Journal of Visualization, Vol. 6, No. 3 (2003) 212

Numerical Simulations of Unsteady Shock Waves around Complex Bodies

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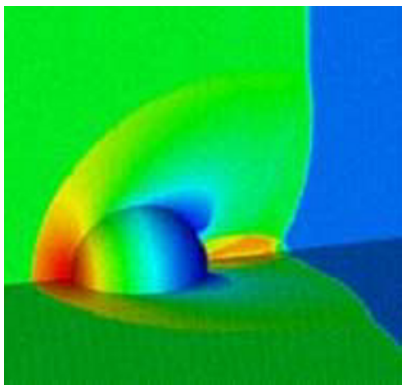

Fig. 1. Density contours around Sphere[1]

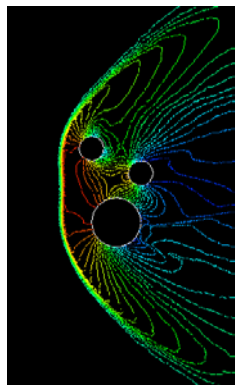

Fig. 2. Density contours around Randomly placed cylinders[2]

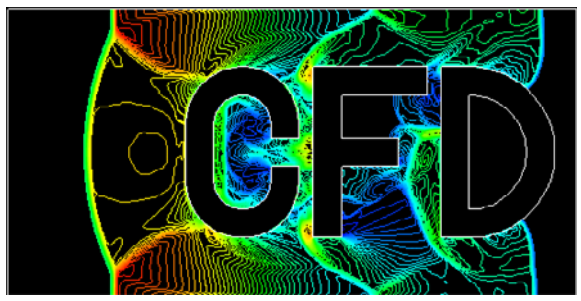

Fig. 3. Density contours around CFD shape[3]

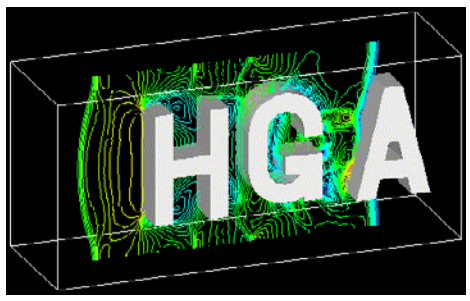

Fig. 4. Density contours around HGA shape

In recent numerical simulations, efficiency of grid generation and efficient use of limited computer resources are demanded. Various solution-algorithms have been proposed. Numerical results of unsteady shock waves in our Laboratory are presented in this paper. Fig. 1 shows density contours around sphere using MPP (Massive Parallel Processors) (M=2.81). Fig. 2 shows density contours of MHD Shock Waves around randomly placed cylinders using AMR (Adaptive Mesh Refinement) Method, which obtains higher resolutions with minimum requirement computer memory by collecting fine grids only in the location where the change of the physical quantity is intense, with Triangular Grid (M=3.00). Fig. 3 shows density contours around CFD shape (M=2.81). Fig.4 shows density contours around HGA shape (M=2.00). Fig. 3 and Fig. 4 are calculated using HGA (Hybrid Grid Adaptation) Method included AMR Method based on Hybrid Grids. In numerical simulation, fully Triangular or Quadrilateral (2D), Tetrahedron or Hexahedron (3D) is usually used. Triangular and Tetrahedron have advantage of shape flexibility. Quadrilateral and Hexahedron can analyze flow problem efficiently. Prism and Pyramid are used as transition grids, too. Therefore, using Hybrid Grids constructed by these cells makes it possible to take a good advantage of both shape flexibility and computational efficiency, and HGA Method takes advantage more both shape flexibility and computational efficiency.

[1] S.Kanou, Graduation thesis, Keio Univ. 1998.
[2] Y.Hara, M.S. thesis, Keio Univ. 2002.
[3] S.Yoshida, M.S. thesis, Keio Univ. 2000.