Higher order mixed finite element methods for elliptic and parabolic equations with solutions of low regularity

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In this talk a higher order finite element approach to the *coupled variably saturated groundwater flow and bioreactive contaminant transport model* is considered. Higher order techniques have proved advantageous in the reliable numerical simulation of biochemically reacting transport processes, due to their less inherent numerical diffusion. For the calculation of the groundwater flow field mixed finite element methods are prefered due to their inherent conservation properties and since they provide a flux approximation as part of the formulation itself. Typically, lowest order mixed Raviart–Thomas elements are used for solving the parabolic-elliptic degenerate Richards equation describing the motion of groundwater, since this model admits solutions of low regularity only.

Here, our numerical results obtained by a higher order mixed finite element approach of Brezzi-Douglas-Marini type to elliptic, parabolic and degenerate partial differential equations with solutions of low regularity are presented and carefully compared to corresponding results based on lowest order Raviart–Thomas mixed finite element calculations. The application of the mixed Brezzi-Douglas-Marini finite element technique to the nonlinear degenerate Richards equation and its implementation in the *parallel software* environment *M++* is also addressed.

References:

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