Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Investigation of flow-induced vibration for energy harvesting using a model soap-film system WENCHAO YANG, MARK STREMLER, Virginia Tech, VIRGINIA TECH TEAM — One way to extract energy from geophysical flows is to take advantage of flow-induced vibration (FIV) caused by vortices being shed from a bluff body. Wake-induced vibration of the downstream cylinder in a tandem pair is a promising design for a FIV energy harvesting system, especially suitable for low Reynolds number flows. For this design, the upstream cylinder is fixed in place, while the downstream cylinder is free to oscillate like a pendulum that is driven by interactions with the flow, including the wake of the upstream cylinder. We use a flowing soap film system, with behavior that resembles two-dimensional hydrodynamics, to experimentally investigate the wake interaction between a stationary upstream circular disk and a free downstream circular disk, which acts as a swinging pendulum. The wake flow generates thickness variations in the thin soap film, allowing direct observation of wake patterns through visualization of interference fringes. With the ability to tie together the wake structure and the object motion, we investigate the relationship between energy generation and flow structure in the simplified model energy harvesting system for Re=150. The research results find the optimal efficiency of the energy harvesting system by a parametric study.

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Date submitted: 31 Jul 2017 Electronic form version 1.4