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Yanzhao Cao* (yzc0009@auburn.edu), Dept of Math & Stat, Auburn University, Auburn, AL 36849. *Hydraulic Conductivity Inverse Formulation for the Groundwater Flow Problem with Variable Density.*

A mathematical optimal control method is developed to identify the hydraulic conductivity distribution in a density dependent flow field. By using the variation method to the nonlinearly coupled flow and transport equations for the density-dependent flow, we deduce the adjoint partial differential equations for the density-dependent equations used for the saline aquifer water flow. The adjoint equations are numerical solved in this study through a finite difference method and then used to identify the hydraulic conductivity distribution through an optimal control problem. To demonstrate the effectiveness of the optimal control method, we conduct two numerical experiments as case studies. The results indicate that by using hydraulic head measurement data, we can accurately identify conductivity distributions in a saline water aquifer flow system. (Received September 15, 2010)