CONSERVATIVE HIGH ORDER COUPLED MIXED FINITE ELEMENT-FINITE VOLUME METHOD FOR TWO-PHASE FLOWS IN HETEROGENEOUS MEDIA

PHILIPPE R. B. DEVLOO, AGNALDO M. FARIAS, SÔNIA M. GOMES, OMAR D. TRIANA, AND JOSÉ VILLEGAS

Abstract. Mass conservation is a crucial requirement of effective computational models for multi-phase flows in hetergeneous porous media [3]. We present a conservative method where Darcy's equation is resolved by the mixed finite element formulation, using hierarchical high order $\mathbf{H}(div)$-conforming approximation spaces, as described in [2], and the transport of components is updated by means of a second order finite volume scheme [5] based on recontruction and limitation of gradients. The nonlinear coupled system given by the weighted pressure formulation [4] is implemented in the multiphysics object-oriented scientific computational environment NeoPZ [1]. This is a general finite element approximation software incorporating a variety of element geometries, variational formulations, approximation spaces (e.g. continuous, discontinuous, H(div), and others), allowing robust implementarions of different type of formulations and approximation spaces in a same simulation, including *hp*-adptivity.

Keywords: finite elements, finite volume, multiphysics simulations, $\mathbf{H}(div)$ spaces, high order methods

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Faculdade de Engenharia Civil, Arquittura e Urbanismo, Universidade Estadual de Campinas, Campinas-SP, Brazil
E-mail address: phil@fec.unicamp.br

Instituto de Matemática, Estatística e Computação Científica, Universidade Estadual de Campinas, Campinas-RJ, Brazil
E-mail address: agnaldofarias.mg@gmail.com

Instituto de Matemática, Estatística e Computação Científica, Universidade Estadual de Campinas, Campinas-RJ, Brazil
E-mail address: soniag@ime.unicamp.br

Departamento de Engenharia de Petróleo, Faculdade de Engenharia Mecânica, Universidade Estadual de Campinas, Campinas-SP, Brazil
E-mail address: omar@dep.fem.unicamp.br

Departamento de Engenharia de Petróleo, Faculdade de Engenharia Mecânica, Universidade Estadual de Campinas, Campinas-SP, Brazil
E-mail address: villegas@dep.fem.unicamp.br