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High-performance Integrated numerical methods for Two-phase Flow in Heterogeneous Porous Media CHIH-CHE CHUEH, University of Victoria, NED DJILALI, WOLFGANG BANGERTH, Texas A&M University — Modelling of two-phase flow in heterogeneous porous media has been playing a decisive role in a variety of areas. However, how to efficiently and accurately solve the governing equation in the flow in porous media remains a challenge. In order to ensure the accurate representative flow field and simultaneously increase the computational efficiency, we incorporate a number of state-of-the-art techniques into a numerical framework on which more complicated models in the field of multi-phase flow in porous media will be based. Such a numerical framework consists of a h-adaptive refinement method, an entropy-based artificial diffusive term, a new adaptive operator splitting method and efficient preconditioners. In particular, it is emphasized that we propose a new efficient adaptive operator splitting to avoid solving a time-consuming pressure-velocity part every saturation time step and, most importantly, we also provide a theoretically numerical analysis as well as proof. A few benchmarks will be demonstrated in the presentation.

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