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Characterization of Mixing Using Experimentally Derived Velocity Fields and Derived Lagrangian Coherent Structures DOUGLAS BOHL, NARATIP SANTITISSADEEKORN, ERIK BOLLT, Clarkson University — In this work a flat rectangular plate is rotated along its long axis and parallel to the z-axis of a circular cylinder. The blade position is varied with respect to the cylinder wall to allow investigation of the effect of the no slip boundary on the flow structure and mixing field. The cylinder is filled with viscous Newtonian fluids and driven at low Reynolds numbers (8-100). Particle Image Velocimetry is used to measure the velocity in the plane perpendicular to the rotation of the plate (i.e. in the r-θ plane of the cylinder). The experimental velocity field is used to 1. Determine numerically the motion of 100,000 simulated zero mass particle tracers for up to 25 cycles of the blade and 2. Calculate the Lagrangian Coherent Structures (LCS) of the flow field. Mixing rates and length scales are found using the particle tracers. Results show that the fluid is segregated into distinct regions with limited interaction by the ridges in the short term LCS field. The results also show that if the Lagrangian Coherent Structures are calculated for long times the resulting LCS field is similar to that of the particle distribution field for the same time number of rotations.

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