A Coupled FEM-FVM Method for Electroosmotic Flow

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Microscale electroosmotic flows occur in many interesting applications, including pore scale processes in fuel cell membranes and sensing with nanopores. We present a new approach for the numerical solution of coupled fluid flow and ion transport in a self-consistent electric field. Ingredients of the method are

- Pressure-robust, pointwise divergence free finite element discretization of the Stokes equations describing the barycentric velocity of the ionic mixture
- Thermodynamically consistent, maximum principle observing finite volume method for ion transport including competition for finite available volume
- Coupling approach between fluid flow and mass transport together with a fixed point iteration to solve the combined system.

The talk introduces the discretization approach and provides first results of numerical simulations confirming the validity of the approach. A number of open problems and challengig directions will be described.

References:

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