Spline functions on manifolds of arbitrary topology for Isogeometric Analysis

Ahmed Blidia*, **Bernard Mourrain***

*UCA, Inria, Aromath
Sophia Antipolis, France
e-mail: ahmed.blidia@inria.fr, bernard.mourrain@inria.fr

ABSTRACT

The space of differentiable functions on a manifold $\mathcal{M}$, which are piecewise polynomials is an interesting space for the development of Isogeometric Analysis on complex geometries.

We present a general framework which allows to describe both the geometry and spaces of regular functions on the geometry, for its use in isogeometric applications.

The manifold is given by topological data and transition maps across shared edges, that satisfy compatibility conditions around vertices. We analyse the finite dimensional vector space of differential functions on the topological manifold $\mathcal{M}$, which are b-spline functions of bound degrees of freedom on each face. We determine its dimension for high enough degrees and construct explicit basis functions attached respectively to vertices, edges and faces. We show that such spaces of geometrically smooth spline functions is suitable for Isogeometric Analysis.

Examples of uses of these spaces for Isogeometric Analysis will be presented, showing their numerical behavior for the approximation of solutions of partial differential equations.

This work is based on the following articles:

REFERENCES

[1] Ahmed Blidia, Bernard Mourrain, and Nelly Villamizar. G 1-smooth splines on quad meshes with 4-split macro-patch elements. *Computer Aided Geometric Design*, 52:106–125, 2017.

[2] Bernard Mourrain, Raimundas Vidunas, and Nelly Villamizar. Dimension and bases for geometrically continuous splines on surfaces of arbitrary topology. *Computer Aided Geometric Design*, 45:108–133, 2016.