Discontinuous Galerkin Isogeometric Analysis on Decompositions with Gaps and Overlaps.

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In the Isogeometric Analysis framework for treating realistic problems, it is usually necessary to decompose the domain into volumetric subdomains (patches). More precisely, we apply a segmentation technique for splitting the initial domain into simpler subdomains and then we define the coresponding control nets of the subdomains that are used for constructing the parametrizations of the subdomains. Usually, we obtain compatible parametrizations of the subdomains, meaning that using a relative coarse control mesh, the parameterizations of the adjoining subdomain interfaces are identical. However, this is not always the case. Due to an incorrect segmentation procedure, we can lead to non-compatible parametrizations of the geometry, meaning that the parametrized interfaces of adjusting subdomains are not identical. The result of this phenomenon is the creation of overlapping regions or gap regions between adjacent subdomains. It is clear that, we can not apply directly the dGIgA methods which have been proposed so far in the literature and are referred to matching interface parametrizations. In this talk, we will present a discontinuous Galerkin Isogeometric Analysis method applied on decompositions, where gap and overlapping regions can appear. We apply a multi-patch approach and derive suitable numerical fluxes on the boundaries of overlapping and gap regions, using the interior subdomain solutions, i.e., the solution on points which are not located on the overlaps and on gaps. These fluxes are used in order to to couple the local patch-wise discrete problems. The ideas are illustrated on a model diffusion problem with discontinuous diffusion coefficients. We develop a rigorous theoretical framework for the proposed method clarifying the influence of the gap/overlapping region size onto the convergence rate of the method. The theoretical estimates are supported by numerical examples in two- and three-dimensional computational domains. We gratefully acknowledge the financial support of this research work by the Austrian Science Fund (FWF) under the grant NFN S117-03.

References:

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