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Measurements in an axisymmetric turbulent wake with rotation downstream of a model wind turbine NATHANIEL DUFRESNE, MARTIN WOSNIK, University of New Hampshire — Energy production data from several of the existing offshore wind farms indicate that turbine arrays may enter a stall condition which can cause an overall energy production shortfall(which can exceed 10%). This deep array stall is (presumably) due to the wakes generated by turbines upstream interacting with turbine rotors downstream. It is hypothesized that there is a critical array spacing at which this stall occurs, but that this spacing is dependent on rotor thrust c_T (which is determined by tip-speed ratio λ and power coefficient c_P of the rotor), Reynolds number, upstream conditions, and possibly wall roughness. An experimental investigation of the axial and azimuthal velocity field measurements in the wake of a single 3-bladed wind turbine with rotor diameter of 0.91m was conducted. The turbine was positioned in the free stream, near the entrance of the 6m x 2.5m test section of the UNH FPF, which can achieve test section velocities of up to 15 m/s and Reynolds numbers $\delta^+ = \delta u_\tau/\nu \approx 30,000$. Hot-wire anemometry was used to obtain velocity field measurements. The data obtained will be used to examine similarity scaling functions for velocity, wake growth, and turbulence derived from an equilibrium similarity analysis of the far wake.

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