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A digital core reconstruction method based on discrete element method considering the actual shape of rock particles

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Abstract
Digital core reconstruction is essential for the numerical simulation of reservoir fluid microscopic flow. However, the existing reconstruction methods, including physical experiments and numerical simulation, cannot construct the digital core reflecting the effect of in-situ stresses. The discrete element method (DEM) is considered reliable in solving this problem. However, in the existing studies on digital core construction based on DEM, commonly used disk or spherical particles, the pore shape of reconstructed digital cores cannot reflect the pore shape of natural rock. Therefore, a digital core reconstruction method based on DEM considering the actual shape of particles is proposed in this paper. Firstly, the Gaussian filter was used to preprocess the CT scan images obtained from the ground condition scanning, the improved watershed algorithm was used to segment the rock particles and porous, and the level set method was used to identify the contour of the particles. Then, clumps composed of multiple particles are used in PFC2D to fill the actual particle contour and construct the clump template library. Finally, according to rocks'particle size distribution and porosity, particles are randomly selected from the established clump template library to accumulate and reconstruct the digital core. The proposed method is used to reconstruct the digital cores of three types of sandstones. The results show that the reconstructed digital cores can keep the properties of the actual rock cores well. This study will provide a reference for reconstructing digital cores in deep (or stress-sensitive) reservoirs.
Keywords: digital core reconstruction; discrete element method; image processing; watershed method; level set method.

Participation

In-Person

References

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