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Numerical simulation on Coupling of Stress-Flow within a Single Fracture

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It has been proved that seepage water in fractured rock mass has an important effect on its mechanical property, sometimes even acting as a determining factor, in large engineering projects. Accordingly, it makes most sense to study the permeability of fractured rock mass. Available research findings [1-6] are mostly based on laboratory testing of coupling of flow-stress within a single fracture, and then using the modify Cubic Law [7] to quantitatively characterize the flow in fractured rock masses. However, laboratory tests lack repeatability, because it is impossible to conduct repeated tests on the same specimen. Numerical experiments can solve this problem perfectly. Therefore, seepage characteristics of fractured rock were studied in this paper using numerical simulation of seepage shear test of fractured rock mass with discrete element software PFC^{3D}(Particle Flow Code in 3 Dimensions). First, simulation of a rough surface of a typical natural fracture was modelled by PFC^{3D}. Simulations of seepage shear test were then conducted under both constant normal load (CNL) and constant normal stiffness (CNS) conditions with built-in FISH language. Hydraulic conductivities in the two conditions are deduced from the numerical simulation result. Finally, rationality of the two test conditions were studied by comparing the simulation results.

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