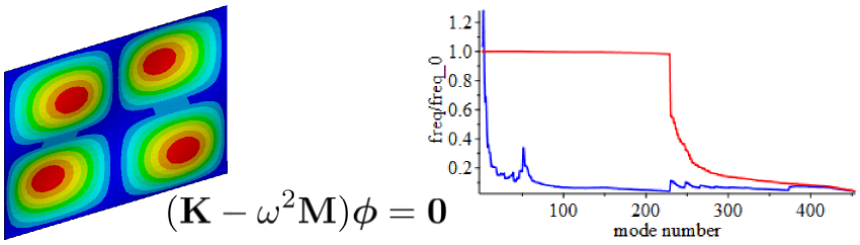
Universität Stuttgart

Baustatik und Baudynamik

Master Theses – Various different topics in the field of

Explicit dynamics and selective mass scaling

The efficiency of explicit dynamic analyses of thin-walled structures is limited by the critical time step size, which depends on the highest frequency of the discretized system. When thin structures are modeled with solids or 3D shell formulations, the highest frequency corresponds to thickness stretch. If Reissner-Mindlin type shell elements are used for discretization, the highest transverse shear frequencies limit the critical time step, while being relatively unimportant for the structural response of the system. The basic idea of selective mass scaling is to scale down the highest frequencies in order to increase the critical time step size, while keeping the low frequency modes unaffected. State-of-the-art methods in commercial explicit solvers still leave space for further improvement. Recent research results from the IBB show promising behaviour in selective mass scaling, both in terms of efficiency and accuracy. Thus, several research oriented Master thesis topics are currently available.



Modal analysis of plate structure. Highly accurate novel sective mass scaling method (red) compared to a method from literature (blue).

Possible topics may include studies on

- explicit dynamics, accurate mass lumping and novel selective mass scaling concepts for isogeometric analysis (IGA) of shells and solid shells,
- novel selective mass scaling methods in traditional FEM, both for solids and shell formulations,
- the interplay of finite element technology and selective mass scaling,
- the performance for distorted meshes, optimal scaling parameters and feasible time steps,
- among many others.

Detailed task descriptions can be discussed and determined between possible candidates and Dr.-Ing. Bastian Oesterle (oesterle@ibb.uni-stuttgart.de).

Recommended fields of interest

FEM, IGA, explicit dynamics, mass scaling, shells, solids, locking, programming