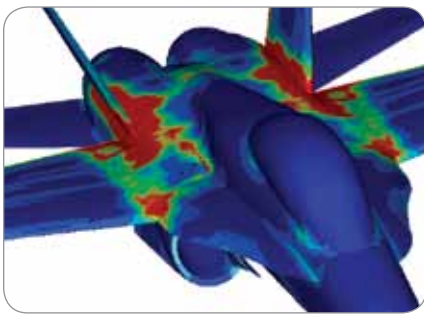


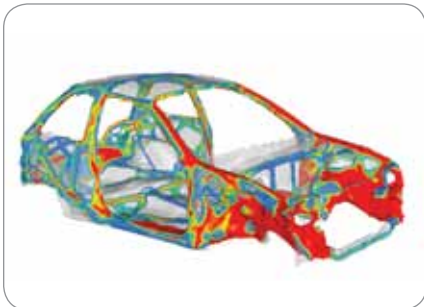
Altair® OptiStruct®

Optimization-Driven Structural Analysis

Altair® OptiStruct® is an industry proven, modern structural analysis solver for linear and non-linear structural problems under static and dynamic loadings. As a market leader for structural design and optimization, OptiStruct helps designers and engineers analyze and optimize structures for their strength, durability and NVH (noise, vibration and harshness) characteristics and rapidly develop innovative, lightweight and structurally efficient designs.



Linear and non-linear static analysis



Structural Architecture Optimization Studies

Advanced Solver Technology and Accurate Results

Based on finite-element and multi-body dynamics method, OptiStruct is designed with state of art structural analysis and optimization technology. The solution algorithms for linear, non-linear, and modal analysis problems are highly efficient compared to conventional solvers. With intelligent memory management, OptiStruct easily simulates structures with millions degrees of freedom (DOFs) without any model size restrictions.

Built-in Fast & Large Scale Eigen Solver
A standard feature of OptiStruct, Automated Multilevel Substructuring Eigen Solver (AMSES) can calculate thousands of modes for models with millions of degrees of freedom in less than one hour.

Most Advanced & Fastest NVH Analysis Solver
OptiStruct supports the most advanced features necessary for efficient and effective full vehicle noise and vibration analysis. It is the fastest NVH (Noise, Vibration and Harshness) analysis solver available in the market, providing unique and advanced functionalities including one-step TPA (Transfer Path Analysis) analysis, AMSES, model reduction techniques, design sensitivities and ERP (Equivalent Radiated Power) response which makes it easy to optimize structures for NVH performance.

Robust Powertrain Durability Analysis Solver
With bolt pre-tensioning, gasket elements, and efficient contact algorithms, OptiStruct is able to perform full powertrain

durability analysis. The gasket elements are very robust and do not require work arounds used by other software.

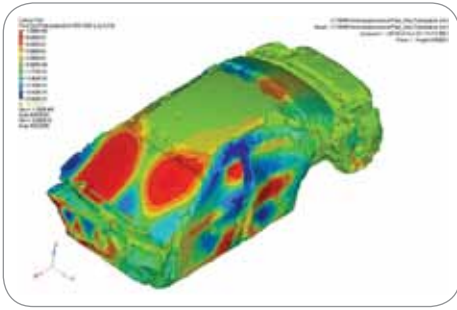
OptiStruct is highly differentiated for its solution speed, accuracy and robustness. The diagnostic capabilities of the solver provide unparalleled model debugging capabilities which further contribute to accurate simulation of design behavior.

Award Winning Optimization Technology

OptiStruct's optimization technology is simply the best in the world. Using highly advanced optimization algorithms, OptiStruct can solve the most complex optimization problems with thousands of design variables in a short period of time. Its advanced optimization engine allows users to combine topology, topography, size and shape optimization methods to create better and more alternative design proposals leading to structurally sound and lightweight design.

Topology Optimization
OptiStruct's award-winning design-synthesis technology uses the topology optimization approach to generate innovative concept-design proposals. In the initial phase of the development process, the user enters the package space information, design targets and manufacturing process parameters. OptiStruct then generates a manufacturable design proposal that is optimized for the given design targets. The manufacturing process parameters are important in achieving interpretable, feasible designs.

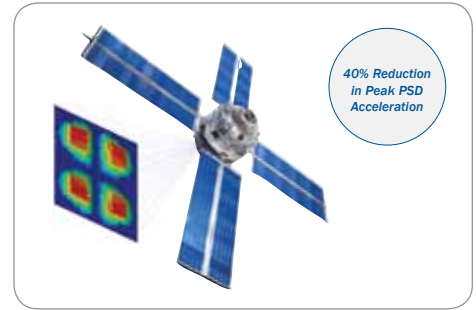
Composite Optimization
OptiStruct's comprehensive composite design and optimization package



Full-vehicle noise & vibration analysis



Complete solution for powertrain durability



Bead design of satellite panel using topography optimization

streamlines composite structure design work for both the designer and the analyst. This ply-based approach simplifies the interpretation of the concept design results from free-size optimization.

OptiStruct also considers manufacturing requirements early in the design process to achieve practical designs and proposes a lay-up sequence that meets these requirements.

Multi-Disciplinary Structural Optimization
OptiStruct's seamless integration of state-of-the-art, gradient-based optimization methods make multi-disciplinary size and shape optimization easy to use, robust, and very fast. Based on the analysis results, product engineers make part modification proposals in order to meet stress, weight, and stiffness requirements.

System Level Design Optimization
The Equivalent Static Load Method (ESLM) is an innovative method implemented for simultaneous optimization of both flexible bodies and rigid bodies during multi-body dynamic analysis. This first in-industry, innovative method, allows for the optimization of system level multi-body dynamic models. Additionally ESLM can be applied to conceptual design synthesis and design fine-tuning.

Fatigue-Based Concept Design & Optimization
OptiStruct's fatigue optimization capabilities allow concept design synthesis (topology, topography, and free-size) and design fine-tuning (size, shape, and free-shape) based on fatigue performance. Damage and life from either stress-life or strain-life fatigue analysis can be used as design criteria. This capability allows concept design using fatigue responses and is computationally efficient compared to fatigue-based optimization using third party applications.

Easy Model Set-up, Post-Processing, Automation

OptiStruct is tightly integrated into the HyperWorks environment enabling fast and easy model set-up in HyperMesh. Animations, contour plots and charts can be generated using the post-processing tools in HyperView and HyperGraph. Moreover, jobs can be easily automated by using the powerful automation and data management layer available in HyperWorks.

Cost-Effective NASTRAN Replacement

OptiStruct is highly compatible with NASTRAN. OptiStruct solutions use standard NASTRAN type input syntax and write analysis results in both NASTRAN PUNCH and OUTPUT2 formats to support legacy models and compatibility within NASTRAN work flows. The most popular linear analysis problems can be solved with OptiStruct. Deeply integrated in HyperWorks, OptiStruct increases end-user efficiency and significantly reduces corporate investments in third-party solver solutions.

Features & Functionalities

Analysis Types

- Linear and non-linear static analysis
- Normal modes analysis for real and complex eigenvalues
- Linear buckling analysis
- Direct and modal frequency response analysis
- Random response analysis
- Linear direct and modal transient analysis
- Coupled fluid-structure (NVH) analysis
- Linear steady-state and transient heat transfer analysis coupled with static analysis

Stiffness, Strength, Stability

- Pre-loading using non-linear results for buckling analysis, frequency response and transient analysis
- Improved convergence of contact analysis with friction
- Contact-friendly second order solid elements

Noise and Vibrations

- AMSES large scale eigen solver
- Fast large scale modal solver (FASTFR)
- Detailed output of results at peak response frequencies (PEAKOUT)
- ERP based optimization and radiated acoustics
- Automatic one step transfer path analysis (PFPATH)

Powertrain Durability

- 1D and 3D bolt pretension
- Modeling of gaskets
- Fast analysis of contact with friction
- Plasticity with hardening

Thermal Analysis

- Linear transient thermal solution
- Thermal contact

Kinematics and Dynamics

- Static structural analysis based on heat transfer results
- Linear transient thermal solution
- Thermal contact

Structural Optimization

- Topology
- Size and free size optimization
- Topography
- Shape and free shape optimization



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