A C^2-smooth isogeometric spline space over planar multi-patch geometries

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ABSTRACT

We present a framework for the construction of a globally C^2-smooth isogeometric spline space over a specific class of planar multi-patch geometries, called bilinear-like G^2 multi-patch geometries. This class of geometries includes the subclass of bilinear multi-patch parameterizations and is characterized by the property to have the same kinds of connectivity functions along the patch interfaces as the bilinear parameterizations. The C^2-smooth isogeometric space is generated as the linear span of three different types of basis functions called patch, edge and vertex functions corresponding to the single patches, edges and vertices of the multi-patch domain. The construction of the single functions is simple, works uniformly for all possible multi-patch configurations and leads to well-conditioned basis functions with small local supports.

The potential of the constructed C^2-smooth space for applications in isogeometric analysis is demonstrated on the basis of several examples. We first numerically show by means of L^2-approximation that the considered space of globally C^2-smooth isogeometric functions possesses optimal approximation properties. Then, we present a framework for solving the triharmonic equation, a sixth order partial differential equation, over planar multi-patch geometries. This problem requires the use of a C^2-smooth space as discretization space for the corresponding partial differential equation. Finally, we perform isogeometric collocation to obtain a C^2-smooth solution of Poisson's equation over a planar multi-patch domain.