Lehrstuhl für Statik und Dynamik
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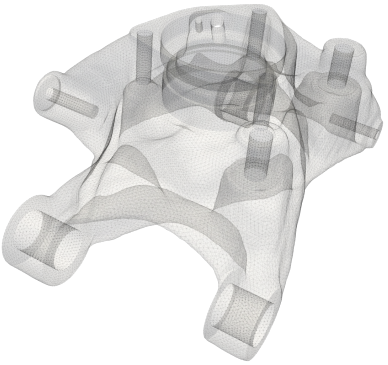
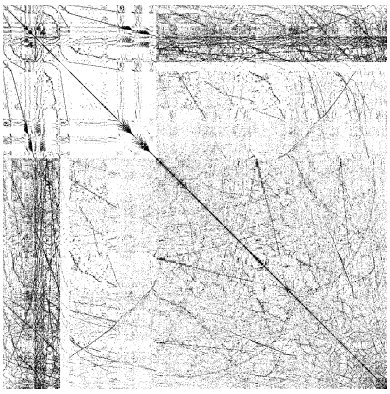
Master's Thesis

Performance Comparison of Linear Solvers for Problems of Diverse Scales and Complexity in Structural Mechanics

Most finite element methods decompose the problem they address to solving sets of large systems of linear equations, which usually consume the bulk of the computational time and resources. The properties of such linear systems have an extreme influence on the amount of effort required to solve them with generic algorithms, so specialized solvers able to exploit such properties and structures are key to improving the efficiency of finite element implementations. Having a clear view on the advantages and drawbacks of each algorithm is thus essential to making an informed choice on properly tackling a given problem.





This project consists of interfacing with existing linear solver libraries to solve various problems in structural mechanics, fluid dynamics and fluid-structure interaction. The candidate is expected to select representative problems of each type and make necessary modifications to analyze the performance of each implementation under different numerical modeling decisions (e.g.: high-order elements, various mesh qualities, presence of multifreedom constraints, node numbering strategies, etc.). An analysis of algorithmic and implementation performance of considered solvers, as well as general remarks and recommendations conclude the thesis.

Main tasks

- Literature review.
- Select and model representative problems.
- Interface with existing linear solvers.
- Run analyses and interpret results.

Requirements

- Familiarity with direct and iterative linear solvers.
- Programming experience in C/C++.
- Experience with CAD systems and meshing software.
- Experience with Linux.

Supervisors

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Language: English
Start date: variable