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High Order direct ALE methods for multi-phase flows

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In this paper we present a family of direct Arbitrary-Lagrangian-Eulerian (ALE) schemes for the solution of the Baer-Nunziato model of compressible multi-phase flows. The schemes belong both to finite volume (FV) [1] and Discontinuous Galerkin (DG) [2] framework and are of high order of accuracy in space and time. A WENO reconstruction operator provides the arbitrary order of accuracy in space, while we rely on a fully-discrete ADER one-step discretization for obtaining high order of accuracy even in time.

The ALE algorithm presented in this article belongs to the so-called *direct* ALE methods because the final mesh moving numerical scheme is based directly on a space-time conservation formulation of the governing PDE system, with the geometry at the new time level t^{n+1} taken already into account during the computation of the fluxes.

The algorithm applies to *moving* multidimensional unstructured meshes composed by triangles and tetrahedra. Both accuracy and robustness of the scheme are assessed on a series of test problems, including smooth flows as well as shock or contact discontinuities in the main fluid motion.

The work will focus on the development of a new numerical flux of the FORCE type in the context of finite volume schemes, while we present a novel *a posteriori* sub-cell finite volume limiter which is suitable for the solution of general nonconservative systems of PDEs, such the Baer-Nunziato model.

REFERENCES

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