Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Characterizing Performance and Unsteady Flow Dynamics of AeroMINE Energy Harvesting Foils[1] ZAVAR ABIDI, ANDRES GOZA, University of Illinois, Urbana-Champaign, SUHAS POL, Texas Tech University, CARSTEN WESTERGAARD, Westergaard Solutions Inc, DAVID MARIAN, BRENT HOUCHENS, Sandia National Laboratories — Commercial wind-energy turbines successfully supply grid-level power production but are not well suited to smaller distributed production because of scaling, building integration and reliability challenges. The AeroMINE system harnesses wind energy by using a rigid two-airfoil assembly that avoids rotating parts and reduces the wake disturbance issues of adjacent devices. The use of AeroMINEs on warehouse-sized structures can provide significant distributed power. Wind tunnel experiments demonstrate increased lift as the angle-of-attack (AoA) of the airfoils increases, corresponding to an increase in power generation. However, if the AoA is too large flow instabilities occur that reduce the harvesting efficiency. We characterize this system using wind tunnel experiments at Reynolds numbers of O(100,000) and high-fidelity simulations at lower Reynolds numbers, O(1,000). We provide performance maps that indicate harvesting potential across the parameter space and describe performance-deteriorating instabilities by correlating dynamics of key flow structures to those of the forces on the airfoil system.

[1]SNL is managed and operated by NTESS under DOE NNSA contract DE-NA0003525.

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Date submitted: 03 Sep 2020 Electronic form version 1.4