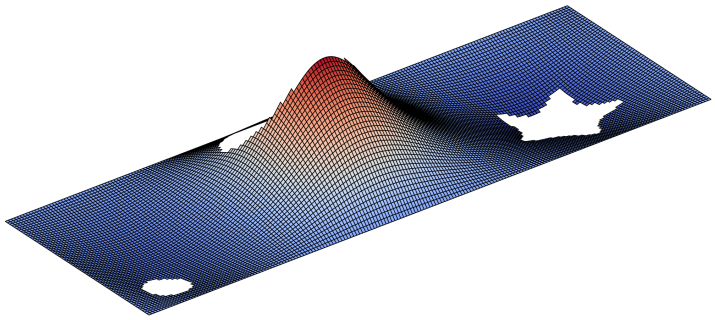
Buckling analysis of cylindrical shells featuring multiple cutouts using CutBFS elements

Bachelor or Master's thesis (CE, Mechanik, Maschinenbau, Bauingenieurwesen, Mathematik)
September 12, 2024

Insitute of Mechanics
Computational Mechanics
Prof. Dr.-Ing. Daniel Juhre
daniel.juhre@ovgu.de

Scope of Work

Thin plates and shells of various shapes are widely used in practice, and the availability of different approaches for modeling their mechanical behavior is essential for engineering and research purposes. One of the simplest possibilities to approximate the deformed shape of a plate/shell was suggested by Bogner, Fox and Schmit (BFS-elements). Based on the use of a bi-cubic Hermitian approximation, C^1-continuity is ensured between neighboring elements. Despite being easy to implement, this element type is hardly used nowadays due to constraints on the topology of suitable finite element meshes, i.e., unstructured meshes are not possible. To circumvent this shortcoming, a fictitious domain approach is employed leading to CutBFS-elements.



The main goal of this thesis is to 're-vitalize´ BFS-elements. To this end, CutBFS-elements should be implemented for the stability analysis (buckling) of cylindrical shells featuring multiple cutouts as often found in aeronautical applications (e.g., airplane fuselage).

Tasks

- Review of the existing literature on shell formulations
- Implementation of BFS-elements in the context of fictitious domain methods
- Investigations regarding the stability of cylindrical shells with multiple cutouts

Prerequisites

- Continuum mechanics
- Computational mechanics (e.g., Finite Element Method)
- Programming skills (preferably Matlab or Julia)

Supervisor: Dr.-Ing. Sascha Eisenträger G10|R013 sascha.eisentraeger@ovgu.de