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Multiscale Hybrid Discontinuous Galerkin method applied to homogenization problems.

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In this presentation we present a numerical method for simulating fluid flow in highly anisotropic and heterogeneous porous media. To understand the behavior of the fluids at the scale of applications (the macro scale), the flow at the scale of pores (the micro scale) needs to be taken into account. In this case, standard numerical methods will either fail or become inefficient due to the complexity of the flow domain.
We present a numerical scheme based on Hybridized Discontinuous Galerkin (HDG) formulation to compute the upscaled behavior of fluids in a porous media, which can include reactive transport and free boundaries in the micro scale. The scheme is a multiscale HDG method that applies generally to elliptic or parabolic problems in complex domains, and involving strongly oscillating characteristics. This method is based on the classical homogenization technique and the results are presented in terms of the convergence of the error in the micro and macro scale.
Finally, we discuss different combinations of the approximation polynomial spaces on both scales and show the advantages of each one compared with the multiscale mixed finite element approach.

References

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