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A parallel pore-scale multiphase flow tool using the lattice Boltzmann method SAHAR BAKHSHIAN, SEYYED ABOLFAZL HOSSEINI, University of Texas at Austin — The main focus of our study is to mimic multiphase flow in realistic three-dimensional rock models that enables us to gain a better insight into the effect of pore-scale phenomena on real reservoir problems. We developed a fluid flow simulator using a D3Q19 multiphase multi-relation-time (MRT) lattice Boltzmann (LB) model. The present LB model is an extended Color-Gradient approach with improved numerical stability and can handle multiphase flow simulations with low capillary number and high viscosity ratio. To improve the computational efficiency of the LB simulations to a reasonable level for industrial applications, the model has been applied to a parallel scheme written in C++ using the Message Passing Interface (MPI). We herein introduce the capability of our tool for multiphase flow simulation in porous media and present its application to CO_2 sequestration in geological formations. The model has been applied to the simulation of CO_2 and brine in sandstone rocks, by employing three-dimensional micro-CT images of rock samples. Injection of supercritical CO_2 into the brine-saturated rock sample is simulated and complex displacement patterns under various reservoir conditions are identified.

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