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Increasing Wind Turbine Power Generation Through Optimized Flow Control Design JOHN COONEY, THEODORE WILLIAMS, THOMAS CORKE, University of Notre Dame — A practical, validated methodology is outlined for implementing flow control systems into wind turbine designs to maximize power generation. This approach involves determining optimal flow control strategies to minimize aerodynamic losses for horizontal axis wind turbines during Region II operation. A quantitative design optimization (QDO) process is completed for the wind turbine utilized in the Notre Dame Laboratory for Enhanced Wind Energy Research. QDO utilizes CFD simulations and shape optimization tools to maximize effectiveness of flow control. Here, only flow control schemes that could be retrofitted on the existing turbine were explored. The final geometry is discussed along with accompanying validations of the predicted performance from wind tunnel experiments at full-scale conditions. Field data from the wind energy laboratory is included.

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