

Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Advective-diffusive transport in microflows PATRICK ANDERSON, MICHEL SPEETJENS, OLEKSANDR GORODETSKYI, Eindhoven University of Technology — Advective-diffusive transport in microflows is studied by means of the diffusive mapping method, a recent extension of the mapping method by Gorodetskyi et al. (Phys. Fluids 24, 2012) that includes molecular diffusion. This greatly expands the application area of the mapping technique and makes the powerful concepts of eigenmode decomposition and spectral analysis of scalar transport accessible to an important class of flows: inline micromixers with diffusion. The staggered herringbone micro-mixer is adopted as a prototypical three-dimensional micro mixer. Simulations with the diffusive mapping method are in close agreement with experimental observations in literature and expose a strong impact of diffusion on the transport. Diffusion enables crossing of Lagrangian transport barriers and thus smoothens concentration gradients and accelerates homogenization. Spectral analysis of the mapping matrix reveals this already occurs on a modal level in that individual eigenmodes progressively smoothen and spread out across transport barriers with stronger diffusion. Concurrently, the corresponding eigenvalues diminish and thus fundamentally alter the mixing process by invariably causing homogenization, irrespective of the Lagrangian flow structure.

Patrick Anderson
Eindhoven University of Technology

Date submitted: 28 Jul 2014

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