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Lagrangian coherent structures in the wake of a streamwise oscillating cylinder NEIL CAGNEY, STAVROULA BALABANI, UCL Department of Mechanical Engineering — Lagrangian analysis of experimental flow measurements has the ability to reveal complex coherent structures and identify phenomena that may not be apparent from standard Eulerian descriptors, such as vorticity. We measure the wake of a cylinder undergoing streamwise vortex-induced vibrations (VIVs) using Particle-Image Velocimetry, and examine the wake dynamics throughout the response regime in terms of the phase-averaged vorticity fields. The Finite-Time Lyapunov exponent (FTLE) fields are also computed in backward- and forward-time in order to identify the Lagrangian Coherent Structures. We examine four distinct wake modes that occur at various points in the response regime. The roll up of the shear layers and the vortex formation process are examined using the FTLE fields. This analysis allows the fluid-structure interaction and dynamics in the near wake to be examined in much greater detail than would be possible using the vorticity fields alone. Particular attention is paid to the symmetric vortex-shedding mode, which is characteristic to streamwise VIV; the forward-time FTLE fields show that the wake is organised into discreet "vortex cells," which enclose each vortex and define its boundary. Finally, the advection of tracers in the wake is studied in order to examine how the different wake modes promote/inhibit mixing. The alternate wake modes tend to promote mixing, particularly in the second response branch, but the symmetric shedding tends to reduce the lateral mixing across the wake.

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