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Persistent Homology of FTLE Patterns Generated by Point Vortex Motion YOUWEI LIU, FIRAS SIALA, Syracuse University, MARKO BUDIŠIC, Clarkson University, MELISSA GREEN, Syracuse University — The method of Persistent Homology (PH) was used to investigate the structure and evolution of a set of point vortices moving and interacting under their own induced velocities. PH is a multiscale approach to quantifying topological features, such as connected components, topological circles, and trapped volumes in point clouds and in level sets of scalar fields. PH was applied to the point cloud of vortices, to the finite-time Lyapunov exponent (FTLE) scalar field, and to the point cloud of points on ridges of FTLE. The goal was to evaluate to what degree their topological features can be quantitatively correlated to each other, for the purpose of robust classification of regimes of fluid motion. In particular, the talk will explore how vortex circulation and FTLE magnitude can be incorporated into the classical distance-based PH framework by comparing generated persistence diagrams and evaluating their interpretation in the context of fluid physics. Results indicate that joining PH and FTLE methods may lead to a way of robust pattern detection in vortex-dominated fluid flows.

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