Abstract Submitted
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Characterization of self-excited fluidic energy harvesters in uniform flows[1] VAHID AZADEH RANJBAR, CORALIE CLER, NIELL ELVIN, YIANNIS ANDREOPOULOS, The City College of The City University of New York — Energy harvesters consisting of a low aspect-ratio hollow circular cylinder attached to the free end of a cantilevered beam which is partially covered by piezoelectric patches near its clamped end to produce electrical power output have been investigated experimentally and analytically. The unsteady nature of vortex shedding is described by the van der Pol equation, a non-conservative oscillator with non-linear damping, which models the near wake dynamics that is coupled with the harvester's equation of motion. This model helps to describe and predict the vortex induced vibration phenomena such as lock-in range, maximum amplitude of oscillations and extension of structural oscillations far away lock-in range with a better physical insight. Both free vibration and wind tunnel tests were carried out to characterize the harvester. Based on the wind tunnel tests data, there is a remarkable difference in magnitude and frequency of the lift force between stationary and oscillating cylinders subjected to stationary uniform flow. Moreover, maximum electrical power output occurs at a forcing frequency somewhat higher than the structural resonance frequency. These experimental results are in good agreement with the results of the mathematical model.

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Vahid Azadeh Ranjbar
The City College of The City University of New York

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