A comparative study of Navier-Stokes and Viscous Shock Layer Solutions for a wide range of Reynolds and Mach numbers

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Abstract

A parametric comparison of solutions of the full Navier-Stokes equations and the full viscous shock layer (FVSL) equations is presented. These equations are both widely used for modelling of steady supersonic viscous gas flows. The time dependent 2D Navier-Stokes equations are solved with a second order explicit shock-capturing ENO scheme with a finite volume approach. To solve 2D FVSL equations the method of global iterations with respect to the streamwise pressure gradient and the shock standoff distance is used. Computed results are compared for a broad range of Reynolds ($10^3 \leq Re_\infty \leq 10^5$) and Mach ($5 \leq M_\infty \leq 15$) numbers.

Key Words: Full Navier-Stokes Equations, Full Viscous Shock Layer Equations, Finite Volume Method, Method of Global Iterations

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