Aerodynamics Characteristics of Compound Delta Wing at Sea Level

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Abstract: Compound delta-wing aircraft are in the top tier for great maneuverability and satisfactory take-off and landing speeds and low distance as delta wing have a property of vortex generation at different speeds, during flight the property of vortex generated depends on factors like the coefficient of lift, coefficient of drag and shock wave impact absorption upon varying speed from subsonic speed and supersonic speed with changing attack angle is studied by flow visualization of the wing in Ansys Fluent using 'k-Ɛ 2nd equation model' to simulate mean flow characteristics for turbulent flow conditions. Vortex generation is studied for flow physics at Subsonic speed and Supersonic speed at sea level over Pressure and Density based respectively. The flow velocity at Subsonic is 260m/s and 686m/s for Supersonic. During the experiment, we observed that the vortex flow generation of observable output starts forming at 5° angle of attack following a powerful vortex at 10° leading to a shortfall powerful vortex at 15° for both subsonic and supersonic speeds but as velocity is more in the supersonic state the vortex is denser and more stable and provides better shock absorption while transitioning on higher attack angle and lift force is very sensitive for the supersonic state as drag is substantially increased with speed.

Nomenclature
C_L: *Coefficient of lift*
C_D: *Coefficient of drag*
α: *Angle of attack*
L: Lift force
D: Drag force

1.Introduction

Compound delta wing is mainly known for the unique ability to create vortex which can benefit the flight performance and stealth operational improvement for conventional and non-conventional aircraft. The vortex can be affected by drag and lift variation by a great deal. The problem associated with delta wing is that more wing area causes more drag increase rather than lift, better aspect ratio of L/D improvement has been the point of concern of most research teams. The other most important aspect of aeronautical engineering is to shorten the landing and take-off distance and speed, have more armament and cargo weight, and most important aerodynamics efficiency.

The flow in leading-edge delta wing is described as a movement in a spiral motion flow from the lower to the upper surface [1]. The wing causes flow separation that results in the pressure difference between the top and bottom of the wing [1].