Efficient Algorithms for the Extraction of (Truncated) Hierarchical B-Splines

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ABSTRACT

One of the fundamental topics of research on Isogeometric Analysis is local refinement. One approach, denoted by (Truncated) Hierarchical B-Splines [1,2], is to define a suitable set of basis functions on different hierarchical levels. Despite its conceptual simplicity, implementing the hierarchical definition of shape functions into an existing code can be rather involved. For this reason, an extraction-based implementation has been proposed in [3].

In this work we review the concept of multi-level extraction [3], as a generalization of the classical Bézier extraction [4]. In this way, the hierarchical overlay of functions assumes a standard element structure. Additionally, we present efficient evaluation and projection algorithms that make use only of small univariate operators. This approach is suitable for non-linear problems and parallelism. The multi-level extraction is presented as a general concept that can be applied to different kinds of refinements and basis functions.

In conclusion, the multi-level extraction is proposed for transforming an existing finite element software into an adaptive isogeometric code being able to tackle local refinement and adaptivity efficiently.

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