T-splines and Isogeometric Analysis

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Isogeometric analysis is an engineering analysis framework capable of interfacing with CAD geometry directly and exactly. It holds great promise to alleviate many current design-through-analysis bottlenecks. To achieve its full potential it requires as input CAD geometry which is analysis-suitable. T-splines overcome the canonical limitations inherent in NURBS while remaining analysis-suitable. T-splines are capable of representing domains of arbitrary topological genus, with high levels of continuity, while maintaining full compatibility with NURBS. T-splines are also trim-free and locally refineable. Unfortunately, the original T-spline local refinement algorithm, when applied in an adaptive analysis environment, is often non-local due to excessive propagation. In fact, it is easy to show that for many simple anisotropic T-mesh configurations refinement propagates globally.

In this talk we introduce T-splines and demonstrate their potential as an analysis technology. First, fundamental T-spline concepts are introduced. We then develop a topological conjecture for "aligned" T-spline spaces. This conjecture provides an important theoretical link between the topology of the T-mesh and the corresponding algebraic properties of the induced T-spline space. We then use this conjecture to develop an efficient, local refinement algorithm for these spaces. This algorithm generates nested, analysis-suitable T-spline spaces which preserve geometry with minimal dimensionality. We demonstrate the feasibility of this refinement approach by applying it to several benchmark problems.