Outlook

We extend our software based on customer requirements towards geometric non-linear elasticity, non-linear materials and pursue further ideas to increase the performance. Additionally, we develop novel concepts for geometric editing of simulation meshes. RISTRA can be adapted towards customer-specific applications or it can be integrated as a library in existing software. Target audience for licensing of our technology are software companies and end users.

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Numerical simulation is an integral part in the product development cycle. Stability analysis is conducted by computing the stress distribution with specified load cases. In case of critical stress peaks, the geometry must be changed locally. This iterative process of geometric design, simulation and analysis is usually carried out with a number of different CAx tools. This process is time intensive as there are not only long execution times for the simulation, but also a need for manually converting data between the tools. Efficiently optimizing different shapes and testing them w.r.t. stability is therefore difficult to accomplish.

**Our approach**

To address these issues, we have developed RISTRA – Rapid Interactive Structural Analysis – with the following characteristics:

- accelerated computations by a factor of more than 80 – computing times in the order of seconds depending on mesh sizes,
- direct visualization of simulation results for stress distribution analysis and
- simple geometric operations for modifying simulation meshes.

Core of our software is an efficient structural mechanics solver that is executed on performant graphics processing units. The simulation results are immediately visualized in our integrated software environment and can be used to directly adapt the geometric design.

Our software addresses use cases from structural mechanics with the following characteristics:

- time-dependent and time-independent computation of deformation,
- geometric linear elasticity,
- geometric non-linear elasticity with small displacements and finite rotations for time-dependent computation of deformation,
- linear isotropic und anisotropic materials and
- linear, quadratic and cubic shape functions on tetrahedral (TET4, TET10 and TET20) elements.

**Benchmark**

An exemplary comparison between RISTRA and a commercial software showed the following results: For a finite element model with more than 1.3 million finite elements, the commercial software computed the results within 150 seconds, whereas RISTRA required 1.8 seconds. Thus, our structural mechanics solver is faster by a factor of more than 80 in comparison to the other software.