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Self-Excited Energy Harvesting in Uniform Fluid Flows Using Piezoelectric Generators[1] DOGUS AKAYDIN, NIELL ELVIN, YIANNIS ANDREOPOULOS, The City College of New York — A novel energy harvesting configuration consisting of a circular cylinder attached to a piezoelectric beam is investigated experimentally in this study. The cylinder is attached to the free end of a cantilever beam and undergoes bending deformation due to vortex shedding under uniform fluid flow. The periodic change of strain along the piezoelectric beam generates an alternating voltage that can be used to power an electrical circuit such as a wireless sensor. Two major governing parameters were studied: First, the ratio of the length of the cylinder to its diameter and second, the ratio of the length of the beam to the diameter of the cylinder. Both parameters alter the forcing frequency and magnitude of the flow, natural frequency of the structure and ultimately determine the magnitude of the resultant vibrations. The configuration is different from those previously studies since it is a combination of an oscillating cylinder with a flexible splitter plate and the vibrations are induced within a steady, uniform flow. Three dimensionality of the flow complicates its structure and nonlinear oscillations and lock-in phenomena were observed in experiments with beams of low stiffness. It was also observed that aerodynamic interference with several components of the harvester can significantly alter the harvested power.

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