



Contribution ID: 592

Type: **Poster (+) Presentation**

Application of the Virtual Element Method to Two-phase Flow of Immiscible Fluids in Porous Media

Tuesday, 1 June 2021 10:00 (1 hour)

The Virtual Element Method (VEM), firstly introduced in [1], is a very recent extension of the Finite Element Method that allows the resolution of partial differential equations using general polygonal grids. This brings forth several advantages including better domain meshing and approximation of geometric features that are of great relevance in tackling problems characterized by complex geometries. Despite the growing interest in testing the performance of this new numerical method on physical and engineering problems characterized by challenging domains, still very few applications exist to complex and realistic geological flow models in porous media. In this framework, the aim of the present contribution [2] is to investigate the potentialities of the VEM in the contest of two-phase flow of immiscible fluids in porous media, a problem described by a system of time-dependent coupled nonlinear partial differential equations. In this work we discretize the equations in time and in space using an iterative Implicit-Pressure-Implicit-Saturation method coupled with a primal C^0 -conforming VEM. We investigate the performance of the resulting fully discrete scheme showing its potentialities in terms of simplified construction of high-order approximations and mesh flexibility, a very attractive feature for the numerical modeling of two-phase flow processes in fractured porous media. The method is tested both on a problem with known analytical solution and on some more realistic benchmark problems that are of interest for engineering applications in porous media [3].

Time Block Preference

Time Block A (09:00-12:00 CET)

References

- [1] L. Beirão da Veiga, F. Brezzi, A. Cangiani, G. Manzini, L. D. Marini, A. Russo, Basic principles of virtual element methods, *Mathematical Models and Methods in Applied Sciences*, 23.01 (2013): 199-214.
- [2] S. Berrone, M. Busetto, A Virtual Element Method for the Two-Phase Flow of Immiscible Fluids in Porous Media, <http://hdl.handle.net/11583/2871023>.
- [3] R. Fučík, J. Mikyška, M. Beneš, T. H. Illangasekare, An improved semi-analytical solution for verification of numerical models of two-phase flow in porous media, *Vadose Zone Journal*, 6.1 (2007), 93-104.

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