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Low-order flow modeling of vertical-axis wind turbine arrays[1]
DANIEL ARAYA, California Institute of Technology, ANNA CRAIG, Stanford University, JOHN DABIRI, California Institute of Technology — We present a potential flow model of recent experimental measurements of a full-scale array of vertical-axis wind turbines. Potential flow elements are used to approximate the flow physics of the array. Average velocity measurements, taken over the course of several months from different locations within the array, are used to compute velocity residuals, which are minimized to find the best-fit model. In addition, we present an approach to extend the empirical model to larger turbine array sizes by deducing the relation of the local flow velocity to the potential flow element strengths. This low-order modeling approach has the advantage of being simple enough for rapid optimization of small turbine arrays, yet robust enough for also at least qualitatively predicting the performance of larger arrays.

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