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Application of multiple-point statistics to reconstructing digital rock

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Building a three-dimensional (3D) porous medium is the basis of carrying out the numerical simulation of the fluid flow. To date, many techniques of constructing porous media have been proposed by scholars. Among them, the multiple-point statistics (MPS) method has a unique merit of reconstructing 3D digital rock because it can reproduce long-range connectivity of pore space. The Single Normal Equation Simulation (SNESIM) is one of the most commonly used algorithms of MPS. In the SNESIM algorithm, the selection of training image is critical because it contains the basic heterogeneous pore structure patterns. In this paper, a 3D training image is used in order to supply the more real heterogeneity of pore structures. On the other hand, the multi-grid search template is applied for the purpose of capturing the pore structures of different scales and speeding up the reconstruction process. Taking Berea sandstone as a test example, the 3D porous media were reconstructed. The two-point correlation function, pore network structure parameters, absolute permeability, flow velocity and the pressure fields are applied as the evaluation indexes to validate the accuracy of the reconstructed models. The comparison result shows that reconstructed models are good agreement with the real model obtained by X-ray computed tomography scanning in the pore throat geometry and topology and transport properties.

References

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Primary author: WU, Yuqi

Co-authors: Prof. LIN, Chengyan; REN, Lihua; JAWAD MUNAWAR, Muhammad; WANG, Yang; ZHANG, Yimin

Presenter: WU, Yuqi

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