DISCONTINUOUS GALERKIN METHODS FOR INTERFACE PROBLEMS

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Abstract. In many different applications, interfaces divide the domain of interest $\Omega \subset \mathbb{R}^{\mathrm{d}}$, where $\mathrm{d} = 2, 3.$, into several subdomains on which the governing equations and/or boundary conditions are different. As the geometrical complexity and required spatial sampling of the subdomains may vary significantly, it is not uncommon to mesh the subdomains separately using different mesh sizes. In this work, we present and analyze a Hybridizable Discontinuous Galerkin (HDG) method for the problem posed by the coupling of the Stokes and Darcy equations, whose domains are discretized by two independent subdomains with different meshes. This causes non-conformity at the intersection of the subdomains or leaves a gap (unmeshed region) between them. To properly couple the two different discretizations, the proposed transmission conditions are based on mass conservation and equilibrium normal forces for matching meshes. For non-matching meshes, we use the transfer technique of the numerical trace/flux and extrapolate the approximate flux in both meshes. Furthermore, we establish the well-posedness of the method and error estimates to show the stability of the HDG method. Finally, we demonstrate the capacities of the method by presenting numerical experiments that validate our theory.

Keywords: Non-matching meshes; dissimilar meshes; hybrid method.

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