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Symbolic Dynamics Applied to 3D Chaotic Fluid Flows with Poorly Defined Vortex Domains JOSHUA ARENSON, KEVIN MITCHELL, University of California Merced — Some popular models of complex three-dimensional fluid flows are based on 3D volume-preserving maps. These maps exhibit chaotic dynamics with complicated geometric structures. The underlying topological structure of these maps can be described using symbolic dynamics techniques. One such method is homotopic lobe dynamics (HLD), which has previously been applied to a chaotic three-dimensional Hill's spherical vortex. In the past HLD was confined to cases where there was a well defined topological vortex domain. However, many flows do not exhibit this topological feature. Through a series of examples, we demonstrate how HLD can be extended to extract symbolic dynamics for such systems; we specifically consider systems where there exists an invariant circle of fluid trajectories connecting two stagnation points. Using this technique we obtain a lower bound for the stretching rate of material surfaces in the fluid.

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