Abstract Submitted
for the DFD06 Meeting of
The American Physical Society

Analysis of the effective viscosity in a lattice-Boltzmann model for flow in porous media XIAOBO NIE, Materials and Construction Research Division, National Institute of Standards and Technology. Dept. of Phys. and Astro., The Johns Hopkins University, NICOS MARTYS, EDWARD GARBOCZI, Materials and Construction Research Division, National Institute of Standards and Technology — The lattice-Boltzmann method has been applied to study fluid flow in porous media. In the lattice-Boltzamnn modeling the macroscopic governing equations as well as the viscosity and the permeability are usually determined using a Chapman-Enskog expansion approach. However, this approach has been validated numerically only for a narrow range of the viscosity and the permeability. We have analytically derived the exact macroscopic governing equations of the lattice-Boltzmann model for the case of simple shear flows in porous media. We find that the effective viscosity in the governing equations is different from the one obtained from the Chapman-Enskog expansion. These findings have been validated numerically. We also find the surprising result that the effective viscosity is anisotropic. Possible improvements and applications of the model will be discussed.

Xiaobo Nie
National Institute of Standards and Technology & The Johns Hopkins University

Date submitted: 01 Aug 2006 Electronic form version 1.4