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INVERSE GROUNDWATER MODELING BASED ON B-SPLINE PARAMETERIZATION AND MODEL OPTIMIZATION

George Kourakos* **and Aristotelis Mantoglou****

* National Technical University of Athens
Iroon Polytechneiou 7, Zografos, Greece, 15780
email. giorgk@gmail.com

**National Technical University of Athens
Iroon Polytechneiou 7, Zografos, Greece, 15780
email. mantog@central.ntua.gr

Summary. An important consideration in inverse groundwater modeling, is the type of parameterization and the number of model parameters. A model with too many parameters (complex model) might be susceptible to errors in the data. A model with too few parameters on the other hand, may be unable to describe the system dynamics. Therefore the right balance between the conflicting goals of complexity and simplicity of the model must be uncovered.

A new method is developed based on B-Spline parameterization of transmissivity. The objective is not only to obtain the values of model parameters but to determine the optimal number of parameters as well (optimal model complexity). The methodology is based on a B-Spline parameterization of transmissivity and a Linear Least Squares transformation between models of different model complexities. BSS are controlled by a number of vertices known as Control Points (CP). One advantage of BSS parameterization is that each CP affects only a limited part (patch) of the surface; hence a change of the value of a CP does not affect the entire transmissivity field. The number of control points of BSS representation, corresponds to model parameters of the inverse model, (i.e. it is related to model complexity). In the proposed formulation, the number of control points is also a decision variable to be determined by optimization. Genetic Algorithms (GA) are employed to perform the search in the parameter space. Notice that the population of GA is composed by individuals of different number of parameters. A transformation procedure is applied, based on Linear Least Squares (LLS), which allows combination of models of different parameters using conventional GA operators. The proposed method is applied to a hypothetical confined aquifer. The results are good when the genetic algorithm stops early. However, if the algorithm is allowed to run for too long, it converges to models of highest allowable complexity.