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Critical Point Analysis of Unsteady Flow Separation from a Pitching Plate[1] FAEGHEH HOOMAN, PAUL S. KRUEGER, SMU — Unsteady flow separation is of interest for force and moment generation by flapping airfoils, but it is often difficult to determine how small differences in the motion lead to differences in the flow field and resulting forces. To better understand the flow evolution during unsteady separation in pitching maneuvers, analysis was performed of two numerical data sets for the pitch-up of a two-dimensional flat plate in a free stream flow with Re=1000 provided by Prof. J.D. Eldredge at UCLA. In each data set, flow was characterized by identifying the first order critical points of the velocity field and their eigenvalues to locate the vortical structures and separation and attachment points as well as the relative locations of these features. The evolution of the flow structure was evaluated quantitatively using a tracking algorithm to pair related critical points in sequential frames. The critical points were further analyzed to understand relationships between the flow configuration and the hydrodynamics including the drag coefficient and lift coefficient. Results from the two data sets will be compared to quantitatively assess the differences in the flow structures.

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