Abstract Submitted
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A Dynamical Systems Approach to the Alpha Problem for Rayleigh-Taylor DANIEL ISRAEL, Los Alamos National Laboratory — Turbulent mixing of the unstable Rayleigh-Taylor layer is observed to exhibit self similar growth which scales as $h = \alpha \mathrm{At} g t^2$. This quadratic growth can be theoretically derived through several different approaches including bubble dynamics, flux balances (Cook et al., 2004), similarity theory (Ristorcelli and Clark, 2004), or simple turbulence modeling. In all these approaches, however, the value of α must be determined empirically. Furthermore, it is not clear from the theory whether α is universal. In fact, reported experimental values for α exhibit a wide variation, almost all of which are well above the values seen in simulations, as documented by Dimonte et al. (2004). That study concluded that all the variation could likely be explained by the presence, or absence, of long wavelength perturbations which can effect the growth for quite a long time. The current work provides a new tool for investigating the transient behavior. Starting with an advanced moment closure model and applying an integral method is shown to result in a set of ordinary differential equations which can be viewed as a low-order model of the turbulence as it evolves towards a self-similar state. Applying the tools of dynamical systems we can examine the possible trajectories of the system in state space. This suggests a new physical picture of how long wavelengths might create the appearance of a high value of α. It also gives us a new set of metrics for validating turbulence models for non self-similar problems.

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