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A projection scheme for the Navier–Stokes/Allan–Cahn model

Projection methods are known for their efficicency for Newtonian fluids. However their use in the context of variable density or viscosity is problematic (but not impossible). We propose in this work a time-discrete formulation of the coupled Navier–Stokes/Allen–Cahn equations based on a projection method. The scheme is based on two ingredients: a projection method for heterogeneous fluid and the concept of coupled projection scheme.

We first establish the well posedness and stability of the time-discrete formulation. Next we propose an iterative schemes for the actual approximation of solutions.In the last part of our presentation, using finite element for spatial discretization, we estimate the order of accuracy in time and illustrate the validity of the scheme through numerical results.