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Experimental study of vortex ring interactions with a flexible beam; investigating the role of viscous effects.[1] ALIREZA PIRNIA, Clarkson University, JIACHENG HU, SEAN PETERSON, University of Waterloo, BYRON ERATH, Clarkson University — Energy can be extracted from flow instabilities in the environment for powering low consumption devices. When vortices pass tangentially over a flexible beam the lower pressure in the vortex core causes the beam to deflect, and induces sustained oscillations which can be converted into energy via piezoelectric materials. The beam dynamics can be parameterized according to the beam properties (nondimensional mass and stiffness ratios) as well as the vortex properties (size, vortex circulation strength and advection velocity). Recently, inviscid models have been developed to solve this fluid-structure interaction problem but they do not capture viscous interactions; features that become more prominent when the beam is positioned close to the vortex core. In this study the interaction of a vortex ring passing tangentially over a flexible beam as a function of circulation strength, beam properties, and offset distance are investigated to identify how viscous interactions influence the energy exchange process. Particle image velocimetry is acquired in tandem with the beam dynamics. The velocity and pressure fields, and transient beam dynamics are compared and contrasted with an inviscid model to identify the role of viscous interactions.

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