

Volumetric NURBS Parameterization from CAD Boundary Representations for Isogeometric Analysis

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We present an automatic algorithm for constructing a volumetric NURBS parameterization from boundary representation CAD models, while also allowing the user to improve the parameterization.

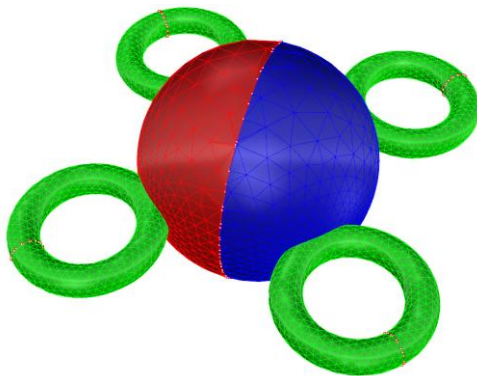


Figure 1: Pants Decomposition of a Genus-4 Surface

Based on pants decomposition, the input surface is automatically decomposed into pairs of pants, i.e. regions that are topologically equivalent to spheres with three boundaries [1]. An optimization is then performed to automatically detect any symmetry and to improve the quality of the segmentation.

By solving a harmonic field with proper boundary conditions, each pair of pants is converted into generalized polycubes. Generalized Polycubes is a novel parametric domain and consist of a set of regular cube domains topologically glued together [2].

With these polycubes, a volumetric NURBS parameterization is obtained and optimized using a fitting algorithm. The volumetric NURBS mesh can be then used for isogeometric analysis [3].

REFERENCES

- [1] E. Verdière and F. Lazarus, "Optimal Pants Decompositions and Shortest Homotopic Cycles on an Orientable Surface", *J. ACM*, Vol. 54, no. 4, p. 18, 2007.
- [2] B. Li, X. Li, K. Wang, and H. Qin, "Generalized Polycubes trivariate splines", *Shape Modeling International Conference*, pp. 261-265, 2010.
- [3] J.A. Cottrell, T. J.R. Hughes, and Y. Bazilev, *Isogeometric analysis: toward integration of CAD and FEA*, Wiley, 2009.