Abstract Submitted
for the DFD05 Meeting of
The American Physical Society

Simulation and modeling of passive scalar mixing in turbulent jets[1] PRADEEP BABU, KRISHNAN MAHESH, University of Minnesota — Direct numerical simulation of passive scalar transport in a spatially evolving turbulent jet is performed at Reynolds number of 2400 and Schmidt number of unity. Good comparison withexperimental data is obtained. The simulation results are used to study role of diffusion in scalar transport. Diffusion–dominated regions are very thin near the jet center, but are fairly thick and 'brush–like', near the jet edge. Longer residence times near the jet edge are proposed as a reason for this behavior. A simple kinematic model is proposed, that predicts the experimentally observed variation of scalar fluctuations with Reynolds number, Schmidt number and radial location. The model assumes that scalar fluctuations at a fixed location in the jet result from the oscillation of scalar fronts, whose thickness depends on Reynolds and Schmidt numbers, and whose oscillation amplitude depends on the level of turbulent fluctuations. The value of $c_{\mathrm{rms}}/\overline{c}$ is predicted to decrease, and asymptote to a constant value as the ratio of the oscillation amplitude of the scalar fronts to their thickness increases. This prediction is consistent with the experimental data discussed by Dimotakis (2000, *J. Fluid Mech.*, **409:** 69–98) in the context of mixing transition. The model results also suggest that Reynolds number and Schmidt number dependencies are likely to be stronger, away from the jet centerline, where the scalar fronts are thicker and the levels of turbulence smaller.

[1]Supported by Department of Energy under the ASC program.

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Date submitted: 12 Aug 2005

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