Computation of compressible two-fluid flows with phase-field models

TECHNISCHE UNIVERSITÄT DARMSTADT

Thesis project in Computational Engineering, Applied Mathematics or Civil engineering
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Scope of Work

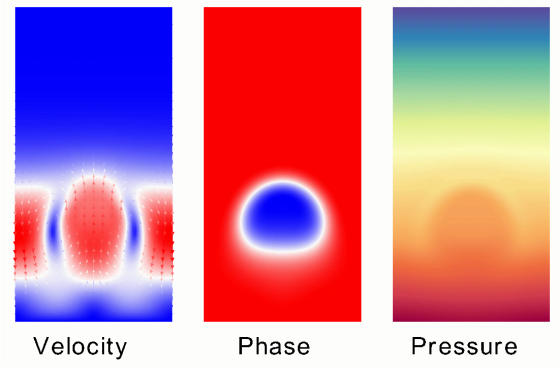
Compressible two-fluid flow phenomena arise in many industrial applications and natural features. Examples are water–air flows, shock–bubble interaction, water hammer phenomena, surface wave impacts, and the transportation of liquefied natural gas. The study of two-fluid flows is a challenging research area in which modeling and numerical simulation play a key role. There exists a wide range of models that can be adopted for the description of compressible two-phase flows. Of particular interest is the class of phase-field models in which a scalar phase-field quantity is employed for the description of the interface. In this project we will utilize a Navier-Stokes Cahn-Hilliard (NSCH) phase-field model for the numerical simulation of compressible two-fluid flow.

Tasks

The main focus of this project lies in the design, implementation and testing of a numerical method for the compressible NSCH model. Within this scope there are several possible roads to take; ranging low Mach number flows (incompressible limit) and energy-stable methods to more practical cases such as mixing problems. We will use the finite element method as the discretization methodology and adopt the open-source FEniCS computing platform for the simulations. The implementation of new methods in FEniCS is easy and parallel computations may directly be performed.

Prerequisites

The project is centered around the computation of two-fluid flow and as such knowledge on the following topics is very useful: continuum (fluid) mechanics, computational fluid dynamics and finite element methods.



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