Adaptive isogeometric methods with THB-splines: admissibility and optimality

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ABSTRACT

Hierarchical spline spaces are one of the most relevant types of adaptive spline spaces used in several applications ranging from model reconstructions to finite element simulations. In particular, they are a major tool in the context of local refinement techniques for isogeometric analysis.

By exploiting the properties of the truncated basis for hierarchical splines [3], a comprehensive analysis of adaptive isogeometric methods (AIGMs) based on THB-splines and residual-based error estimator was recently presented. More precisely, a fully automatic AIGM was developed in [1] thanks to the definition of certain *admissible meshes*, residual-based error indicator, and a refinement routine that preserves the admissibility of the mesh along the refinement. It was there proved the efficiency and reliability of the estimator, together with the convergence of the adaptive scheme. The admissibility of the mesh is a key point to obtain crucial approximation properties of isogeometric methods based on hierarchical spline spaces. The adaptivity analysis of the designed AIGM was further extended in [2] by proving that the method delivers optimal convergence rates as soon as the solution of the underlying partial differential equation belongs to a suitable approximation class.

In the presentation we analyze the behaviour of the AIGM on a selection of numerical examples, realized by integrating the adaptive scheme in the hierarchical version of the Matlab/Octave package GeoPDEs presented in [4]. The results not only confirm the optimal convergence of the method, but also highlight the impact of using meshes characterized by different classes of admissibility.

REFERENCES

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