A Level-Set Particle Method with Remeshing for Multifluids Simulations

Lisl Weynans[1], Georges-Henri Cottet[2], Bernard Rebourcet[3]
[1] *Laboratoire Jacques-Louis Lions, UMPC, 175, rue du Chevaleret, 75013 Paris, France*
[2] *Laboratoire Jean Kuntzmann, Tour IRMA, BP 53, 38041 Grenoble Cedex 9*
[3] *CEA/DAM, BP 12, 91680 Bruyeres-le-Chatel*

We present a particle-grid method applied to the system of compressible Euler equations. The fluid is divided into particles, that is, masses concentrated on points. These particles carry the conservative quantities of the fluid: mass, momentum and total energy, and move in a lagrangian way, at the velocity of the fluid.

At the beginning of each time step, particles are located at the centers of the cells of a underlying grid. Euler equations are solved on this grid, and particles locations evolved according to the local velocity. In order to preserve their uniform distribution, particles are then "remeshed" on the grid by a conservative interpolation process, using high-order interpolation kernels, which represents the key element of this method.

A level-set-like technique is then adapted to the particle method: the level-set function ϕ is discretized on the particles, advected and remeshed in the same way as the other variables. We present numerical results obtained with this method for several hydrodynamic instabilities: Kelvin-Helmholtz instability, shock-bubble interaction, and Richtmeyer-Meshkov instability. A multilevel technique applied to the variable ϕ allow us to improve the interface resolution and the conservation of partial masses for a small additional cost.