1. **Modeling of Transient Groundwater Flow Using Fuzzy Approach**.

**Abstract**

This study considers modeling transient groundwater flow under imprecisely known parameters using fuzzy approach. A new approach has been developed to study the effects of parameters uncertainty on the dependent variable, here the head. The proposed approach is developed based on fuzzy set theory combined with interval analysis. The kind of uncertainty modeled here is the imprecision associated with model parameters as a result of machine or human imprecision or lack of information. In this technique each parameter is described by a membership function. The fuzzy inputs into the model are in the form of intervals so are the outputs. The resulting head interval represents the change in the output due to interval inputs of model parameters. The proposed technique is illustrated using a two dimensional flow problem solved with a finite difference techniques using triangular and trapezoidal fuzzy membership functions. Three input parameters are considered as a fuzzy number (transmissivity, storage coefficient, and recharge). This model was applicable for transient flow through isotropic, heterogeneous soil. The groundwater flow problem analysis requires interval input values for the parameters, the output may be presented in terms of mean value, upper and lower bounds of the hydraulic head. The width of the resulting head interval can be used as a measure of uncertainty due to imprecise inputs.The model compared with other models (fuzzy with finite difference, stochastic, and kriging ), analytical solution, many examples, and with field data (Bahr Al- Najaf, a case study in Iraq ), the proposed technique shows a good results. When more than one parameter are considered as a fuzzy number, the state considered more complicated and the uncertainty will be increase and that was shown by the proposed model. The model outputs can be used as the inputs for the subsequent risk analysis and decision making – processes.