Effect of image resolution on LBM simulation results of porous media

Ali Takbiri, Mayank Tyagi
Department of Petroleum Engineering, Louisiana State University, Baton Rouge

With recent advances in micro-imaging technology, advances in High Performance Computing (HPC) platforms, and the simple representation of complex porous media geometries, Lattice Boltzmann method (LBM) has been shown to be one of the most efficient tools for solving fluid flow and transport problems in porous media. LBM simulation results of real porous media images (image-based simulations), however, are dependent on the resolution of the computational domain. It is shown in this article that LBM simulations of cases with different numerical resolutions of a random sphere pack result different permeability values. In one hand, these differences are resulted from change in the topology of the pore space; lower resolution resulted in narrower and shorter flow pathways. On the other hand, they might be attributed to the limit of our numerical simulator in handling low-resolution geometries. Two-point correlation functions and probability distribution functions of different cases are used to show differences.