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Topological chaos in spatially periodic mixers MATT FINN, JEAN-LUC THIFFEAULT, Imperial College London, EMMANUELLE GOUILLART, Ecole Normale Superieure — In many industrial fluid stirring processes it is desirable to produce a high stretching rate of material lines. In two-dimensional flows this stretching rate is given by the *topological entropy* of the flow. *Topological Chaos* offers a way of constructing flows that have a rigorous topological entropy lower bound that is robust against changes in fluid properties and the exact details of the apparatus geometry. We examine topologically chaotic fluid advection in two-dimensional flows where either or both directions are spatially periodic. Our study is motivated by the ubiquity of periodic boundary conditions for prototype flows in the literature, and also by some rare examples of actual flows that exhibit spatial periodicity. For nonperiodic domains, it is already known how to obtain topological entropy lower bounds for such flows by analysing the braid formed by the stirring apparatus using the Bestvina–Handel train-track algorithm. However, in spatially periodic flows, in addition to usual braiding motions, there are new motions corresponding to stirring rods traversing the periodic directions. This leads to the study of braids on the cylinder and the torus. We describe how the train-track algorithm may be applied in such cases to produce topological entropy lower bounds. Through analysis and numerical simulation we show how periodic boundary conditions are of great assistance in creating chaos. We also analyse the well-known sine-flow but from a new topological perspective.

Matt Finn
Imperial College London

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