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Large eddy simulations of vertical axis wind turbines to optimize farm design SEYED HOSSEIN HEZAVEH, ELIE BOU-ZEID, Princeton University — Wind energy production, and research have expanded considerably in the past decade. These efforts aim to reduce dependence on fossil fuels and the greenhouse gas emissions associated with current modes of energy production. However, with expanding wind farms, the land areas occupied by such farms become a limitation. Recently, interest in vertical axis wind turbines (VAWTs) has increased due to key advantages of this technology: compared to horizontal axis turbines, VAWTs can be built with larger scales, their performance is not sensitive to wind direction, and the ability to place their generators at the bottom of the mast can make them more stable offshore. In this study, we focus on how the Atmospheric Boundary Layer (ABL) will react to the presence of large VAWT farms. We present a state-of-art representation of VAWTs using an actuator line model in a Large Eddy Simulations code for the ABL. Validations are made against several experimental datasets, which include flow details and power coefficient curves, the wake of an individual turbine is visualized and analyzed, and the interaction of adjacent turbines is investigated in view of optimizing their interactions and the configuration of VAWT farms.

Seyed Hossein Hezaveh
Princeton University

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