NUMERICAL SIMULATION OF FLOW FIELD OVER A SHARP-TIPPED DOUBLE CONE AT HIGH SPEED

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Abstract

The flowfield over a sharp-tipped double cone axisymmetric configuration is carried out by solving time dependent axisymmetric laminar compressible Navier-Stokes equations for freestream Mach number range of 2.0 - 6.0. The fluid dynamics equations are discretized in spatial coordinates using integral formulation in conjunction with finite volume method which reduces the governing equations to semi-discretized ordinary differential equations. Temporal integration is performed employing multistage Runge-Kutta time-stepping scheme. A local time step is used to achieve steady-state solution. The numerical computation is carried out on a mono-block with structured grids. The flowfield features over the sharp-tipped double cone configuration such as conical shock wave, separation region, separation and reattachment shock wave and bow shock wave in the cone region, expansion fan, and recirculation flow in the base region are well captured at Mach number 3 and 6 which are identical to the Edney VI type shock interaction. The velocity vector, Mach contours plots and variations of surface pressure coefficient along the sharp-tipped double cone configuration are analyzed at various Mach numbers. The fore-body aerodynamic drag is calculated employing computed pressure distribution. The paper presents the influence of the freestream Mach number on the flows with shock interactions over the sharp-tipped double cone geometry.

***Key words**: CFD, Compressible flow, Gas dynamics, Laminar flow, Shock wave*

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