Weighted quadrature for isogeometric analysis

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ABSTRACT

The concept of k-refinement was proposed as one of the key features of isogeometric analysis, "a new, more efficient, higher-order concept", in the seminal work [1]. The idea of using high-degree and continuity splines (or NURBS, etc.) as a basis for a new high-order method appeared very promising from the beginning, and received confirmations from the next developments. k-refinement leads to several advantages: higher accuracy per degree-of-freedom, improved spectral accuracy, the possibility of structure-preserving smooth discretizations are the most interesting features that have been studied actively in the community. At the same time, the k-refinement brings significant challenges at the computational level: using standard finite element routines, its computational cost grows with respect to the degree, making degree raising computationally expensive. However, recent results confirm that the k-refinement is significanlty superior from the point of view of computational efficiency, with respect to low-degree h-refinement, when a proper code design beyond standard finite element technology is adopted. We consider here the framework developed in [2]. A fundamental ingredient of [2] is the weighted quadrature, which is an ad-hoc strategy to compute the integrals of the Galerkin system. Weighted quadrature has been introduced in [3]. Its aim is to reduce the number of quadrature points, that are 2 per element per direction, that is, independent of the spline degree. This talk is a presentaion of the main ideas behind weighted quadrature and its application to the isogeometric k-refinement.

REFERENCES

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