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Evolution of Surface Topology and Flow Structure on a Delta Wing Due to Pitching Motion TUNC GORUNEY, DONALD ROCKWELL, Lehigh University — Unmanned Combat Air Vehicles (UCAVs) and Micro Air Vehicles (MAVs) undergoing steady flight or unsteady maneuvers generate complex flow patterns, the physics of which must be clearly identified in order to optimize maneuverability and minimize unsteady loading that can lead to undesired vibrations and fatigue. Near-surface flow patterns of a basic delta wing having moderate sweep angle, representative of key features of the foregoing configurations, are visualized by a technique of high-image-density particle image velocimetry. Emphasis is on definition of the states of relaxation of the flow patterns following a pitch-up maneuver, in terms of patterns of velocity, streamline topology and vorticity, along the near-surface plane. The changes of the topological features observed during the early stages of the relaxation process are analogous to the alterations of the surface patterns obtained for the stationary wing at smaller angles-of-attack. These features include negative (separation) and positive (reattachment) bifurcation lines, saddle points, foci and nodes.

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