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Studying Wake Deflection of Wind Turbines in Yaw using Drag Disk Experiments and Actuator Disk Modeling in LES[1] MICHAEL HOWLAND, The Johns Hopkins University, JULIAAN BOSSUYT, JOHAN MEYERS, KU Leuven, CHARLES MENEVEAU, The Johns Hopkins University — Recently, there has been a push towards the optimization in the power output of entire large wind farms through the control of individual turbines, as opposed to operating each turbine in a maximum power point tracking manner. In this vane, the wake deflection by wind turbines in yawed conditions has generated considerable interest in recent years. In order to effectively study the wake deflection according to classical actuator disk momentum theory, a 3D printed drag disk model with a coefficient of thrust of approximately 0.75 – 0.85 and a diameter of 3 cm is used, studied under uniform inflow in a wind tunnel with test section of 1 m by 1.3 m, operating with a negligible inlet turbulence level at an inflow velocity of 10 m/s. Mean velocity profile measurements are performed using Pitot probes. Different yaw angles are considered, including 10, 20, and 30 degrees. We confirm earlier results that (e.g.) a 30 degree yaw angle deflects the center of the wake around 1/2 of a rotor diameter when it impinges on a downstream turbine. Detailed comparisons between the experiments and Large Eddy Simulations using actuator disk model for the wind turbines are carried out in order to help validate the CFD model.

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