Abstract Submitted
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Parametric Study of the the Train of Frozen Boxcars Model for Fluidic Harvesters[1] AMIR DANESH-YAZDI, Penn State Univ, Erie, OLEG GOUSHCHA, Manhattan College, NIELL ELVIN, YIANNIS ANDREOPOULOS, City College of New York — One of the challenges that arises in the study of fluid-structure interactions is the development and application of simple mathematical models that properly capture the behavior of both media due to the inherently coupled nature of the physical problem. If, however, the typical two-way interaction between the fluid and solid can be effectively reduced to a one-way coupling for a certain flow case, the modeling of the fluid-structure interaction can be greatly simplified. In this talk, one such model, the Train of Frozen Boxcars (TFB) is developed for piezoelectric fluidic harvesters. The TFB approach involves the advection of several boxcars of different amplitudes, widths and separations as a model for the fluidic force acting on the beam. For the single vortex case, the TFB model is able to predict the average harvested power within 13% of the experimental value. A parametric study of this model is also conducted to observe the influence of five boxcar parameters on the power output from the harvester: number of boxcars, boxcar amplitude, width, separation from the following boxcar and advection speed. Further development of this model would allow for the prediction of the power output of stiff piezoelectric harvesters in vortex and potentially even turbulent flows.

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