Abstract Submitted
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Non-Linear Aerodynamic Coupling of Piezoelectric Harvesters in Grid Turbulence[1] AMIR DANESH-YAZDI, Penn State Univ, Erie, OLEG GOUSHCHA, NIELL ELVIN, YIANNIS ANDREOPOULOS, City College of New York — Experimental and analytical results relating to the extraction of fluidic energy from decaying homogeneous and isotropic turbulence using two side-by-side cantilever beams with attached piezoelectric patches are reported. Turbulence carries mechanical energy distributed over a range of temporal and spatial scales and the resulting interaction of these scales with the immersed piezoelectric beams creates a strain field in the beam which generates electric charge. Experiments are carried out in a large scale wind tunnel in which a turbulence-generating grid is used to excite the piezoelectric cantilever beams for different gap widths between the beams at various distances from the grids and for different flow velocities. We observe that the aerodynamic coupling decays exponentially with increasing gap width between the beams. More importantly, however, it is observed that the aerodynamic coupling due to the presence of a second beam greatly improves the energy harvesting process, so much so that when the aerodynamic coupling between the beams is strong, the average power generated per beam increases by up to 20 times, potentially allowing for significant power extraction from a random, non-resonant phenomenon such as turbulence.

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