POSTER PRESENTATION

The Density Ratio Dependence of Self-similar Rayleigh-Taylor Mixing

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Very high resolution large eddy simulations (mesh sizes ~1500x1000x1000) are used to investigate the properties of high Reynolds number self-similar Rayleigh-Taylor (RT) mixing at a range of density ratios from 1.5:1 to 20:1. In some cases mixing evolves from "small random perturbations". In other cases random long wavelength perturbations (k^{-3} spectrum) are added to give self-similar mixing at an enhanced rate, more typical of that observed experimentally. The properties of the mixing zone (dissipation of turbulence kinetic energy, molecular mixing parameter etc) are related to the RT growth rate parameter, α, defined by bubble distance, $h_1 = \alpha \dfrac{\rho_1 - \rho_2}{\rho_1 + \rho_2} g t^2$. Comparisons are made with experimental data on the internal structure and the asymmetry of the mixing zone (spike distance/bubble distance). The main purpose of this series of simulations is to provide data for calibration of engineering models (i.e. RANS models). Sample results at a density ratio of $\rho_1 / \rho_2 = 7$ are shown in figures 1 and 2. The plane averaged fluid 1 volume fraction, $\bar{f}_1$, the molecular mixing parameter, $\theta = \overline{f_1 f_2} / \bar{f}_1 \bar{f}_2$, and turbulence kinetic energy , $\boldsymbol{k} = \overline{\rho(\boldsymbol{u} - \tilde{\boldsymbol{u}})^2} / \bar{\rho}$, are plotted against the scaled distance, x/W , where $W = \int \bar{f}_1 \bar{f}_2 dx$ is an integral measure of the mix width. Profiles of $\bar{f}_1$ and k are insensitive to α . However, as α increases, θ is reduced and its profile becomes more asymmetric.

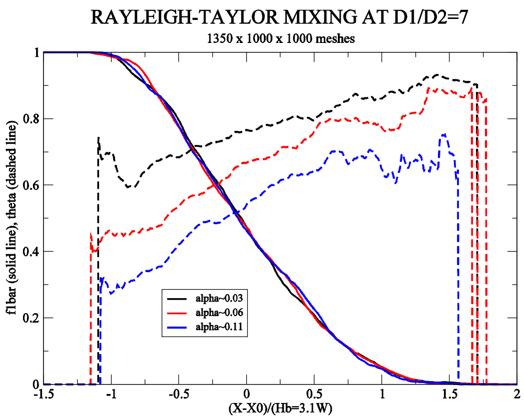

Fig. 1: Profiles of $\bar{f}_1$ and θ

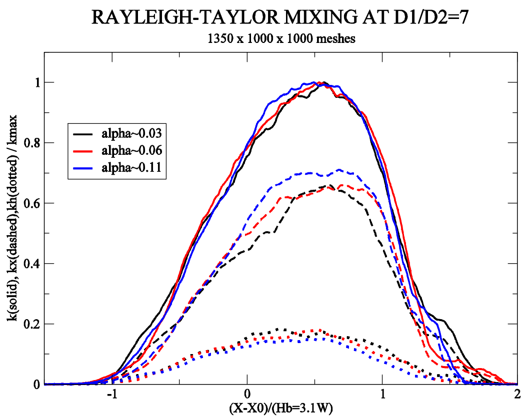

Fig.2 : Profiles of k, k_x (vertical component) and $\frac{1}{2}(k_y + k_z)$ (horizontal component)