

TOSCA Structure

The Structural Optimization System

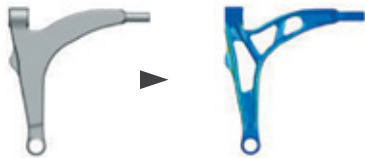


TOSCA Structure is a flexible, modular software system for non-parametric structural optimization that provides topology, shape, and bead optimization using industry standard finite element solvers (ANSYS, Abaqus, MSC Nastran, NX Nastran). The setup is simple – model parameterization is not necessary. Existing solver input files are used for the optimization. TOSCA Structure is based on market-leading technology and provides advanced capabilities for optimization with nonlinear analysis, fatigue, and NVH.

TOSCA Structure Features

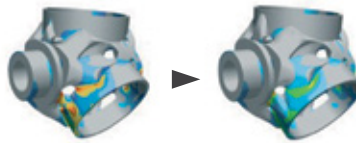
Innovative, lightweight design concepts

Topology optimization – conceptual design for lighter and stiffer structures. Create lightweight, ready-to-manufacture product designs and reduce time-to-market, physical tests, and prototype builds.



Improved designs for more durability and strength

Shape optimization – improve existing designs for more reliable and durable components. Minimize stress, strain, and damage – or any combination of these – by automatic modification of the surface geometry.



Efficient bead patterns for increased stiffness and reduced noise

Bead optimization – improve the static and dynamic properties of shell structures. Generate optimal bead layouts while accounting for manufacturing constraints, complex geometries, and realistic loads.



Powerful graphical user interface

TOSCA ANSA environment – intuitive GUI for easy setup and execution of optimization tasks. Save time with customizable, reusable workflow templates and fully automated validation runs. Define your optimization tasks interactively on a 3D FE model and make use of automatic consistency checks.



TOSCA Structure Advanced Capabilities

Full optimization potential with realistic simulation models

Nonlinear analysis – topology and shape optimization in combination with contact, material nonlinearity and large deformation. Avoid error-prone and time consuming model simplification.

Reduced weight and ensured reliability

Durability – shape optimization using fatigue simulation results, with standard or in-house fatigue solvers. Save weight and ensure highest result quality for reliable components.

Improved comfort through reduced noise vibration

NVH – topology and bead optimization using the results from acoustic and frequency response analysis. Generate optimal solutions for rib and bead layouts, balance mass and stiffness effects for reduced acoustic emission, sound pressure level, and dynamic reaction forces.

TOSCA Structure Key Benefits

Features and Benefits with TOSCA Structure

TOSCA Structure features best-in-class optimization technology for high quality simulation results. Take full advantage of your optimization potential while leveraging advanced simulation capabilities such as material and geometrical nonlinearity (large deformation and contact).

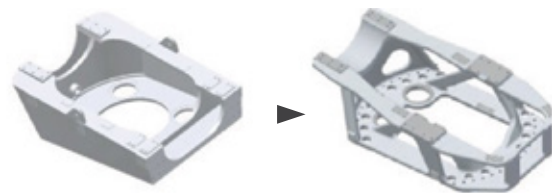
- Seamless integration with leading FEA & durability solvers
- Direct use of existing knowledge and models
- Full design flexibility without time-consuming parameterization
- High fidelity optimization for nonlinear analysis, durability and NVH
- Simultaneous optimization to meet static, dynamic, and thermo-mechanical requirements
- Automatic validation analysis runs and direct data transfer to CAD systems
- Fewer prototypes and less physical testing
- Economic use of existing IT investments
- Fewer prototypes and less physical testing
- Faster turnaround from analysis to design or manufacturing
- More durable and lightweight designs
- Optimized products drive innovations in your market

Examples of the industrial use of TOSCA Structure

Wind turbine mainframe - optimization with TOSCA Structure.topology

For larger wind turbines stiffness and strength requirements are more difficult to meet. The redesign of the mainframe should result in an economic design with optimal vibration behavior.

Topology optimization of the mainframe led to a lightweight structure which met static and dynamic criteria. Manufacturing constraints were considered during the optimization to generate a producible design, e.g. to avoid under-cuts. Mass reduction approaching 40%, a feasible final design, and a faster development process were achieved.



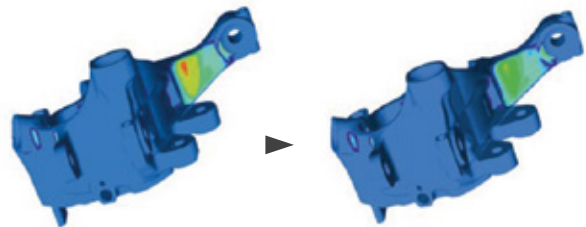
Courtesy of Suzlon GmbH

The integration of TOSCA Structure into the product development process resulted in a shorter time-to-market for the mainframe, and a lightweight cast structure with 40% mass reduction.

Rear wheel carrier - optimization with TOSCA Structure.shape

For the weight optimization of the chassis component multiple criteria such as strength, fatigue, plasticity and stiffness had to be considered.

Violated stiffness demands required a modified design for the rear wheel carrier considering damage requirements for multiple loads and maximum allowed strain for breaking loads. With TOSCA Structure a shape optimization was performed directly on the existing model without error-prone model simplification or time consuming parameterization. After 20 automated analysis steps a redesign was derived with better performance and even a reduced mass compared to the initial design.



Courtesy of BMW Group

Damage was reduced by 60% from the initial value. At the same time formerly violated stiffness constraints were met.



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