

عنوان مقاله:

Investigation of pore-scale random porous media using lattice boltzmann method

محل انتشار:

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خلاصه مقاله:

The permeability and tortuosity of pore-scale two and three-dimensional random porous media were calculated using the Lattice Boltzmann method (LBM). Effects of geometrical parameters of medium on permeability and tortuosity were investigated as well. Two major models of random porous media were reconstructed by computerized tomography method: Randomly distributed rectangular obstacles in a unit-cell as two-dimensional porous media, and random granular media in a cubic unit-cell as three-dimensional porous media. Results were validated using available theoretical, experimental, and numerical results from the literature. It is observed that permeability is a weak function of porosity in low porosity regions, but a strong function of porosity at high porosities. It also depends on the aspect ratio and hydraulic diameter of obstacles. Permeability results were obtained regarding to ۷۳ random two-dimensional samples with different porosities and obstacle aspect ratios. Also ۲۹ random sphere-packings including three different cases with three different sphere diameters were investigated as three-dimensional cases. Employing nonlinear regression based on the "least-squares" method, two permeability correlations were proposed with minimum curve-fitting errors. Besides, the effect of porosity on required time-steps to reach the converged solutions was investigated. It is concluded that an increase in the required time-steps to convergence is seen with reaching both high and low ends of porosity. © ۲۰۱۵ Published by Semnan University Press. All rights reserved

کلمات کلیدی:

Lattice Boltzmann, pore-scale simulation, Creeping flow, Random porous media

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