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Numerical analysis of a nonlinear CVFE scheme for the compressible two phase flow in heterogeneous and anisotropic porous media

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Studying the two phase flow model is of a great importance. It occurs in many fields of engineering such as oil recovery, the storage of nuclear wastes and the remedy of the groundwater infected naps. The mathematical formulation of this problem includes nonlinear partial differential equations. Moreover, various numerical investigations have been the object of the approximation of these equations. Yet, in the case of anisotropic and heterogeneous media, most of the considered contributions fail to satisfy some relevant properties, such as the maximum principal, that the approximate solutions must fulfill. These properties are remarkable in order to ensure the efficiency of the method and to establish the convergence of the scheme. As a consequence, we propose a control volume finite element scheme for the discretisation of the two phase flow model involving these kind of media. This approximation turns out to be efficient and robust since it combines between the feature of finite volume methods, which is the local conservation of the fluxes, and that of finite element, which provides a simple discretisation of the gradient. In addition, we prove that discrete solution converges toward that of the continuous problem. Finally, as to sustain the obtained results, we give some numerical experiments that illustrate the behavior of the scheme in the presence of the anisotropy.

References

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