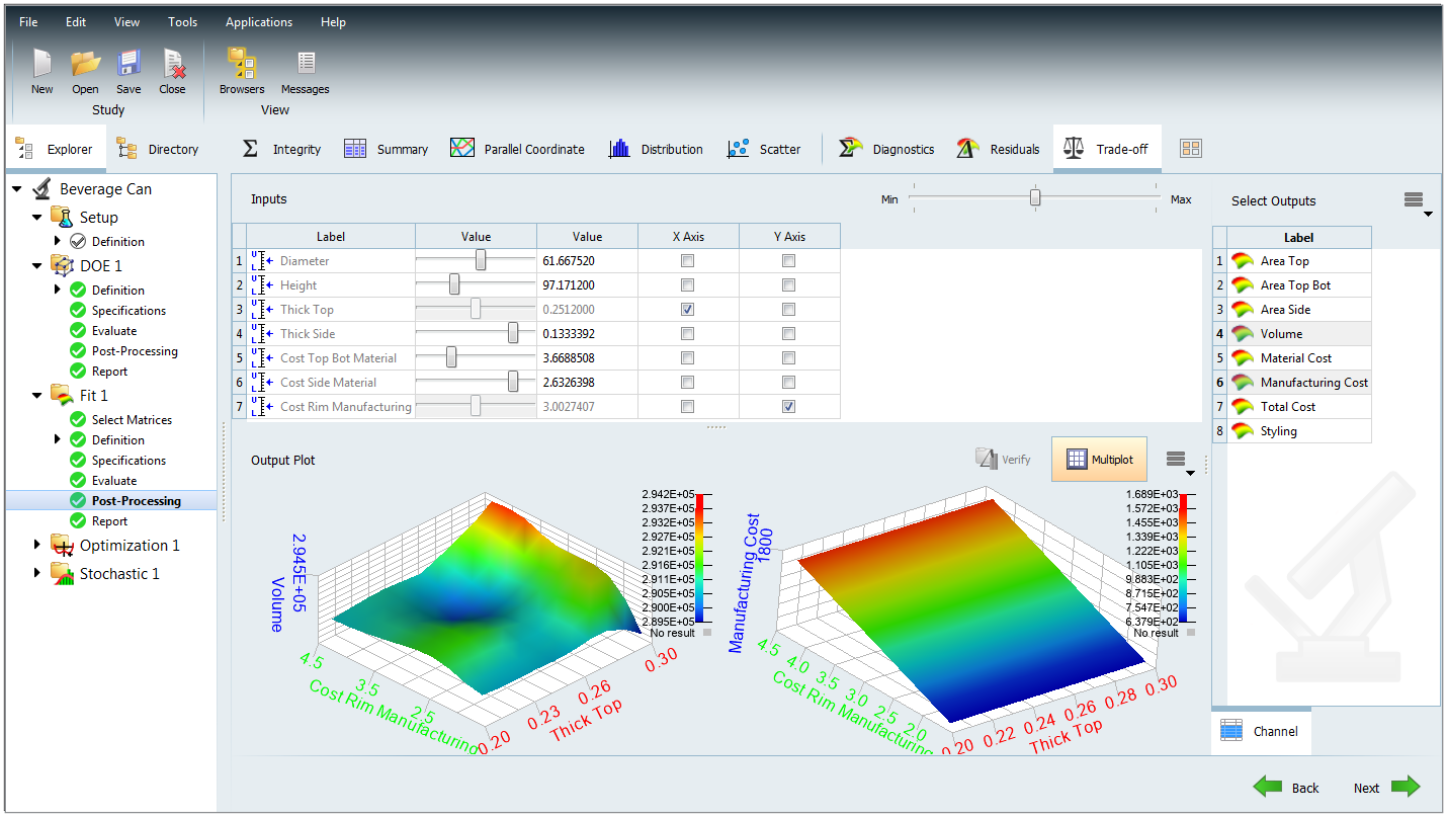
Altair HyperStudy™

Multi-disciplinary Design Exploration & Optimization

Altair | HyperWorks



Altair HyperStudy is a multi-disciplinary design exploration software helping engineers to improve their designs. By using an automatic processes combining state-of-the-art mathematical methods, predictive modeling and data-mining, HyperStudy explores the design space smartly and efficiently. Users are guided to understand data trends, perform trade-off studies, and optimize design performance and reliability. The intuitive user interface combined with seamless integration to Altair HyperWorks™ makes design exploration technology accessible to non-experts.

Product Highlights

- State-of-the-art design exploration, predictive modeling, and optimization methods
- Data mining tools that are easy to understand and interpret
- Direct interface to the most popular CAE solvers
- Fully integrated with Altair HyperWorks, seamless shape optimization

Learn more:
altair.com/hyperstudy

Benefits

HyperStudy provides engineers and designers a user-friendly environment with state-of-the-art design exploration methods and data mining tools to:

- Efficiently understand the relationships between design parameters and design requirements
- Easily sort, analyze, and explore large design data sets
- Perform quick trade-offs between conflicting designs requirements
- Quickly calibrate simulation models to correlate with test data
- Increase product life and robustness
- Reduce design development cycles
- Increase the return on their CAE solver investments

Capabilities

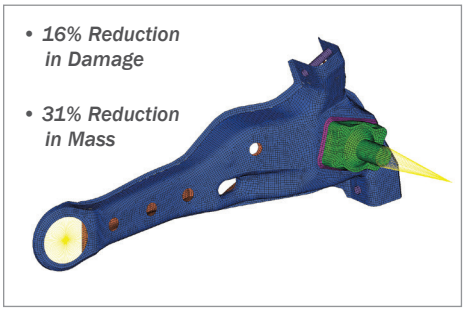
Uncover Relationships

A Design of Experiments (DOE) helps engineers to clearly understand the relationships between design variables and overall system performance in order for instance to investigate correlations, identify key parameters. Available methods include:

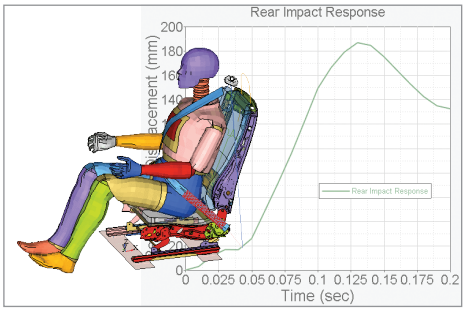
- Box-Behnken
- Central composite design
- D-Optimal
- Direct input of external run-matrix
- Fractional factorial
- Full factorial
- Hammersley
- Modified Extensible Lattice Sequences (MELS)
- Latin HyperCube
- Plackett-Burman
- Taguchi
- User defined

Make Predictions

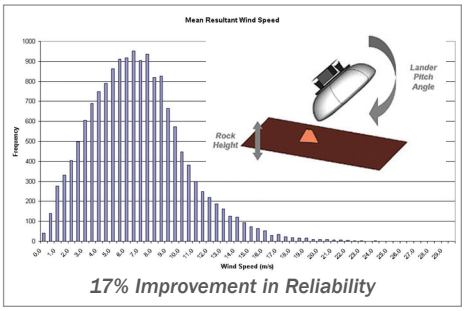
Predictive models (fit approximations) are used to replace computationally intensive simulations. They are also used to smooth noisy functions to enable optimization algorithms to work more effectively.



Trailing arm design optimized for durability



7% weight reduction of an automotive seat design using Altair HyperStudy



Reliability optimization of the Mars lander

Fit models can be used in DOE, optimization, and stochastic studies. HyperStudy's fit module provides an advanced data fitting process using Fit Automatically Selected by Training (FAST). This technology automatically compares the Fit results, then selects the best approximation method and adjusts settings to match the data with its highest quality predictive model. Available approximation methods include:

- Least squares regression
- Moving least squares
- Radial basis function
- HyperKriging

Improve Performance & Reliability

HyperStudy offers multidisciplinary optimization as well as reliability and robustness optimization. Through multidisciplinary design optimization, 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 to reduce the sensitivity of designs to these variations. Available optimization algorithms include:

- Altair's proprietary optimization algorithms, Adaptive Response Surface Method and Global Response Search Method (ARSM and GRSM)
- Sequential Quadratic Programming (SQP)
- Method of Feasible Directions (MFD)
- Genetic Algorithm (GA)
- Multi-Objective GA (MOGA)
- Sequential Optimization and Reliability Assessment (SORA).
- ARSM based SORA (SORA_ARSM)
- System Reliability Optimization (SRO)
- User-defined optimization algorithms (through included API)

Assess Reliability

Stochastic studies allow engineers to assess reliability and robustness of designs and provide qualitative guidance to improve and optimize the design based on these assessments.

Stochastic studies can be performed using either the exact simulation or fit model. Available sampling methods include:

- Modified Extensible Lattice Sequence (MELS)
- Latin Hypercube
- Hammersley
- Simple Random
- Statistical distribution functions (Normal, Uniform, Triangular, Weibull and Exponential)

Gain Insight

Extensive post-processing and data-mining capabilities are available helping engineers to gain a deeper understanding of a design. This significantly simplifies the task of sorting, analyzing and exploring large design data sets. Some of the available tools are:

- Correlation matrices
- Scatter plots
- Effects and Interactions tables and plots
- Histograms
- Parallel coordinate plots
- Pareto plots
- Ordination plots
- Box plots

Leverage in 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.

Software Interoperability

A number of models are available providing direct integration to:

- Altair tools such as Altair HyperMesh™, Altair MotionView™, Altair SimLab™, Altair Feko™, Altair Flux™ and Altair FluxMotor;
- Third party tools such as Excel, Ansys Workbench and Ansa B PreProcessor;
- Many popular solvers including:

ABAQUS	Altair MotionSolve™
Adams	NASTRAN
ANSYS	Altair OptiStruct™
Fluent	Pam-Crash
LS-DYNA	Altair Radioss™
MADYMO	Star-CCM+
MARC	
Matlab/Simulink	

- Parameterized File model allows the interface to any tool using a general ASCII text file;
- Lookup model provides an easy import of data, such as measurement data sets, aiding data exploration and its use when building predictive models for trade-off studies;
- HyperStudy Fit provides an easy import of Fit functions, making thus possible to share predictive models between users, and group them within one study;
- Operator model allows executing a process flow that can be defined as a sequence of models, including Operators, rather than a single model with a single detailed and non-reusable solver script;
- Internal Math model provides the capability to perform studies based on analytical models.

Multiple-models workflows can be defined including input resources definition, variables linking and dependencies between models. Model Resources feature allows files and the entire contents of a directory to be assigned as resources. It also enables defining and visualizing dependencies between models, for instance, by setting up a file transfer workflow from one model into another for multiphysics analysis and optimization