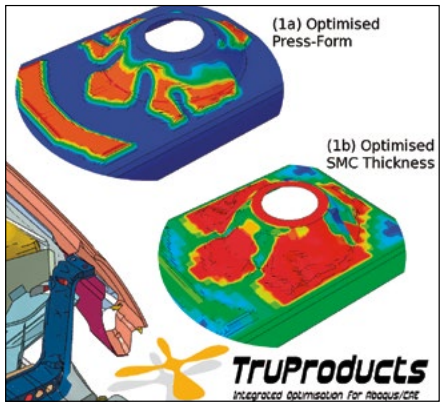
TruProducts Optimization Enables Part Reduction in Composite Automotive Body Design

Meeting structural requirements for stiffness, strength and durability can often lead to the introduction of additional reinforcements, adding mass and cost to a design. Automotive Body in White (BIW) design is a typical example of this challenge.

As a SIMULIA alliance partner since 2009, GRM has provided topology optimization to many Abaqus customers through its TruProducts family. These tools give users an efficient and cost effective solution to optimize structures for stiffness, stress and plastic strain. TruProducts modules include:

- TruForm – Topology Optimization
- TruPly – Composite Laminate Optimization
- TruSize – Shell Gauge and Topometry Optimization
- TruShape – Topography and FreeShape Optimization



Case Study

For one auto OEM, the turret design of a new, lightweight vehicle was creating issues for torsional stiffness and strength requirements. While meeting the requirements could be achieved through the addition of a localized reinforcement, this would have resulted in adding mass and cost, compromising the objectives of the lightweight body design. TruProducts was successfully applied to the turret design in two stages; first, to optimize the pressed form of the turret top; and second to minimize thickness in a Sheet Molding Compound (SMC) composite material option.

TruShape Pressed Form Shape Optimization

Considering the existing steel material, the form of the turret top was optimized to minimize the peak stress under abuse loading and maximize the stiffness. Allowing reinforcements not deeper than 5mm to be added to the design, the maximum stress was reduced to 50% of its initial value and the stiffness was increased by 280%.

TruPly SMC Composite Material Optimization

Further to the development of the steel part, the introduction of a lightweight, composite SMC material was applied, allowing for further mass reduction. TruPly was used to automatically determine the SMC material thickness distribution to meet the strength and stiffness requirements.

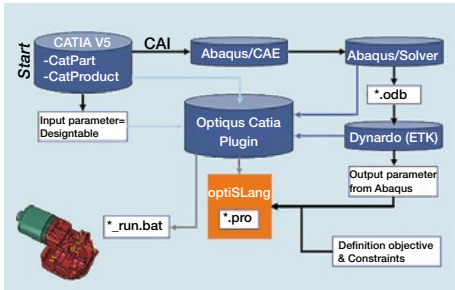
For More Information

www.grm-consulting.co.uk

Robust Design Optimization using CAD-based Parametric Geometry

Robust Design Optimization (RDO) using Computer Aided Engineering (CAE) parameter-based optimization techniques has become increasingly important in meeting product performance requirements as well as cost and time-to-market challenges. One of the main challenges of using CAE parameter-based RDO is the parameterization of the geometry. In addition to CAE-based geometry variations using mesh morphing or shape functions, leveraging CAD-based geometry variations, to accelerate design optimization, provides promising potential.

To investigate CAD-based geometric variation, an automated process flow becomes necessary starting with a parametric geometry update followed by all required CAE simulations and result extraction. An example of this process was presented by engineers from Robert Bosch at the 7th Weimar Optimization and Stochastics conference. In their application, the parametric CAD model was created in CATIA, the FEA modeling was in Abaqus, and RDO was performed using optiSLang from Dynardo. optiSLang provides capabilities for performing sensitivity analysis and investigating design optimization and robustness.



Workflow of sensitivity analysis of a power unit.

To support this process, BOSCH initiated the development of a plugin by the SIMULIA services team in Germany. The plug-in, named Optiqus, creates all necessary interfacing files to automate the CAD/CAE parameter updates, and to interface with optiSLang. Bosch has published several examples of successful applications using parametric CAD-based modeling and Abaqus simulations for product optimization and tolerance investigation using sensitivity studies, optimization and robustness evaluations. These capabilities of CAE-based parametric modeling and process automation enable RDO technologies to be implemented as standard virtual prototyping processes for optimizing product performance and robustness.

For More Information

www.dynardo.de/fileadmin/Material_Dynardo/dokumente/Presentation_Power_Unit.pdf (German language)