Special Program in Applied Mathematics and Applied Mechanics

Computation of interfacial flow problems with the mixed interface-capturing/tracking technique

2015 - 03 - 25 (Wed.)
15:00 - 18:00
308, Mathematics Research Center Building (ori. New Math. Bldg.)

Interfacial flows are ubiquitous in natural environment and industrial processes, such as droplets, castings, polymer blending, water waves, ink-jet printers, and so on. In computations, many algorithms have been devised to track the interface with a formulation varying from algebraic to geometric system. Volume tracking methods are the most popular, because of their established conservation, robustness, and versatility properties, with the achievable property of local volume conservation being particularly valued. More advanced volume of fluid methods have not been extended from 2D to 3D study, because the increase in complexity of the geometry primitives involved has made implementations excessively difficult and ultimately infeasible. In this study, we propose a mixed interface capturing/tracking technique to capture the topology changes at the interfaces of interfacial flows in multidimensional spaces. A computationally efficient and second-order accurate interface reconstruction method is applied. The sequence of the Lagrangian advection in each direction is considered to restrain the fragmentation or the filament occurs as the fluids propagate. The mass conservation is numerically assessed, thus allowing computations to reach the machine precision. A series of numerical experiments have been conducted to verify the robustness of the proposed model for tracking distorted and broken interface.


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