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Numerical Study on the Influence of Natural Fracture Size on Heat Transfer Process in Hot Dry Rock

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Geothermal is a kind of unconventional energy with abundant reserves. It owns the advantages of low carbon emissions, climate-free, widely distributed, and enormous mining potential. At present, the research on the development of hot dry rock (HDR) are mainly studied from the perspective of the macroscopic scale. However, due to the existence of natural fractures of different scales in real rocks, these studies find it is a great challenge to obtain the seepage and heat transfer laws of the heat transfer medium in the fracture. For this reason, the rock porosity porous media model with different porosities is constructed by QSGS method in this paper, and the numerical simulation is carried out with the Lattice Boltzmann Method. To verify whether the construction method of porous media has effect on the calculation results, several porous media structures method are adopted for comparison. According to the mesoscopic simulation results, the seepage heat transfer laws of three kinds of fractures with different sizes are found to be quite different. For further study the influence of seepage flow with different fracture sizes on the heat transfer process, the porous media model is divided into three categories according to the natural fracture size. After the three kinds of fractures are blocked respectively, the Lattice Boltzmann Method is implemented and the results are compared and analyzed. The results illustrate that the heat transfer of micro fracture can be represented by the correction coefficient, this correction method can ignore the complex seepage characteristics of micro channel and reduce the calculation burden. The method presented in this paper is of great importance to the simulation of the hot dry rock development with large computational area.

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