Abstract Submitted
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Computation of time-periodic solutions of the vortex sheet with surface tension JON WILKENING, UC Berkeley, DAVID AMBROSE, Drexel University — I will describe a spectrally accurate numerical method for finding non-trivial time-periodic solutions of nonlinear PDE. We minimize a functional (of the initial condition and the period) that is positive unless the solution is periodic, in which case it is zero. We use adjoint methods (originally developed for shape optimization in fluid mechanics) to compute the gradient of this functional with respect to the initial condition. We then minimize the functional using a quasi-Newton gradient descent method (limited memory BFGS). We use our method to compute families of time-periodic solutions of the vortex sheet with surface tension separating two incompressible, irrotational, immiscible, inviscid fluids. As a starting guess, we use analytically determined time-periodic solutions of the linearized problem about a flat interface with constant vortex sheet strength. We then use our numerical method to continue these solutions beyond the realm of linear theory to explore the topology and bifurcation structure of a two-parameter manifold of symmetric breathing solutions.

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