A simple diffuse interface approach for compressible flows around moving solids of arbitrary shape

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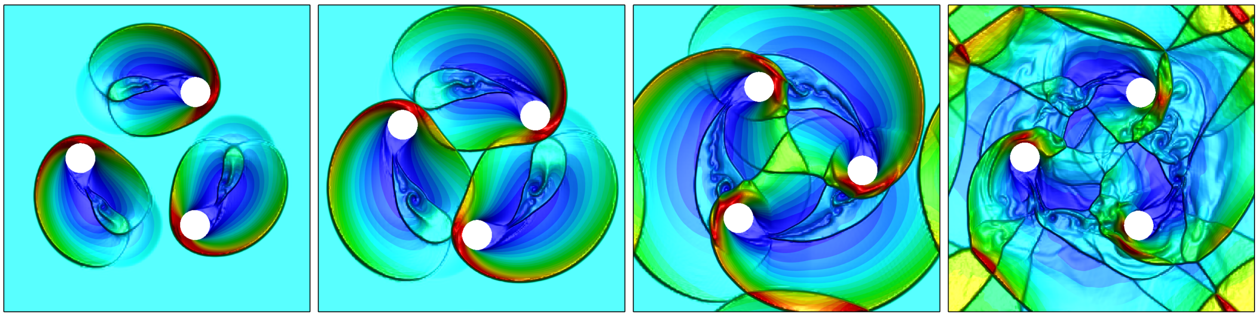
In this talk we propose a new diffuse interface model for the numerical simulation of *inviscid* compressible flows around fixed and moving solid bodies of arbitrary shape assumed to be moving rigid bodies, without any elastic properties [1].
The mathematical model is a nonlinear system of hyperbolic conservation laws with non-conservative products, obtained as a simplified case of the seven-equation Baer-Nunziato model of compressible multi-phase flows [2, 3]. In particular, the geometry of the solid bodies is simply specified via a scalar field that represents the volume fraction of the fluid present in each control volume which allows the discretization of arbitrarily complex geometries on simple uniform or adaptive Cartesian meshes. Inside the solid bodies, the fluid volume fraction is zero, while it is unitary inside the fluid phase. Due to the diffuse interface nature of the model, the volume fraction function can assume any value between zero and one in mixed cells that are occupied by both, fluid and solid. Moreover it is also possible to proof that at the material interface the normal component of the fluid velocity assumes the value of the normal component of the solid velocity.
The numerical solution is computed on simple uniform Cartesian grids via a high order path-conservative ADER discontinuous Galerkin (DG) finite element method with *a posteriori* sub-cell finite volume (FV) limiter and the effectiveness of the proposed approach is tested on a set of different numerical test problems, including 1D Riemann problems as well as supersonic flows over fixed and moving rigid bodies.



Références

[1] F. Kemm, E. Gaburro, F. Thein, M. Dumbser. A simple diffuse interface approach for compressible flows around moving solids of arbitrary shape based on a reduced Baer-Nunziato model. *Computer and Fluids* (2020).

[2] E. Gaburro, M. Castro, M. Dumbser. A well balanced diffuse interface method for complex nonhydrostatic free-surface flows. *Computers and Fluids* (2018).

[3] M. Dumbser. A simple two-phase method for the simulation of complex free surface flows. *Computer Methods in Applied Mechanics and Engineering* (2011).

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