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Towards a Wind Turbine Wake Reduced-Order Model¹ NICHOLAS HAMILTON, Portland State University, National Renewable Energy Laboratory, BIANCA VIGGIANO, Portland State University, MARC CALAF, University of Utah, MURAT TUTKUN, Institute for Energy Technology, University of Oslo, RAL BAYON CAL, Portland State University — A reduced-order model for a wind turbine wake is sought for prediction and control. Basis functions from the proper orthogonal decomposition (POD) represent the spatially coherent turbulence structures in the wake; eigenvalues delineate the turbulence kinetic energy associated with each mode. Back-projecting the POD modes onto the velocity snapshots produces coefficients that express the amplitude of each mode in time. A reducedorder model of the wind turbine wake (wakeROM) is defined through a series of polynomial parameters that quantify mode interaction and the evolution of each mode coefficient. Tikhonov regularization is employed to recalibrate the dynamical system, reducing error in the modeled mode coefficients and adding stability to the system. The wakeROM is periodically reinitialized by relating the incoming turbulent velocity to the POD mode coefficients. A high-level view of the wakeROM provides as a platform to discuss promising research direction, alternate processes that will enhance stability, and portability to control methods.

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