Faster. Stronger. Lighter

Meeting Today's Design Challenges With Innovative Virtual Simulation Technology

HyperWorks is a division of △ Altair

"HyperWorks offers our engineers the full potential of CAE in all of its bandwidth at a very competitive price; and, with the third-party products offered within the HyperWorks Enabled Community, the multidisciplinary portfolio offered by Altair is further increased."

EADS Innovation Works

"In partnership with Altair, Ford has established a development process which consistently delivers vehicles with a superior safety performance. RADIOSS is one of the cornerstones of this process and these dramatic performance improvements will offer us a broad set of new opportunities."

Ford Motor Company
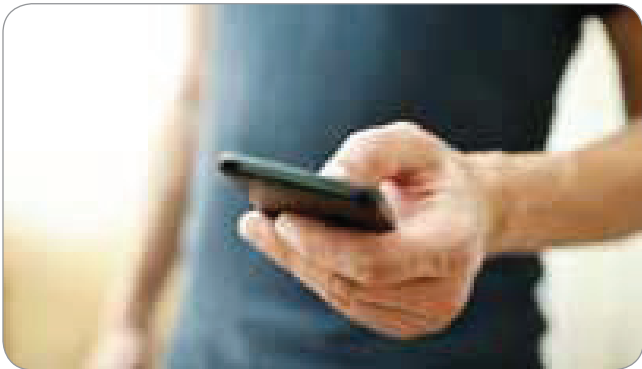
"The increased quality of results we have obtained implementing the HyperWorks suite allows for a highly accurate and predictive analysis of our electronic products."

Samsung

"With simulation software like HyperWorks, we have been able to dramatically increase our rate of development. This not only allows us to produce better products but also it frees up our time and allows us to look into the future for the next great technology in golf."

Cleveland Golf

HyperWorks Glossary

As the most comprehensive, open-architecture CAE enterprise solution in the industry, HyperWorks includes best-in-class modeling, analysis, visualization and data management solutions for linear, nonlinear, structural optimization, fluid-structure interaction, and multi-body dynamics applications. Products within the HyperWorks suite include:

HyperMesh®
HyperMesh is a high-performance finite element pre-processor with the broadest set of direct interfaces to commercial CAD and CAE systems, HyperMesh provides a proven, consistent analysis platform for the entire enterprise.

HyperView®
HyperView is a high-performance post-processing and visualization environment for CAE and test data. Amazingly fast 3D graphics and unparalleled functionality set a new standard for speed and integration of CAE results post-processing.

HyperGraph®
HyperGraph is a powerful data analysis and plotting tool with interfaces to many popular file formats. Its sophisticated math engine is capable of processing even the most complex mathematical expressions. HyperGraph combines these features with high-quality presentation output and customization capabilities to create a complete data analysis system for any organization.

RADIOSS®
RADIOSS is a fast and accurate finite-element solver for linear static and dynamics problems. Over the past 20 years, RADIOSS has become the linear and nonlinear solver of choice of leading manufacturers, government agencies and researchers.

AcuSolve®
AcuSolve is a leading general-purpose finite element-based Computational Fluid Dynamics (CFD) flow solver. Its next-generation FE-based formulation assures superior robustness, speed, and accuracy, easily handling the most difficult industrial problems.

OptiStruct®
OptiStruct is an award-winning CAE technology for conceptual design synthesis and structural optimization. By predicting optimal shapes of structures with minimum input early in the process, OptiStruct facilitates analysis to lead the design process which results in more efficient designs in less time.

MotionSolve®
MotionView is the world's leading open multi-body Systems Modelling Environment. MotionSolve is a next-generation, multi-body systems analysis software for mechanical system simulation.

MotionView®
MotionView provides analysts and designers with an intuitive and powerful interface for studying mechanical systems.

HyperMath®
HyperMath is a general purpose numerical computing environment that allows customers to easily develop and perform custom mathematical operations on various types of data, including data associated with CAE pre- and post-processing.

HyperStudy®
HyperStudy is a solver-neutral design study, optimization and stochastic study software that allows the exploration and optimization of design performance and robustness.

HyperCrash®
HyperCrash is a robust pre-processing environment specifically designed to automate the creation of high-fidelity models for crash analysis and safety evaluation.

HyperForm® & HyperXtrude®
Fully integrated virtual manufacturing for enhanced product feasibility and detailed process analysis in sheet metal forming, metal and polymer extrusion and injection molding.

Compute Manager
Compute Manager is a novel set of software modules, making the management of simulation data a natural and enjoyable experience. The integration of Altair's HyperWorks® simulation tools with PBS Works™ workload management solutions increases high-performance computing productivity, providing users with a reliable and affordable enterprise simulation platform.

HyperWorks On-Demand™
HyperWorks On-Demand is a High Performance Computing solution for design innovation in the Cloud. It leverages Altair's patented licensing system, providing access to a selection of the HyperWorks products and a modern, scalable HPC infrastructure through a secure and efficient web based platform.

Inspire
A breakthrough in digital product development, solidThinking Inspire® adds new computational capabilities to solidThinking's traditional capabilities, allowing designers to explore virtually countless forms and shapes.

Evolve
solidThinking Evolve™ is the 3D industrial design/styling software that is redefining the way design concepts are created and evaluated.

▶ Visit **www.altairhyperworks.in** to learn more

Altair® HyperMesh™

The Fastest, Solver Neutral CAE Environment for High Fidelity Modeling

Altair® HyperMesh® is a high-performance finite-element pre-processor that provides a highly interactive and visual environment to analyze product design performance. With the broadest set of direct interfaces to commercial CAD and CAE systems and a rich suite of easy-to-use tools to build and edit CAE models, HyperMesh provides a proven, consistent analysis platform for the entire enterprise.
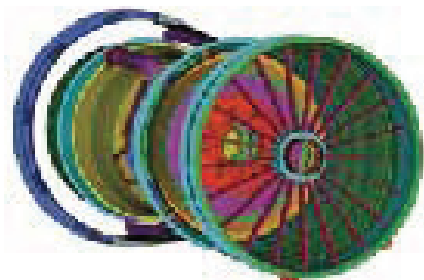
High-fidelity Model Generation for all Industries and Use Cases

High-performance CFD Meshing

Benefits

Open-Architecture Design
Combining the broadest set of direct CAD and CAE interfaces with user-defined integrations, HyperMesh fits seamlessly within any simulation environment.

High-Speed, High-Quality Meshing
Streamlining the modeling process and provides a suite of tools to model even the most complex geometries.

One Integrated CAE Environment
Modern, configurable, and easy-to-use graphical user interface provides seamless data exchange for pre and post processing.

Advanced 3D Model Visualization
3D Visualization of all element types (1D, 2D and 3D elements) within a FEA model eases model checking and visual verification.

Increases End-User Modeling Efficiency
Using sophisticated batch meshing technology,HyperMesh eliminates the need to perform manual geometry clean-up and meshing, thus accelerating the model development process.

Composites Modeling
Ply and laminate entities facilitate composites modeling in terms of individual layer shapes and their stacking sequence. CATIA CPD and Fibersim readers extract composite data and map it onto FE meshes automatically. Plies and ply angles can be visualized in 3D for easier model verification.

Advanced Model Morphing
Delivering the most powerful model morphing tool in the industry HyperMesh allows users to modify existing meshes to meet new designs and reduce model development costs.

Best In Class Meshing

HyperMesh presents users with an advanced suite of easy-to-use tools to build and edit CAE models. For 2D and 3D model creation, users have access to a variety of mesh generation capabilities, as well as HyperMesh's powerful automeshing module.

High Fidelity Meshing
- Surface meshing
- Solid map hexa meshing
- Tetra-meshing
- CFD meshing
- Acoustic cavity meshing
- Shrink wrap meshing
- SPH meshing

Surface Meshing
The surface meshing module in HyperMesh contains a robust engine for mesh generation that provides users with unparalleled flexibility and functionality. This includes the ability to interactively adjust a variety of mesh parameters, optimize a mesh based on a set of user-defined quality criteria, and create a mesh using a wide range of advanced techniques.

Solid Meshing
Using solid geometry, HyperMesh can utilize both standard and advanced procedures to connect, separate or split solid models for tetra-meshing or hexa-meshing. Partitioning these models is fast and easy when combined with HyperMesh's powerful visualization features for solids. This allows users to spend less time preparing geometries for solid meshing. The solid-meshing module allows users to quickly generate high quality meshes for multiple volumes.

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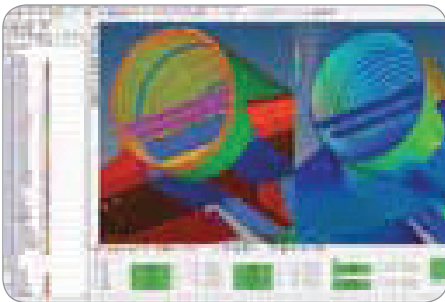
Modern and Efficient CAE Modeling Environment
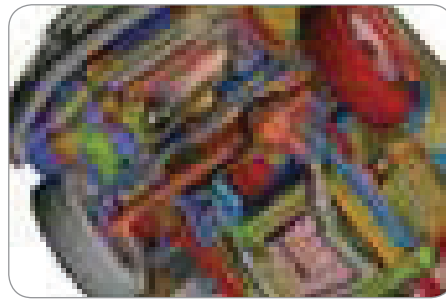
Easily Handles Large Models and Assemblies
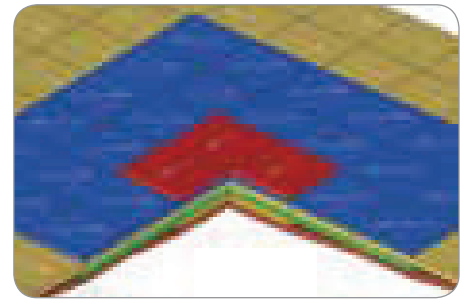
Fast Composite Modeling Process and Sophisticated Layer Visualization

Batch Meshing

The BatchMesher™ module in HyperMesh is the fastest way to automatically generate high-quality finite element meshes for large assemblies.

By minimizing manual meshing tasks, this automeshing technology provides more time for value-added engineering simulation activities. BatchMesher provides user-specified control over meshing criteria and geometry clean-up parameters as well as the ability to output to customized model file formats.

Mesh Morphing

HyperMorph is a powerful HyperMesh module for interactively and parametrically changing the shape and of a finite element model. Its unique approach enables rapid shape variations on the finite element mesh without sacrificing mesh quality, or changing node id's and element id's. HyperMorph can be used to dynamically create shape variables for subsequent design optimization studies.

CAD Interoperability

HyperMesh includes direct readers to popular native CAD file formats. Moreover, HyperMesh has robust tools to clean-up (mend) imported CAD geometry that contain surfaces with gaps, overlaps and misalignments which hinder high-quality mesh generation.

By eliminating misalignments and holes, and suppressing the boundaries between adjacent surfaces users can mesh across larger, more logical regions of the model significantly increasing meshing speed and quality. Boundary conditions can also be applied to these surfaces for future mapping to underlying element data.

- CATIA V4/V5
- PRO-ENGINEER
- UNIGRAPHICS
- ACIS
- Tribon
- IGES
- PARASOLID
- STEP
- JT Precise
- SolidWorks

Customize HyperMesh to Fit Your Environment

Customize your modeling experience through an easy-to-use interface containing drag-and-drop toolbars, configurable pull-down menus and keyboard-controlled shortcuts.

Custom Utilities: Create custom applications that are fully integrated within the HyperMesh interface.

Solver Input Translators: Users can extend HyperMesh's interface support by adding input translators to read different analysis data decks.

Solver Export Templates: Export templates allow the HyperMesh database to be exported to user-defined formats for proprietary and specialized solvers.

CAE Solver Interfacing

HyperMesh provides direct import and export support to the industry's most popular solvers. Additionally, HyperMesh provides a completely tailored environment for each supported solver.

- Adams
- Abaqus
- Actran
- AcuSolve
- Ansys
- CFD++
- Femfat
- Fluent
- Ls-Dyna
- Madymo
- Marc
- HyperMath
- Moldflow
- Moldex3D
- MotionSolve
- Nastran
- nCode
- Permas
- PAM-CRASH
- RADIOSS
- OptiStruct
- Samcef
- Simpack
- StarCD

Flexible Modeling Tools for all Industries and Use Cases

Altair® HyperView™

High-performance Post-processing and Visualization Environment for CAE and Test Data

High-end Visualization Enables HyperView to Easily Handle Large CAE Models
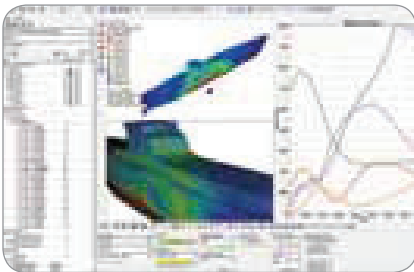
Multiple Window Results Post-Processing

Altair® HyperView® is a complete post-processing and visualization environment for finite-element analysis (FEA), multi-body system simulation, digital video and engineering data. Amazingly fast 3D graphics, open architecture design and unparalleled functionality, set a new standard for speed and integration of CAE results post-processing. Coupling these features with HyperView's advanced process automation tools dramatically improves results visualization, correlation, and reporting.

Benefits

Improve Productivity:
- Industry-leading 3D graphics manipulation and animation speed.
- Direct readers for popular CAE solvers and the ability to create user-defined results translators.
- Powerful XY-plotting and 3D-plotting.
- Customize the interface and create specialized tools to fit individual engineering environments and needs.
- Direct link to Altair HyperView Player for web communication and collaboration.

Gain Design Insight:
- Synchronize and visualize of FEA results, multi-body systems results, XY plotting, and video data.
- Overlay of multiple CAE models in one window.
- Perform results mathematics to build user-defined results types such as failure indexes.
- In-depth model interrogation based on user-defined criteria.

Automation and Report Creation
- Automated session building: Automate the generation and presentation of standard plots and tables, as well as quickly compare results and correlation studies using the "Report: Overlay" option.
- One step report generation: Export HyperView session reports to HTML or PowerPoint XML, including text, images, AVIs and H3Ds.

Extendable User Interface
- Templex programming: Create custom-curve math functions, perform data analysis and curve statistics within annotations and labels, and parameterize any text file.
- Custom pull-down menus: Develop user-defined menus to provide easy access to reports, plot macros and custom wizards.
- Tcl programming layer: Automate procedures through a programmable Tcl/Tk command layer.
- Custom import and export templates: Define custom import and export templates for reading and writing XY plotting data.

CAE Animation & Data Plotting

HyperView delivers a complete suite of interactive animation, data plotting and digital video functionality that dramatically improves results visualization, analysis and correlation. Its synchronization capabilities enable users to explore detailed model integrity and behavior. By utilizing HyperView's extensive post-processing platform users can easily synchronize, compare and visualize FEA results, multi-body systems results, XY plotting (simulation or test data) and digital video data simultaneously in the same environment.

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Animations

- Contours (Scalar & Tensor)
- Vector plots
- Tensor plots
- Deformation plots
- CFD streamline plots
- Deformed animations
- Linear animations
- Modal animations
- Transient animations
- Multi-body dynamics animations with flex-bodies

To aide in results comparison and correlation HyperView provides user oriented image and video planes for combining test data with simulation results. Advanced capabilities in HyperView include toolsets for model query, result comparisons for single and overlaid models and results math for custom results manipulation needs. HyperView also supports:

- Exploded views
- Iso-surfaces
- Advanced querying
- Part and component tracing
- Interactive cut planes
- Graphic annotations
- User oriented image and video planes
- 3D stereoscopic view
- Symmetry

Report Generation

Generating a standard report is made easy with HyperView by using the "Publish Session" capability along with the Report Templates functionality. HyperView allows the user to export the active session to a HTML or PowerPoint XML report and provides users with the control to decide which information gets exported and in which format.

- Report export — HTML, PowerPoint
- Animation export — AVI, H3D, GIF
- Image export — BMP, JPEG, PNG, TIFF
- Summary data export — Multi-column, customizable formatting

Solver Interfacing

HyperView supports many popular CAE solver formats through direct readers, providing a flexible and consistent high-performance post-processing environment for animating and plotting CAE simulation results. Additional solver formats can be supported through user-defined results translators that convert results into the Altair H3D compressed binary format.

HyperWorks also offers two translators, HvTrans and HgTrans, for working with any type of engineering data. HvTrans allows you to extract, translate, and compress CAE results while HgTrans enables you to convert, compress and process data files using custom math expressions that can be built from the embedded math function library.

Solvers Supported Include:

- RADIOSS
- OptiStruct
- MotionSolve
- Abaqus
- LS-DYNA
- NASTRAN
- ANSYS
- PAMCRASH
- Adams
- MADYMO
- DADS
- SIMPACK
- MOLDFLOW
- MARC
- NIKE3D
- LLNL DYNA
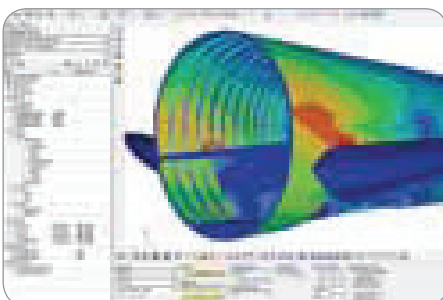
Stress Analysis Results: Aircraft Fuselage

Correlation of Simulation and Physical Results of Offset Barrier Vehicle Test


Impact Analysis, Evaluation, and Correlation

Altair® RADIOSS®
The Standard behind Structure Safety

Altair® RADIOSS® is a leading structural analysis solver for highly non-linear problems under dynamic loadings. It is highly differentiated for Scalability, Quality and Robustness, and consists of features for multiphysics simulation and advanced materials such as composites. RADIOSS is used across many industries worldwide to improve the crashworthiness, safety, and manufacturability of structural designs.

Safety and Crash Evaluation
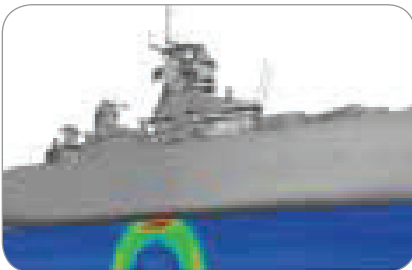
Blast and Ballistic Analysis

Scalability, Quality and Robustness
RADIOSS' advanced multi-processor solution (Hybrid Massively Parallel Processing) has enabled the best scalability in the industry for large, highly non-linear structural simulation. The use of Advanced Mass Scaling (AMS) and intelligent single precision calculation option increases simulation speed by orders of magnitudes while retaining the same accurate results. AMS provides an advanced and competitive solution for quasi-static problems in the case of implicit non-linear simulations with convergence problems due to high non-linearity in the contacts, complex material behaviors and rupture modeling.

With RADIOSS' multi-domain approach, detailed and accurate analysis can be achieved without decreasing the global time step or increasing overall simulation time. Special provisions in the implementation guarantee full repeatability of results regardless of the number of computer cores, nodes or threads used in parallel computation. Numerical scattering of results is highly minimized.

Industry Standard for Crash, Occupant Safety and Impact Analysis
For over 20 years, RADIOSS has established itself as a leader and an industry standard for crash, safety and impact analysis. The number of customers continues to increase at an impressive rate to include over 900 companies worldwide, with 40% of these customers in the automotive industry.

RADIOSS is ranked as the 5-star worthy crash code. Automotive and aerospace companies value the contribution RADIOSS makes in understanding and predicting design behavior in complex environments such as automotive and aerospace crash and impact simulations.

RADIOSS has direct access to a large library of finite element dummy, barrier and impactor models to perform vehicle occupant safety simulation. It provides the most comprehensive and high quality toolset in the industry through partnerships with leading crash and safety testing facilities and model providers. In addition, Altair's HyperCrash modeling environment provides outstanding support for automotive crash and safety simulation with RADIOSS.

Most Comprehensive Material and Rupture Libraries
RADIOSS has the most comprehensive material and rupture libraries with more than 300 combinations. A comprehensive collection of linear and non-linear material, failure and rupture models is provided for modeling complex events. Correlated material laws and failure criteria include definitions for concrete, foam, rubber, steel, composites, biomaterials, and more. Multiple failure criteria may be applied to any material. Crack propagation can be followed using an XFEM method.

Advanced Multiphysics Simulation
Besides Finite Element technology, RADIOSS is also equipped with other technologies such as Euler, Arbitrary Lagrangian Eulerian (ALE), Smoothed-Particle Hydrodynamics (SPH) and the Finite Volume Method (FVM).

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With Euler, ALE and SPH formulations, RADIOSS enables Fluid-Structure Interaction (FSI) simulation taking into account multiple fluids. The innovative Finite Volume Method enables full FSI simulation of airbags in full car models with accuracy and speed.

Optimization Ready
Integration with HyperWorks environment makes RADIOSS a powerful design tool. Aside from modeling and visualization, RADIOSS models are ready for optimization. Advanced design optimization and robustness studies can be performed easily through Altair's OptiStruct and HyperStudy products to improve design performance. RADIOSS' high scalability, quality and robustness are essential for successful numerical optimization.

High Performance Computing
With a sophisticated customer base who values performance, reliability, safety and innovation, the RADIOSS team is committed to supporting the most up-to-date, advanced computing architectures and integrating new technologies to improve performance, scalability and usability. RADIOSS is leading the industry in understanding many of the state-of-art coprocessor's potential for powering complex simulation software applications and environments.

Features and Capabilities

Analysis Types
- Non-linear explicit dynamic structural analysis
- Non-linear implicit structural analysis
- Explicit Computational Fluid Dynamics (CFD)
- Euler and Arbitrary Euler-Lagrangian (ALE) formulation

- Smoothed-Particle Hydrodynamics (SPH)
- One-step (inverse) and incremental sheet metal stamping analysis

RADIOSS' application areas include simulations of crash safety, drop and impact, blast and hydrodynamic impact, fluid structural interaction, terminal ballistics, forming and composite mapping.

Elements
- Full and under-integrated elements:
  - Thin and thick shells, 3 to 8 nodes
  - Hexa with 4 to 20 nodes, tetrahedron solids
  - Bar and beam elements
- Crash beams, rigid bodies, joints, general springs and dampers, ...

Contact Interfaces
- Kinematic tied contacts with rupture
- Penalty tied contacts
- ALE/Lagrangian contacts
- CEL (Euler/Lagrangian) contacts
- Library of penalty formulation contacts

Material Laws and Rupture Criteria
- Library of Material Laws for
  - Steel, high strength steel, soil, rocks, concrete
  - Composite and ceramics
  - Hyper elastic laws (rubber, ...)
  - Hydrodynamic laws
- Library of Rupture Criteria
  - Energy and plasticity based
  - User defined
  - Johnson Cook, Tuler Butcher, Chang and Chang, Tsai Wu, Puck, Hashin
- Equation of State (EOS)
  - JWL, Lee Tarver, Homquist, P-Alpha

Boundary Conditions
- Lagrangian structures
- Fluids (inlet, outlet)

Dummies
- Frontal impact dummies: Aero HII 50%, Humanetics_Express HIII5% and HIII5%, HIII 5%, 50% 95%
- Side impact dummies: ES2 and SID-IIs families from Humanetics, 5 and 50% WorldSid
- Rear impact dummy: BIORID IIg
- Child dummies: Hybrid, P, Q families and Crabi 12 months mainly developed with Humanetics
- Pedestrian impactors: head, legs, standing dummy, FlexPli (Humanetics)
- Human dummy model: Humos2, leg and foot models

Barriers
- Frontal barriers: ODB, PDB V8XT TRL_full shell and solid modelings
- Side barriers: NHTSA, Progress Aemdb, IIHS SUV (Cellbond) shell and solid modeling
- Rear barriers: RCAR and US Rear FMVSS 310
  - RCAR IIHS low impact
  - US Rear impact barrier FMVSS 310
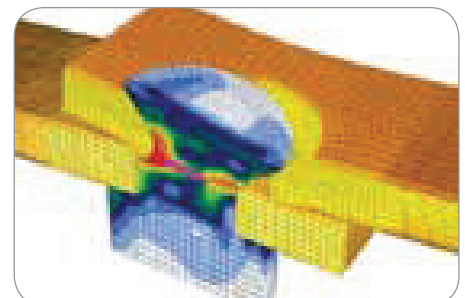
Supported Platforms
- Windows (32 and 64)
  - XP
  - Vista
  - Windows 7
- Linux (64 bit)
  - RedHat, SUSE, SLES
  - Intel Xeon Phi
  - NVIDIA Fermi C2070 and M2090 (RADIOSS Implicit Iterative Solver)

Non-Linear Explicit Analysis on Composites
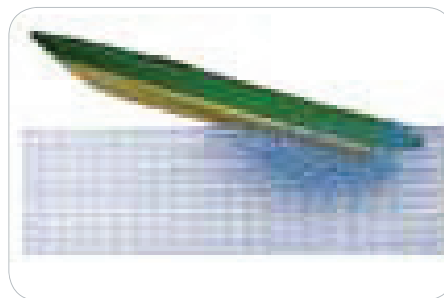
Smooth Particle Hydrodynamics (SPH) Analysis

Correlated Material Law and Rupture Model Library

Isosurface of Turbulent Structure From Large Eddy Simulation (LES) of Flow Over a Smooth Cylinder at Re = 140,000.

AcuConsole – A Powerful GUI-Based Pre-Processor

AcuSolve comes with a powerful yet easy to use GUI-based pre-processor, AcuConsole™. It has a built-in mesh generator which operates on most 3D CAD models. It also allows users to import an existing mesh in various formats. Through an intuitive menu structure, AcuConsole helps the user fully set up a problem, generate an input file, and launch AcuSolve. CAE automation is available through the Python scripting language, allowing users to customize menus and functions for specific applications.

Altair® AcuSolve®

Better Technology, Better Solution

Altair® AcuSolve® is a leading general-purpose Computational Fluid Dynamics (CFD) solver that is capable of solving the most demanding industrial and scientific applications. AcuSolve's robust and scalable solver technology empowers users by providing unparalleled accuracy on fully unstructured meshes. Applications ranging from steady RANS simulations to complex, transient, multiphysics simulations are handled with ease and accuracy.

Advanced Technology, Accurate Results

AcuSolve is based on the Galerkin/Least-Squares (GLS) finite element method. GLS is a higher-order accurate, yet stable formulation that uses equal order nodal interpolation for all variables, including pressure. The method is specifically designed to maintain local and global conservation of relevant quantities under all operating conditions and for all meshes.

In addition to excellent spatial accuracy, AcuSolve has a second-order time integration option. Since AcuSolve obtains rapid nonlinear convergence within each time step, temporal accuracy is achieved in practice.

AcuSolve has a very rich mathematical foundation, translating into superb numerical behavior. AcuSolve can easily solve the largest and most complex mission critical industrial problems.
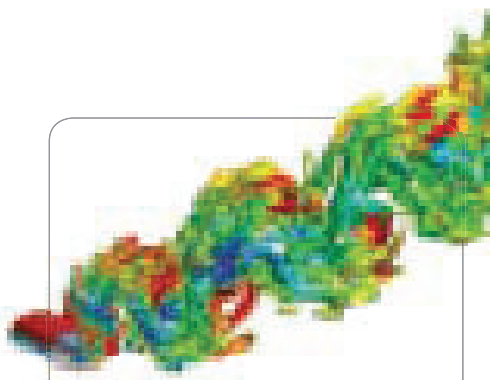
Robust Solution

AcuSolve typically solves a given problem in the first attempt. Fully converged solutions are reliably obtained using AcuSolve's efficient steady-state solver. Nonlinear convergence remains strong even as solutions approach their final result.

Two key components contribute to this robustness: the GLS finite element formulation, and a novel iterative linear equation solver for the fully coupled pressure/velocity equation system. This powerful iterative solver is highly stable and is capable of efficiently handling unstructured meshes with high aspect ratios and badly distorted elements commonly produced by fully automatic mesh generators. This linear solver yields significant stability and convergence advantages over the segregated solution procedures commonly found in many commercial incompressible flow solvers.

High Speed, Parallel Performance

AcuSolve achieves fast solutions via three mechanisms:

- Solution of the fully-coupled pressure/velocity equation system, which yields significant linear and nonlinear convergence speed.
- Architected from the ground up for vector and cache-based super-scalar computers.
- All algorithms are designed for multi-core parallel clusters, using a hybrid distributed/shared-memory (MPI/OpenMP) parallel model. The parallelization is completely transparent to end users.

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AcuSolve Simulation Features and Functionality

- **Conservative Equations in 3D**
  - Incompressible & weakly compressible Stokes and Navier-Stokes equations
  - Thermal analysis and conjugate heat transfer
  - Multi-layered thermal shell equations
  - Multi-species transport equations
  - Viscoelastic material modeling
- **Radiation**
  - Gray body enclosure radiation
  - View-factor computation (in parallel)
  - Solar radiation model
- **Turbulence Models**
  - Direct Numerical Simulation (DNS)
  - Large Eddy Simulation Models (Smagorinsky and Dynamic sub-grid scale)
  - Hybrid RANS/LES (DES, DDES, IDDES and SST-DES) models
  - One- and two-equation RANS model (Spalart-Allmaras, SST & k-omega)
- **Moving Mesh Simulation Technology**
  - Arbitrary Lagrangian Eulerian (ALE) technology
  - Flexible mesh movement
  - Free surface simulation
  - Guide surface technology
  - Sliding mesh technology
  - Specified mesh motion
  - Non-conformal mesh interfaces
- **Powerful User-Defined Function (UDF) Capability**
  - Allows definition of material models, source terms, boundary conditions, etc.
  - Client-server interface with external programs
- **Component Technology**
  - Fan component
  - Heat exchange component

- **Multiphysics Capabilities**
  - Rigid body dynamics coupling
  - Practical Fluid/Structure Interaction (P-FSI)
  - Direct-Coupling Fluid/Structure Interaction (DC-FSI)
- **Computational Aero Acoustics (CAA) Simulations**
  - Integrated Ffowcs-Williams-Hawkings acoustic solver
  - Support for 3rd party acoustics solver
- **Unstructured Mesh Support**
  - 4-node tetrahedron, 5-node pyramid, 6-node wedge, 8-node brick, and 10-node tetrahedron elements
- **Highly Effective Solver Technology**
  - Novel and highly efficient iterative solver for fully coupled pressure/velocity equation systems
  - Fully coupled temperature/flow iterative equation solver
  - Fully parallel on shared and distributed memory machines, transparent to the user
- **Particle Tracer**
  - Fast and accurate parallelized particle tracer
  - Laminar and turbulent diffusion
  - Bi-directionally coupled

AcuConsole Features and Functionality

- **Build Simulations from CAD or Mesh**
  - Import geometry from PTC Pro/ENGINEER, Parasolid, ACIS, Discrete, Dassault Catia V5
  - Import mesh from Altair HyperMesh, ANSYS ICEM-CFD, MSC FluidConnection, Pointwise

- **Generate Mesh from CAD**
  - Automatic tet mesher
  - Robust boundary layer meshing capabilities
  - Full mesh size control on surfaces, volumes and arbitrary zones
  - Advanced extrusion and periodic meshing capabilities
- **Set up Entire Problem within GUI Environment**
  - Intelligent default settings simplify user set-up
- **Launch Solver**
  - Interactive or batch processing
  - Progress monitors provide real-time feed back
- **Interface directly with visualization packages**
  - AcuFieldview, FieldView and EnSight
- **Customize for Easy Deployment**
  - CAE automation

AcuFieldView
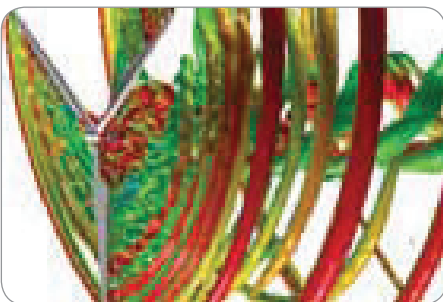**Industrial Strength and World Class Post-Processor**

AcuSolve comes equipped with a powerful post-processing solution AcuFieldView. AcuFieldView is an OEM version of Intelligent Light's class-leading FieldView CFD post-processor that furnishes the ability to manage large and complex CFD data visualization requirements. It incorporates Intelligent Light's most recent advancements in FieldView, including a new codebase that produces optimized graphics performance and a common graphical user interface (GUI) on all platforms.
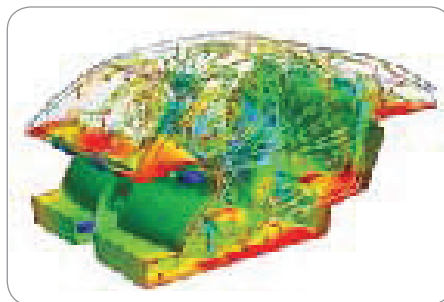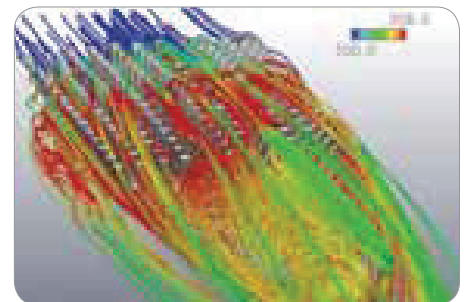
Supported Platforms

- Windows XP/Vista/Windows 7 (32 & 64 bit)
- Windows HPC Server 2008
- Linux (x86-64, NVIDIA Tesla GPGPUs)

Wind Energy: Turbulent Flow in the Wake of a Three-bladed Wind Turbine Rotor

*Automotive: Thermal Analysis for Cabin Comfort*

*Electronic Cooling: Thermal Flow Solution of a Diverging Fin Heat Sink*

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.
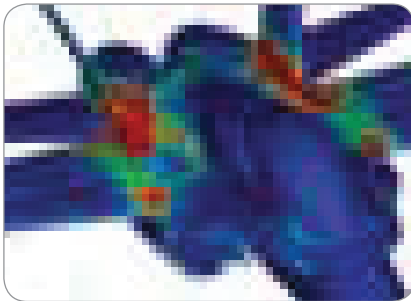
Linear and Non-linear Static Analysis
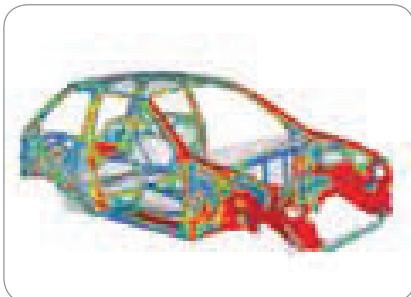
Structural Architecture Optimization Studies

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

Altair | HyperWorks®

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
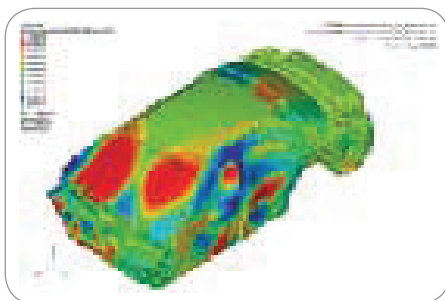- Plasticity with hardening

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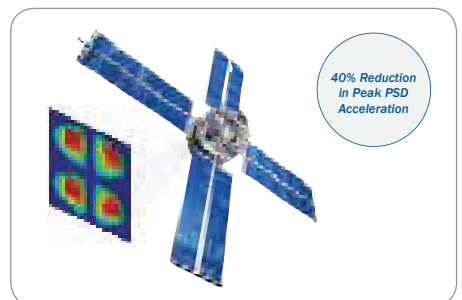
Structural Optimization
- Topology
- Size and free size optimization
- Topography
- Shape and free shape optimization

Full-vehicle Noise & Vibration Analysis

Complete Solution for Powertrain Durability

40% Reduction in Peak PSD Acceleration

Bead Design of Satellite Panel using Topography Optimization

Altair® MotionSolve®

Optimize System Performance

Altair® MotionSolve® is an integrated solution to analyze and optimize multi-body system performance. Through extensive customer partnership, MotionSolve is thoroughly validated for quality, robustness and speed. MotionSolve offers powerful modeling, analysis, visualization and optimization capabilities for multi-disciplinary simulations that include kinematics and dynamics, statics and quasi-statics, linear and vibration studies, stress and durability, loads extraction, co-simulation, effort estimation and packaging synthesis.

Flexbody Analysis

Proximity and Clearance Analysis

Benefits

Reduce Time to Market
Bring the products to market faster using MotionSolve. MotionSolve is very fast and maintains accuracy even while solving stiff problems including flexible multibodies, complex contact and long-duration durability.

Comprehensive Solution for any Multibody Dynamics Simulation
• Create complex, nonlinear systems
  - Evaluate the dynamic behavior of systems
  - Study vibration isolation
  - Design control systems
  - Perform packaging studies
  - Generate realistic loads to predict component life and damage
• Assess system design and performance
  - Nonlinear dynamic studies
  - Kinematics studies
  - Linear studies
  - Static studies
  - Quasi-static studies

Innovative Solver Functionality
• Continuing to introduce innovative modeling elements and methods to handle even the most complex multibody systems.
• Modern solver formulations and modeling capabilities such as deformable curves and flexbody contact further differentiate MotionSolve from other mechanical systems solvers.

Robust and Accurate Solutions
MotionSolve is used in a wide variety of industries and is rigorously tested for specific classes of problems. As core technology in the HyperWorks CAE suite and deep integration with Altair's FEA solvers, MotionSolve delivers the flexibility, robustness and quality required by the multibody dynamics community.

Perform System-level Analysis Through Co-simulation
Streamlined processes for working with detailed hydraulic, pneumatic and control models.

Capture Your Corporate Standards Through Customization
MotionSolve delivers the unique capability to customize your mechanical systems simulation environment to fit your needs. From writing custom functions and subroutines to custom messages and creating custom outputs, MotionSolve helps to set corporate standards by tailoring the solver to fit any environment.
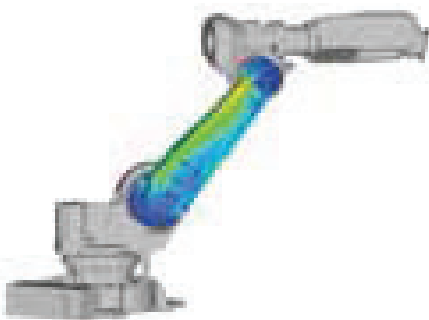
Capabilities

Powerful Analysis Techniques
Through a broad and varied array of analysis techniques, MotionSolve provides new and advanced options for studying mechanical system behavior.

• Six integrators to solve a large variety of dynamics problems. The integrators include implicit/explicit, stiff/nonstiff and DAE/ODE based algorithms.
• Four static/quasi-static solvers to predict static equilibrium configurations and loads. The algorithms together cover force imbalance, energy and DAE-based methods.

- Kinematic analysis with automatic redundant constraint detection and removal
- Linear analysis with state matrix export and eigenvalue computation.

Solver Customization Tools

While most solvers do not support customization, MotionSolve offers a truly customizable and flexible solution.

- Custom functions to support industry or domain-specific terminology
- User-defined statements for incorporating multiple elements into a single entity
- Customized messaging to extract meaningful solver information and statistics
- Tailoring the solver output format to fit any CAE environment

Rich Library of Modeling Elements

A key enabler for simulating complex mechanisms is the availability of advanced modeling elements. MotionSolve supports a comprehensive set of modeling elements that allows users to build complex mechanisms.

- Common system-modeling entities
  - Mass- and inertia-bearing rigid elements
  - Flexible bodies
  - Constraint connectors
  - Force connectors
  - Non-mechanical modeling elements
  - Commonly used lower-pair constraints, forces and motions
- Advanced modeling elements
  - Deformable curve

- Deformable surfaces
- 3D contact between faceted and primitive graphics of any shape
- Flexbody contact using deformable surfaces
- Interpreted language-based user subroutines to capture complex functions or extend the solver capabilities

Open and Flexible Architecture

Often users performing a system-level analysis must exchange data with various CAE applications. MotionSolve's open-architecture design allows it to be easily deployed within heterogeneous CAE environments and is highly compatible with third-party mechanical systems simulation products.

- Unmatched integration between FE and MBD domains through support of the bulk data files (BDF)
- Legacy support for models such as ADAMS® (ADM & ACF)
- Co-simulation interface with Simulink
- Embedded co-simulation with hydraulic or pneumatic models from DSHPlus
  - Use MotionSolve as S-function
  - Support for native RTW code

Direct Integration with HyperWorks

With MotionSolve, HyperWorks delivers a complete mechanical systems simulation solution: from best-in-class pre- and post-processing to optimization and robustness studies.
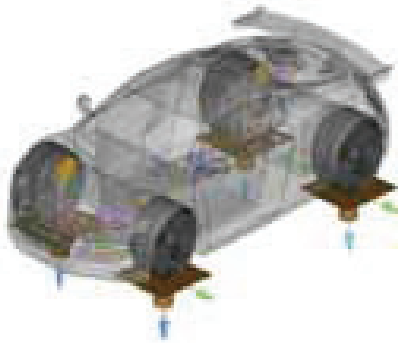- Easily build multibody models in MotionView® as well as in HyperMesh®

- Perform DOE, optimization and stochastic studies through MotionSolve's direct integration with HyperStudy®
- Increase design efficiency and insight with HyperWorks' world-class post-processing solutions, HyperView® and HyperGraph®, for mechanical systems simulation
- Improve results accuracy by generating CMS flexbodies using OptiStruct – HyperWorks' structural analysis and optimization solver
- Take advantage of HyperWorks' industry-leading system and component optimization technology, OptiStruct®, to quickly achieve program requirements
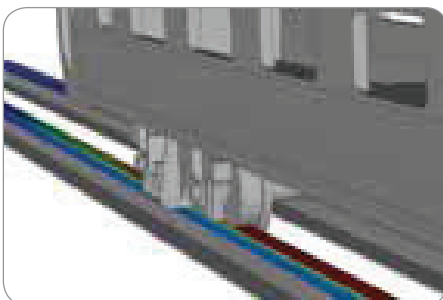
Flexible Contact Simulation

Co-simulation for Hydraulics, Pneumatics, and Control Systems

Altair® MotionView®

The Premier Modeling Environment for Innovative Mechanical System Designs

Altair® MotionView® is a user-friendly and intuitive multibody systems modeling environment. Its built-in parametric modeling capability and open architecture allows users to quickly build, analyze, and improve mechanical system designs even before physical prototypes are available. Coupled with a next generation solver in MotionSolve, MotionView provides a perfect solution for your multibody dynamics simulation needs.

Load Extraction For Fatigue Analysis

Comprehensive Built-in Automotive Suspension Libraries for Half and Full Vehicle Analysis

Benefits

Accelerate Product Innovation
Increased global competition is forcing manufacturers across the world to find intrinsically better ways to design and manufacture products. MotionView allows you to create innovative products by allowing you to easily construct alternative designs, assess product performance and optimize designs to meet the product objectives.

Reduce Product Design Time and Cost
MotionView's physics-based simulation capabilities allow you to evaluate products early in the development cycle.

- Automate standard model assembly and save time on getting to the initial configuration.
- Build a model once, validate it and reuse it in different contexts with domain-specific solvers for multidisciplinary studies.
- Use the automation capabilities to reduce repetitive procedural tasks.

Improve Product Quality
Use MotionView to improve product quality by evaluating its performance in realistic scenarios. Easily perform what-if analyses and stochastic simulations to understand and mitigate the effects of manufacturing variations on product performance.

Ensure Corporate Quality Standards
Capture your company know-how in repeatable processes to ensure consistency.

- Customize the interface to enable consistent processes.

- Standardize and share subsystems and system models amongst the user community.

Comprehensive & Open Environment
An open architecture that supports a variety of methods for:
- Construction
- Data input
- Performance evaluation
- Design improvement
- Report generation

Capabilities

Powerful and Effective Modeling Environment
A typical mechanical system tends to have several subsystems. A modular approach to model building lets users have more control over the modeling. MotionView's powerful environment contains many core capabilities designed to simplify and streamline the creation of complex mechanical modelsthat are required to solve the most challenging problems.

- A hierarchical modeling structure lets users build system level models as a combination of reusable sub-systems and components
- MotionView's modeling language supports symmetry and conditional logic, enabling multiple model topology configurations within a single model and tremendous control over modeling entities and properties
- Parametric model definitions provide easy analysis studies of model variations

Altair | **HyperWorks**®

- Automated modeling is available via a "wizard" linked to a comprehensive, and extensible, library of systems and analysis tasks. This facilitates assembling complex models in just a few "mouse clicks"

Easy Flexbody Generation and Usage

Flexible-body modeling within a mechanical system can be a complex and challenging task, since it typically requires familiarity with finite element modeling and knowledge of finite elements solvers. MotionView's flexbody modeling processes were developed to overcome these challenges by providing easy-to-use tools for flexbody creation, system integration and post-processing.

- Smooth and simplified processes for flexbody generation
- One-step conversion between rigid and flexible components
- Comprehensive array of utilities to minimize flexbody pre-processing errors

Modern Easy to Use GUI

MotionView's intuitive layout and logical work flow enhance its very user-friendly interface. This allows both experienced and novice engineers to get started quickly to build and analyze multibody systems rapidly.

- Efficient and intuitive workflows simplify and standardize mechanical systems modeling
- Modern user interface with context menus directly in the graphics area

- Advanced context sensitive model browser helps easily navigate through the model elements with less mouse travel and fewer "mouse clicks"

Automation and Customization

MotionView is completely customizable and automation ready giving users control over the both the "automation-ready", giving graphical user interface and the modeling processes. This allows MotionView to seamlessly fit within any simulation environment.

- Fully customizable user interface providing users with the flexibility to modify the existing environment, turn panels on and off, and build custom panels
- Build custom utilities that fit seamlessly into the interface to support unique requirements
- Powerful scripting enabling users to automate repetitive modeling tasks and streamline intricate processes
- Integration with HyperMath provides live debugging capabilities for automations

End to End Solution

MotionView delivers a complete solution for the entire mechanical systems simulation process through its powerful functionality, open architecture, direct interfaces to many CAD packages and CAE solvers, and direct integration with HyperWorks®.

- Modeling: Highly efficient and intuitive solution for the generation of mechanical system models

- Results Analysis: Analyze and correlate simulation results and test data with state of the art visualization and data plotting capabilities
- Flexbodies: Prepare flexible bodies for accurate MBD analysis using OptiStruct®
- Load Export Utility: Export component load channels, supporting several different FE & fatigue formats
- Optimization: Execute DOE, optimization and stochastic studies through HyperStudy® and OptiStruct®
- Solver Interfacing: Take advantage of MotionView's multiple solver support including MotionSolve®, OptiStruct®, ADAMS and Abaqus (experimental)

*Complete Multi-body System Environment*
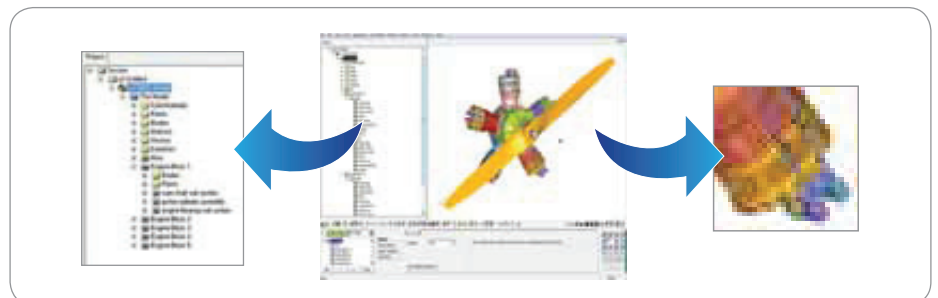
Parametric Modeling with Unlimited Hierarchy

Altair® HyperCrash™

Highly-Tuned Modeling Environment for Crash Analysis and Safety Evaluation

Altair® HyperCrash® is a highly tuned pre-processing technology specifically designed to automate the creation of high-fidelity models for crash analysis and safety evaluation. Through a comprehensive and procedure-oriented toolset, HyperCrash improves and simplifies complex problems of creating a quality crash model.
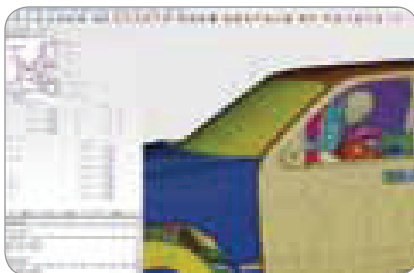
Complete Environment for Building High-fidelity Crash Models

Comprehensive Library of Easy-To-Use Safety Tools

Benefits

- **Reduce Model Assembly and Load Case Set-up Time**
  Go from days to hours with advanced model management procedures
- **Input Deck Conversion**
  Easy migration between solvers while supporting legacy data
- **Fast, High-Quality Model Creation and Set-up**
  Easily manage penetrations, intersections, model assembly contact management and dummy positioning
- **Capture and Re-use Corporate IP**
  The HyperCrash database enables organizations to seamlessly support

standard and proprietary corporate engineering procedures and data structures
- **Database-Driven Part Replacement**
  HyperCrash enables part replacement at all modeling levels – component, subsystem and complete assembly
- **Fast and User-Friendly Model Building Environment**
  - A generic data model simplifies and optimizes model creation and modifications
  - Interactive, hierarchical model and connection tree view streamlines model management

Capabilities

GUI

HyperCrash employs a modern graphical user interface (GUI) to provide streamlined processes for building complex crash simulation models. Users can visualize, organize and manage all levels of modeling data and information with a point-and-click access to the tree-style browser. In addition, HyperCrash provides a fast and intuitive toolset for preparation and set-up of analysis input decks.

- Full access and control over all modeling entities through an intuitive Model Browser
- Cross reference: exposes how a specific card is used and how it relates to different keywords
- Model Browser
  - View complete model (entities, materials, properties, contacts, etc.)
  - Control entity display
  - Define include content
  - Search

Quality

The Quality module is a configurable and customizable set of utilities for evaluating the quality of a mode by performing hundreds of different checks on the part, component and model level. A variety of checks are executed, ranging from simple element checks to part connectivity and modeling errors in the input deck. Users visually review the state of each check represented by status color (red, orange and green).

- Model Cleaner
  - Remove unused options
  - Check connectivity for failed welds, unconnected parts and topology of connected parts
  - Automatically remove initial penetrations
- Model Checker
  - Exercises hundreds of unique checks
  - Model robustness for crash-worthiness criteria
  - User-defined criteria checks
- Optimize model per solver

Mesh Editing And Model Connections

Users can modify and edit crash meshes from within HyperCrash. There are many straightforward methods and options for editing and tuning a mesh for crash analysis. Mesh editing capabilities include but are not limited to:

• Adding, duplicating and moving nodes
• Finite element creation (1D, 2D, and 3D)
• Split parts or move elements from part to part
• Renumber selected entities, parts or the complete model
• Clean the model by removing unused entities
• Create, modify and check rigid bodies
  - Full support for connection types (Spotweld, Mastic, Adhesive, and more)
  - User defined connection representations

Safety Tools Module

This module provides a streamlined, user-friendly interface to set up, edit and define all safety-related characteristics for crash simulation and analysis. In addition to the standard set of safety tools, HyperCrash contains a unique seat-deformer utility that allows the seat foam, on both the lower and back of the seat, to be deformed based on the intersection between the dummy and the seat. Safety features include:

• Dummy positioning
  - Interactively position dummy (torso, head, limbs)
  - Load / save dummy positions
  - Merge dummy in the model
  - Works with LS-DYNA & FTSS dummies
• Seat belts
  - Seat belt creator
  - Seat belt routing
• Airbag toolset
  - Create airbag
  - Folding airbag (Simple, Tuck-type, Double-Tuck, Superimposed Tuck)
• Seat deformer: Deform the seat automatically to remove the initial intersections with the dummy.

Mass Balance

The Mass Balance module completely manages the mass and inertia properties of each part as well as the entire crash model. After the masses are set for all parts and components, HyperCrash automatically balances the total mass of the model according to the mass on the front and rear tires.

Also HyperCrash can:
• Display the center-of-mass locations for each part, rigid body and the complete model
• Check and report the mass, inertia and center of mass location of each part, component and rigid body of the model
• Automatically fits the finite element model mass of each part based on the mass of the CAD part

Multiple Solver Support

HyperCrash now includes comprehensive support for both RADIOSS and LS-DYNA. This includes a LS-DYNA user profile that contains a series of highly intuitive features and utilities specifically tuned for crash users.
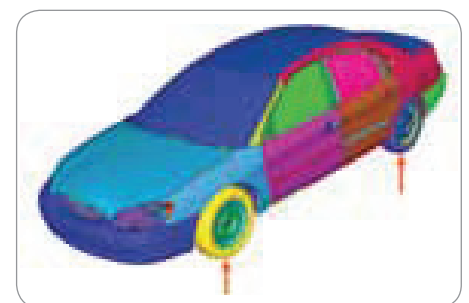
• Comprehensive support for over a thousand keywords
• Complete dummy positioning module
• Belt systems
• Joints
• Connections
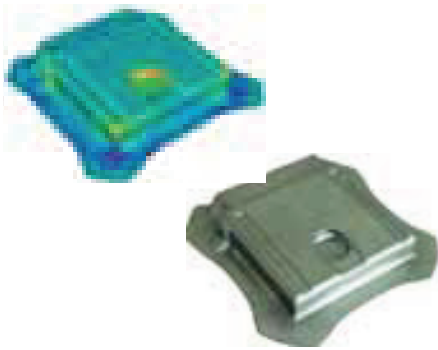

Modern Graphical User Interface

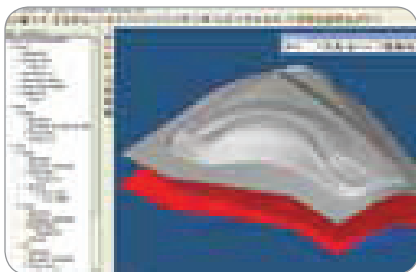*Streamlined and Intuitive Model Browsing and Navigation*

Advanced Mass-Balancing Module

Altair® HyperForm™

Highly Efficient Platform to Capture the Stamping Process

Simulation Results Accurately Predict Part Failure

Capturing the Process Knowledge Through the Intuitive Graphical User Interface

Altair® HyperForm® is a comprehensive finite-element-based sheet metal forming simulation framework. Its unique process-oriented environment captures the forming process with a suite of highly tailored and configurable analysis and simulation tools. HyperForm delivers a cost-effective solution that allows users to develop an optimal manufacturing process.

Benefits

Immediate Cost Savings
Remarkable cost savings is possible because of competitive pricing (based on Altair's patented HWU licensing) and dramatic reduction of product development lead time.

Accurate and Reliable Solver
The most accurate incremental sheet metal forming solver on the market (Altair® RADIOSS™) is seamlessly integrated into HyperForm's process-driven user interface. This solver allows users to quickly predict wrinkles and splits prior to cutting steel, avoiding the unnecessary costs associated with die machining and press downtime.

Efficiently Captures the Stamping Process
HyperForm's open framework combined with an extensive built-in knowledge of the manufacturing domain efficiently captures the stamping process.
This further increases user productivity through a comprehensive collection of tailored, process-oriented automations for virtually every stamping application.

Complete Solution for Stamping
HyperForm offers a complete solution for managing the entire stamping simulation process. This stamping platform boasts robust functionality, such as a feasibility analysis utility, parametric rapid draw die design, final process validation, process optimization, and results visualization to meet and exceed user's high-performance requirements.

Metal Forming Solution for Every Need

Product and Cost Engineers can study manufacturing feasibility in combination with post-manufacturing performance changes.

Die Designers can build a process and create conceptual die designs with a parametric die module and run quick feasibility analysis or a detailed forming simulation.

Process Engineers can validate the conceptual or real die by performing a full-forming contact simulation to predict areas of wrinkling, high thinning, low spots, springback and related manufacturing issues.

Die Tryout Engineers can communicate more efficiently and improve productivity and part quality by utilizing the detailed reports automatically generated from the analysis.

Capabilities

Fastest Feasibility Analysis
The fastest inverse solver in the marketplace for quick one-step feasibility analysis and results mapping addresses forming feasibility early in the product development cycle, minimizing downstream formability challenges and associated costs.

Efficient Cost Analysis
The accurate blank shape-prediction and intuitive nesting interface proposes

Fast and Robust Part Feasibility Analysis
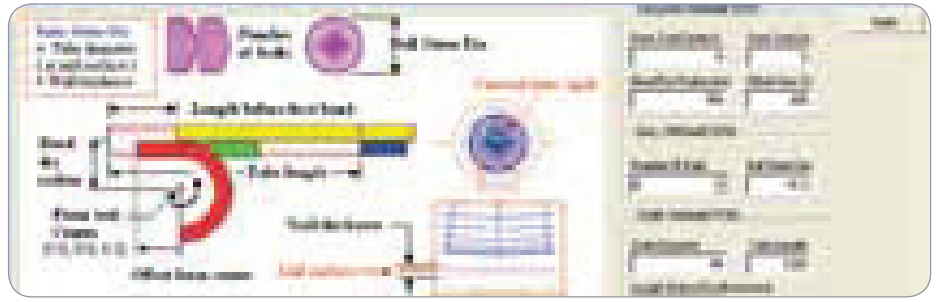
Specialized Panels for Automated Model Setup

proper blank-sizing, minimizing material scrap in the early stages of the product development process.

Concept Draw Die Design Development
The intuitive, parametric, and NURBS-based die-face-development tool delivers a powerful tool for engineers to quickly modify and verify multiple draw scenarios.

Seamless Data Mapping
Product engineers can study manufacturing feasibility in combination with post-manufacturing performance changes, seamlessly mapping the forming results to the structural or crash analysis models.

Fast and Robust Process Validation
Through its best-in-class incremental solver (Altair® RADIOSS™), HyperForm provides product and die engineers with powerful capabilities to:

• Analyze and validate the robustness of the manufacturing process
• Determining wrinkles and splits prior to cutting steel
• Avoiding unnecessary costs associated with die machining and press downtime

Optimize the Process
Through a seamless integration with the HyperWorks optimization tools

(Altair® HyperStudy® and OptiStruct®), HyperForm offers unique capabilities to analyze and optimize not only the sheet metal but even the tool structure, allowing the die designers to conceive lightweight, robust and validated structures.

Tube Bending and Hydroforming
In addition to the complete sheet metal forming capabilities, HyperForm includes powerful utilities for tube bending and hydroforming, delivering a nearly hands-off model auto-setup process.
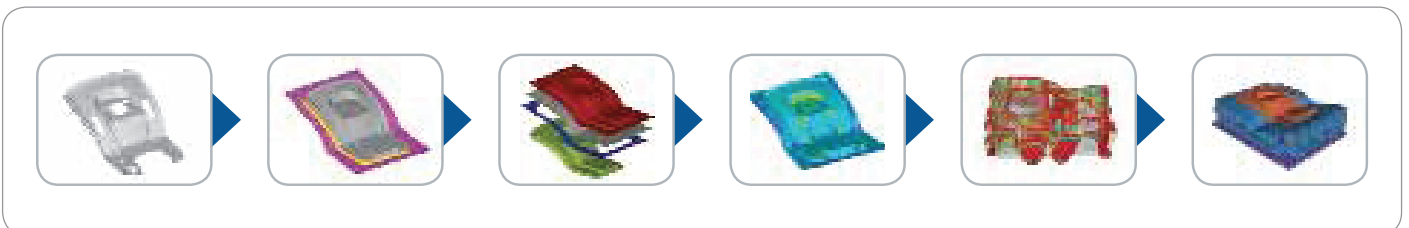
Complete Manufacturing Platform for Stamping Simulation

INSPIRE

Base Model of an Airplane Rib

Resulting Design Concept

solidThinking Inspire™ is a simulation-driven concept design tool for engineers and architects. Inspire uses industry-leading Altair OptiStruct® technology to generate design concepts that are efficient for structural performance and weight. Inspire's simple interface guides users to begin generating concepts within hours.

Benefits

Shortened Design Cycles
Generate concepts which meet structural performance requirements at the beginning of the design cycle. This results in significant time savings over the traditional approach of design, validate, redesign to meet structural requirements.

Deeper Understanding of Designs
Inspire makes it easy to perform "what-if" scenarios where package space, connections, load conditions, and shape controls can be modified. Reviewing the resulting concepts often reveals valuable insights.

Reduced Design Weight
Inspire makes efficient use of material, only placing it where required to satisfy structural performance requirements. Reduced design weight leads to material cost savings, performance improvements and reduced shipping costs.

Capabilities

Geometry Creation
Create, modify, and de-feature solid models using Inspire's modeling tools:
- Sketch Tools – Build or modify parts by sketching lines, rectangles, circles, and arcs. Geometric constraints such as tangency and perpendicularity can also be applied.
- Trim/Break – Cut and remove sketch curves at the point of intersection.

- Push/Pull – Extrude flat or cylindrical faces to create solid parts or holes, modify dimensions, or remove features such as fillets.
- Boolean Operations – Add, subtract, or intersect solid parts to create more complex geometry.

Manufacturing and Shape Controls
Generate design concepts that are not only structurally efficient but also manufacturable using Inspire's shape controls:
- Symmetry Planes – Force asymmetric design spaces to generate symmetric optimized shapes.
- Cyclic Repetition – Create cyclically repeating shapes like propellers or wheels.
- Draw Directions – Generate shapes that can be easily molded or stamped by applying single or split draw directions.
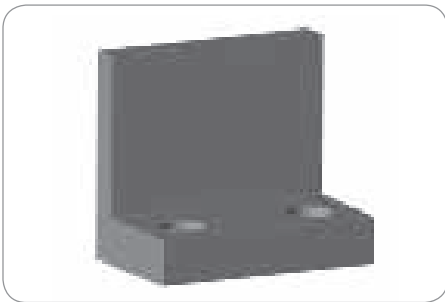
Customizable Materials Database
Inspire is packaged with a material library including various aluminum, steel, magnesium, and titanium alloys. Custom materials can also be added.

Part Instances
- Parent-Child Instances – Individual parts can be copied and pasted as an instance. Whenever one is updated, the other is automatically updated as well. Instancing information can also be imported from CAD files.

- Pattern Repetition – When a design space is repeated multiple times in a model using

Original Model

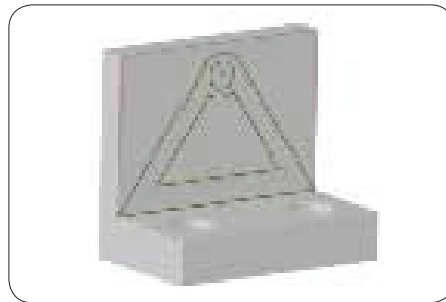*New Profile Drawn Using Sketch Curves*

Surfaces Trimmed

part instances, Inspire will automatically apply pattern repetition to the design spaces so they generate identical shapes.

Interactive Results Visualization
Explore optimized shapes using a simple slider to add or remove material. Users can decide which features are important and then pick the concept design best suited to their needs.

Geometry Reader Support
Geometry readers for AutoCAD 3D, Unigraphics, CATIA, SolidWorks, Pro/ENGINEER, Parasolid, STEP, ACIS, JtOpen, and IGES formats are provided.

Rapid Prototyping
Design concepts can be exported in STL format for use with 3D printers.

Integration with solidThinking Evolve
Import models from Evolve to generate design concepts in Inspire, and export structural shapes back to Evolve with a single click.

Assembly Configuration
Multiple assembly configurations can be created. These configurations can then be used to evaluate various design scenarios and the resulting concepts.
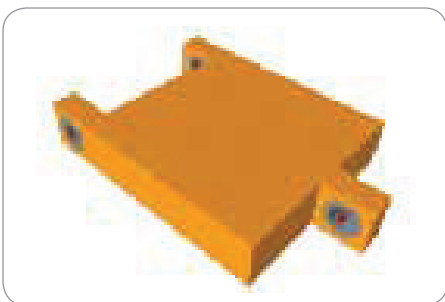
Multiple Language Formats
English, Japanese, and Italian languages are available.

Hardware Support
Windows 32/64 bit (XP, Vista, 7) and Mac OS X 10.6 and greater are supported.


Base Model

Design Concept Using 30% of the Material

Design Concept Using 30% of the Material and Manufacturing Controls

EVOLVE

A 3D conceptual design environment which empowers designers to swiftly capture and evolve forms using powerful NURBS modeling tools, an advanced construction history and photorealistic visualization all supported on both Windows and Mac.
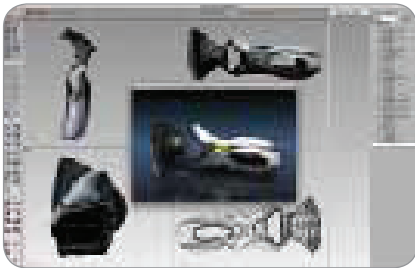
Intuitive GUI Created Specifically for Designers with Integrated Rendering Capabilities

Benefits

Create Winning Designs Faster

- Model in complete freedom using a hybrid modeling approach that combines organic surfacing with solid modeling all controlled through an automated construction history.
- Invent, explore, and perfect designs without limitations of traditional software.
- Visualize product concepts in stunning realism with the fully integrated rendering environment.
- Share designs and complex ideas with photo realistic animations.
- Eliminate design reinterpretations between designers and engineers by passing 3D data to and from CAD/CAM/CAE systems.
- Supports both Windows and Mac.

Reduce Time and Cost

- Compress the product-development cycle by creating and exploring more ideas in less time. Speed and improve the quality of decision-making.
- Reduce product-development costs by decreasing prototype development expenses. Eliminate flaws early in the product-development process by creating realistic, accurate 3D models and using design evaluation and visualization tools.

Capabilities

Best-in-class Construction History

- Unlimited construction history provides real-time updates when modifications are made to parameters or surfaces.

- Browse the graphic representation of the construction history to identify and select source objects within the history tree with immediate reconstruction.
- Manipulate both the parameters and points of all objects freely. Never forget the steps involved in construction - the entire tree is saved inside the file and is accessible at any time.
- Thanks to the possibility to freely manipulate your models, you can easily experiment with new shapes and improve your creativity.
- Once you have experienced how the exclusive construction history improves your productivity, you will never want to live without it.

Advanced NURBS Modeling

Evolve uses NURBS (Non Uniform Rational B-Splines) as its geometry type. This curve and surface definition method offers the greatest flexibility and precision. NURBS are capable of representing any desired shape, both analytic and free form, and their algorithms are extremely fast and stable. Full NURBS-based modeling, construction history and the most advanced modeling tools make Evolve a matchless tool for designers.

Polygonal Modeling and Subdivision Surfaces

Evolve also features an advanced polygonal modeler with support of n-side polygons. It is possible to create and extrude polygons, split faces and edges, refine, decimate, and perform many other operations.

The unique implementation of interactive subdivision surfaces with construction history gives the user maximum power for refinement and smoothing of polygonal meshes.

Reverse Engineering

- Fit points - Create a surface from a point cloud data set.
- PointCloud from object - Create a PointCloud given a surface.
- Planar Clouds from PointCloud - Creates a specified number of points clouds lying on parallel planes from a given points cloud. This command can be useful to simplify a points cloud derived from 3D scanning. Beside a section planes direction, the user can specify either the number of planes, or the distance between planes.
- Curve from PointCloud - Creates a curve from a point cloud. This tool creates a curve starting from a selected point and approximating the points ordered by minimal distance.

Real-Time Photo Realistic Rendering

Take advantage of a truly comprehensive rendering system integrating all industry-leading rendering techniques. The most efficient memory management functions, unlimited output resolution, as well as multi-threaded and multi-processor renderings makes Evolve the perfect tool for generating photo realistic images. Real-time rendering further improves interactivity during the review and visualization phases of design.

Animation

Take your design presentations to the next level by creating photo realistic animations. Create videos or Quicktime VR movies to communicate complex ideas, or import H3D files to produce stunning simulations.

Data Exchange

Effortlessly exchange digital data throughout the design process using fast and high-quality translators.

Export

- DXF
- DWG
- IGES
- Lightwave
- Maya
- Parasolid (x_t and x_b)
- Rhinoceros
- RIB
- STEP
- STL
- VDA/FS
- VET
- VRML
- 3DS
- OBJ
- Keyshot (.bip)
- SAT (Acis)

Direct Import

- V4
- Catia V5
- DXF
- DWG
- IGES
- Lightwave
- Maya
- Parasolid (x_t and x_b)
- Pro/ENGINEER
- Rhinoceros
- RIB
- SAT (ACIS)
- SolidWorks
- STEP
- STL
- UGS NX
- VDA/FS
- VET
- VRML
- 3DS
- OBJ
- Adobe Illustrator (.ai and .ps)
- Point Cloud (.cld and .txt)

Rapid Sketch Modeling

Flexible Parametric Editing

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About Altair

Altair empowers client innovation and decision-making through technology that optimizes the analysis, management and visualization of business and engineering information. Privately held with more than 1,800 employees, Altair has offices throughout North America, South America, Europe and Asia/Pacific. With a 27-year-plus track record for high-end software and consulting services for engineering, computing and enterprise analytics, Altair consistently delivers a competitive advantage to customers in a broad range of industries. Altair has more than 3,000 corporate clients representing the automotive, aerospace, government and defense, and consumer products verticals. Altair also has a growing client presence in the electronics, architecture engineering and construction, and energy markets.

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