Numerical Analysis of Second Order, Fully Discrete Energy Stable Schemes for Phase Field Models of Two-Phase Incompressible Flows

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Abstract

In this paper, we propose several second order in time, fully discrete, linear and nonlinear numerical schemes for solving the phase field model of two-phase incompressible flows, in the framework of finite element method. The schemes are based on the second order Crank-Nicolson method for time discretization, projection method for Navier-Stokes equations, as well as several implicit-explicit treatments for phase field equations. The energy stability and unique solvability of the proposed schemes are proved. Ample numerical experiments are performed to validate the accuracy and efficiency of the proposed schemes.

Keywords

Author Keywords: Phase field; Navier-Stokes; Stability; Finite element method

KeyWords Plus: NAVIER-STOKES EQUATIONS; CONVEX SPLITTING SCHEMES; CAHN-HILLIARD EQUATIONS; FOURIER-SPECTRAL METHOD; TIME-STEPPING SCHEME; THIN-FILM EPITAXY; PROJECTION METHODS; FINITE-DIFFERENCE; NONUNIFORM SYSTEM; CRYSTAL EQUATION

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