11. DRIVING MULTIDISCIPLINARY OPTIMIZATION USING STATE-OF-THE-ART SIMULATION TECHNOLOGIES

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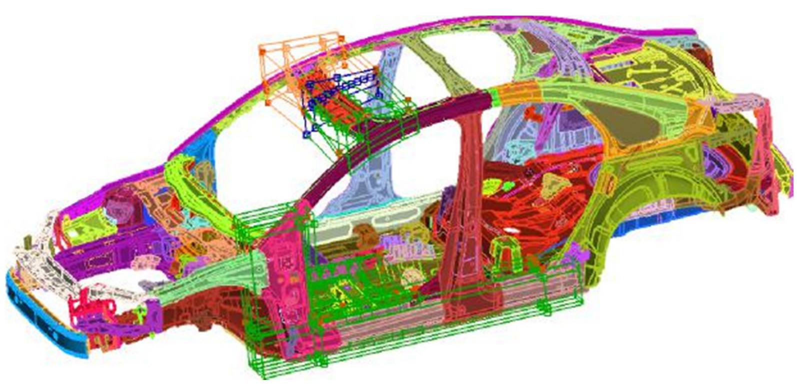
SUMMARY

This paper presents case studies from the automotive industry showcasing the latest developments in simulation technologies used to drive the multidisciplinary optimization in the product design and development process.

The automotive industry is a very dynamic and competitive environment which is perpetually driven to produce safer and more fuel efficient vehicles while keeping costs low. There are a lot of factors which drive the design of the vehicle and it becomes a very demanding task to optimize this design by taking into account all the variables which are interdependent and influence fuel economy, safety, and overall cost.

The latest developments in software and computing capabilities have enabled engineers to perform complex simulations which were not possible earlier. The use of these advanced techniques allows engineers to gain better insight for improving product designs. In a complex setup to find a multidisciplinary optimization solution, one of the important variables is the shape and size of different components of the vehicle. Many automotive companies, including Volkswagen [1], Audi [2], BMW [3], and Ford [4] have adopted morphing techniques to perform shape optimization.



Key Enablers

The advancements in pre-processing software, such as ANSA, have provided engineers with a single integrated environment to perform all the necessary tasks including shape morphing. This makes automating the entire process seamless and eliminates the need to switch between multiple software packages which can reduce the robustness of the process and lead to errors.

Following are the latest state-of-the-art advancements which are used by many automotive companies worldwide and are key enablers which make the automated shape optimization process work.

1. Efficient re-shaping of both FE and/or Geometry based models
2. Precise control over dimension changes
3. Parametric morphing for complex shape changes
4. Maintaining integrity of a variety of different weld types
5. Re-welding by following predefined welding guidelines
6. Adding/removing welds based on new dimensions
7. Maintaining smooth mesh on morphed surfaces for external aerodynamic applications
8. Full model build-up capability in an integrated environment
9. Automated mesh and model quality checks and fixes
10. Support for user scripts to perform additional actions

11.Ability to build different discipline models from same base model 12.Ability to create library of complete meshed models for DOE studies 13.Automated tasks t o perform morphing and final FE model building

14. Robust process for performing DOE's and optimization studies
15. Batch mode for driving the model variants using the "design variable" ASCII file interface
16. Easy interface for coupling this process with optimization software
17. Writing reports about the weight, welds, dimension changes, etc.

The ability to automate the construction of model variations from a single initial base model without additional input from the user is critical to the success of this process.