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Abstract

Following a series of recent innovations, isogeometric shell analysis based on trimmed CAD surfaces is currently being developed into an accurate, efficient and mature design-through-analysis methodology. This work contributes to this emerging technology with respect to the following aspects. On the analysis side, we present a robust variationally consistent Nitsche-type formulation for thin shells at large deformations that weakly enforces coupling constraints at trimming curves. On the geometry side, we present a set of algorithms that enable automatic interaction of trimmed shell analysis with CAD data structures based on the STEP exchange format. We integrate these methodologies in a comprehensive framework for isogeometric trimmed shell analysis. We demonstrate that our framework is able to seamlessly perform large-deformation stress analysis of an industry-scale 76-patch surface model of a Dodge RAM hood, while delivering comparable accuracy with respect to Simulia's commercial software package Abaqus.

Keywords: Isogeometric analysis, trimmed shell surfaces, Kirchhoff-Love shells, weakly enforced interface constraints, STEP exchange format, Abaqus

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