AOGS 2005

Application of Genetic Algorithm and Simulated Annealing for Inverse Modeling of Groundwater Systems abstract

V.P. HUGGI and A. K. RASTOGI

Civil Engineering Department, Indian Institute of Technology, Mumbai-400 076, India
Email: akr@civil.iitb.ac.in

Efficient management of groundwater systems depends primarily on adequate assessment of its hydro geologic parameters. Estimation of these spatially distributed aquifer parameters such as transmissivity, hydraulic conductivity, storage coefficient, specific yield, longitudinal dispersivity and transverse dispersivity in the large aquifer systems often involves considerable time, human efforts and financial resources. These parameters are required for groundwater system simulation to predict head and solute concentration behavior in the flow domain. Inverse modeling of the system helps in adequate assessment of these parameters for a meaningful system simulation. An approach for inverse modeling of groundwater systems based upon genetic algorithm (GA) and simulated annealing (SA) global optimization techniques coupled with Galerkin's finite element model is presented. The applicability and robustness of the coupled numerical model developed for the inverse modeling is verified by solving a confined aquifer problem involving nine zones and a set of realistic boundary conditions, source and sink terms. The inverse modeling results show that the GA and SA can be successfully used to obtain optimal estimates of aquifer parameters. The solutions of the chosen problem are compared with results of another simulation - optimization model based upon Gauss-Newton-Marquardt (GNM) method. From the analysis of results it was found that largely the results of GA and SA based inverse model were better compared to GNM approach solutions for noisy data. The present study concluded that the proposed inverse models can be successfully applied for aquifer parameter estimation for distributed parameter systems like regional aquifers.

Keywords: Simulated annealing; genetic algorithm; inverse modeling; parameter estimation.