Chair of Computational Mechanics
Department of Vehicle Safety, BMW AG

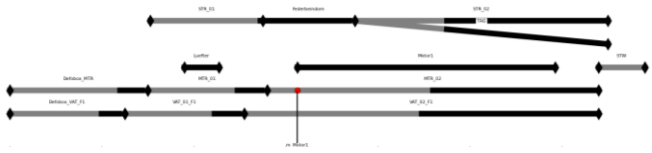
Software Lab:

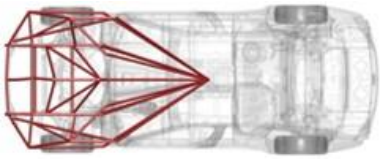
Modeling: ★★★★☆
Mathematics: ★★★☆☆
Programming: ★★★★★

A Deformation Order Analysis Tool for Vehicle Structures in Crashworthiness Design

Setting

Physical surrogate models are used to predict the crashworthiness in early phase vehicle structure design. During this phase, the necessary data for more detailed models like FEM is usually not yet available. These methods are impartial to the used materials and reduce the vehicle structure to a basic topology representing the relevant load paths [1, 2].
Each load path consists of multiple components, which are divided into a deformable and non-deformable part. Due to offsets created by the non-deformable parts, components at the same geometric position do not necessarily deform simultaneously. This is further complicated due to possible changes regarding the component's order of deformation.





Task

Develop a python application that analyzes a provided surrogate model's topology and

- Identifies all possible deformation sequences.
- Identifies the resulting deformation for specific masses and havior of the components.

Based on these results, create a visualization using the python interface for the Blender animation software for both, the

- General deformation sequences and
- Deformation of the specific model.

The latter case should reflect the different deformation modes, e.g. global bending or axial folding, depending on the respective component's force-deformation curves.

Supervisors

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References

[1] Lailong Song, Direkte Methoden zur Berechnung von Lösungsräumen in der Fahrzeugstrukturauslegung, *Diplomarbeit, Technische Universität München*, 2013.

[2] Malfavon Farias, Schorr, Shahrour, A Load Path Analysis Tool for the Vehicle Structure in Crashworthiness Design, *Software Lab, Technische Universität München*, 2015.