Space-Time Adaptive Isogeometric Analysis of Parabolic Initial-Boundary Value Problem

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ABSTRACT

We derive reliable space-time Isogeometric Analysis (IGA) schemes for parabolic initial-boundary value problems. In particular, we deduce functional-type a posteriori error estimates, and show their efficient implementation in space-time IGA. Since the derivation is based on purely functional arguments, the estimates are valid for any approximation from the admissible (energy) class. They imply a posteriori error estimates for mesh-dependent norms associated with stabilized space-time IGA approximations introduced in [2]. We propose an efficient technique for minimizing the majorant leading to extremely accurate, guaranteed upper bounds of the norm of the error with efficiency indices close to 1. Since this upper bound is nothing but the sum of the local contributions, these local values of the majorant can be used as error indicators for mesh refinement. Mesh refinement in IgA is more involved than in the finite element method. In particular, we use Truncated Hierarchical B-spline (THB-spline) for localized meshes in our fully unstructured space-time adaptive IGA scheme. Finally, we illustrate the reliability and efficiency of the presented a posterior error estimates for IGA solutions to several examples exhibiting different features. We also report about the costs of computing the upper bound. In all our examples, this is only a small portion of the time required for generating the IgA approximation. Last but not least, the numerical examples show that the space-time THB-spline based adaptive procedure works very well. The talk is partly based on the results published in our arXiv paper [1].

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REFERENCES

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