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IMPLEMENTATION OF MIXED METHODS AS FINITE DIFFERENCE METHODS AND APPLICATIONS TO NONISOTHERMAL MULTIPHASE FLOW IN POROUS MEDIA

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摘要
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IMPLEMENTATION OF MIXED METHODS AS FINITE DIFFERENCE METHODS AND APPLICATIONS TO NONISOTHERMAL MULTIPHASE FLOW IN POROUS MEDIA

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Abstract In this paper we consider mixed finite element methods for second order elliptic problems. In the case of the lowest order Brezzi-Douglas-Marini elements (if $d=2$) or Brezzi-Douglas-Dur\'an-Fortin elements (if $d=3$) on rectangular parallelepipeds, we show that the mixed method system, by incorporating certain quadrature rules, can be written as a simple, cell-centered finite difference method. This leads to the solution of a sparse, positive semidefinite linear system for the scalar unknown. For a diagonal tensor coefficient, the sparsity pattern for the scalar unknown is a five point stencil if $d=2$, and seven if $d=3$. For a general tensor coefficient, it is a nine point stencil, and nineteen, respectively. Applications of the mixed method implementation as finite differences to nonisothermal multiphase, multicomponent flow in porous media are presented.

Key words Finite difference Implementation Mixed method Error estimates Superconvergence Tensor coefficient Nonisothermal multiphase Multicomponent flow Porous media.

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