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**Designing a Robust Micromixer Based on Fluid Stretching**[1]
DAVID MOTT, Naval Research Laboratory, DIPESH GAUTAM, GREG VOTH, Wesleyan University, ELAINE ORAN, Naval Research Laboratory — A metric for measuring fluid stretching based on finite-time Lyapunov exponents is described, and the use of this metric for optimizing mixing in microfluidic components is explored. The metric is implemented within an automated design approach called the Computational Toolbox (CTB). The CTB designs components by adding geometric features, such a grooves of various shapes, to a microchannel. The transport produced by each of these features in isolation was pre-computed and stored as an "advection map" for that feature, and the flow through a composite geometry that combines these features is calculated rapidly by applying the corresponding maps in sequence. A genetic algorithm search then chooses the feature combination that optimizes a user-specified metric. Metrics based on the variance of concentration generally require the user to specify the fluid distributions at inflow, which leads to different mixer designs for different inflow arrangements. The stretching metric is independent of the fluid arrangement at inflow. Mixers designed using the stretching metric are compared to those designed using a variance of concentration metric and show excellent performance across a variety of inflow distributions and diffusivities.

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