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Scaling in the Transition from Selective Withdrawal to Viscous Entrainment CHRIS POMMER, MICHAEL HARRIS, OSMAN BASARAN, Purdue University — In selective withdrawal, fluid is withdrawn through a tube that has its tip suspended a distance S above a flat interface separating two fluids. When the withdrawal rate Q is low, the interface forms a steady-state hump and only the upper fluid is withdrawn. When Q is increased (or S decreased), the interface undergoes a topological transition so that the lower fluid is entrained with the upper one, forming a steady-state spout. Here, this discontinuous transition is analyzed computationally when both fluids are incompressible and Newtonian. The numerical method employed is an implicit method of lines ALE algorithm which uses finite elements with elliptic mesh generation. 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, it is shown that the critical withdrawal rate at which the aforementioned transition occurs scales with the nozzle separation raised to some power n. A study of the effect of the physical parameters of the system on the scaling behavior is also presented.

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