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Proper Orthogonal Decomposition analysis of Large Eddy Simulation data of a single wind turbine wake with uniform inflow[1]
CLAIRE VERHULST, Johns Hopkins University, ROBERT MIKKELSEN, JENS NORKAER SORENSEN, Technical University of Denmark, CHARLES MENEVEAU, Johns Hopkins University — Large Eddy Simulations have been performed using the EllipSys3D code to model the NREL 5 MW reference wind turbine with uniform incoming flow at 10 m/s. Instantaneous snapshots of the velocity field are decomposed using a fully three-dimensional Proper Orthogonal Decomposition (POD) analysis. This method unambiguously identifies the bases of velocity fields that most efficiently represent the turbulent kinetic energy of the snapshots on average. The structure of the resulting POD modes and the evolution of their magnitude in time provide insight into the dynamics of breakdown of tip vortices and recovery of the wake velocity deficit. In this presentation, we will discuss the structure of the first few POD modes and how the observed structure relates to the dynamics of the wind turbine wake.

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