Constructing IGA-suitable planar parameterization from complex CAD boundary by domain partition and global/local optimization

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ABSTRACT

In this paper, we propose a general framework for constructing IGA-suitable planar B-spline parameterization from given complex CAD boundary consisting of a set of B-spline curves. Instead of the computational domain formed by simple boundary, planar domains with high genus and more complex boundary curves are considered in this paper. Firstly, some pre-processing operations, such as Bézier extraction and subdivision are performed on each boundary curve in order to generate a high-quality planar parameterization; then a robust planar domain partition framework is proposed to construct high-quality patch-meshing results with few singularities from the discrete boundary formed by connecting the end points of the resulting boundary segments. After the topology partition is obtained, the optimal placement of interior Bézier curves corresponding to the interior edges of the quadrangulation is constructed by a global optimization method to achieve a patch-partition with high quality. Finally, after the imposition of C^1/G^1-continuity constraints on the interface of neighboring Bézier patches with respect to each quad in the quadrangulation, the high-quality Bézier patch parameterization is obtained by C^1-constrained local optimization method to achieve uniform and orthogonal iso-parametric structure while keeping the continuity conditions between patches. The efficiency and robustness of the proposed method are demonstrated by several comparison examples with the skeleton-based parameterization approach.

Preliminary work on G^1 volumetric interpolation of unstructured hexahedral meshes will be also discussed.