Computational Mechanics Group
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Topic proposal

Floating Isogeometric Analysis

Isogeometric Analysis (IGA) was proposed two decades ago with the aim to close the gap between Computer Aided Design (CAD) and numerical analysis. Its core feature is the replacement of Lagrange polynomial basis functions as employed in Finite Element Analysis (FEA) by functions from CAD, such as B-Splines, NURBS, and others, which possess higher and tunable continuity at the element boundaries.
Being a mesh-based method, IGA, like FEA, suffers from mesh distortion in large deformation analysis of solids (Figure 1 left). In order to overcome this problem, we recently proposed a new strategy called Floating Isogeometric Analysis (FLIGA) (Figure 1 right), which avoids mesh distortion allowing to robustly simulate problems with extremely large deformations along one (possibly curved) direction. One of the main applications is the simulation of material extrusion processes where large viscoelastic deformations orient along the extrusion direction (Figure 2).
In the context of a student project, there is a large number of possible topics to be investigated in FLIGA, including e.g. numerical quadrature, implementation of constitutive models, algorithmic improvements or benchmarking.

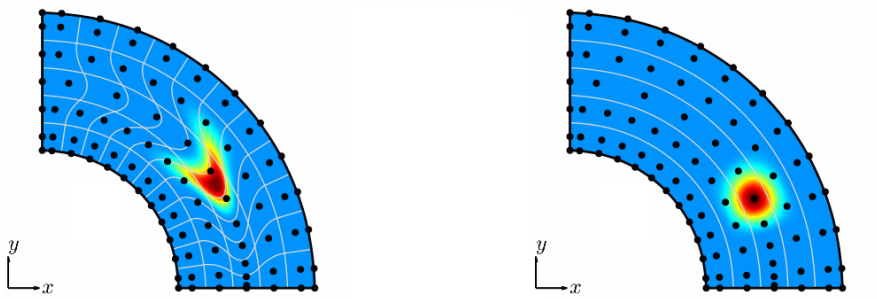

Figure 1: Exemplary basis function for the same deformed node set in IGA (left) and FLIGA (right).

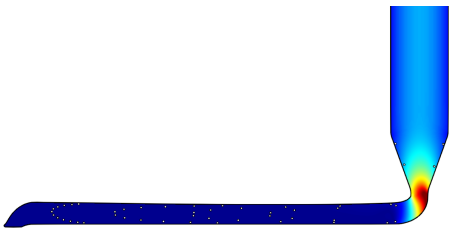

Figure 2: Simulation of extrusion-based additive manufacturing with FLIGA.

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