

Abstract Submitted
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Transport induced by vortex formation SHAWN SHADDEN, KAKANI KATIJA, JOHN DABIRI, JERROLD MARSDEN, Caltech — This presentation will address the transport structure of vortex ring formation and the induced stirring and mixing properties. Vortex rings are empirically generated in water by a piston- cylinder apparatus. Digital Particle Image Velocimetry (DPIV) is used to obtain cross-section measurements of the velocity field within and around the cylinder exit. Dynamical systems methods are used to compute Lagrangian coherent structures (LCS) from the DPIV data during the vortex formation. The LCS clearly indicate the geometric structure of how fluid is entrained to form the vortex ring. This topological picture is compared with traditional mechanisms of vortex formation. Additionally, the LCS are shown to offer a convenient tool for predicting the stirring/mixing of the surrounding fluid. The information provided from the LCS is compared with traditional stirring/mixing metrics and paradigms. This study provides valuable insight on how vortex rings form, and how vortical flows can be used to produce efficient stirring/mixing of fluids.

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