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Scaling in two-fluid pinch-off CHRIS POMMER, MICHAEL HARRIS, OSMAN BASARAN, Purdue University — The physics of two-fluid pinch-off, which arises whenever drops, bubbles, or jets of one fluid are ejected from a nozzle into another fluid, is scientifically important and technologically relevant. While the breakup of a drop in a passive environment is well understood, the physics of pinch-off when both the inner and outer fluids are dynamically active remains inadequately understood. Here, the breakup of a compound jet whose core and shell are incompressible Newtonian fluids is analyzed computationally when the interior is a "bubble" and the exterior is a liquid. The numerical method employed is an implicit method of lines ALE algorithm which uses finite elements with elliptic mesh generation and adaptive finite differences for time integration. Thus, the new approach neither starts with a priori idealizations, as has been the case with previous computations, nor is limited to length scales above that set by the wavelength of visible light as in any experimental study. In particular, three distinct responses are identified as the ratio m of the outer fluid's viscosity to the inner fluid's viscosity is varied. For small m, simulations show that the minimum neck radius r initially scales with time τ before breakup as $r \sim \tau^{0.58}$ (in accord with previous experiments and inviscid fluid models) but that $r \sim \tau$ once r becomes sufficiently small. For intermediate and large values of m, $r \sim \tau^{\alpha}$, where the exponent α may not equal one, once again as r becomes sufficiently small.

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