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Curvature instability of a vortex ring with density differences and surface tension[1] CHING CHANG, STEFAN LLEWELLYN SMITH, University of California, San Diego — Curvature instability is a parametric instability of vortex rings that was first reported by Hattori and Fukumoto (2003) in the short-wavelength limit and then investigated using normal modes in Fukumoto and Hattori (2005). The basic state consists of a Rankine vortex tube perturbed by small curvature of $O(\epsilon)$. This leads to resonance between two neutrally stable Kelvin waves whose azimuthal wavenumbers are separated by 1, leading to instability. We calculate the curvature instability using normal modes for a thin vortex ring whose density differs from that of the ambient fluid, with surface tension acting at the boundary of the ring. The growth rate and the instability bandwidth are calculated for the principal modes, defined appropriately, and some of the non-principal modes. Results show that density increases with growth rate of the instability for long waves, while surface tension has a marginal effect.

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Ching Chang
University of California, San Diego

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