FLOATING ISOGEOMETRIC ANALYSIS

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Isogeometric Analysis (IGA) has been introduced by Hughes and co-workers with the aim to unify the worlds of geometric design and numerical analysis [1]. Employing basis functions adopted from Computer Aided Design (CAD) for analysis, IGA offers both a mathematically precise description of the computation domain and an adjustable continuity at element boundaries. Yet, if deformations are too large, element distortion hinders the application of IGA within the Lagrangian viewpoint. This is especially unfortunate for problems in which the material response is dominated by solid-type behaviour and the alternative Eulerian viewpoint becomes less attractive.

Recently, Floating Isogeometric Analysis (FLIGA) was proposed [2]. Incorporating meshless strategies to IGA, FLIGA offers a solution to element distortion along one direction of the parametric domain, while preserving both isogeometric and Lagrangian concepts. Hence, it conveniently solves problems of extrusion-based Additive Manufacturing (AM) with large deformations along the extrusion axis, incompressible flow, and challenging viscoelastic material behaviour.

Due to its mathematically exact description of the computation domain, FLIGA lends itself to adaptive mesh refinement along the extrusion direction. We present the first extension of FLIGA by such a strategy, adopting the well-known concepts of knot insertion for univariate B-Splines. Such enhancements naturally come along with a review of numerical quadrature in FLIGA and we discuss the different possibilities. Finally, these novel techniques allow us to simulate the AM process for highly challenging deformations and material behaviour.

The talk begins with a repetition of the basic concepts of FLIGA and then proposes the above extension to refinement strategies based on knot insertion. We give all important details for the enhancements and also elaborate on important benefits and current limitations with respect to other available techniques. Finally, a selection of numerical examples concludes the talk.

REFERENCES

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