



An Error-estimate-based Adaptive Integration Scheme For Immersed Isogeometric Analysis

Finite Cell Method (FCM) – an immersed finite element method introduced by Rank and co-workers [2] – together with Isogeometric analysis (IGA) – a spline-based finite element framework proposed by Hughes et al. [1] – has been applied successfully in various problems in solid mechanics, in image-based analysis [3], fluid-structure interaction and in many other applications.

A challenging aspect of the isogeometric finite cell method is the integration of cut cells. In particular in three dimensional simulations the computational effort associated with integration can be the critical component of a simulation. A myriad of integration strategies has been proposed over the past years to ameliorate the difficulties associated with integration, but a general optimal integration framework that suits a broad class of engineering problems (particularly in 3D) is not yet available.

In this contribution we will investigate the accuracy and computational effort of the octtree integration scheme [4], which in this study is supplemented with a triangulation procedure at the lowest level of bisectioning [3] to construct an explicit approximation of the geometry. We study the contribution of the integration error using the theoretical basis provided by Strang's first lemma. Based on this study we propose an error-estimate-based adaptive integration scheme for immersed isogeometric analysis. Additionally, we will apply and investigate the proposed integration technique to two- and three-dimensional linear elasticity problems.

REFERENCES

- [1] Hughes, T.J., Cottrell, J.A. and Bazilevs, Y., 2005. Isogeometric analysis: CAD, finite elements, NURBS, exact geometry and mesh refinement. *Computer methods in applied mechanics and engineering*, 194(39–41), pp.4135–4195.
- [2] Parvizian, J., Düster, A. and Rank, E., 2007. Finite cell method. *Computational Mechanics*, 41(1), pp.121–133.
- [3] Verhoosel, C.V., Van Zwieten, G.J., Van Rietbergen, B. and de Borst, R., 2015. Image-based goaloriented adaptive isogeometric analysis with application to the micro-mechanical modeling of trabecular bone. *Computer Methods in Applied Mechanics and Engineering*, 284, pp.138–164.
- [4] Düster, A., Parvizian, J., Yang, Z. and Rank, E., 2008. The finite cell method for three-dimensional problems of solid mechanics. *Computer methods in applied mechanics and engineering*, 197(45-48), pp.3768–3782.

Ms. Sai Chandana Divi

PhD Candidate

TU/e University, Eindhoven, Netherlands – UNIPV, Pavia, Italy

October 11th, 11:00 (sharp)

Aula MS1, DICAr

Via Ferrata, 3 – Pavia