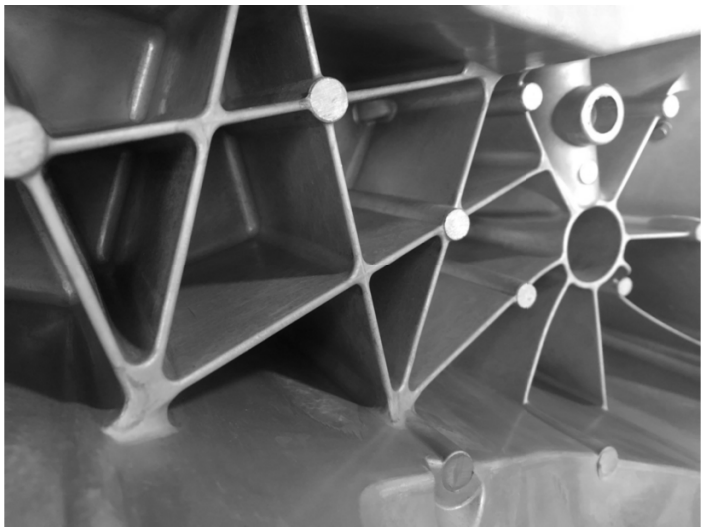
BMW Group: Modelling of casting structures
A comprehensive investigation

Challenge

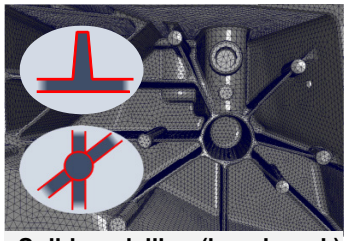
- Find the best modelling approach for complex casting geometries.
- Evaluation of accuracy, computational time, handling full-scale models and, modelling effort.

Approach

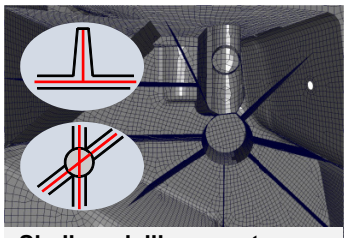
- Develop and generate various modelling approaches with different levels of discretization.
- A solid mesh made of hexa and tetra elements, respectively, was set as the benchmark.
- Application of an explicit finite element solver to account for non-linearities, large deformations and failure.
- Investigation of three component test set-ups: Global bending, local bending and axial crushing.
- Investigation of selected variants in a full-scale crash test.



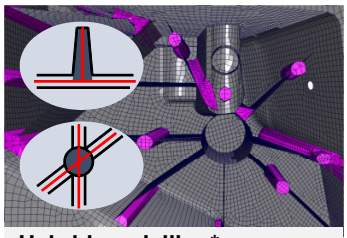
Original geometry



Solid modelling (benchmark)



Shell modelling exact



Hybrid modelling*

Results - Benefits

- Shell modelling exact: Exact modelling based on shell elements with T-junctions is still the best compromise between overall performance and modelling effort. Here, ANSA's casting functions significantly reduce the modelling effort.
- Hybrid modelling*: A shell mesh obtained from the exact modelling approach is reinforced by solid elements as needed. This approach shows a great benefit in accuracy without sacrificing computational time and handling. However, further development in ANSA's casting functions is required.

*Octavian Knoll: A Probabilistic Approach in Failure Modelling of Aluminium High Pressure Die-Castings, PhD Thesis, NTNU Trondheim, Norway, 2015.

"The exact shell modelling approach is our standard for casting structures. Here, ANSA's meshing functions – especially the casting functions – significantly reduce the modelling effort. The accuracy can be easy increased by reinforcing solid elements. This hybrid modelling approach should be taken into account for future work."

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