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Topological chaos in wide lid-driven channels JIE CHEN, MARK A. STREMLER, Virginia Polytechnic Institute and State University — Rapid fluid mixing can be produced in laminar flows through a high-aspect-ratio microchannel by means such as pressure-driven flow with staggered surface groove patterns or electro-osmotic flow with potential differences between the upper and lower boundaries. Under certain conditions, passive fluid particles or groups of particles can act as "rods" that stir the surrounding fluid and produce exponential stretching. The occurrence of "topological chaos" guarantees rapid mixing in these flows, and the Thurston-Nielsen theorem predicts a quantitative lower bound on complexity in the dynamics of the flow. We will present an exact solution for two-dimensional Stokes flow in a lid-driven cavity with periodic side wall boundary conditions and extend this model to approximate three-dimensional channel flow. We will examine the occurrence of topological chaos in these flows and discuss the mixing efficiency.

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