Application of innovative entropic lattice Boltzmann method for multiphase fluid flow through porous media

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ABSTRACT

In this work, using the recently introduced constant speed kinetic model (CSKM) with the unconventional entropies of Burg and Tsallis and employing the Pseudo-Potential model of Shan and Chen (SC), two phase flow of the incompressible and immiscible fluids through porous media is studied. It is known that for the conventional lattice Boltzmann model (LBM) with polynomial equilibrium distribution function (EDF) an H-theorem does not exist. Hence, the thermodynamic consistency of the conventional LBM, under all flow conditions (e.g. for the multiphase flows with high density ratio) cannot be guaranteed and numerical instabilities can occur. In this work, the accuracy and stability of the CSKM and conventional LBM are compared, by simulating the phase separation, Laplace law, and contact angles. Next, two phase flow in simple channel and through porous media are simulated and the relative permeability versus wettability are reported. The present results are in excellent agreement with previous works of others.

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