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Experimental investigation of the interaction of a vortex dipole with a deformable cantilevered plate EUGENE ZIVKOV, SEAN D. PETERSON, SERHIY YARUSEVYCH, University of Waterloo — The coupled interaction of a vortex dipole impacting the tip of a deformable cantilevered plate is investigated experimentally using both flow visualization and time-resolved particle image velocimetry (PIV). Experiments are performed in shallow, density stratified salt water, which is known to reduce three-dimensional effects and maintain dipole stability through the action of buoyancy forces. The flow visualization, in which florescent dye is used to trace both the dipole and the fluid in the vicinity of the plate, is performed to elucidate the vortex dynamics upon impact. On impact, the dipole splits and forms two secondary dipoles by entraining fluid in the vicinity of the plate. The secondary dipoles follow circular trajectories and may return for subsequent impacts with the plate. PIV is employed to measure the circulation and kinetic energy of the dipole, while plate deflections extracted from sequential flow field images are used to estimate the plate strain energy. By analyzing the results obtained on a rigid and compliant plate, the effect of compliance on the attendant vortex dynamics is investigated. The results are compared with previously published numerical simulations and conclusions are drawn with regards to energy harvesting from vortices using smart materials.

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