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Abstract Submitted
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Simulation of the Initial 3-D Instability of an Impacting Drop Vortex Ring LORENZ SIGURDSON, JUSTIN WIWCHAR, Vortex Fluid Dynamics Lab, Mechanical Engineering Department, University of Alberta, JENS WALTHER, Mechanical Engineering, Danish Technical University, VF DL TEAM — Computational vortex particle method simulations of a perturbed vortex ring are performed to recreate and understand the instability seen in impacting water drop experiments. Three fundamentally different initial vorticity distributions are used to attempt to trigger a Widnall instability, a Rayleigh centrifugal instability, or a vortex breakdown-type instability. Simulations which simply have a perturbed solitary ring result in an instability similar to that seen experimentally. Waviness of the core which would be expected from a Widnall instability is not visible. Adding an opposite-signed secondary vortex ring or an image vortex ring to the initial conditions, to trigger a Rayleigh or breakdown respectively, does not appear to significantly change the instability from what is seen with a solitary ring. This suggests that a Rayleigh or vortex breakdown-type instability are not likely at work, though tests are not conclusive. Perhaps the opposite-signed secondary vortex was not strong enough or placed appropriately. Elliptical streamlines, as expected, are visible in the core of the solitary ring at early times. Support from the Canadian Natural Sciences and Engineering Research Council grant 41747 is gratefully acknowledged.

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