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Piezoelectric Energy Harvesters in Isotropic Turbulence[1] AMIR DANESH-YAZDI, OLEG GOUSHCHA, NIELL ELVIN, YIANNIS ANDREOPOULOS, CUNY-CCNY — In the present work, we will report experimental and analytical results related to the extraction of fluidic energy in decaying homogeneous, isotropic turbulence using cantilever beams with attached piezoelectric patches of various materials. 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 large scale wind tunnels in which passive, semi-passive and active turbulence-generating grids are used to excite the piezoelectric cantilever beams at various distances from the grids. We observe that the average power generated in the piezoelectric layer obeys an exponential decay law with respect to the dimensionless distance parameter, as predicted from our theoretical hypothesis. The pertinent parameters that influence the power output of the beams are identified as (1) the dimensionless distance of the beam from the grid with respect to the grid size and (2) the dimensionless length of the beam with respect to the turbulence integral length scale. Furthermore, the efficiencies associated with each step of the energy conversion process in the beams are discussed.

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Amir Danesh-Yazdi
CUNY-CCNY

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