H^1-parameterizations of surfaces in Isogeometric analysis

Meng Wu*, Xuhui Wang

* School of Mathematics,
Hefei University of Technology,
230009, Hefei, Anhui Prov.. P. R. China
e-mail: wumeng@mail.ustc.edu.cn

ABSTRACT

Singularities of a surface's geometric mapping are often unavoidable, especially when we consider a complex surface. For example, there are two singularities at the poles of a sphere if it is parametrized by the standard geometrical representation with NURBS basis functions [1][2]. In isogeometric analysis [3], singularities impact on the regularity of test functions on the surface [4][5]. For example, when we solve a second order elliptic equation on a sphere [2] by its standard geometrical representation, the test functions should be H^1-functions on this sphere. However, previous works, such as [4][5], focused on the regularity of test functions on planar domains. In this paper, we consider the H^1-regularity condition of test functions on surfaces with isolated singularities. And H^1-regularity property of the test functions on a sphere by its standard geometrical representation with NURBS is presented.

REFERENCES

[1] L. Piegl and W. Tiller. *The NURBS Book*. Springer, 2 edition, (1997).

[2] L. Dedé and A. Quarteroni. Isogeometric analysis for second order partial differential equations on surfaces. *Computer Methods in Applied Mechanics and Engineering.* (2015) **284**:807–834.

[3] T. J. R. Hughes, J. A. Cottrell and Y. Bazilevs. Isogeometric analysis: CAD, finite elements, NURBS, exact geometry and mesh refinement. *Computer Methods in Applied Mechanics and Engineering.* (2005) **194**:4135–4195, 2005.

[4] T. Takacs and B. Jüttler. Existence of Stiffness Matrix Integrals for Singularly Parameterized Domains in Isogeometric Analysis. *Computer Methods in Applied Mechanics and Engineering.* (2011) **200**:3568–3582.

[5] M. Wu, B. Mourrain, A. Galligo and B. Nkonga. H1-parameterizations of planar physical domains with complex topology in Isogeometric analysis. *Computer Methods in Applied Mechanics and Engineering.* (2017) **381**:296–318.