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Chemical and Vibrational Nonequilibrium Hypersonic Viscous Flow around an Axisymmetric Blunt Body

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Abstract : Hypersonic flows around spatial vehicles during their reentry phase in planetary atmospheres are characterized by intense aerothermodynamics phenomena. The aim of this work is to analyze high temperature flows around an axisymmetric blunt body taking into account chemical and vibrational non-equilibrium for air mixture species and the no slip condition at the wall. For this purpose, the Navier-Stokes equations system is resolved by the finite volume methodology to determine the flow parameters around the axisymmetric blunt body especially at the stagnation point and in the boundary layer along the wall of the blunt body. The code allows the capture of shock wave before a blunt body placed in hypersonic free stream. The numerical technique uses the Flux Vector Splitting method of Van Leer. CFL coefficient and mesh size level are selected to ensure the numerical convergence.

Keywords : hypersonic flow, viscous flow, chemical kinetic, dissociation, finite volumes, frozen and non-equilibrium flow
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