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# A discontinuous approximation for modeling multiphase flow and transport in complex porous media structures

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The control volume finite element (CVFE) method is inherently flexible for modelling flow and transport in complex geological features such as faults and fractures. The finite element method that captures complex flow characteristics is combined with the control volume approach known for its stability and mass conservative properties. The classical CVFE approach exploits two meshes: the element mesh that represents the petrophysical properties element-wise and the control volume mesh, centered on the element vertices, representing the saturation solution in the medium. The discrepancy between those two meshes introduces inconsistency in the transport solution especially along material discontinuities or abrupt material interfaces.

In this work, we present an original discontinuous formulation based on the CVFE method for modeling multiphase flow and transport in porous media. We introduce the element pair $P_{1,DG} - P_{0,DG}$ denoting a linear discontinuous Lagrangian velocity approximation and an element-wise pressure approximation, respectively. The formulation enables the use of a single mesh that, in return, does not exhibit the inconsistency issues described earlier. We validate the method and demonstrate the effectiveness of the approach with numerical examples of complex fractures in highly heterogeneous domains.

## Participation

In-Person

## References

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