Parameter-free coupling of trimmed isogeometric shells

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ABSTRACT

Multi-patch analyses of CAD-generated models are still a fundamental challenge in isogeometric analysis including aspects of trimming, coupling, non-conformity of patches and native CAD data. Standard CAD exchange formats provide data that are able to retrieve the geometric representation, but are limited in terms of analysis-ready information. The transformation of geometric data into an analysis model requires a number of merge and join operations of multiple data sets. This often includes forward/backward mappings between the physical space and corresponding parameter spaces of spline-based geometry segments to allow a unique identification and specification of the required surface and interface data.

In this talk, we address the challenges of multi-patch modeling and present a conceptual approach for a seamless workflow with multi-patch models based on the STEP file format. We demonstrate the robustness and reliability of the proposed workflow in the context of modeling industry relevant shell structures. We focus on weak coupling of patches using the non-symmetric variant of Nitsche's method that was recently applied successfully for variationally enforcing boundary and interface conditions in non-boundary-fitted discretizations. In contrast to its symmetric variant, this approach does not require stabilization terms and therefore does not depend on the appropriate estimation of stabilization parameters. We present several representative examples to demonstrate accuracy and robustness of the parameter-free patch coupling as part of a STEP-based multi-patch modeling and analysis framework.

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