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Identification of Fracture Properties by Inverse Analysis of Tracer Tests Using Genetic Algorithms

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Any fractures present in a porous medium have a greater influence on the flow of fluid than the porosity of the bulk material because the fractures are much more permeable. The tracer test, one method for detecting fractures, can estimate the properties of fractures by inverse analysis of effluent-tracer concentration data. This study simulated tracer tests for a porous medium containing a single fracture and tried to identify the properties of the fracture by inverse analysis of the effluent-tracer concentration curve. The complex variable boundary element method (CVBEM), which precisely describes the flow around a fracture, was utilized for the simulation and the genetic algorithm (GA) was used for the inverse analysis.

Several model studies showed that accurate identification of the fracture was difficult by inverse analysis using only one series of effluent-tracer concentration data, whereas two series of concentration data obtained in different well arrangements could identify the fracture more accurately. The crucial parameters that determine the shape of the tracer concentration curve were identified from the convergence behavior in the GA.

Keywords: Fracture, Tracer test, Inverse analysis, CVBEM, Genetic algorithm

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