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Simulations of Vertical Axis Wind Turbine Farms in the Atmospheric Boundary Layer SEYED HOSSEIN HEZAVEH, ELIE BOU-ZEID, Civil and Environmental Engineering Department, Princeton University, MARK LOHRY, LUIGI MARTINELLI, Mechanical and Aerospace Engineering Department, Princeton University — Wind power is an abundant and clean source of energy that is increasingly being tapped to reduce the environmental footprint of anthropogenic activities. The vertical axis wind turbine (VAWT) technology is now being revisited due to some important advantages over horizontal axis wind turbines (HAWTS) that are particularly important for farms deployed offshore or in complex terrain. In this talk, we will present the implementation and testing of an actuator line model (ALM) for VAWTs in a large eddy simulation (LES) code for the atmospheric boundary layer, with the aim of optimizing large VAWT wind farm configurations. The force coefficients needed for the ALM are here obtained from blade resolving RANS simulations of individual turbines for each configuration. Comparison to various experimental results show that the model can very successfully reproduce observed wake characteristic. The influence of VAWT design parameters such as solidity, height to radius ratio, and tip speed ratio (TSR) on these wake characteristics, particularly the velocity deficit profile, is then investigated.

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