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Topological Chaos in Simple Mixers

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Topological chaos is discussed in a two-dimensional batch mixer and a three-dimensional static mixer, under very viscous flow conditions. Topological ideas may be used to calculate a minimum stretch rate for certain flows, but cannot predict the size of the region in which this stretching is achieved. Numerical simulations of dye advection are used to test whether topological ideas can be used to practically enhance mixing quality. In two dimensions it is found that material stretch rates are in tight accordance with theoretically predicted values dependent on flow topology. Furthermore, effective mixing is readily achieved in a useful sized domain. However, in three dimensions we find flow features which make topological arguments less practical for improving mixing quality.

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