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Spline-Based Parameterisation Techniques and Applications To Complex Engineering Designs

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ABSTRACT

Numerical techniques rely heavily on geometry parameterisation / meshing routines that address the Surface-to-Volume problem (StV) of finding a valid geometry description of the domain's interior from no more than a description of its contours. While the contours are typically represented by spline-based parametric curves / surfaces, the vast majority of numerical workflows still approximate the interior using piecewise-linear representations, potentially leading to a disruptive conversion overhead.
This talk discusses the recent advances in spline-based parameterisation techniques for the StV problem aimed at avoiding the disadvantages associated with the use of differing formats for geometry and simulation. Hereby, we mainly focus on the generalisation of the class of methods based on *Harmonic Maps* [1] from the classical realm to higher-order spline methods.
Besides streamlining the computational workflow, the presented methodology provides several potential advantages over its classical analogue and has many applications within numerical applications based on Isogeometric Analysis (IGA) [2], such as IGA-based shape optimisation [3].
For a broader impact, we discuss the applications of spline-based descriptions to within industrial workflows based on classical numerical techniques [4].

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