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A reconstruction method for 3D porous media based on a 3D training image using multiple-point statistics and multiple-grid templates

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At present, many methods of porous media modeling have been proposed. Among them, the multiple-point statistics (MPS) method has a unique advantage in reconstructing 3D digital rock in that it can characterize long-range connectivity of pore space. The Single Normal Equation Simulation (SNESIM) is one of most commonly used algorithms of MPS. In the SNESIM algorithm, the selection of training image is critical because it contains the basic pore structure patterns. In the previous reconstruction of 3D porous media using SNESIM, a 2D slice was usually employed as the training image. However, it is difficult for a 2D slice to contain complex 3D pore space geometry and topology patterns. In this paper, a 3D training image are used in order to supply the more real heterogeneity of pore space. 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. The Berea sandstone is taken as the test example, 3D porous media of Berea sandstone 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 test 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 property, which validates the reliability of the proposed method.

References

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