College of Arts and Sciences

Department of Mathematics

University of South Carolina

Math Colloquium

Subsurface Flow Simulations in Stochastic Discrete Fracture Networks

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LeConte 412

Discrete Fracture Network (DFN) models are widely used in the simulation of subsurface flows; they describe a geological reservoir as a system of many intersecting planar polygons representing the underground network of fractures. The mathematical description is based on Darcy's law, supplemented by appropriate interface conditions at each intersection between two fractures. Efficient numerical discretizations, based on the reformulation of the equations as a pde-constrained optimization problem, allow for a totally independent meshing of each fracture.

We consider stochastic versions of DFN, in which certain relevant parameters of the models are assumed to be random variables with given probability distribution. The dependence of the quantity of interest upon these variables may be smooth (e.g., analytic) or non-smooth (e.g., discontinuous). We perform a non-intrusive uncertainty quantification analysis which, according to the different situations, uses such tools as stochastic collocation, multilevel MonteCarlo, or multifidelity strategies.

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