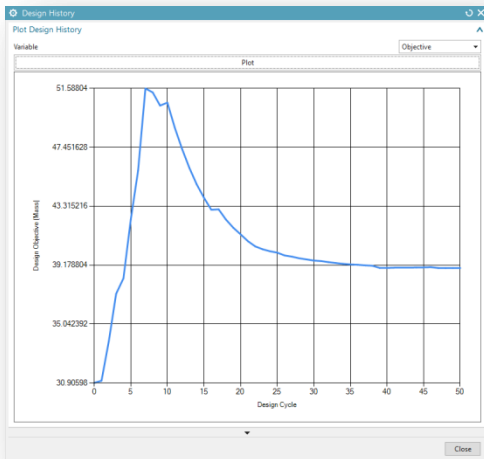
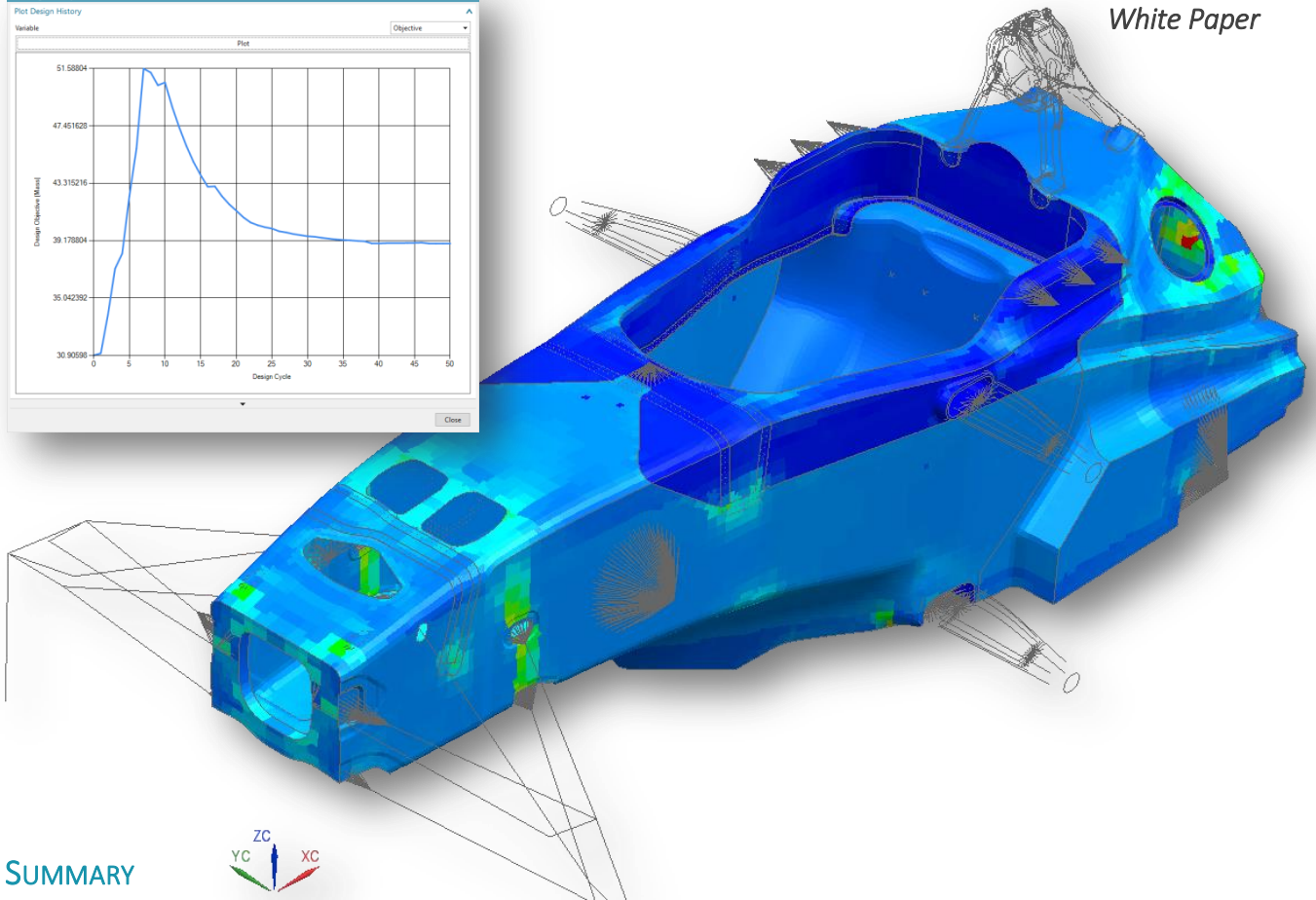


## OptiAssist for Simcenter 3D

# Unlocking Nastran Design Optimisation for Composite and Shell Structures



White Paper



### SUMMARY



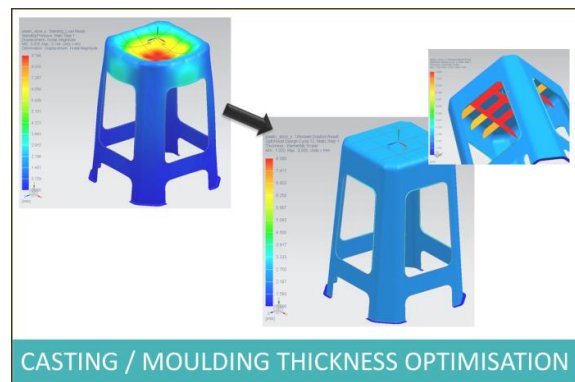
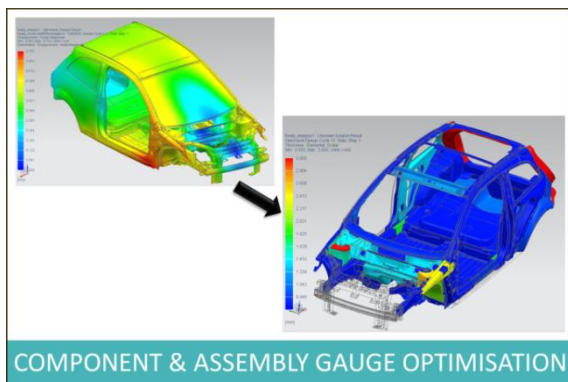
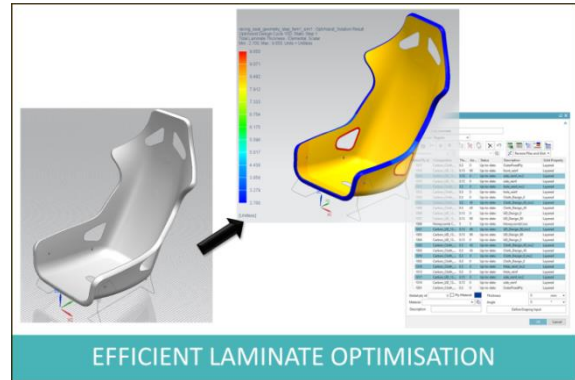
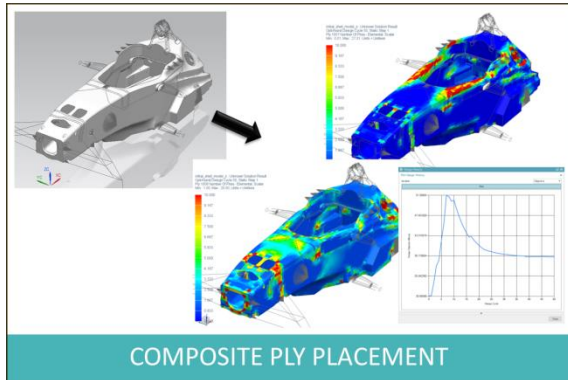
OptiAssist for Simcenter 3D is an add-in for Simcenter 3D, designed to unlock the power of structural optimisation using the Nastran Optimisation module (SOL200). Embedded within the familiar Simcenter 3D interface, OptiAssist can quickly and easily guide the engineer through the process of creating, analysing and post processing optimisation solutions. Using OptiAssist allows engineers to rapidly deliver high performance, lightweight products within a short timeframe.

**OptiAssist unlocks the Simcenter™ Nastran® optimisation module, providing focussed engineering workflows.**

- Composite Ply Placement
  - Efficient Laminate Optimisation
  - Component & Assembly Gauge Optimisation
  - Casting / Moulding Thickness Development

# Key Software Processes

Version 1.0 of OptiAssist for Simcenter 3D provides 4 optimisation workflows, focussed around the development of specific engineering and manufacturing methods. Whilst tailored towards specific engineering processes, these workflows may be applied to any composite or shell structure where optimisation can be applied, eliminating the costly and inefficient process of manual iteration.



Through the OptiAssist interface, engineers are able to efficiently develop their products, seamlessly integrating optimisation into their engineering development cycle.

**Composite Ply Placement** – Ply Pattern optimisation is used to determine the best layout and shape of composite plies for a structure. Stiffness, strength and modal requirements can be considered. OptiAssist can automatically update the Global Layups with the optimised ply patterns or can work with PCOMP data where the user does not have the Laminate Composites Module.

**Efficient Laminate Optimisation** – Detailed Sizing is used to optimise an existing laminate/layup to refine its performance at a later stage of the design process. Ply thickness & angle can be optimised simultaneously whilst considering the performance requirements of the structure.

**Component & Assembly Gauge Optimisation** – Gauge optimisation is used on structures consisting of thin panels or many thin features (shell elements). Thickness of each selected Physical Property will be updated automatically to meet the defined constraints and meet the optimisation goal.

**Casting / Moulding Thickness Optimisation** – Casting or Moulding optimisation is very similar to Gauge Optimisation, however, each designed Physical Property is subdivided into smaller areas, which can each have their own individual thickness. This allows the thickness to vary across the property.

## A Pedigree of Success in Formula 1®

Developed through 15 years of continual work with leading Formula 1® teams, OptiAssist's composite laminate optimisation techniques have been refined to be robust and efficient. Working with teams such as Red Bull<sup>1</sup>, Renault F1<sup>2</sup>, Force India<sup>3</sup> and Caterham F1<sup>4</sup>, OptiAssist has been used by the Formula 1® Team winning the driver's Championship for 13 of the last 14 years.

- 1 - *Development Of Composite Laminate Optimisation Techniques Using Topometry Optimisation In Genesis*, Lewis Butler, Red Bull Racing Ltd, 2006
- 2 - *Optimised Roll Hoop Design Methods*, Richard Whilte, Renault F1, 2016
- 3 - *A Comparison Of Optimisers In The Application Of Formula 1 Monocoque Design*, Dr. Simon Gardner, Force India, 2008
- 4 - *Case Studies in Composite Laminate Optimisation*, Adam Moore, Caterham F1, 2013



OptiAssist for Simcenter 3D provides efficient optimisation work trails within Simcenter 3D, automatically preparing the Nastran optimisation (SOL200) solution data based upon the user's setup. Users may select their existing Nastran solution / subcase objects and OptiAssist will automatically migrate these to the optimisation solution set. Version 1.0 supports static and dynamic modal solution types. Within the OptiAssist trails users may consider the following structural responses:

- Displacement
- Stress
- Failure Index
- Frequency
- Mass
- Global Stiffness (Strain Energy)

Further to managing the optimisation data creation, solution, post-processing and model update, all data created by OptiAssist is stored in the Simcenter model tree, allowing direct further editing for more experienced users.

## A Platform for Unlocking Design Optimisation

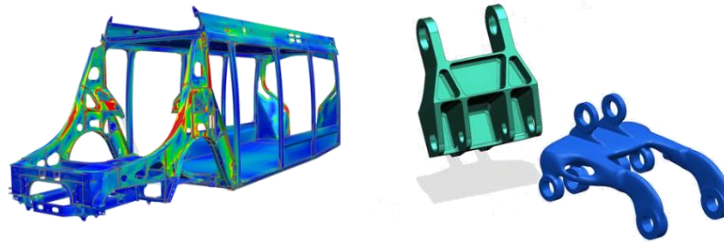
Design optimisation techniques are not new, but their adoption into engineering developments remains relatively low; often applied by an 'optimisation expert.' OptiAssist for Simcenter 3D builds on GRM's experience of applying design optimisation to real world engineering developments, providing an interface that guides engineers, allowing them to unlock the capabilities of design optimisation.



## SIMCENTER NASTRAN DESIGN OPTIMISATION MODULE (SOL200)

Available within Simcenter Nastran since its release in 2001, the design optimisation module, also known as SOL200, provides users with a very powerful and flexible set of optimisation tools. Using a gradient optimisation method, the module allows engineers to efficiently consider thousands of design variables, whilst simultaneously managing design targets and constraints across the many different solution types.

### Simcenter Nastran Optimisation (SOL200) Feature Summary



Nastran's optimisation module supports the following techniques:

- Topology – Optimal design layout within a given package volume
- Size – Physical property changes to a design. For example, thickness
- Shape – Geometric changes to a design
- Topography – Swaging/bead form development of thin panels
- Topometry – Physical property changes to a design at an element level
- Sensitivity Analysis – Provides understanding of the change in response behaviour to design variables defined using the above methods

The optimisation module of Nastran is an additionally licensed option, available from your Siemens software provider.

## BENEFITS OF USING OPTIASSIST FOR SIMCENTER 3D

- Shorten laminate development times and reduce engineers iteration overhead
- Maximise potential of composite materials through optimisation
- Develop optimal thickness shell structures such as castings, mouldings, machinings and fabricated assemblies
- Seamlessly integrate powerful optimisation tools into your engineering team
- Optimise and develop products directly within the Simcenter 3D environment

## COMPATIBILITY

As a direct add-in to the Simcenter 3D environment, OptiAssist provides an optimisation environment for Simcenter 3D that works directly with the native model data. Composite Model updates work with both the standard Simcenter 3D composite model and the extended capabilities of the Laminate Composites module.