G-CSC Kolloquium

"Numerical Simulation of Saturated/Unsaturated Ground Water Flow"

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Abstract

Richards equations for saturated/unsaturated groundwater flow is based on state equations relating saturation to capillary pressure.
The numerical solution of the resulting degenerate parabolic problems typically suffers from strong nonlinearities and ill-conditioning in the presence of strongly varying saturation. As a remedy, we suggest a solver-friendly discretization based on Kirchhoff transformation
which can be reinterpreted in physical variables in terms of suitable quadrature rules. In this way ill-conditioning is separated from the numerical solution process.
This approach is extended to heterogeneous state equations by domain decomposition methods based on nonlinear transmission conditions. We show convergence and illustrate the theoretical results by numerical computations.
In order to account for uncertain parameters, we consider a polynomial chaos approach to stochastic variational inequalities arising as spatial problems in time-discretized stochastic versions of Richards equations.