Chair of Structural Analysis
TUM School of Engineering and Design
Technical University of Munich

Modeling:
Mathematics:
Programming:
Science:

Software Lab:

Next-gen Simulation: CAD-Integrated Isogeometric Analysis, Shell Structures, and Enhanced Visualization Frameworks

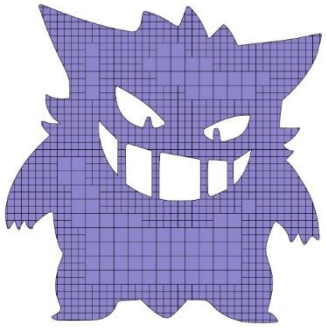
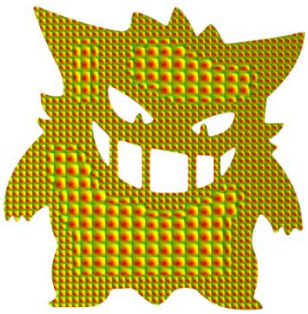
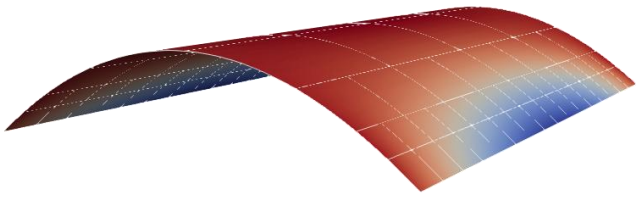
Description

Shells, as part of thin-walled structures, are well-known and used in many engineering applications thanks to their load-carying behavior and lightweight shapes. Over recent years, Isogeometric Analysis (IGA) [1], using Non-Linear Uniform B-Spline (NURBS) as shape functions in finite element analysis, has been established as an exceptional tool for modeling and simulating these curved, slender structures. Extending this capability of IGA by incorporating the geometry description in CAD enables more complex applications with trimmed multipatch models.

This project offers a hands-on opportunity to dive into cutting-edge research in IGA. The focus will be on extending the Reissner-Mindlin shell model [2] to the nonlinear case and developing advanced techniques for visualization and postprocessing using spline-based methods.

Task

- Literature Review: Familiarize with state-of-the-art methods in IGA, nonlinear shell theory, and spline-based visualization.
- Lightweight Python Frameworks: Start with easy-to-use Python scripts provided by the supervisors to quickly get into the topic.
- Nonlinear Shell Modeling: Extend the existing Reissner-Mindlin shell formulation to the nonlinear regime.
- Visualization and Postprocessing: Use spline-based techniques to visualize and interpret simulation results.

Supervisors

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References

[1] Cottrell, J. A., Hughes, T. J., & Bazilevs, Y. (2009). *Isogeometric analysis: toward integration of CAD and FEA*. John Wiley & Sons.
[2] Benson, D. J., Bazilevs, Y., Hsu, M. C., & Hughes, T. (2010). Isogeometric shell analysis: the Reissner–Mindlin shell. Computer Methods in Applied Mechanics and Engineering, 199(5-8), 276-289.