A new surface tension algorithm for compressible multimaterial flows

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We derive a new algorithm for the discretization of surface tension forces for compressible multimaterial flows in the framework of the FVCF-ENIP method.

The FVCF-ENIP method (Finite Volume with Characteristic Fluxes - Enhanced Natural Interface Positioning), [1, 2], is a hybrid Eulerian/Lagrangian finite volume method that has been designed for simulating non-miscible multimaterial flows. Pure parts of the computational domain, that is parts where only one fluid is present, are treated with a classical upwind finite volume scheme with co-located variables, namely the FVCF scheme [3]. On the contrary, near the material interfaces, intermediate structures are constructed that condensate mixed cells together. These structures, called *condensates*, allow the writing of a conservative lagrangian scheme over mono-material control volumes evolving in time. Time evolution in these controle volumes is obtained by adding ingoing and outgoing fluxes and therefore allows to take precisely into account interface velocities and pressures which are necessary for several physical models.

In this context, surface tension forces are taken into account as source terms. An upwind consistent discretization is given that ensures sufficient robustness with respect to well known instabilities, the so-called "spurious currents". Several numerical simulations show the good behavior of our algorithm; in particular the simple, but discriminating, Laplace equilibrium test case.

References

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