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**Nested contour-dynamic models for axisymmetric vortex rings and vortex wakes** CLARA O'FARRELL, JOHN O. DABIRI, California Institute of Technology — Jetting swimmers, such as squid and jellyfish, propel themselves by forming vortex rings. It is known that vortex rings cannot grow indefinitely, but rather "pinch off" once they reach their physical limit, and that a decrease in efficiency of fluid transport is associated with pinch-off. Previously, the Norbury family of vortices has been used as a model for axisymmetric vortex rings, and the response of this family to shape perturbations has been characterized. We improve upon the Norbury models, using nested patches of vorticity to construct a family of models for vortex rings generated by a piston-cylinder apparatus at different stroke ratios. The perturbation response of this family is considered by the introduction of a small region of vorticity at the rear of the vortex, which mimics the addition of circulation to a growing vortex ring by a feeding shear layer. Model vortex rings are found to either accept the additional circulation or shed it into a tail, depending on the perturbation size. A change in the behavior of the model vortex rings is identified at a stroke ratio of three. We hypothesize that this change in response is analogous to pinch-off, and that pinch-off might be understood and predicted based on the perturbation responses of model vortex rings.

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