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Simulation of two-phase flow by diffuse interface methods

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Diffuse interface methods are popular methods for modeling two-phase flow at the pore scale. These methods are based on the minimization of Helmholtz free energy of the fluid system and approximate the interface between the phases by a transition region of finite thickness. The mathematical model is a coupled system of time-dependent Cahn-Hilliard and Navier-Stokes equations. Contact angle is imposed on each rock-fluid interface via a boundary condition. We discretize the differential operators in spce by the interior penalty discontinuous Galerkin methods. For the Cahn-Hilliar equations, we use a convex-concave splitting of the chemical energy density. For the Navier-Stokes equations, we employ a pressure-correction projection algorithm. We validate the method on a series of benchmark problems.

References

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