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On the Numerical Modeling of Fluid Instabilities in the Small-Amplitude Limit[1] STEVEN ZALESAK, A.J. SCHMITT, A.L. VELIKOVICH, Plasma Physics Division, Naval Research Laboratory, Washington, DC — The problem we wish to address is that of accurately modeling the evolution of small-amplitude perturbations to a time- dependent flow, where the unperturbed flow itself exhibits large-amplitude temporal and spatial variations. In particular, we wish to accurately model the evolution of small-amplitude perturbations to an imploding ICF pellet, which is subject to both Richtmyer-Meshkov and Rayleigh-Taylor instabilities. This modeling is difficult despite the expected linear evolution of the perturbations themselves, because these perturbations are embedded in a highly nonlinear, strongly- shocked, and highly complex flow field which in and of itself stresses numerical computation capabilities, and whose simulation often employs numerical techniques which were not designed with the proper treatment of small-amplitude perturbations in mind. We will review some of the techniques that we have found to be of use toward this end, including the imposition of a "differentiability condition" on the component numerical algorithms of the codes which implement such modeling, the appropriate representation of interfaces in an Eulerian hydrodynamics context, and the role of exact energy conservation.

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