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Direct Numerical Simulation of Tilted Rayleigh-Taylor Instability

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— The tilted Rayleigh-Taylor instability, where the initial interface is not perpendicular to the driving acceleration, is investigated using Direct Numerical Simulations (DNS). In this configuration, the inclination of the initial interface results in a large-scale overturning motion in addition to the buoyancy driven instability. The DNS results are compared to the rocket-rig experiments of Smeeton and Youngs (AWE Report No. 35/87) at several Atwood numbers (A=0.267, 0.48, and 0.90). Since the initial conditions in these experiments are largely unknown, an extensive range of initial conditions have been explored to match the mixing layer growth between DNS and experiments. The evolution of the mixing layer was found to be strongly influenced, for the duration of the experiments, by the initial spectrum shape and peak location, as well as the perturbation amplitude. A set of initial conditions matching the experimental growth rates has been determined. Results are also presented on the interaction between shear and buoyancy, including the parameters influencing the overturning and mixing.

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