Abstract Submitted
for the DFD15 Meeting of
The American Physical Society

Evaluation of the unstructured lattice Boltzmann method in porous flow simulations[1] MAREK MISZTAL, RASTIN MATIN, ANIER HERNANDEZ, JOACHIM MATHIESEN, Niels Bohr Inst — Flows in porous media are among the most challenging to simulate using the computational fluid dynamics methods, primarily due to the complex boundaries, often characterized by a very broad distribution of pore sizes. The standard (regular grid based) lattice Boltzmann method with the multi-relaxation time (MRT) collision operator is often used to simulate such flows. However, due to the lack of coupling between the positions of the computational grid nodes and the solid boundaries, the properties of the simulated flow might unnaturally vary with the fluid's viscosity, depending on the parameters of the MRT operator. This is, for instance, the case with the otherwise popular, single-relaxation time Bhatnagar–Gross–Krook (BGK) collision operator. Our focus has been on the unstructured grid based, finite element variant of the LBM. By using such approach, we can place the computational grid nodes precisely at the solid boundary. Since there is no prior work on the accuracy of this method in simulating porous flows, we perform a thorough permeability study using both BGK and MRT operators at a wide range of viscosities. We benchmark these models on artificial samples with known solutions, and further, we demonstrate the findings of our studies in the porous networks of real rocks.

[1]Predicting Petrophysical Parameters: A Project Sponsored by HTF and Maersk Oil and Gas

Marek Misztal
Niels Bohr Inst

Date submitted: 31 Jul 2015 Electronic form version 1.4