11th World Congress on Computational Mechanics (WCCM XI)
5th European Conference on Computational Mechanics (ECCM V)
6th European Conference on Computational Fluid Dynamics (ECFD VI)
July 20–25, 2014, Barcelona, Spain

A 3D SYMMETRIC CELL-CENTERED LAGRANGIAN SCHEME BASED ON A MULTI-DIMENSIONAL MINMOD LIMITER

GABRIEL GEORGES[1,*], JEROME BREIL[1] and PIERRE-HENRI MAIRE[2].

[1] UMR CELIA, Université Bordeaux 1, 351 Cours de la Libération, 33405 Talence, France, georges@celia.u-bordeaux1.fr

[2] CEA/CESTA, 15 Avenue des Sablières CS 60001, 33116 Le Barp cedex, France

Key words: *Lagrangian hydrodynamics, cell-centered, multi-dimensional, second-order, slope limiter.*

The gas dynamic equations under the Lagrangian formalism are well adapted to the simulation of multi-material compressible fluid flows such as those encountered in the domain of Inertial Confinement Fusion (ICF). Different cell-centered finite volume schemes have been developed for solving these equations [1, 2]. In these schemes, the node velocity is computed by imposing a momentum balance conservation condition around each node. The multi-dimensional scheme presented here is a symmetric version of [3] for unstructured meshes. Both momentum and total energy are globally conserved. The second order extension is based on a piecewise linear reconstruction of the pressure and velocity fields obtained via a least squares procedure. A new slope limiter based on a multi-dimensional extension of the minmod method is developed to ensure the monotonicity. Several academic test cases are studied in order to prove the robustness and accuracy of the scheme.

REFERENCES

[1] P.-H. Maire, R. Abgrall, J. Breil and J. Ovadia. A cell-centered Lagrangian scheme for two-dimensional compressible flows problems. *SIAM Journal on Scientific Computing*, 29 (2007), 1781-1824.

[2] B. Després, C. Mazeran. Lagrangian gas dynamics in 2D and Lagrangian systems. *Arch. Rat. Mech. Anal.*, 178 (2005), 327-372.

[3] P.-H. Maire, B. Nkonga. Multi-scale Godunov-type method for cell-centered discrete Lagrangian hydrodynamics. *Journal of Computational Physics*, 228 (2009), 799-821.