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Almost cyclic sets, topological chaos, and mixing in a lid-driven cavity flow PRADEEP RAO, MOHSEN GHEISARIEHA, SHANE ROSS, MARK STREMLER, Virginia Tech — Topological chaos, or chaos that is guaranteed to exist in a system due to sufficiently complex motion of a few periodic orbits, has been demonstrated for a variety of flows, with a primary focus on creeping or ideal flows. Nearly-periodic systems can by analyzed in a similar way based on the presence of "braiding" Almost Cyclic Sets (ACS) with similarly complex space-time trajectories. For flow in a two-dimensional lid-driven cavity, this analysis can also be accurately extended to finite Reynolds numbers using a 2D Fourier-Chebyshev spectral algorithm for the streamfunction-vorticity formulation. We investigate the connection between the occurrence of braiding ACS, exponential stretching of material lines associated with topological chaos, and the efficiency of mixing for laminar flow in a lid-driven cavity.

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