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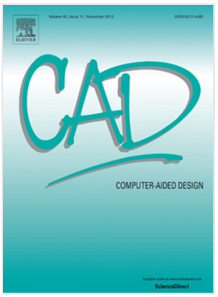

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Arbitrary-degree T-splines for isogeometric analysis of fully nonlinear Kirchhoff-Love shells

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Abstract

This paper focuses on the employment of analysis-suitable T-spline surfaces of arbitrary degree for performing structural analysis of fully nonlinear thin shells. Our aim is to bring closer a seamless and flexible integration of design and analysis for shell structures. The local refinement capability of T-splines together with the Kirchhoff-Love shell discretization, which does not use rotational degrees of freedom, leads to a highly efficient and accurate formulation. Trimmed NURBS surfaces, which are ubiquitous in CAD programs, cannot be directly applied in analysis, however, T-splines can reparameterize these surfaces leading to analysis-suitable untrimmed T-spline representations. We consider various classical nonlinear benchmark problems where the cylindrical and spherical geometries are exactly represented and point loads are accurately captured through local h-refinement. Taking advantage of the higher inter-element continuity of T-splines, smooth stress resultants are plotted without using projection methods. Finally, we construct various trimmed NURBS surfaces with Rhino, an industrial and general-purpose CAD program, convert them to T-spline surfaces, and directly use them in analysis.

Keywords:
Isogeometric analysis, Analysis-suitable T-splines, Arbitrary-degree T-splines, Trimmed surfaces, Nonlinear Kirchhoff-Love shells, Incompressibility

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