A quasi-onedimensional approach for hypersonic stagnation-point flows

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Abstract

An approximate method for the efficient calculation of stagnation streamline quantities in hypersonic flows about spheres or cylinders is suggested. Based on the local similarity of the flow field the two-dimensional Navier-Stokes equations are simplified to a one-dimensional approximation for the stagnation streamline. The dimensionally reduced equations are solved with an implicit finite-volume scheme. Comparisons with fully two–dimensional Euler and Navier–Stokes calculations for flows about spheres are presented, that include perfect gas flows and flows in chemical non-equilibrium. Comparisons with a number of experiments conclude this report.

Key Words: Non-equilibrium, Stagnation Streamline, Local Similarity, Navier-Stokes equations, Chemically reacting flows.

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