



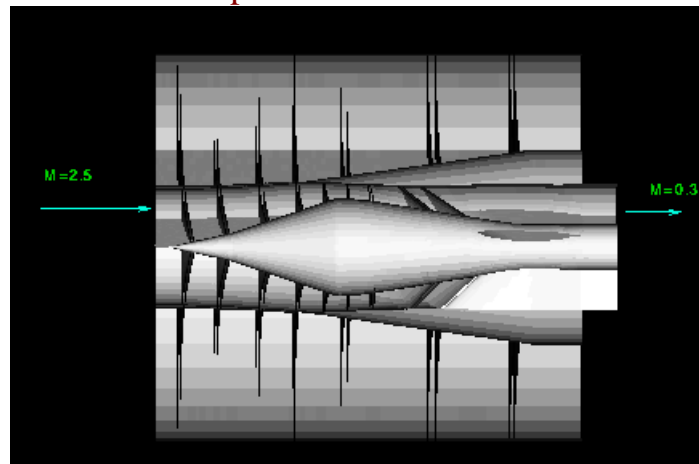
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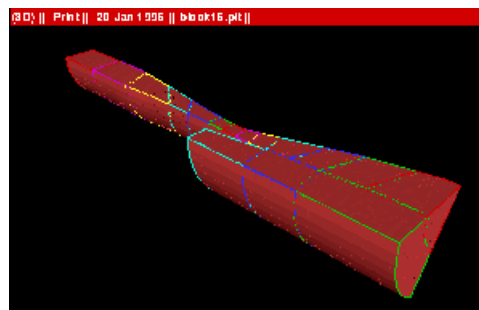
Supersonic Flow Through a Multi-Block 3D Inlet

Mixed-Compression VDC Inlet Half-Section

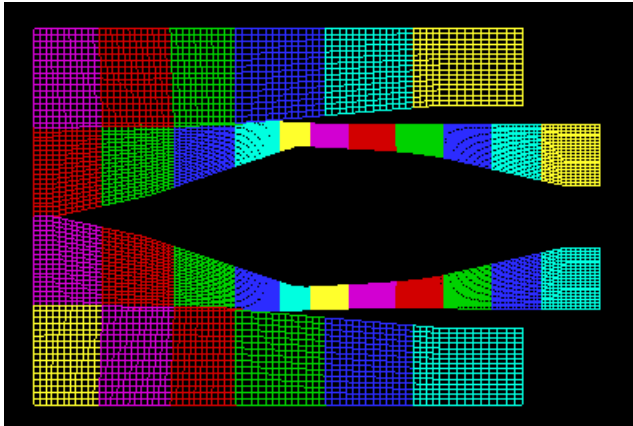


A mixed-compression inlet was supplied by NASA LeRC to investigate the efficiency of computation on parallel computers with various computation and communication schemes. A half-section of the three-dimensional inlet is shown, the cut being along the longitudinal direction. Also, a solid shaded model of a 60 degree sector of the same axisymmetric inlet is shown.

60 Degree Sector of the Axisymmetric VDC Inlet



Grid division into 17 Blocks for each Radial Section

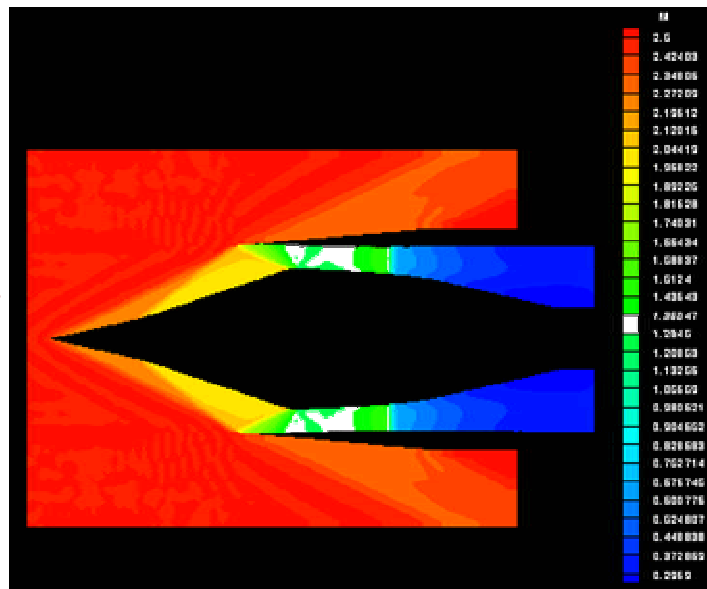


A steady-state solution of the Euler equations of compressible flow was sought for this inlet, and a two-dimensional section of the grid constructed is shown in the following nathfigure. The grid is divided into 17 blocks and rotated 360 degrees to form the complete three-dimensional grid. The inlet Mach number is 2.5 and the compressor face Mach number is 0.3. The static pressure at the inlet is 117.8 lb/ft/ft, and the static temperature is 395 Rankine.

The density contours are plotted for the above case, and it can be observed that a normal shock stands in the diverging section of the inlet. The steady-state solution for a pressure ratio of 14.77 requires a shock to be present in that location. The Mach number contours are also plotted in addition for the two-dimensional section considered.

Density Contours

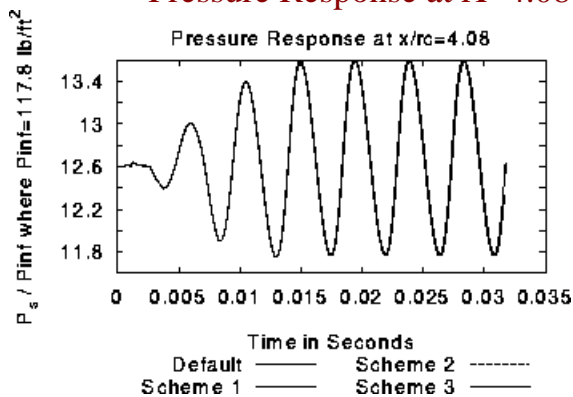
Mach Number Contours



Sinusoidal Inlet Temperature Perturbation

A sinusoidal temperature perturbation with a frequency of 225Hz and an amplitude of 5% of the mean value was applied at the inlet section and the pressure response was studied at two locations downstream of the shock in the diverging section of the inlet, at $x=4.08$ and $x=5.01$. Three different communication schemes were used with progressively greater efficiencies during parallel computation of this problem. The following curves show that with improved communication schemes higher parallel computing efficiencies can be achieved while maintaining time accuracy of the solution.

Pressure Response at X=4.08



Pressure Response at X=5.01

