COUPLING OF SMOOTHED PARTICLES HYDRODYNAMICS AND FINITE VOLUME METHODS

A. N. Nimakov, G. D. Rublev, S. A. Dyachkov

FSUE “Dukhov Automatics Research Institute” (VNIIA), Moscow, Russia

To expand the range of problems that can be solved, it is proposed to use an algorithm that combines the finite volume method (FVM) and smoothed particle hydrodynamics (SPH) [1], which allows for simultaneous calculations using a suitable method for each spatial domain. For the FVM method, a Riemann solver [2] is used, taking into account the velocity of the contact discontinuity, as well as for SPH. The time step is chosen based on the Courant criterion for each method, and integration is performed with a common minimum time step. Near the interface boundary, virtual cells and particles are created, for which data is recalculated from real particles and cells, respectively. To ensure a smoother and more accurate transition of material from the cell region to the particle region, as well as to preserve the continuity of the SPH medium, an algorithm was developed for generating virtual particles that works together with the Particle Shifting Technique (PST) [3] and the free-surface detection method [4]. This comprehensive algorithm performs particle generation and subsequent shifting, allowing for uniform distribution of particles throughout the problem domain and ensuring continuity of the density field.

The results of applying the coupling algorithm are demonstrated on a series of test examples, showing sufficient accuracy in preserving mass, momentum, and energy flux when transitioning material through the interface region.

References

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