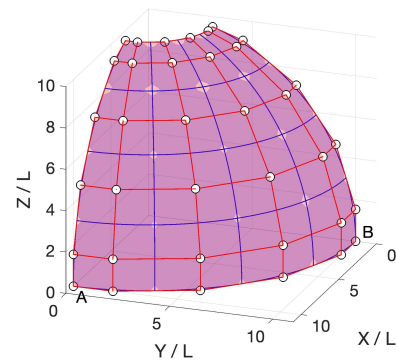


Master's Thesis

Isogeometric Modeling and Analysis of Complex Thin Shell Structures Using a Hybrid Formulation

Supervisor: M. Sc. Lennart Stöttelder

Background: Isogeometric analysis (IGA) enables the accurate representation of curved structures by employing NURBS-based basis functions. However, conventional isogeometric formulations may suffer from numerical locking effects, particularly when analyzing thin-walled shell structures. To alleviate membrane locking, Sauer et al. [1] have recently developed a hybrid formulation that combines quadratic NURBS basis functions for bending with linear Lagrange basis functions for membrane contributions.



Hybrid discretization of a hemisphere with a hole [1]

Task: The objective of this Master's thesis is to develop hybrid discretizations for selected challenging shell benchmarks with complex geometries and investigate the influence of mesh quality on their numerical performance.

The following steps are to be addressed:

- Study of the theoretical foundations of the hybrid formulation based on isogeometric analysis
- Development and implementation of isogeometric meshes for selected challenging shell benchmarks, with particular emphasis on mesh quality
- Verification of the implementation against available reference solutions from the literature
- Comparison of the hybrid formulation with conventional isogeometric shell formulations in terms of accuracy, convergence and computational efficiency

[1] Sauer, R. A., Zou, Z., and Hughes, T. J. (2024). A simple and efficient hybrid discretization approach to alleviate membrane locking in isogeometric thin shells. *Computer Methods in Applied Mechanics and Engineering*, 424:116869.

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