An elliptic/integro-differential system for modeling miscible transport in porous media

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Abstract

Miscible transport in porous media is traditionally modeled using the so-called advection diffusion equation (ADE). However, several studies have shown that there are quite significant discrepancies between experimental results and numerical simulations based on the ADE. In this talk, we present an alternative model based on an integro-differential equation (IDE). In order to validate the superiority of the proposed IDE over the usual ADE we compare both models with experimental data obtained from the literature [1]. Moreover, to fully describe the transport problem, we couple our IDE for concentration with an elliptic equation for pressure. A numerical scheme to approximate the solution of this coupled system is presented and analyzed. The piecewise linear finite element method is applied for space discretization and an implicit-explicit scheme is used for time discretization. Convergence estimates are derived, showing that the numerical approximation for the concentration and the pressure are second order convergent in a discrete L^2-norm and in a discrete H^1-norm, respectively [2].

Keywords: miscible transport, porous media, integro-differential, validation, finite element method, supraconvergence.

References

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