Wed4.1 Jacobs & Chapman

Experiments on the three-dimensional incompressible Richtmyer-Meshkov instability

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Experiments will be presented in which an incompressible system of two miscible liquids is impulsively accelerated to produce Richtmyer-Meshkov instability. The initially stratified liquids (a calcium nitrate/water solution and an isopropyl alcohol/water solution) are contained within a tank mounted to a vertical rail system. A three-dimensional single-mode perturbation of square shape is given to the interface by oscillating a tank of square cross section in the direction of its diagonal. The tank is then released allowing it to fall until it bounces off of a fixed spring giving it an impulsive acceleration. After bouncing the tank travels upward and then downward on the rails in freefall allowing the instability to evolve in the absence of gravity. The resulting fluid flow is visualized using PLIF yielding cross-sectional views of the flow (figure 1). Flood illuminated experiments are also performed in which one of the fluids is made opaque using milk (figure 2). In both cases motion sequences are captured using a video camera that travels with the fluid system. Amplitude measurements taken from these experiments indicate that the three-dimensional instability grows significantly faster in the nonlinear regime (after differences in the linear growth rate are accounted for) than its two-dimensional counterpart. This difference can be attributed to fundamental differences in vorticity distributions of the two flow patterns.

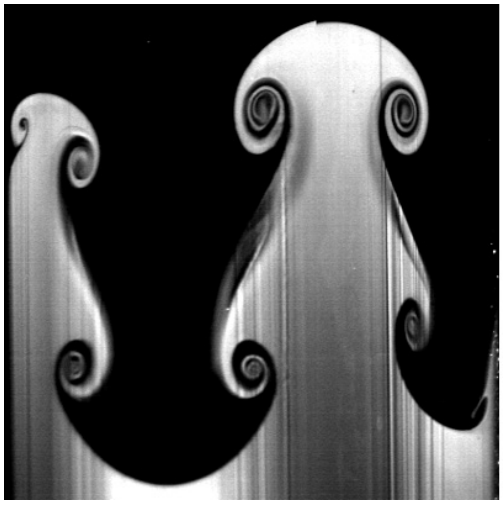

Figure 1: PLIF image.

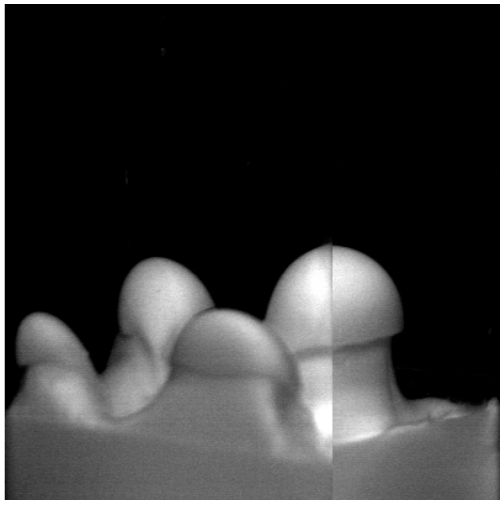

Figure 2: Opaque image.