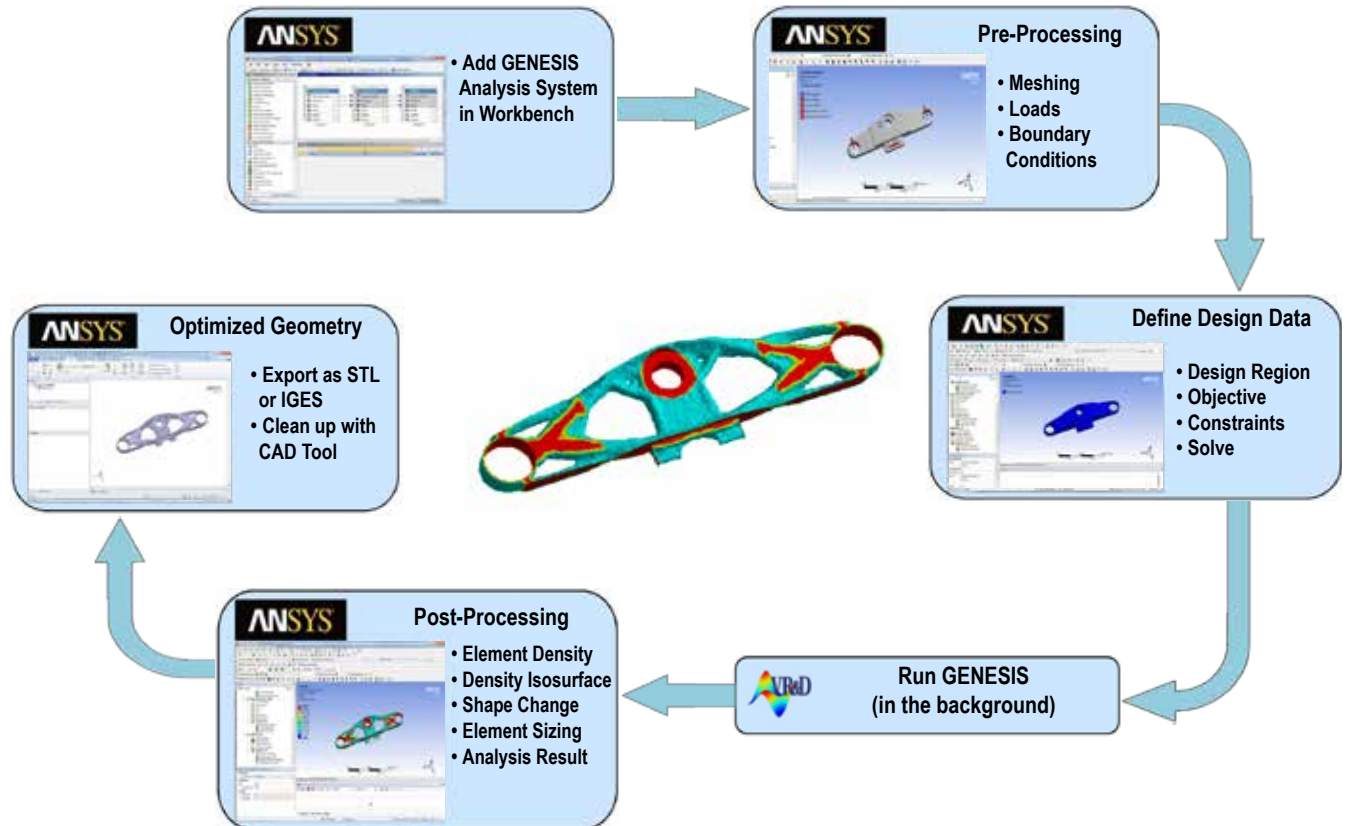


# GSAM



## GENESIS Structural Optimization for ANSYS Mechanical

GENESIS Structural Optimization for ANSYS Mechanical (GSAM) is an integrated extension that adds topology, topography, freeform, sizing and topometry optimization to the ANSYS environment. Designers benefit by automatically generating innovative designs in a reliable, robust and easy-to-use interface.



### Benefits and Highlights

- Generate Innovative Designs
- Reduce Cost and Improve Performance
- Reduce Engineering Time
- Easily add structural optimization to existing ANSYS workbench workflow
- Fast and reliable structural optimization
- Easy and Convenient to post-process optimization results

### Structural Optimization Capabilities

- Topology
- Topography
- Freeform
- Shape Optimization with Domains (access through Design Studio)
- Sizing
- Topometry
- Mix of any of the above

## Supported ANSYS Analysis Systems

- Static Structural (Linear and Nonlinear)
- Modal
- Linear Buckling
- Harmonic
- Random
- Transient Structural
- Multiple analysis systems simultaneously

## Multiple Material Properties

- Isotropic
- Orthotropic
- General Anisotropic

## Use ANSYS Solver for Nonlinearity

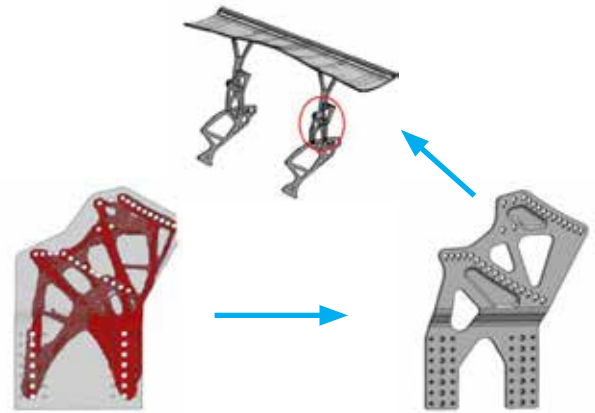
- Nonlinear Large Deformation
- Nonlinear Material
- Nonlinear Contact
- Transient

## Wide Range of Design Responses

- Strain Energy
- Displacement
- Relative Displacement
- Frequency
- Buckling load factors
- Modal/direct/random displacement, velocities and accelerations
- Moment of Inertia
- Mass/Volume and Topology Mass Fraction
- Stresses
- Contact Pressure
- Contact Clearance
- Equivalent Radiated Power
- Others

## Topology Optimization

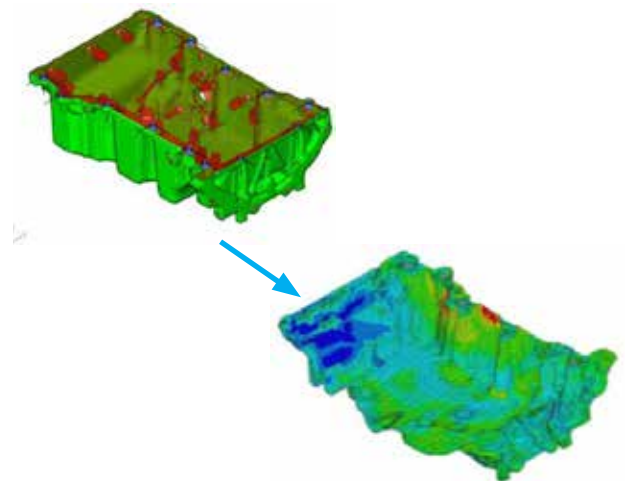
Topology design is to find the optimal distribution of material in a given package space while improving the product performance. Typically topology optimization is used by engineers in the early design stages to generate innovative design proposals. GENESIS provides an extensive family of fabrication constraints such as casting, extrusion, symmetries, etc., that helps the user to obtain easy to build designs.



Topology Design for C6.R Tail Frame Assembly  
(Courtesy of Pratt & Miller Engineering)

## Topography Optimization

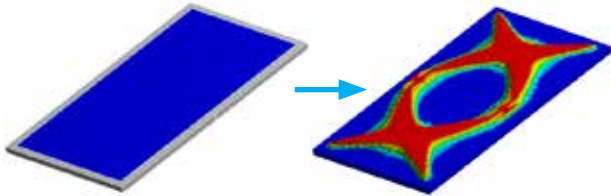
Topography design is a special type of shape optimization where the grids are moved along the normal direction of selected surfaces. Typically topography optimization are used by designer to generate bead patterns on a plate to improve the design performance. Fabrication requirements such as symmetries, extrusion and bead fraction can be imposed if necessary.



Topography Optimization for Oil Pan

## Freeform Optimization

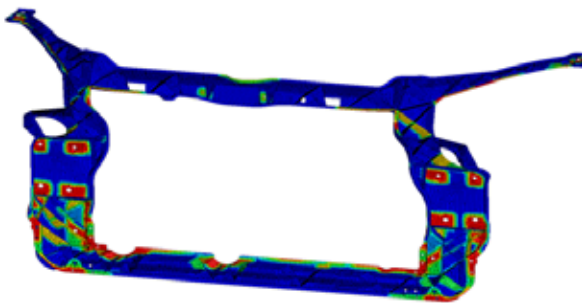
Freeform design is also a special type of shape optimization. The intention is to increase the design freedom with little effort from the user. GSAM will automatically create perturbations for grids on selected surfaces. During optimization process the grid locations are changed to achieve a better design. Optionally the user can apply fabrication requirements such as symmetries, extrusion or grid fraction. Freeform optimization can also be used by automatically linking adjacent grids to reduce computational cost.



Freeform Optimization for a Solid Plate – Ribs Design

## Topometry Optimization

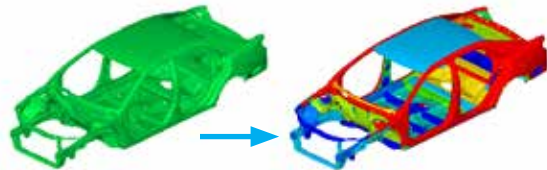
Topometry is an element by element sizing optimization capability. This capability is to increase the design freedom for problems where the user has flexibility for design changes. Typically topometry design can be used to find the thickness distribution of plates. It can also be used to find the best elements to keep from a pool of elements. Fabrication constraints such as symmetries and extrusion can be imposed on topometry designed regions. Coarse topometry option is available to reduce computational cost.



Topometry Design for Automobile Support Frame

## Sizing Optimization

Sizing optimization is to design the dimension of the elements. In current GSAM implementation, the thickness of shells can be designed. GSAM will automatically create design variables associated with the thickness of the shell. Sizing optimization is typically used at detailed design stage to gain more material savings and improve design performance.

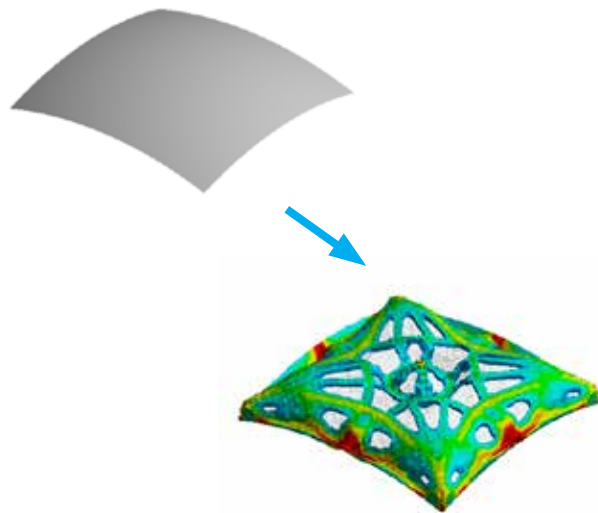


Normalized original thickness      Normalized optimized thickness

Sizing Optimization for Car Body

## Mixed Optimization

Topology optimization can be combined with sizing, topometry, topography, and/or freeform design. Optimization problems may have both topology designable regions and parametric designed entities at the same time. All response types may be used in any optimization setup (i.e., topology-only, parametric-only or mixed).



Combined Topology and Freeform Optimization for a Curved Shell

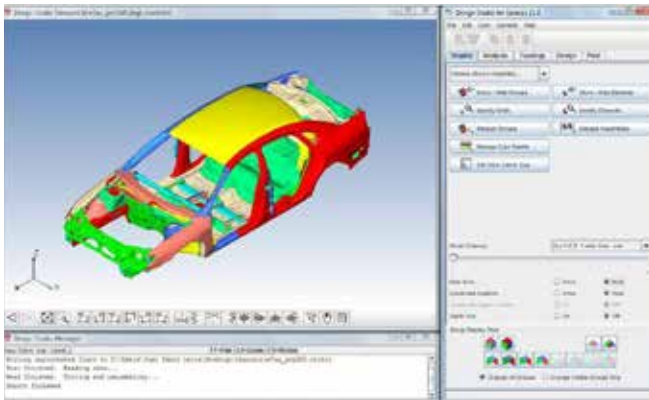
## Other VR&D Products

### GENESIS - Structural Analysis & Optimization

GENESIS is a fully integrated finite element analysis and design optimization software package. Analyses include static, normal modes, direct and modal frequency analysis, heat transfer and system buckling. Design optimization is based on the advanced approximation concepts approach to find an optimum design efficiently and reliably. Actual optimization is performed by the well established DOT and BIGDOT optimizers, also from VR&D. Design capabilities include: topology, shape, sizing, topography, topometry, and freeform optimization. Typically the optimization requires less than ten detailed finite element analyses, even for large and complex design tasks.

### Design Studio for GENESIS

Design Studio for GENESIS is a design oriented pre- and post-processor graphical interface for the GENESIS program. It features built-in and easy-to-use trails for setting up the optimization problem and running GENESIS from the interface. It also supports post-processing of the optimization results with contour plots, deformed plots, animations, etc.



Design Studio for GENESIS

### VisualDOC - Multidiscipline Design Optimization

VisualDOC is a software system that simplifies adding optimization to almost any design task. It uses a powerful intuitive graphical interface, along with gradient based and non-gradient based optimization, response surface (RS) approximate optimization, and design of experiments (DOE) methods. VisualDOC interfaces easily to your own code or third-party analysis program. For example, VisualDOC can be easily coupled with ANSYS Workbench.

### About Vanderplaats Research & Development, Inc.

Vanderplaats Research & Development, Inc. (VR&D) mission is to provide the best technology, software, staff of experts and client support in the optimization world. The company was founded by Dr. Garret Vanderplaats, one of the best known experts in the optimization world. VR&D has a track record for consistently delivering a competitive advantage to customers in a broad range of industries.

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LS-DYNA is a trademark of Livermore Software Technology Corporation

### DOT - Design Optimization Tools

DOT is a general purpose numerical optimization software library which can be used to solve a wide variety of nonlinear optimization problems. If you require only an optimization engine to incorporate into your design software, DOT will serve that purpose.

### BIGDOT

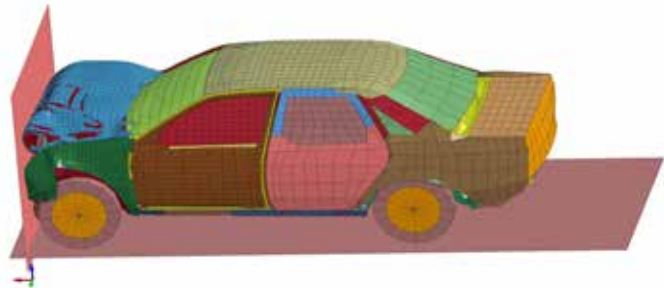
BIGDOT is intended to solve very large, nonlinear, constrained problems where gradient information is available, and function and gradient evaluation is efficient. BIGDOT is capable of solving continuous, discrete/integer or mixed variable problems. Problems in excess of three million variables have been solved by BIGDOT.

### SMS Fast Eigensolver

The SMS eigensolver may be added to existing NASTRAN installations to offer significant performance advantages over the default method when a large number of eigenmodes are required for a system with many degrees of freedom. Benchmark studies and user experience show 2-10 times speedup. SMS may also be embedded into your product/software.

### ESLDYNA - Optimization Software for LS-DYNA

ESLDYNA is based on the Equivalent Static Loads (ESL) method to perform optimization based on a nonlinear finite element analysis with GENESIS as the structural optimization program. ESLDYNA takes advantage of the capability of GENESIS, a linear structural optimization program, to solve large scale optimization problems based on the responses from a nonlinear finite element analysis. It also helps to significantly reduce the design time by identifying high performance designs with five to ten nonlinear analyses.



Topometry Optimization to Minimize Firewall Intrusion