Abstract Submitted
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Optimal control of wind farms for power tracking using simplified one-dimensional convection-diffusion equation[1] CARL SHAPIRO, Johns Hopkins University, PIETER BAUWERAERTS, JOHAN MEYERS, Katholieke Universiteit Leuven, CHARLES MENEVEAU, DENNICE GAYME, Johns Hopkins University — Coordinated control of wind turbines within a wind farm, accounting for wake interactions and associated flow phenomena, has the potential to provide a number of important services to the power grid. In this work we develop a simple time-dependent extension of a standard steady-state wake model that is used to obtain an optimal control strategy for tracking a time-varying power signal. First, we introduce a one-dimensional convection-diffusion equation for wind turbine wakes that is based on the Jensen wake model and the actuator disk model. This equation is tested during wind farm start up by comparing to large-eddy simulations of wind farms with both aligned and staggered turbine arrangements. Second, we investigate optimal control for power tracking applications, where turbines are controlled via the local thrust coefficient. The control strategy is designed to minimize the squared difference between the modeled farm power and a given power reference signal. Finally, the control strategies obtained are tested using large-eddy simulations.

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