FEMtools Optimization

An Integrated Solution for Structural Design Optimization

FEMtools
simulate > validate > update > optimize

DDS
Dynamic
Design
Solutions
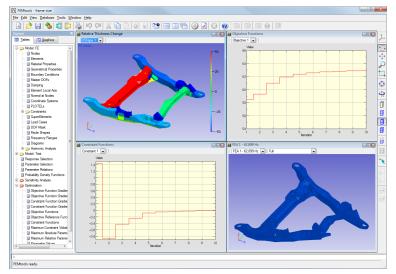
An Integrated Solution for Structural Design Optimization

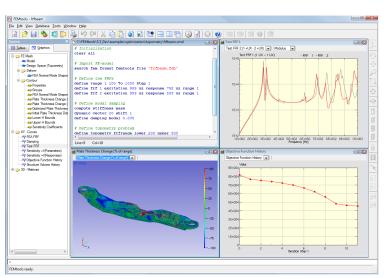## Structural Design Optimization

Designing products today offers many challenges: they must be stronger, lighter, safer, quieter, or using new materials. Products have to satisfy a widening range of design criteria, including environmental impacts.

To keep development time and cost competitive, companies rely on simulation tools. Finite element analysis (FEA) is a powerful technique to simulate the mechanical behavior of a product. The FEA method has matured to a point where design, meshing, analysis and post-processing are highly integrated and automated.

In combination with numerical optimization algorithms, the finite element analysis technique can also be used to optimize existing designs or even propose radical new designs. However, a successful application of this approach requires a seamless integration of the optimization routines into the FEA-analysis software.

Size optimization of engine frame plate thickness.

Topometry optimization to reduce the maximum FRF-level.

What is FEMtools Optimization?

FEMtools Optimization is a toolbox for general purpose and structural design optimization.

Based on the acting loads, the design constraints, and the required structural behavior, FEMtools Optimization computes the optimal design parameters for the considered component or assembly.

The state-of-the-art optimization techniques of FEMtools Optimization enable to increase the performance of the considered component in a more efficient and productive way than trial-and-error approaches.

FEMtools Optimization has an open architecture providing virtually unlimited flexibility in the problem definition and offering the possibility to drive your preferred FE solver for function re-evaluation or you can use the solvers from FEMtools Dynamics.

Using Validated Models

Together with the FEMtools Model Updating, FEMtools Optimization offers the unique possibility to first validate and update the FE-model of the initial design using test data obtained on a prototype, before optimizing the design of the structure.

Essential Optimization Tools
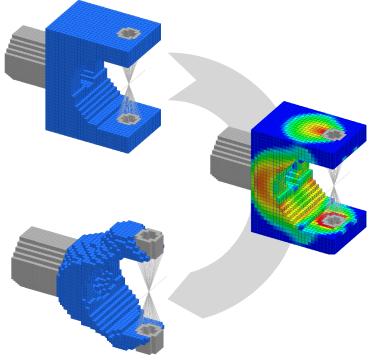
General Non-Linear Optimization

FEMtools Optimization comprises a powerful general non-linear optimization solver. The optimizer does not has any fixed limits on the number of optimization parameters, objective functions or constraints. The integrated FEMtools Script language can be used to program any arbitrary objective or constraint function.
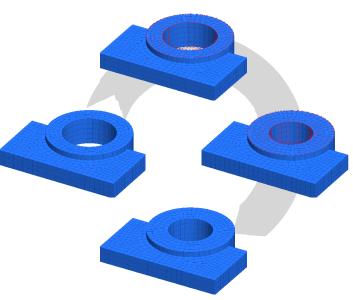
Sensitivity Analysis

Efficient structural optimization requires the analytical computation of gradient information for the objective and constraint functions. FEMtools Optimization has a sensitivity module that is designed to compute gradients with respect to design parameters such as plate thickness, cross-sectional area, etc. in the most efficient way.

Size Optimization

FEMtools Optimization provides a module to solve general size optimization problems. The database management and sensitivity analysis functions enable a user-friendly definition of size optimization problems.

Modifying the inner diameter of a ring using mesh morphing.

Shape Optimization

Shape optimization problems can be solved using free mesh deformation techniques or using a shape basis. With the first approach the FE-mesh is optimized by shifting the position of a limited number of lattice points that control the shape of the mesh. With the second approach, the final shape is the optimal linear combination of a set of reference shapes. Both approaches do not require the underlying CAD data of the FE-mesh to optimize the shape of the structure.

Topology Optimization

The topology optimization module can create new designs with an optimal topology. FEMtools offers topology optimization for both static and dynamic design problems. A series of commonly used manufacturing constraints are available to improve the manufacturability of the design. Additionally, any other user-defined manufacturing constraint can be added by using the FEMtools Script programming language.

Topometry Optimization

The topometry optimization module can perform a size optimization on an element-by-element basis. FEMtools offers topometry optimization for both static and dynamic problems. A series of commonly used manufacturing constraints are available to improve the manufacturability of the design. Additionally, any other user-defined manufacturing constraint can be added by using the FEMtools Script programming language.

Design of Experiments/Response Surface Modeling

DOE techniques sample the design space in an efficient way with a minimum number of sampling points. RSM is used to build an approximate model from the DOE runs. This model can be used for optimization in a more efficient way than the model from which it is derived.

Topology optimization of a joint bracket.

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Supported Platforms

- Windows 7, 8, 10 (64-bit)
- Linux (64-bit)

Software Licensing

Flexible node-locked or network licensing of annual or paid-up licenses.

FEMtools licenses are sold and supported directly by Dynamic Design Solutions and by FEMtools Solutions Partners worldwide. Check the web pages or contact us to find out which partner serves your area.

DDS Customer Services

- Regular software maintenance
- Installation, training and customization
- Hotline support by e-mail and phone
- Internet support site
- Custom software development
- Project research
- Engineering services

About Dynamic Design Solutions

Dynamic Design Solutions ("DDS") is an independent and privately owned company that develops CAE software tools for validating simulation models, optimizing engineering designs, modal testing and automating simulation processes.

We provide solutions that help FEA and test engineers to improve the fidelity of FE models, identify structural properties, assess uncertainty of variables and incorporate variability into models. These validated models can then be used with more confidence to improve performance under real world conditions.

Dynamic Design Solutions is a technology leader in Finite Element (FE) model updating using static or dynamic reference test data. We service a wide spectrum of industries including aerospace, automotive, defense, marine, manufacturing, power, sports and education.

Many prestigious companies and institutions have relied on our unique and proven technologies combined with the best possible support and technical expertise by a dedicated team of specialists.

DDS Dynamic Design Solutions

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