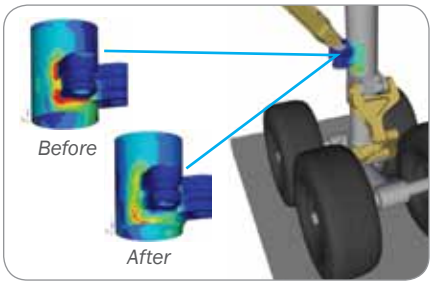
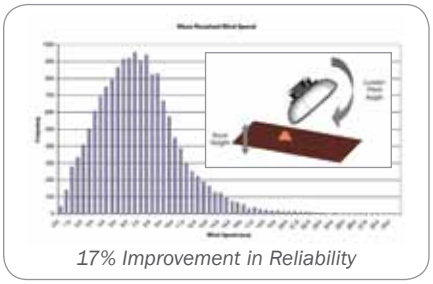
Altair® HyperStudy™

Explore, Study, Optimize

Altair® HyperStudy® is solver-neutral study, design and optimization software that streamlines exploring and optimizing the performance and robustness of designs. HyperStudy is a tool of choice for the designer and engineer who are tasked with improving designs, running what-if scenarios, correlating test data, optimizing multidisciplinary design problems or assessing design reliability and robustness.



Multidisciplinary Optimization of a Landing Gear Lug



Reliability Optimization of the Mars Lander

Benefits

HyperStudy provides engineers and designers a user-friendly environment to

- Design high-performance products meeting design targets under various operating conditions and manufacturing requirements
- Decrease design weight
- Reduce overall design costs
- Minimize time to market through reduced design development cycles
- Increase the return on their CAE solver investments
- Apply design exploration and optimization techniques easily
- Study, sort and analyze large design data sets using advanced data-mining capabilities
- Evaluate, rate, and correlate simulations with test data using a comprehensive library of mathematical functions
- Streamline the design exploration, study and optimization process
- Improve overall product reliability and robustness

Capabilities

Design of Experiments (DOE)
DOE helps engineers to clearly understand the relationship between design variables and overall system performance.

DOE methods in HyperStudy include:

- Full factorial
- Fractional factorial
- Box-Behnken
- Plackett-Burman
- Central composite design
- Latin HyperCube
- Hammersley
- User defined
- Direct input of external run-matrix.

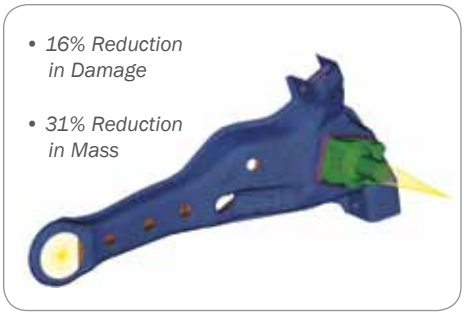
Approximations
Approximations are meta-models that are used to replace computationally intensive simulations. They are also used to smooth noisy functions to enable optimization algorithms to work more effectively on any given design problem. Approximations can be used in both optimization and stochastic studies.

HyperStudy's approximation module allows creation of different approximations for different responses. Available approximation methods are least squares regression, moving least squares and HyperKriging.

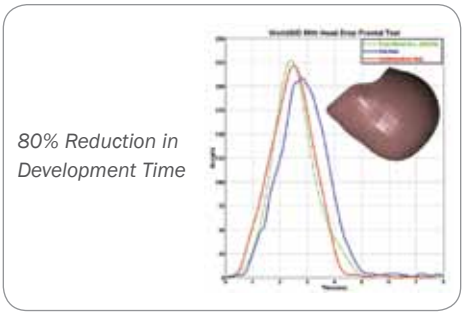
Multidisciplinary, Reliability, and Robustness Optimization
HyperStudy offers multidisciplinary study capabilities as well as reliability and robustness optimization. Through multi-disciplinary design studies, engineers can improve the overall design performance. If variations in design and operating environments are critical to design quality, reliability and robustness optimization can be used reduce the sensitivity of designs to these variations.

HyperStudy contains a comprehensive suite of optimization algorithms that include:

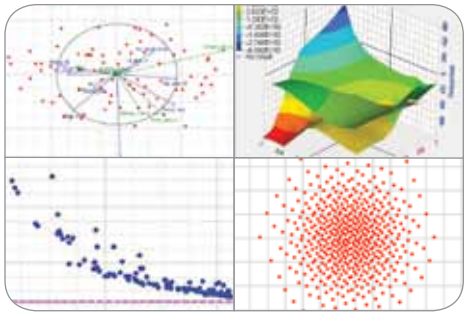
- Altair's proprietary efficient-optimization algorithm adaptive response surface method and scalable response surface method (ARSM and SRSM)



Trailing Arm Design Optimized for Durability



Improving Injury Correlation in Head Impact Simulations



Advanced Post-Processing of Study Results

- Sequential quadratic programming (SQP)
- Method of feasible directions (MFD)
- Genetic algorithm (GA)
  - Multi-objective GA (MOGA)
  - Gradient-based method for multi-objective problems (GMMO)
- Sequential optimization and reliability analyses (SORA).
- User-defined optimization algorithms (through included API)

Stochastic Studies

The stochastic study capability in HyperStudy allows engineers to assess reliability and robustness of designs and provide qualitative guidance to improve and optimize the design based on these assessments.

HyperStudy sampling methods include:

- Simple Random
- Latin Hypercube
- Hammersley
- Statistical distribution functions (Normal, Uniform, Triangular, Weibull and Exponential)

Stochastic studies can be performed using either the exact simulation or approximation model.

Post-Processing and Data Mining

HyperStudy helps engineers to gain a deeper understanding of a design through extensive post-processing and data-mining capabilities. This significantly simplifies the task of studying, sorting and analyzing results.

Study results can be post-processed as:

- Statistical data
- Correlation matrices
- Scatter plots
- Interaction effect plots
- Histograms
- Snake view plots

In addition, HyperStudy provides a series of data-mining tools, such as principal components analysis and clustering analysis.

Evaluation and Rating

A large database for signal analyses and comparison functions allows engineers to perform data correlations. These correlations can then be evaluated and rated based on user-defined criteria.

Parameterization of Analysis Models

HyperStudy's direct integration with Altair HyperMesh and Altair MotionView provides the capability to directly parameterize finite-element, multi-body and fluid-dynamics-solver input data for CAE solvers, thus making the study parameterization process easy and efficient. For other solvers, HyperStudy employs a streamlined parameterization method for preparing an input deck using a built-in text and numeric processor.

Shape Parameter Definition Using Morphing Technology

Shape changes can be easily created on complex finite-element models using the powerful morphing technology in HyperMesh. These morphed shapes can be saved as HyperStudy shape parameters and examined to evaluate their effect on design performance.

Direct Interfaces to Popular Solvers

To facilitate streamlining the study process without additional data filtering and translation steps, HyperStudy directly reads the plot and animation data of many solvers, including:

- ABAQUS
- Adams
- ANSYS
- DADS
- Excel
- Fluent
- LS-DYNA
- MADYMO
- MARC
- Matlab/Simulink
- MotionSolve
- NASTRAN
- OptiStruct
- PAMCRASH
- RADIOSS
- StarCD

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