Implementation of axisymmetric spectral elements for wave propagation analysis

Bachelor or Master's thesis (Computational Methods in Engineering, Maschinenbau, Mathematik)
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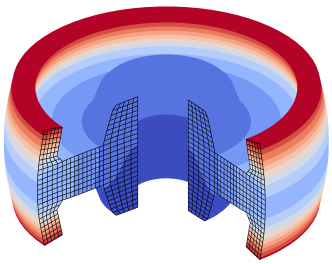
Scope of Work

Despite the ever increasing computational resources three-dimensional computations of transient problems are very expensive and sometimes even impossible due to the fine spatial and temporal discretizations that are required. Therefore, reducing a three-dimensional problem to a two-dimensional one without sacrificing accuracy is a significant step. This can be easily achieved if the computational domain, boundary conditions (BCs), and applied loads are invariant to rotation around an axis (axisymmetric model). Even for general BCs and loads, it is possible to reduce the three-dimensional problem to a finite number of two-dimensional ones.



The main goal of this thesis is to implement a spectral axisymmetric element and to study its performance by means of several transient benchmark problems. An area of application is seen in seismic wave propagation, where vibration isolation measures could be tested in a virtual environment.

Tasks

- Review of the existing literature on axisymmetric elements
- Implementation of axisymmetric spectral elements
- Investigations regarding suitable integration techniques of axial elements
- Computation of benchmark problems

Prerequisites

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

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