Exploring refinement strategies for locally linear independent LR B-splines

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Locally refined B-splines, which were introduced by Dokken et al. [2], provide a generalization of tensor-product B-splines to the case of locally refined meshes. While refinement strategies that ensure linear independence have been studied recently [4, 3], the construction of LR B-splines may potentially generate basis functions that possess the even stronger property of *local* linear independence (LLI). More precisely, LLI ensures that exactly $(p+1)^d$ basis functions take non-zero values on any cell of the mesh and entails optimal sparsity properties of the matrices that arise, e.g., in applications to numerical simulation. Motivated by the notion of semi-regular tensor-product B-splines, which was introduced by Weller and Hagen [1], we investigate related refinement strategies for locally linear independent LR B-splines in the bivariate case.

Joint work with: Bert Jüttler, Maodong Pan.

References

[1] F. Weller and H. Hagen. Tensor-product spline spaces with knot segments. In: *Mathematical Methods for Curves and Surfaces* (M. Dæhlen et al., eds), pages 563–572, Vanderbilt University Press, Nashville 1995.

[2] T. Dokken, T. Lyche and K.F. Pettersen. Polynomial splines over locally refined box-partitions. In: *Computer Aided Geometric Design* 30, pages 331–356, 2013.

[3] F. Patrizi, C. Manni, F. Pelosi and H. Speleers. Adaptive refinement with locally linearly independent LR B-splines: Theory and applications. In: *Computer Methods in Applied Mechanics and Engineering* 369, 2020.

[4] A. Bressan and B. Jüttler. A hierarchical construction of LR meshes in 2D. In: *Computer Aided Geometric Design* 37, pages 9–24, 2015.