study we will report large-eddy simulations (LES) of a Windspire VAWT. Computations will be conducted using an immersed boundary formulation, where the equations of motion are solved on a fixed Cartesian grid and the turbine blades rotate with a fixed tip speed ratio. The primary objective of this first series of LES is to understand the interaction between the wakes generated by the individual airfoils. To keep the computational cost low and increase the parametric regime we can examine, we will consider only part of the turbine hight and utilize periodic boundary conditions along the turbine axis. The computations will exactly mimic the conditions of closely coordinated experiments of a scaled down VAWT, which will enable us to access the impact of features that will not be captured, such as the tip vortices for example, on the results. Preliminary results reveal a complex interaction of the wakes created by the rotating airfoils and the boundary layer on the airfoils.

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