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Wake flow control using a dynamically controlled wind turbine[1]
RICARDO CASTILLO, YEQIN WANG, SUHAS POL, ANDY SWIFT, FAZLE HUSSAIN, CARSTEN WESTERGAARD, Texas Tech University, TEXAS TECH UNIVERSITY TEAM — A wind tunnel based "Hyper Accelerated Wind Farm Kinematic-Control Simulator" (HAWKS) is being built at Texas Tech University to emulate controlled wind turbine flow physics. The HAWKS model turbine has pitch, yaw and speed control which is operated in real model time, similar to that of an equivalent full scale turbine. Also, similar to that of a full scale wind turbine, the controls are developed in a Matlab Simulink environment. The current diagnostic system consists of power, rotor position, rotor speed measurements and PIV wake characterization with four cameras. The setup allows up to 7D downstream of the rotor to be mapped. The purpose of HAWKS is to simulate control strategies at turnaround times much faster than CFD and full scale testing. The fundamental building blocks of the simulator have been tested, and demonstrate wake steering for both static and dynamic turbine actuation. Parameters which have been studied are yaw, rotor speed and combinations hereof. The measured wake deflections for static yaw cases are in agreement with previously reported research implying general applicability of the HAWKS platform for the purpose of manipulating the wake. In this presentation the general results will be introduced followed by an analysis of the wake turbulence and coherent structures when comparing static and dynamic flow cases. The outcome of such studies could ultimately support effective wind farm wake flow control strategies.

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