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Identification of separate flow features in the shear layer KAREN MULLENERS, SWATHI KRISHNA, EPFL, MELISSA GREEN, Syracuse University — Analyzing unsteady flow fields primarily involves the identification of dynamically significant regions of vorticity in the flow. Detection of all the flow features is essential for an accurate description of the physics of the flow, which eventually helps in improving flow modeling and predictions. Eulerian criteria such as λ_2 and Γ_2 successfully identify large scale structures based on local velocity gradients and topology but do not detect the coherent vortices with the concentrated vorticity in a shear layer. The identification of these smaller structures within the shear layer is important when predicting the overall circulatory contribution to the aerodynamic forces produced, in applications such as flapping wing design. In order to detect the smaller flow features along with the prominent large scale vortices, an alternative method of vortex identification is proposed in which the flow structures are detected based on the vorticity contours. This method is applied to numerical and experimental data of a pitching panel to highlight its robustness. In addition, the finite time Lyapunov exponent (FTLE) is calculated to show that the boundaries of the material lines and identified vorticity contours coincide.

Karen Mulleners
EPFL

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