Two-fluid compressible flows with Automatic Mesh Refinement

Study of two-fluid flows is challenging due to complex topology of the moving interface and wide range of scales involved. Automatic Mesh Refinement (AMR) is a numerical strategy allowing to tackle this problem and has already proven its efficiency (in both single and two-fluid flows).

While representation of the interface in two-fluid flows in Eulerian Finite Volume framework is still an open challenge, the Sharp interface method (SIM [1]) is employed for this study for its accuracy of position, its easy numerical conception and its ability to be consistent with interface effects as surface tension or phase change.

Flows of interest for this study are characterized by incompressibility or vicinity of incompressibility (so called low-Mach regime). One approach to address these specific compressibility effects while avoiding numerical diffusion is to consider full-compressible system and to take care of the numerical design. This path is successfully explored with the all-regime Lagrange-projection numerical scheme coupled with Level-Set method [2] developed in previous PhD thesis.

To apply this new method to other engineering fields in which interface experiences different physical effects, future PhD candidate will focus developments on the extension to heat and mass transfer modelling along with adequate numerical schemes. Coupling with AMR will allow to accurately describe interface at very fine resolution to correctly capture these heat transfer and phase change while keeping performance and flexibility.

Keywords
Physics, Fluid Mechanics, Numerical simulation, CFD, Multi-Fluids, Sharp Interface, Compressible, AMR, Mesh Refinement, Development, Programming, Parallel computation, HPC, Falling films

Requirements
- Training with solid background in numerical methods for fluid mechanics.
- Skills in scientific languages (Fortran, C, C++) required.
- Skills in parallel programming (MPI) are valued.

Supervisory staff
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