Adaptive Refinement with Patchwork B-splines

Nora Engleitner* and Bert Jüttler†

* MTU Aero Engines AG
Dachauer Str. 665
80995 München, Germany
e-mail: nora.engleitner@mtu.de

† Johannes Kepler University Linz
Altenberger Str. 69
4040 Linz, Austria
e-mail: bert.juettler@jku.at

ABSTRACT

The established construction of hierachical B-splines relies on a single sequence of nested spline spaces. This implies that once we insert a knot hyperplane at some level it is also present in all higher levels. The available strategies for performing adaptive refinement are therefore limited. In order to overcome this restriction, while maintaining the good mathematical properties of the hierarchical B-splines, we introduce the concept of Patchwork B-splines, which is a generalization of the hierarchical B-spline framework that requires only *partially* nested spline spaces and thus provides a greater flexibility when performing adaptive refinement. In particular, it enables the use of non-nested spaces in different areas of the domain. Under certain assumptions on the patchwork structure we are able to construct a basis for the patchwork spline space by adapting Kraft's selection mechanism [1] to the new framework. In order to obtain a non-negative partition of unity we introduce a truncation mechanism that is based on a concept originally formulated in [2]. Finally, we provide algorithms and first experimental results for the application of Patchwork B-splines in an industrial environment.

REFERENCES

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[2] C. Giannelli and B. Jüttler and H. Speleers. THB-splines: The truncated basis for hierarchical splines, *Computer Aided Geometric Design*, Vol. 29, pp. 485–498, 2012.