

# Numerical simulation of weakly compressible multi-material flows

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In this talk, we propose an implicit relaxation scheme for the simulation of weakly compressible multi-material flows. We adopt a monolithic Eulerian model describing gases, fluids and elastic solids with the same system of conservation laws. The chosen state law is highly non-linear and describes the different physical behaviours of each material, including a neohookean hyperelastic materials [1].

The mono-material numerical scheme is based on the relaxation technique introduced by Jin and Xin in [2]. With this method, the fluxes are relaxed at the continuous level, obtaining a linear transport operator. Thanks to this, the use of Riemann solvers is not necessary and fully implicit time integrators are easily implemented. This allows to get rid of demanding acoustic CFL constraints when the low Mach limit approaches. The spatial discretization is obtained by a combination of upwind and centered schemes, in order to recover the correct numerical viscosity at low Mach number but also in the compressible regime [3].

We employ the same relaxation scheme inside every material. In order to solve also multi-material flows, a model to describe the interaction of two non-miscible compressible materials that are separated by an interface is introduced. In the proposed numerical model, the interface is tracked by a level set function and the equilibrium interface conditions are imposed via extrapolations. Therefore, the evolution of the material discontinuity is sharp by construction. We present numerical illustrations of the evolution of fluid/fluid, solid/fluid and solid/solid interfaces in the low Mach regime.

## References

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