Abstract Submitted
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Eulerian and Lagrangian methods for vortex tracking in 2D and 3D flows[1] YANGZI HUANG, MELISSA GREEN, None — Coherent structures are a key component of unsteady flows in shear layers. Improvement of experimental techniques has led to larger amounts of data and requires of automated procedures for vortex tracking. Many vortex criteria are Eulerian, and identify the structures by an instantaneous local swirling motion in the field, which are indicated by closed or spiral streamlines or pathlines in a reference frame. Alternatively, a Lagrangian Coherent Structures (LCS) analysis is a Lagrangian method based on the quantities calculated along fluid particle trajectories. In the current work, vortex detection is demonstrated on data from the simulation of two cases: a 2D flow with a flat plate undergoing a 45^o pitch-up maneuver and a 3D wall-bounded turbulence channel flow. Vortices are visualized and tracked by their centers and boundaries using Γ_1, the Q criterion, and LCS saddle points. In the cases of 2D flow, saddle points trace showed a rapid acceleration of the structure which indicates the shedding from the plate. For channel flow, saddle points trace shows that average structure convection speed exhibits a similar trend as a function of wall-normal distance as the mean velocity profile, and leads to statistical quantities of vortex dynamics.

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