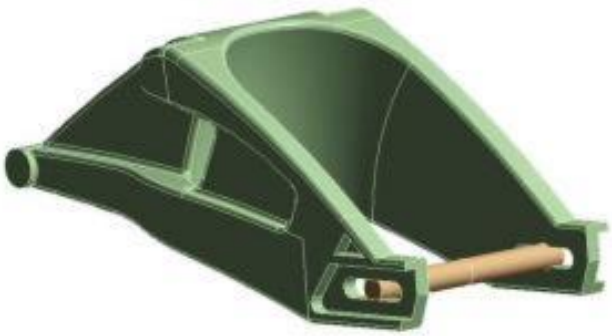
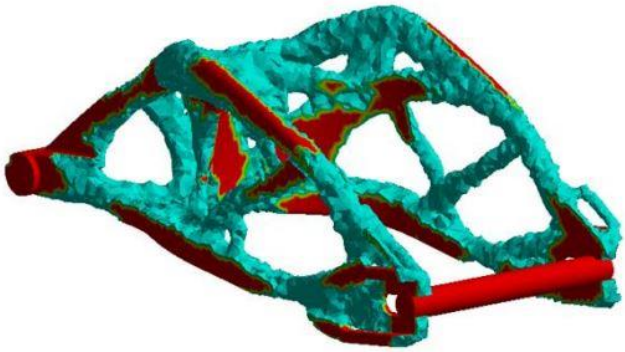
GTAM/GSAM – Fully Integrated Optimisation for ANSYS

White Paper





Summary

GTAM and GSAM are fully integrated implementations of the leading structural optimisation tool, GENESIS, fully embedded within the Ansys Workbench environment. GTAM provides topology optimisation, whilst GSAM includes the full GENESIS optimisation package for ANSYS. This enables users to create efficient, light and innovative designs at a reduced time and cost.

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GTAM/GSAM WORKFLOW

GENESIS Structural Optimisation for ANSYS Mechanical (GSAM) adds various optimisation prospects, all within the familiar ANSYS Workbench workflow as an integrated extension. The extension enables the user to develop revolutionary designs at reduced cost and development time, ultimately decreasing time to market.

Workbench
- Simply Add GENESIS Analysis to Workbench

→ **Pre Processing**
- Meshing and definition of loads and boundary conditions

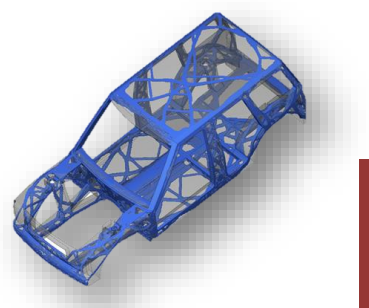
→ **Design Data**
- Define design space, objectives, constraints and solve

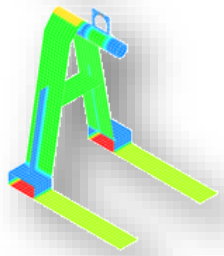
→ **Run GENESIS**
- Process runs in the background

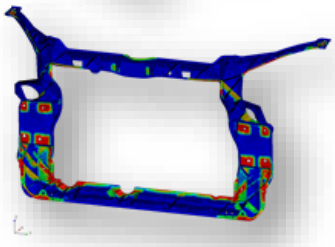
→ **Post Processing**
- Review optimisation results directly in Workbench

→ **Output**
- Export result as IGES or STL data for design modification

GSAM Optimisation







Topology – GTAM is used to find the optimal distribution of material in a given design space

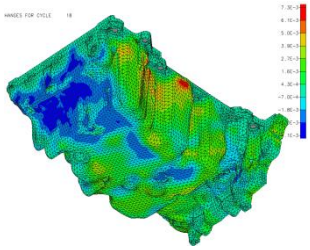
Shape Optimisation – Via Design Studio, define parameterised shape changes and develop optimal configuration

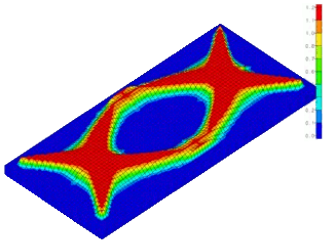
Sizing – Determine optimal section sizes and properties for a given design (For example shell panel thickness)

Topography – Optimise swage and bead patterns of panels to maximise stiffness and minimise vibrations

Topometry – Optimise properties on an element basis (For example casting/ moulding thickness)

Freeform – Refine your design through automatic shape modification





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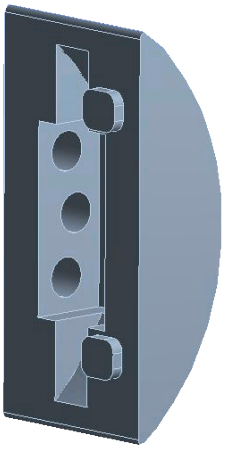
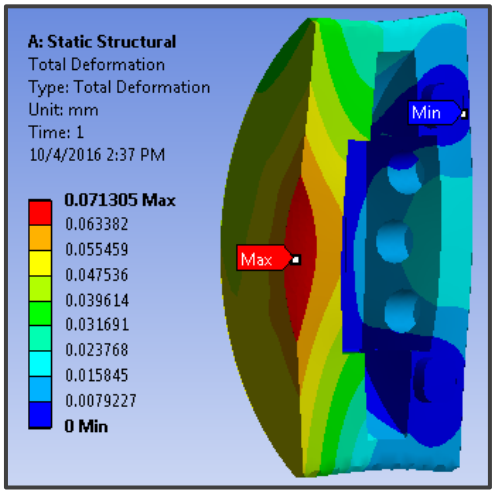
Case Study – Optimising a Brake Caliper Using GTAM

In order to convey the capabilities of GTAM, a brake caliper case study was selected. The initial design space includes the part that holds the caliper assembly in order to apply a reaction which would then result in braking. In the simulation study presented, the caliper is to be mounted at two points representing supports, with a 15 MPa pressure applied across the six pistons, and a 10000N vertical force simulating the interaction between the pads and discs.

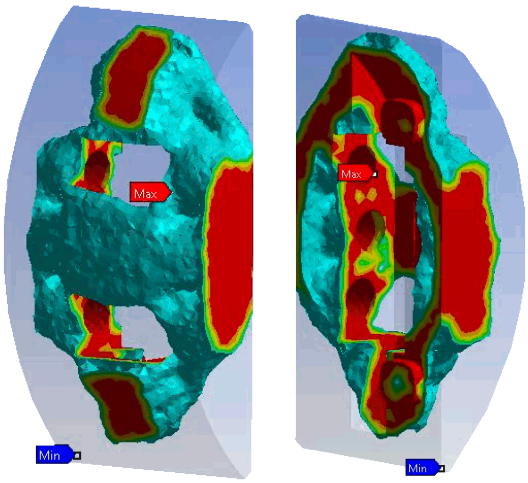


A static structural analysis with the defined loads and constraints then presents the deformation results shown opposite. Results are as expected, with the least deformation occurring at the supports. Over engineering of the part conveys a displacement under 0.1mm.



By following the simple instructions provided in the installation document, GENESIS was added to the appropriate version of ANSYS as an extension. This was then integrated to the project Workbench workflow. This means that without having to leave the familiar ANSYS Mechanical environment, GENESIS features can be accessed.

As part of the post processing, the results can then be interpreted as an Isosurface, defining an envelope of the material which should be developed into a manufacturable design. The results can then be exported as an STL.



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GTAM

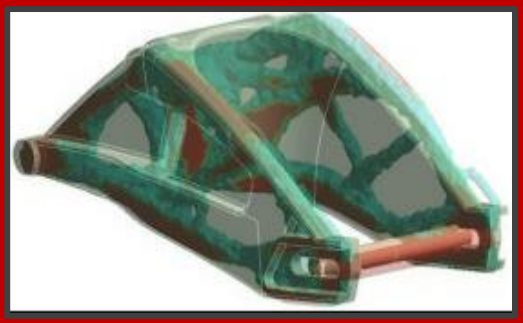
GENESIS Topology for ANSYS Mechanical guides the development of lightweight designs within the familiar ANSYS Workbench workflow. The design space can then be optimised to a defined target mass set as a percentage of the overall design space mass. From a provided concept design, single or multiple simulation studies including different combinations of loads and constraints can be applied and optimised.

GTAM Features

- Support multiple loading conditions including: Static, Modal, Linear Buckling, Harmonic and Random Vibrations.
- Built in responses for objectives and constraints such as: Strain Energies, Frequencies, Mass, Displacement etc.
- Built in manufacturing constraints such as: Symmetries, Casting, Extrusion etc.

Motorbike Swing Arm Optimisation Case Study

A motorbike swing arm concept was to be developed with the design guidance of GTAM. Vertical, lateral and torsional simulation cases were presented with constraints defined; the optimisation was carried out for maximum stiffness, with a target mass being 30% of the original design space mass. In many cases such as this, topology optimisation can be used to convey the key load paths through the part. The optimisation result presented opposite conveyed the possibility for a lightweight part. Furthermore, a right first time approach means a feasible design with the potential to reduce cost and minimise time to market.



Other Features of GTAM/GSAM

- Support Ansys Analysis Systems including:
  - Static Structural (Linear and Non Linear)
  - Modal, Linear Buckling, Harmonic, Random and Transient Structural
  - Multiple analysis systems simultaneously
- Multiple Material Properties including:
  - Isotropic, Orthotropic and General Anisotropic
- Use ANSYS Solver for:
  - Nonlinear Large Deformation
  - Nonlinear Material and Contact

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