Chair for Computation in Engineering
Department of Geo, Civil and Environmental Engineering
Technical University of Munich

Modeling: ★★★★☆
Mathematics: ★★☆☆☆
Programming: ★★★★★
Science: ★★★★☆

Software Lab:

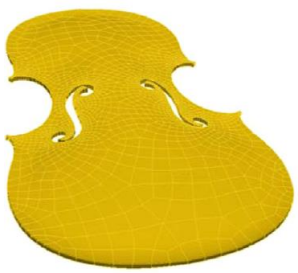
Trimmed Isogeometric Elements for an Acoustic Boundary Element Method

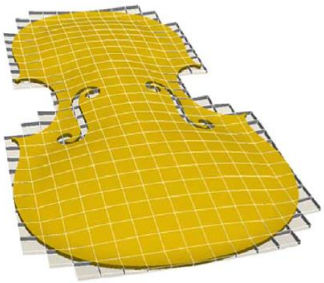
Novicos
Noise and Vibration Concepts

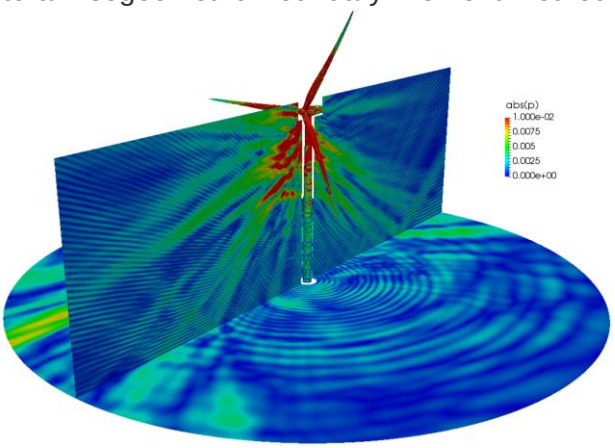
Setting

An Acoustic BEM requires the surface of the computation domain, hereby the geometries that are available in a CAD software are defined by Spline patches that trim each other. In this procedure one geometry can be subtracted from another one. For the design engineer the trimming is a simple approach to build complex structures, but for the computational engineer this approach introduces some challenges, especially, for the numerical integration on isogeometric elements.

Different techniques are available to realize a transfer of trimmed surfaces from the CAD to the CAE software. One possibility is to apply an Embedding Domain Method to an Isogeometric Boundary Element Method that subdivides a regular non-trimmed patch to account for the complex structure.







Task

Implement the trimmed Isogeometric elements into an existent acoustic BEM C++ code. Therefore, you will

- Extend the mesh reader of the program to deal with trimmed CAD,
- Adapt the numerical integration on trimmed surfaces, as described by [1], to the Isogeometric BEM [2].

Supervisors

Benjamin Wassermann, Simulation in Applied Mechanics Group, benjamin.wassermann@tum.de
Sören Keuchel, Novicos GmbH, keuchel@novicos.de

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References

[1] E. Rank, S. Kollmannsberger, Ch. Sorger, A. Düster,. "Shell Finite Cell Method: A high order fictitious domain approach for thin-walled structures." Computer Methods in Applied Mechanics and Engineering, Volume 200, Issues 45–46, 2011, 3200-3209.

[2] S. Keuchel, N. C. Hagelstein, O. Zaleski, O. von Estorff. "Evaluation of hypersingular and nearly singular integrals in the Isogeometric Boundary Element Method for acoustics." Computer Methods in Applied Mechanics and Engineering, Volume 325, 2017, 488-504.