Asociación Argentina de Mecánica Computacional

Mecánica Computacional Vol XXVIII, págs. 3007-3007 (resumen)
Cristian García Bauza, Pablo Lotito, Lisandro Parente, Marcelo Vénere (Eds.)
Tandil, Argentina, 3-6 Noviembre 2009

FINITE VOLUME SIMULATION OF GASDYNAMICS AND MAGNATOGASDYNAMICS EQUATIONS FOR AEROSPACE AND ASTROPHYSIC APPLICATIONS

Sergio Elaskar

Departamento de Aeronáutica, Universidad Nacional de Córdoba and CONICET, Av. Vélez Sarfield 1611, Córdoba, Argentina, selaskar@efn.uncor.edu

Keywords: Finite volume, Magnetogasdynamics, Gas dynamics, minimod, superbee

Abstract. Two research lines in computational mechanics have been developed. One, to study flows in which an electrically conducting gas moves in a magnetic field and the other one to solve Euler equations. The first code solves 1D and 2D, time-dependent, viscous and resistive magnetogasdynamics flows and 3D time-dependent, ideal magnetogasdynamics flows. Its numerical approach is based on a finite volume discretization technique and to compute the numerical fluxes across cells interfaces, an approximate Riemann solver coupled with the Total Variation Diminishing (TVD) scheme proposed by Harten and Yee is utilized. The eigensystem technique and the eigenvectors normalization have also been implemented. To verify its accuracy, the code has been applied to the simulations of a magnetogasdynamics Riemann problem and of the Hartmann flow. The results obtained show good agreement with those reported by other authors. At the present this code is applied to simulate the internal plasma dynamics of post-flare loops and the dark inflow in post-flare-supra-arcade. In the second code, a TVD scheme has been implemented on a non structured 3D finite volume formulation for solving the Euler equations. To simultaneously, achieve adequate accuracy in smooth flows, high resolution at flow discontinuities and to avoid spurious oscillations, different flux limiter functions are applied in a wave-to-wave basis. In this paper are analyzed the numerical viscosity reduction resulting after using compressive limiter functions in waves from the families two to four, and the ability of diffusive limiter functions for the family waves one and five to capture pressure discontinuities whereas preserving the robustness of the TVD scheme. This sort of adaptive scheme has satisfactorily been applied to the slip interface between two parallel flows, and to supersonic flows over and airfoil, a wedge and a blunted bi-conic body. This code is implemented to simulate the atmospheric re-entry.