Comparison of Second Order Finite Volume Schemes on Polyhedral Meshes

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Polyhedral grids play an important role in subsurface modeling of flow and transport processes and the application of higher order accurate schemes is important to reduce effects of numerical diffusion, especially for reactive transport. In realistic applications such higher order methods are typically not used because no straight forward extension to polyhedral or corner point grids exists.

In this work we compare different approaches to construct linear reconstructions for second order Finite Volume schemes on polyhedral grids [1]. A variety of second order Finite Volume approaches exist and have been successfully applied to different applications on mostly structured or simplicial grids. For polyhedral grids the absence of a reference element mapping and a possibly high number of neighboring cells make the application of higher order schemes more complicated. We present several different possibilities to construct second order schemes on polyhedral grids. The different schemes are compared in terms of accuracy, runtime, and feasibility of implementation. In addition, we present the performance of the discussed schemes when applied to CO2-EOR cases for real field models, e.g. the NORNE case [2].

The implementation of the presented schemes in based on DUNE (dune-project.org) and OPM (opm-project.org).

References

[1] R. Klöfkorn, A Kvashchuk and M. Nolte. *Comparison of linear reconstructions for second-order finite volume schemes on polyhedral grids*, Computational Geosciences, 21, pp. 909-919, 2017.

[2] A. Kvashchuk, R. Klöfkorn and T.H. Sandve. *Comparison of Higher Order Schemes on Complicated Meshes and Reservoirs*, In SPE Reservoir Simulation Symposium, Texas, 2019. SPE 193839.

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