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Investigation of Flow Structure over X-45 Type Non-Slender Delta Wing Planform

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Abstract : Delta wing planform is an essential aerodynamic configuration, which could be effectively used at relatively high angles of attack than conventional wings in subsonic flow conditions. The flow over delta wings can be characterized by a pair of leading edge vortices emanating from wing apex. Boundary layer separation causes these vortical structures formed by rolling up of viscous flow sheet. This flow separation mechanism is occurred due to angle of attack and sharp leading edges of the delta wing. Therefore, complexity and variety in planform designs rise to catch the best under abnormal flow conditions. The present experimental study investigates the near surface flow structure and aerodynamic flow characteristics of X-45 type non-slender delta wing planform using dye visualization, Stereoscopic Particle Image Velocimetry (stereo-PIV). The instantaneous images are acquired on the plan-view plane within 5o≤α≤20o to calculate the time-averaged flow data. It can be concluded that vortical flow with a pair of well-defined LEVs over X-45 develop at very low angles of attack, secondary vortex are also evident and form close to the wing surface similar to delta and lambda planforms. The stall occurs at an angle of attack α=32o.

Keywords : aerodynamic, delta wing, PIV, vortex breakdown
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