TOSCA Structure delivers powerful optimization solutions for design of lightweight, stiff, and durable parts and assemblies within shorter development cycles. Rely on TOSCA’s leading optimization technology to achieve highest product performance and meet business objectives faster.
TOSCA Structure
The Suite for Structural Optimization

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.

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.

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.

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.
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 undercuts. Mass reduction approaching 40%, a feasible final design, and a faster development process were achieved.

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.

Automotive muffler - optimization with TOSCA Structure.bead

Noise issues motivate engineers to find the optimal dynamic behavior of the muffler. Key quality factors such as structural stiffness and vibration behavior should be met.

In order to reduce noise and improve structural stiffness, bead patterns are formed in sheet metal structures. In an automatic loop with TOSCA Structure.bead the optimal bead layout was achieved after only three finite element analyses. Manufacturing requirements were directly applied to achieve a faster turnaround from analysis to the production process.

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.

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

After only three FE analyses, a bead layout was created using TOSCA Structure. The 1st and 2nd eigenfrequencies were increased significantly - from 280 to 520 Hz, and from 340 to 570 Hz, respectively. A corresponding reduction of noise was achieved.

Find more applications from a variety of industries on our website: www.fe-design.de/en/solutions/applications
Key benefits -
for optimization solutions with TOSCA Structure

Technical highlights
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
- Handling of complex manufacturing conditions
- Automatic validation analysis runs and direct data transfer to CAD systems

Economic advantages
TOSCA Structure creates optimized design concepts with significant potential for savings of material and weight. Optimization in an early phase speeds up the product development and hence results in a shorter time-to-market. Gain and maintain a better competitive position in the marketplace with innovative, state-of-the-art designs.

- 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

Key industries

Find our references on
www.fe-design.de/en/solutions