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Slender and Non-Slender Delta Wing Simulation and Analysis

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Abstract : Stability, controllability, and maneuverability are critical factors for aircraft with short take-off and landing distances, such as modern fighter aircraft and UAVs. Delta wings are commonly employed in these aircraft due to their efficient aerodynamics, enabling high maneuverability and performance at both low and high speeds. Non-slender wings are used for low-speed performance and agility, while slender wings offer reduced drag and are suited for high-speed operations. In flight, an aircraft encounters different airflow patterns, including vortices that circulate from the higher-pressure lower side of the wing to the lower-pressure upper side, contributing to lift generation. However, as the angle of attack increases, the vortices can become unstable and fluctuate, resulting in induced drag. Understanding this phenomenon is crucial for developing highly stable and maneuverable aircraft. This paper focuses on studying vortex breakdown in delta wings with varying sweep angles and at different angles of attack. It aims to validate experimental and numerical solutions from previous studies on the variation of vortex breakdown in both slender and non-slender delta wings using Computational Fluid Dynamics (CFD). By examining vortex breakdown characteristics in different wing configurations, the paper aims to contribute to the development of aircraft designs that prioritize stability and maneuverability.

Keywords : CFD, delta wings, non-slender slender wings, vortices, vortex breakdown
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