UNCERTAINTY IN THERMAL BASIN MODELING: AN INTERVAL FINITE ELEMENT APPROACH

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Uncertainty assessment in basin modeling and reservoir characterization is traditionally treated by geostatistical methods which are normally based on stochastic probabilistic approaches. In this talk, an alternative interval-based approach will be present. A solution for the transient heat conduction in sedimentary basins will be introduced using an interval finite element approach. For this purpose, a novel formulation is developed to deal with both the special interval arithmetic properties and the transient term in the differential equation governing heat transfer. In this formulation, the "stiffness" matrix resulting from the discretization of the heat conduction equation is assembled using an element-by-element technique in which the finite elements are globally independent and lagrange multipliers are used to enforce continuity. This formulation is suggested as an alternative to traditional Monte Carlo method, where repetitive simulations are required to handle uncertainty and worst case system response is underestimated. The newly developed technique is applied to a one-dimensional thermal basin simulation to assess its potential and limitations. Numerical results will be introduced and their quality assessed.