HDG approximation of boundary value problems on curved domains by extensions from polygonal subdomains

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ABSTRACT

We present a technique for numerically solving boundary-value problems on curved domains. This is achieved by using suitably defined extensions from polygonal subdomains where a hybridizable discontinuous Galerkin (HDG) method is used to approximate the solution. One of the advantages of this technique is that the mesh does not necessarily need to fit the boundary to maintain high order accuracy when polynomials of high degree approximate the solution in the local spaces.

In the case of Dirichlet boundary conditions, we provide error estimates for Poisson equation and computational simulations supporting the theory. In addition, we numerically study the robustness of this method with respect to the polynomial degree and Péclet number for convection-diffusion problems. Numerical examples where part of the boundary is Neumann are presented as well.

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