Numerical modeling of fluid flow and species transport by a coupled finite element/finite volume approach.

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We present a coupled discretization approach for species transport in an incompressible fluid. The Navier-Stokes equations for the flow are discretized by the point-wise divergence-free Scott-Vogelius element. The convection-diffusion equation describing the species transport is discretized by the Voronoi finite volume method on boundary conforming Delaunay meshes. This approach guarantees that the discrete species concentration fulfills discrete global and local maximum principles. We report convergence results for the coupled scheme and an application of the scheme to the interpretation of limiting current measurements in an electrochemical flow cell.

References:

[1] J. Fuhrmann, A. Linke, and H. Langmach. A numerical method for mass conservative coupling between fluid flow and solute transport. Applied Numerical Mathematics, 61(4):530 - 553, 2011.

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