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WAVERIDER DESIGN WITH LONGITUDINAL STABLE SELF-TRIM CHARACTERISTICS

Abstract

Waverider configurations have been attracting more and more attentions for hypersonic vehicle applications mostly due to their high lift-to-drag ratio characteristics. For hypersonic vehicles aerodynamic design, longitudinally self-trimmed at cruise angle of attack with static stable characteristics is preferable. However, the windward longitudinal profile of a waverider configuration created with traditional planar shock or conical shock methods is either a straight line or a positive camber curve. As a result, the waverider is longitudinally unstable when self-trimmed at the design angle of attack. In order to create a waverider configuration with negative cambered windward profile, a new waverider design method was developed based on shock-fitting numerical simulation technique. With this new method, the design space of a waverider is extended to general 3D flow field with shock wave. By choosing an appropriate Shock Generating Body configuration, a waverider configuration with negative cambered windward profile is created. CFD simulation results show that the waverider configuration designed with the new method is self-trimmed at the designed angle of attack and longitudinally stable.