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Topological chaos in cavities and channels JIE CHEN, MARK A. STREMLER, Virginia Polytechnic Institute and State University — Moving three or more stirrers around in a two-dimensional fluid domain can generate topological chaos, that is, chaos that cannot be removed by continuous deformation of the fluid with the boundaries and stirrers held fixed. Those stirrer motions that generate topological chaos are determined using the ThurstonNielsen classification theorem, which also predicts a lower bound on the fluid stretching rate. Equivalent motions can be produced in a lid-driven cavity without stirrers by using periodic, piecewise constant motion of the top and/or bottom boundaries. We explore the properties of topological chaos in lid-driven cavities. Lid-driven cavity flow can also be combined with rectangular Poiseuille flow as a model of either pressure-driven flow in a channel with surface grooves or electro-osmotic flow in a channel with variations in surface potential. We demonstrate that this combination can be used to generate topological chaos in three-dimensional steady channel flow.

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