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A posteriori error estimation in adaptive isogeometric analysis

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ABSTRACT

Reliability and efficiency are two major challenges in simulation based engineering. These two challenges may be addressed by error estimation combined with adaptive refinements. A lot of research has been performed on error estimation and adaptive mesh refinement. However, adaptive methods are not yet an industrial tool, partly because the need for a link to traditional CAD-system makes this difficult in industrial practice. Here, the use of an isogeometric analysis framework introduced by Professor Thomas J. R. Hughes (UT at Austin) and coworkers [1] may facilitate more widespread adoption of this technology in industry, as adaptive mesh refinement does not require any further communication with the CAD system.

A posteriori error estimation in numerical approximation of partial differential equations aims at:

- give an upper bound on the error of numerical solution, if possible give a guaranteed upper bound;
- estimate the error locally and assure that this represents a lower bound for the actual error, up to a multiplicative constant (i.e. efficiency);
- assure that the ratio of the estimated error and actual error goes to one, i.e., asymptotic exactness.

Three main techniques of a posteriori estimates in the finite element method have evolved during the last decades; *(i)* Explicit residual-based estimators *(ii)* Implicit residual based estimators and *(iii)* Recovery based estimators, see Ainsworth and Oden [2] . The purpose of this project is to extend these posteriori techniques in adaptive isogeometric analysis framework for elliptic problems. We also discussed the above three properties for our developed posteriori error estimators. The adaptive refinement is achieved using local refinement strategies developed in Johannessen *et al*. [3]. The developed a posteriori based adaptive refinement methodology will be tested on some classical benchmark elliptic problems.

References

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