



MSC Software SOLUTIONS

Simulating Reality, Delivering Certainty™



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DISCIPLINE: ENGINEERING LIFECYCLE MANAGEMENT

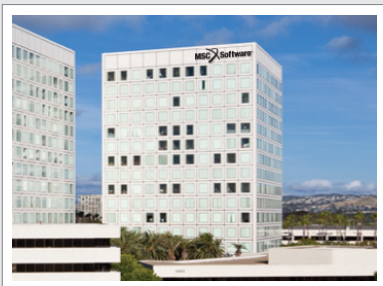
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Our products and services are used by 900 of the top 1000 manufacturers in the world, including:

- Aerospace & Defense
- Automotive & Transportation
- Agricultural Equipment
- Heavy Machinery
- Medical Devices
- Oil and Gas
- Nuclear
- Renewable Energy
- Consumer Products
- Packaging
- Electronics

About MSC Software

Simulating Reality, Delivering Certainty

MSC Software is one of the ten original software companies and a global leader in helping product manufacturers to advance their engineering methods with simulation software and services. As a trusted partner, MSC Software helps companies improve quality, save time, and reduce costs associated with design and test of manufactured products. Academic institutions, researchers, and students employ MSC's technology to expand individual knowledge as well as expand the horizon of simulation.

MSC Software's engineering simulation technology is used by leading manufacturers for linear and nonlinear finite element analysis (FEA), advanced material modeling, acoustics, fluid-structure interaction (FSI), multi-physics, optimization, fatigue and durability, multi-body dynamics, controls, and manufacturing process simulation. The company's products accurately and reliably predict how products will behave in the real world to help engineers design more innovative products - quickly and cost effectively.

Company Profile

MSC Software Corporation was formed in 1963 and was awarded the original contract from NASA to commercialize the finite element analysis (FEA) software known as NASTRAN (NASA Structural Analysis). MSC pioneered many of the technologies that are now relied upon by industry to analyze and predict stress and strain, vibration & dynamics, acoustics, and thermal analysis in our flagship product, MSC Nastran.

Over our rich history, MSC has developed or acquired many other well-known CAE applications including Patran, Adams, Marc, Dytran, Fatigue, SimXpert, SimDesigner, SimManager, Easy5, Sinda, Actran, Digimat, and Simufact. We are committed to the continued development of new CAE technology that integrates disciplines and technologies from standalone CAE tools into unified multi-discipline solvers and user environments. These "next generation" products enable engineers to improve the reliability and accuracy of their virtual prototypes by including multi-physics and multi-discipline interactions.

MSC is also the CAE industry's leader in extending simulation to the engineering enterprise with Engineering Lifecycle Management solutions. Our customers recognize the need to scale the benefits of virtual prototyping and testing from pockets of experts to mainstream engineering and product development. MSC offers a Materials Data and Process Management platform as well as the only Simulation Data and Process Management solution in the world that has been successfully deployed in industries including automotive, aerospace, shipbuilding, electronics, and more. MSC Software employs 1,100 professionals in 20 countries.

Message from the CEO

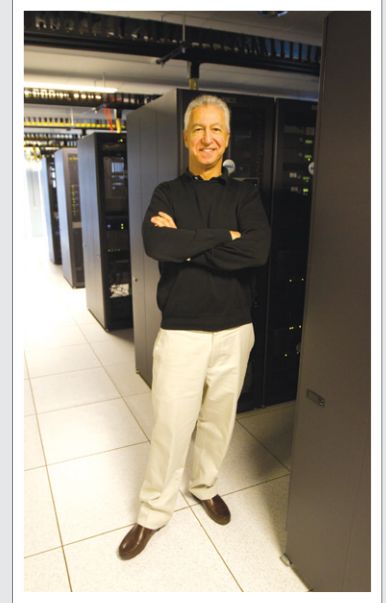
Dominic Gallelo

For half a century, MSC has been delivering certainty to our customers. By simulating the reality of complex manufactured systems through our software, we deliver certainty... so our users can delight their customers with great products, and certainty in business results by reducing time to bring the right products to market, reduce physical testing and warranty claims long after product design is over.

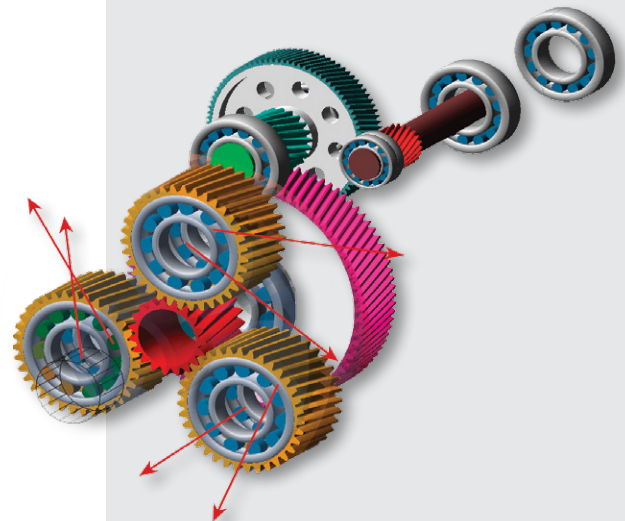
We do this by pushing the edge of physics and the latest computing technology to simulate real world behaviors. These principles that MSC was founded upon continue as our guiding light. We help to make cars safer and more efficient, airplanes more aerodynamic and more comfortable for passengers, ships stronger and able to travel longer distances, machinery run more efficiently and with less maintenance, and medical devices more effective to help us to live longer.

Our customers are faced with difficult questions every day; can I reduce the time it takes to develop? Will it work? Will it be innovative? Will it be safe? Will it be fuel efficient? Will it provide a new standard of passenger comfort? Will it last longer? Will it beat my competition? By knowing exactly how products will behave before they are built, manufacturers can deliver better products faster and with more reliability.

The first adopter of simulation technology was the aerospace industry. The challenge of safe flight from the very first test drove an industry to push the state of the art in simulation technology, long before any other industry. MSC became a trusted partner with the world's leading aerospace companies, delivering certainty every step of the way. In 2003, NASA put a value to society in excess of 10 billion dollars on the NASTRAN structural analysis simulation software delivered by MSC. Eventually, this kind of simulation technology became broadly adopted in nearly every industry from automotive to machinery, energy, infrastructure, consumer products and medical devices. Virtually every major OEM and manufacturer in the world is an MSC customer.

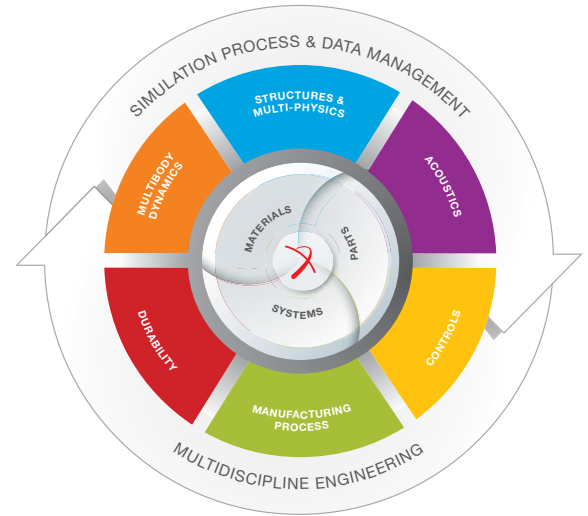


Dominic Gallelo
President & CEO
MSC Software



Solution Portfolio

MSC Software makes products that enable engineers to validate and optimize their designs using virtual prototypes. Customers in almost every part of manufacturing use our software to complement, and in some cases even replace the physical prototype “build and test” process that has traditionally been used in product design.



MSC Products

Simulating Reality, Delivering Certainty

MSC Apex

Modeler & Structures

Modeler
Structures

Integrated Solutions

Adams

Multibody Dynamics
Simulation Solution

Actran

Powerful Acoustic
Simulation Software

Digimat

The Nonlinear Multi-scale
Material & Structure
Modeling Platform

Easy5

Advanced Controls
& Systems Simulation

Marc

Advanced Nonlinear
Simulation Solution

Simufact

Manufacturing Process
Simulation

SimXpert

Fully-Integrated
Multidiscipline Simulation
Solution

Solver Solutions

MSC Nastran

Multidisciplinary
Structural Analysis

Dytran

Explicit Dynamics & Fluid
Structure Interaction

MSC Fatigue

FE-Based Durability
Solution

Sinda

Advanced Thermal
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Multidiscipline Simulation
for the Desktop

SimDesigner

CAD-Embedded
Multidiscipline Simulation

Modeling Solutions

Patran

Complete FEA
Modeling Solution

SimXpert

Fully-Integrated
Multidiscipline Simulation
Solution

Engineering Lifecycle Management

SimManager

Simulation Process
& Data Management

MaterialCenter

Materials Lifecycle
Management





Unlock the World of Engineering Simulation

Overview

MSC One is an expanded products token system that lets you take advantage of the breadth and depth of MSC Software's simulation portfolio within a flexible token based licensing system*.

Offered on an annual subscription basis, MSC One provides efficient implementation of your investment in product development with access to a suite of multidisciplinary engineering software tools.

Key aspects of MSC One include:

- Substantially all current and future products will be available in the MSC One*.
- As a subscription product, MSC One capacity can be expanded or contracted based on current and future project needs.
- Access to more connected physics and disciplines allows better prediction of part and system behavior.
- Ability to leverage MSC's ecosystem of products including MSC Apex, MSC Nastran, Patran, Adams, Marc, SimManager, MaterialCenter and more.
- Access to MSC Apex and the new modules as they become available (such as Structures, Nonlinear, Multi-body Systems).

The MSC One Method

With the new subscription based token system, you receive a pool of tokens. Your tokens are checked out from the pool and are used to access and run a full range of CAE solutions available under the MSC One licensing system from MSC Software. Each individual software item requires a certain number of tokens to run. After each use, your tokens are returned to the pool for other use. There are dozens of software items available under MSC One.

Who is it for?

- Large-scale global enterprises
- Small-Medium sized companies with tight budgets and heavy engineering needs
- Consulting firms that cannot invest in outright per-seat purchases

*Exceptions do apply with certain products. Please talk with your MSC representative for more information.

Benefits

- Innovation
 - Accelerate innovation in your product line by taking advantage of simulation solutions that your company did not have access to previously.
- Improve Productivity
 - Create a flexible environment, as your project and CAE needs mature or change.
- Reduce Risk
 - Reduce your financial risk with the ability to increase or decrease capacity as your engineering needs change.
- Reduce Cost
 - Obtain access to infrequently-used CAE applications that might otherwise be difficult to cost justify.
 - Consolidate your CAE software suppliers to most effectively stretch your limited budget.
- The benefits of MSC One will interest your entire organization:
 - Engineering project managers
 - CAE engineering departments
 - VP of Engineering
 - Purchasing and procurement

Capabilities

- Sketching
 - Sketch lines, squares, circles, ellipsoids, fillets, and chamfers
 - Project, split, and edit existing sketches
- Direct Modeling
 - Interactively edit solids and surfaces with Push/ Pull or Vertex/Edge drag
- Geometry Edit Tools
 - Identify features and defeature
 - Geometry cleanup and check
- Midsurface Creation and Repair Tools
 - Extract mid-surfaces by auto offset, constant thickness, distance offset, or tapered methods
 - Incrementally build mid-surfaces of uniform or non-uniform thickness for planar or curved solids
 - Connect surfaces via direct modeling (Vertex/ Edge Drag), auto Surface Extend or stitching
 - Split and fill surfaces
 - Add/Remove and Suppress/Un-suppress vertices or edges
- Meshing and Mesh Editing
 - Mesh curves, surfaces, and solids, available element types: beam, quad, tria, tet, hex
 - Regenerate meshes automatically as geometry is modified
 - Refine meshes with Feature Base Meshing or mesh Seeding
 - Visually inspect element quality
 - Construct Hard Points to facilitate part connection
 - Mesh surfaces via paver, 4 side map, or 4+ side map mesh methods
- Model Attribution
 - Material Creation and Assignment
 - Behavior Creation and Assignment
 - Automatic creation of thickness and offset properties for uniform and non-uniform cross sections
 - Glue Connections

MSC Apex® | Modeler

Direct Modeling & Meshing Solution

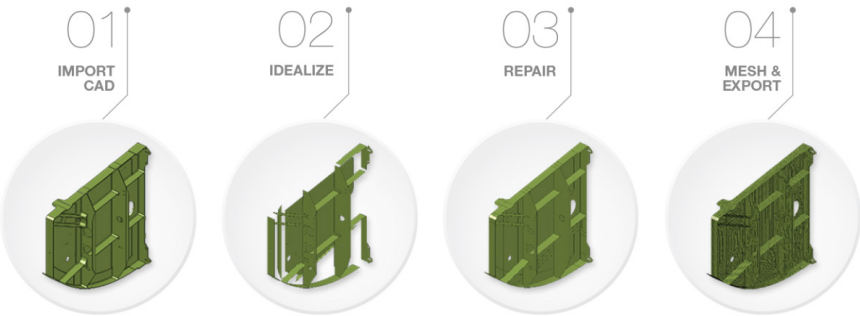
MSC Apex Modeler is a CAE specific direct modeling and meshing solution that streamlines CAD clean-up, simplification and meshing workflow. The solution features sophisticated and interactive tools that are easy to use and easy to learn.

- Direct Modeling Direct: modeling allows users to create and edit geometry interactively. Simply select the entities of interest, such as a face, edge or vertex, and push, pull, or drag to implement any modifications. Direct Modeling is complemented with built in meshing technology.
- Direct Modeling and Meshing: For models that have already been meshed and require further geometry modification, use any of the Direct Modeling or Geometry Clean-up/ Repair tools and the mesh will be immediately regenerated.
- Easy to Use, Easy to Learn: MSC Apex is designed to have multi-purpose tools so as to make the application easy to use. It also features numerous learning aids such as tutorials, video based documentation, workflow and at-mouse instructions which promotes single day productivity.

Productivity Gains

Geometry creation and meshing of this aerospace bulkhead required 50 hours with conventional CAE tools. In MSC Apex Modeler, the process only took 5.5 hours and required little effort to extract mid-surfaces, connect separate surfaces, mesh, and assign thicknesses and offsets.

	Today's Workflow	MSC Apex Workflow
Expertise Required	High	Low
Analysis geometry creation	35h	3h
Mesh creation	3h	2h
Property Assignments	12h	.5h
Complete entire scenario	50h	5.5h



MSC Apex® | Structures

Computational Parts Based Structural Analysis

MSC Apex Structures is an end-to-end simulation solution that expands upon MSC Apex Modeler functionality with capabilities for linear structural analysis.

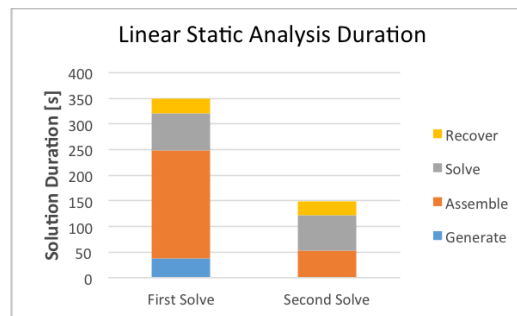
MSC Apex Structures packages a user interface for scenario definition and results post-processing, as well as integrated solver methods. This solution is unique in that it combines computational parts and assemblies technology with a generative framework, which enables interactive and incremental analysis.

The integration of the user interface with solver methods gives the user a unique ability to interactively and incrementally validate that FEM models are solver ready. At the user's demand, a series of solver checks can be run against individual parts and assemblies and the model diagnostics are reported in the Analysis Readiness panel. This Incremental Validation is a radical departure from the very time consuming traditional approach where pre/post processor and solver are separate.

In addition, with Computational Parts and Assemblies, MSC Apex Structures is a true parts-based solution, where each part behavioral representation (Stiffness, mass, and damping) can be pre-computed and stored independently. This approach is especially efficient when combined with the MSC Apex generative framework, as the solver execution will only re-compute behavioral representations for parts that have changed since the last solver execution. We call this Incremental Solving. This new solver architecture is especially efficient in the context of trade studies.

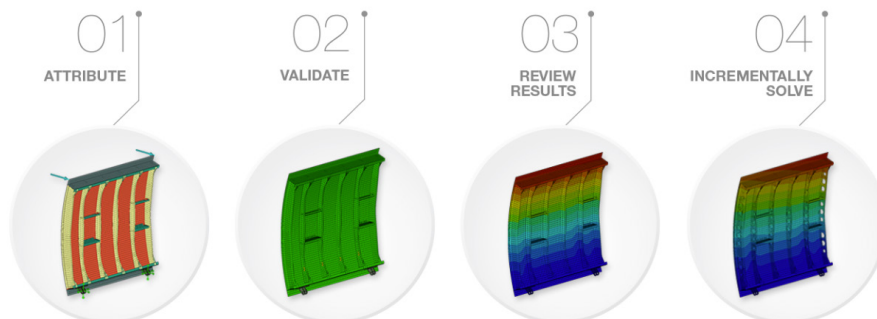
Productivity Gains

Computational Parts technology was used to perform an incremental analysis of this landing gear door assembly. After modifying one part of the assembly, an incremental or subsequent analysis completed 2.5x faster than its first solve.



Capabilities

- Generative Framework
 - Geometry, Mesh, Material, Property and Behaviors, Glue, Load and Boundary Conditions, Scenarios and Results
- Linear Structural Analysis
 - Linear Statics and Normal Modes
- Loads & Constraints
 - Concentrated Force and Pressure
 - Fixed Constraint
- Incremental Validation
 - Regenerative Analysis Readiness for mesh, materials, properties, LBCs, interactions, and simulation settings
 - Context specific (Part, Sub-assembly, Assembly)
- Incremental Solve
 - Computational Parts and Assemblies
- Study Manager
 - Manage multiple scenarios (model representations, output requests, analysis type)
- Post-Processing
 - Results display for static and normal modes
 - Results animation, including modes navigator
 - Spectrum controller
 - Results display in Cartesian, cylindrical or spherical coordinate systems



Capabilities

- Import of CAD geometry formats including STEP, IGES, DXF, DWG or Parasolid
- Extensive library of joints and constraints to define part connectivity
- Definition of internal and external forces on the assembly to define your product's operating environment
- Model refinement with part flexibility, automatic control systems, joint friction and slip, hydraulic and pneumatic actuators, and parametric design relationships
- Ability to generate flexible parts without the need to import MNF file from FEA software
- Ability to iterate to optimal design through definition of objectives, constraints, and variables
- Automatic generation of linear models and complex loads for export to structural analyses
- Comprehensive and easy to use contact capabilities supporting 2D and 3D contact between any combination of modal flexible bodies and rigid body geometry
- Comprehensive linear and nonlinear results for complex, large-motion designs
- Incorporate geometric and material nonlinearity through Adams-Marc co-simulation
- Create geometric nonlinear beam parts using FE part

High Performance Computing (HPC)

- Parallel processing support for Adams/Tire results
- Shared Memory Parallel solver
- State of the art Linear analysis capabilities
- High fidelity Adams-to-Nastran translation utilities to replace manual translation
- HHT integrators for a faster numerical integration of the equations of motion for a dynamic analysis



INTEGRATED SOLUTIONS

Adams™

Multibody Dynamics Simulation Solution

Adams is the world's most widely used multibody dynamics simulation software. It lets you build and test functional virtual prototypes, realistically simulating on your computer, both visually and mathematically, the full-motion behavior of your complex mechanical system designs.

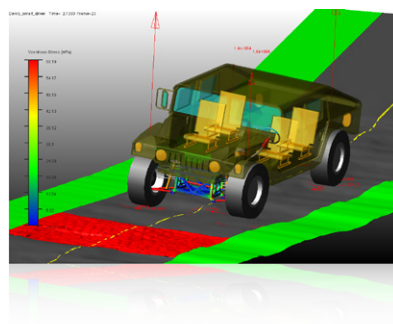
Adams provides a robust solution engine to solve your mechanical system model. The software checks your model and automatically formulates and solves the equations of motion for kinematic, static, quasi-static, or dynamic simulations.

With Adams, you don't have to wait until the computations are complete to begin seeing the results of your simulation. You can view animations and plots – and continue to refine your design – even as your simulation is running, saving valuable time.

For design optimization, you can define your variables, constraints, and design objectives, then have Adams iterate automatically to the design, providing optimal system performance.

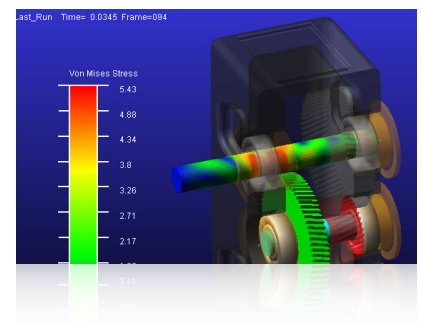
Adams/Car

- Explore the performance of your design and refine your design before building and testing a physical prototype
- Analyze design changes much faster and at a lower cost than physical prototype testing would require
- Vary the kinds of analyses faster and more easily
- Work in a more secure environment without the fear of losing data from instrument failure or losing testing time because of poor weather conditions



Adams/Machinery

- High-fidelity simulation of common mechanical parts, such as gears, bearings, belts, chains, Electric Motor and Cam
- Enhanced productivity with incredibly quick model-solve-evaluate process times
- An automated, wizard-driven model creation process for ease-of-use
- Straightforward evaluation of results in Adams/Postprocessor



INTEGRATED SOLUTIONS

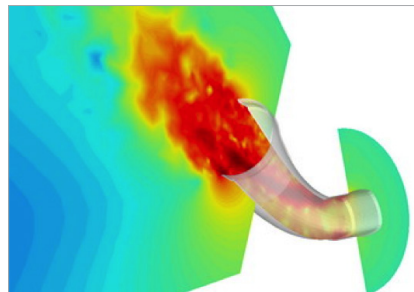
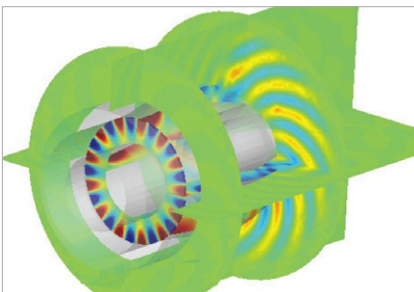
Actran™

Powerful Acoustic Simulation Software

Actran is a premier acoustics software solution for simulating acoustics, vibro-acoustics, and aero-acoustics quickly, easily, and accurately. Under a common technological umbrella provided by the finite and infinite element method, Actran has a rich library of elements, material properties, boundary conditions, solution schemes and solvers. With the high performance solution coupled with easy to use modeling environment, engineers can gain insight into the acoustic behavior of their products and improve designs early in the product development cycle.

Actran is used in industries like automotive manufacturers and suppliers, civil and military aircraft and aircraft engine manufacturers, and consumer product manufacturers including loudspeakers and audio device producers to acoustic problems in diverse products ranging from hearing aids, loudspeakers and audio devices, to exhaust systems, aircraft engine, and solar array panels. Some applications include:

- Acoustic radiation of vibrating structures like engine, gearbox or turbo compressor
- Acoustic and vibro-acoustic performance of ducted systems like exhaust systems
- Aero-acoustic analysis in vehicle interiors generated by climate control systems
- Noise transmission due to Turbulent Boundary Layer (TBL) to study of the performance of acoustic insulation in an aircraft fuselage panel during flight
- Acoustic fatigue behavior by co-simulation with MSC Nastran and MSC Fatigue
- Trimmed vehicle body NVH by co-simulation with MSC Nastran or other third-party solvers
- Noise of aircraft turbo-reactors and design acoustic liners
- Acoustic radiation from moving mechanisms by co-simulation with Adams
- Sloshing noise analysis by co-simulation with Dytran, MSC Nastran or other third-party solvers

**Capabilities**

- Analyze acoustic propagation and radiation in static medium or complex flow
- Simulate free field radiation with infinite elements or Adaptive Perfectly Matched Layer (APML)
- Model acoustic visco-thermal loss in small fluid domains
- Coupled vibro-acoustic analyses with direct frequency approach or modal frequency approach
- Rich structure element library: solids, shells, beams, springs, rigid bodies, multilayered composite structures etc.
- Poro-elastic element library based on the BIOT theory for modeling bulk reacting materials
- Analyses of fully trimmed vehicle NVH problems combining Nastran body-in-white models with Actran trim models
- Piezo-electric element libraries for modeling active structures
- Random excitations: diffuse sound field, turbulent boundary layer, etc.
- Perform 2D, 3D and axisymmetric analyses with linear and quadratic elements
- Predict noise due to turbulent flows: Lighthill analogy and Möhring analogy for retrieving aeroacoustic sources from CFD results
- Fan noise simulation
- Interface with CFD codes using native CFD file format
- Direct and iterative solvers
- KRYLOV fast frequency response solver
- Solve your models faster with shared and distributed parallel solutions
- Adaptive meshing technology for efficient computations and users' minimal meshing efforts

Benefits

- Model accurately and efficiently acoustic problems
- Enable optimization through scripting
- Co-simulation with structural analysis FEA software like MSC Nastran
- Improve productivity with parallel solvers
- GUI support for advance results visualization
- Co-simulation with time-domain codes such as Adams or Dytran

Capabilities

- Holistic approach to model composite materials (materials, physics, CAE technology)
- Multi-scale modeling from the microscopic to the macroscopic scale, with representative volume elements, homogenization technology
- Material exchange platform to prepare, store, retrieve and securely exchange Digimat material models between material experts & structural engineers
- Virtual testing of composite materials with flexible loading definitions – monotonic & cyclic
- Support for broad range of composite materials, including fiber reinforced plastics, hard metals, ceramics, nano, and sandwich panels
- Complex material morphologies (multi-phase, multi-layer)
- Support for linear/nonlinear, temperature & strain rate dependent behaviors
- Analysis of failure, creep, and fatigue
- Interfaces to all major FEA and processing simulation software

Benefits

- Improve fidelity in simulations through better material modeling
- Characterize multi-phase composite materials with ease
- Improve accuracy by bridging the gap between FEA and processing simulation
- Improve communication and standardize material library to reduce errors

INTEGRATED SOLUTIONS

Digimat™

The Nonlinear Multi-scale Material & Structure Modeling Platform

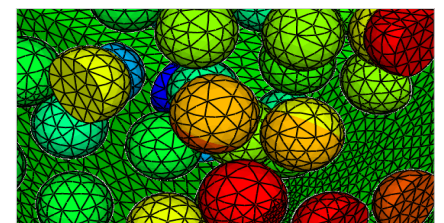
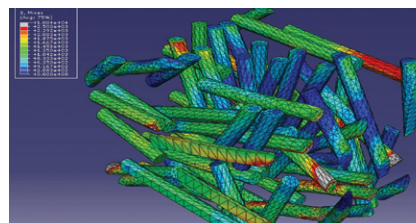
Digimat enables engineers perform both micro- and macro-scale analyses of composites, predicting their performance and calculating their mechanical, thermal and electrical properties. A large variety of composite materials, including those made from thermoplastic and thermoset polymers, and elastomers, can be effectively modeled with Digimat.

Digimat composites modeling technology relies on micromechanical approaches to accurately predict the behavior of multi-phase material. Digimat offers optimized solution to bridge the gap between manufacturing process, material design and structural FEA. Outputs of the manufacturing simulation, fiber orientation, residual stresses, weldlines, void density are used by Digimat to compute the exact non-linear strain-rate dependent material performance of composite materials. NVH, stiffness, crash, durability, creep are examples of analysis where Digimat solutions can be applied.

With Digimat as part of your CAE suite, your product development becomes more predictive, enabling you to optimize composite structure design with confidence saving both time and resources.

Digimat Modules:

- **Digimat-MF:** For a fast & accurate prediction of the nonlinear behavior of multi-phase materials using Mean-Field homogenization technology.
- **Digimat-FE:** For an accurate prediction of the local/global nonlinear behavior of multiphase materials using FEA of realistic Representative Volume Element (RVE).
- **Digimat-MX:** For the preparation, storage, retrieval and secure exchange of Digimat material models between material suppliers and users.
- **Digimat-CAE:** Interfaces to process and structural FEA codes for an accurate prediction of composite materials and reinforced plastics parts performance using nonlinear multi-scale modeling approach.
- **Digimat-MAP:** For an efficient mapping of scalar & tensorial data between dissimilar shell and solid FE meshes.
- **Digimat-HC:** Easy and efficient solution for the design of honeycomb sandwich panels.
- **Digimat-RP:** An integrative simulation environment dedicated to integration of Digimat material model inside your FEA model for short fiber reinforced plastic components and systems simulation.



INTEGRATED SOLUTIONS

Easy5®

Advanced Controls & Systems Simulation

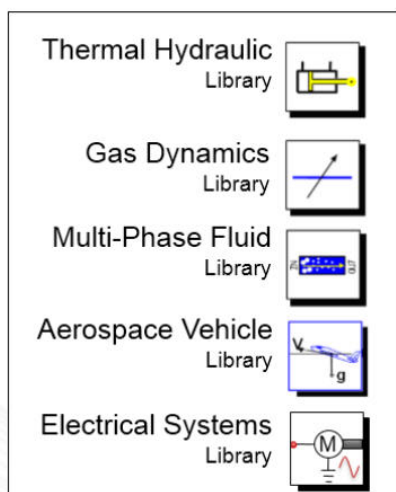
Engineering aircraft, vehicles, agricultural equipment, and other complex systems requires a systems-engineering approach in which not only the components and subsystems but the entire system as a whole is tested. Traditional build and test methodologies are time-consuming and expensive; and now more than ever, every industry is challenged to meet the conflicting requirements of increasing innovation while reducing cost and time to market.

Easy5 provides accurate, reliable multi-domain modeling and simulation of dynamic physical systems. Using Easy5, some of the most respected companies in the world are evaluating system level performance with CAE to reduce physical prototypes, cut cost, and accelerate their product development process.

Dynamic systems, those systems whose behavior as a function of time is important, are typically defined using first-order differential (or difference) equations. Easy5 simplifies the construction and analysis of such systems by means of a graphical, schematic-based application, offering a comprehensive set of pre-packaged “components”, stored in application-specific libraries, to simplify the assembly and simulation of such systems. Systems engineers work within a familiar schematic drawing environment to add and specify simple, yet complex, connections between components in an intuitive, simple-to-use, multi-level hierarchical modeling environment.

Typical applications of Easy5 include control systems, hydraulics (including thermal effects), pneumatics, gaseous flow, thermal, electrical, mechanical, refrigeration, environment control, lubrication or fuel systems, and sampled-data/discrete-time behavior.

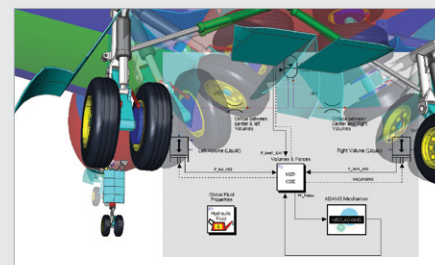
Packaged in 5 Application Libraries:

**Capabilities**

- Assemble models easily from hundreds of pre-built system components
- Easy to use schematic based system-level modeling, simulation and analysis
- Complete system virtual prototyping by linking Easy5 to other MSC applications
- 64-bit support for Windows and Linux
- Integration with SimManager for easy sharing of models and results (Windows only)
- Customizable libraries of components
- Easy to use GUI with Windows style functionalities
- Integration with other CAE software packages like Adams®, MSC Nastran® and Simulink®
- FMI (Functional Mockup Interface) Support for easier co-simulation

Benefits

- Assess complex multi-domain systems quickly and accurately
- Improve products early in the design process
- Understand problems and design countermeasures effectively
- Reduce CAE cost with shareable libraries
- Improve CAE effectiveness by integrating with other tools



Capabilities

- Advanced nonlinear materials
- Industry proven contact to accurately simulate product performance and manufacturing
- Coupled solutions of nonlinear structural, thermal, electromagnetics.
- Advanced heat transfer analysis capabilities
- Special purpose material models including Shape Memory Alloy and Solder models
- Comprehensive connector and fastener models to simulate commonly found connections
- State-of-the-art iterative solvers and parallel processing on shared and distributed memory machines
- Automated remeshing and adaptive meshing to increase solution robustness and accuracy
- Advanced damage and fatigue analysis of metals and composite structures
- Predict crack initiation and propagation under realistic load conditions

Benefits

- Shorten the design optimization process, while improving design and product performance through integrated simulation
- Reliable analysis capabilities to reduce product design, development, manufacturing & warranty costs
- Robust solver technology that greatly enhances the value of nonlinear solutions encountered in many industries

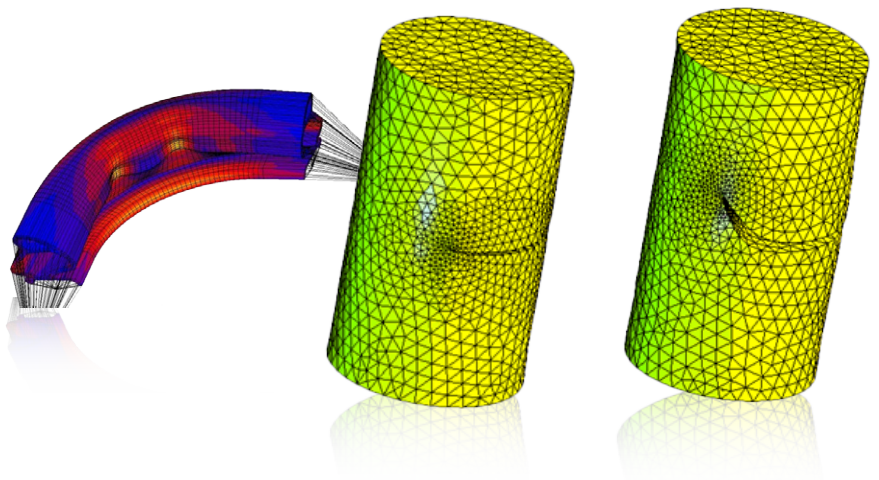
INTEGRATED SOLUTIONS

Marc®

Advanced Nonlinear Simulation Solution

Marc is a powerful, general-purpose, nonlinear finite element analysis solution to accurately simulate the response of your products under static, dynamic and multi-physics loading scenarios. Marc's versatility in modeling nonlinear material behaviors and transient environmental conditions makes it ideal to solution for your complex design problems.

- **Nonlinear and Multiphysics Solution Schemes:** Solve problems spanning the entire product lifespan, including manufacturing process simulation, design performance analysis, service load performance and failure analysis with robust nonlinear algorithms and multiphysics capabilities that include coupled thermomechanical analysis, electromagnetics, piezoelectric analysis, electrical-thermal-mechanical, electrostatics and magnetostatics coupled with structural response and more.
- **Nonlinear Materials:** Choose from an extensive library of metallic and non-metallic material models, along with a library of nearly 200 elements for structural, thermal, multiphysics and fluid analyses.
- **Failure and Damage Analysis:** Investigate damage and failure using models suited for several material classes, including ductile, brittle, composites, elastomers, and concrete. Study crack propagation to avoid catastrophic structural failures.
- **Contact Analysis:** Easily set up a contact model, analyze and visualize the ever-changing component interaction. Account for friction and plasticity generated heating in a coupled analysis.
- **Automatic Remeshing:** Use local and global adaptive remeshing capabilities to overcome problems due to high stress gradients and/or large element distortions.
- **Parallel Processing:** Achieve higher productivity with the time tested parallel analysis capabilities. Take complete advantage of the multi-core processors and the GPUs available on their systems, to achieve higher performance.
- **Integrated Pre-/Post-Processing:** Create and analyze complex models with an integrated user interface designed expressly for nonlinear analysis. Customize the application with Python scripting language to automate repetitive tasks across the entire simulation process.



INTEGRATED SOLUTIONS

Simufact®

Manufacturing Process Simulation for Metalworking Industry

Simufact is a leading FEA based simulation solution for metal forming, welding and heat treatment. With the ability to simulate the entire manufacturing process chain, starting from blanking, shearing of wires or billets, to multi-stage forming, punching, trimming, and heat treatment followed by joining operations, welding and structural analysis, Simufact helps optimize the manufacturing processes, and reduce costs and time-to-market, while improving product quality.

Two product lines are available as part of Simufact family to help simulate forming and welding processes.

Simufact.forming covers the complete spectrum of forming technologies and guarantees a realistic portrayal of the processes with full 3D functionality and 3D representation of all the tools and parts. Accurate simulations are achieved by capturing all the key aspects that affect the processes.

Multiple modules are available to address the processes of interest to you. The core module of Forming Hub includes the key functionality necessary for the operating and handling ability of the simulation software (GUI, solver, material database etc.), along with capabilities to perform cold forming and hot forging simulations. Users can choose from any of the others listed below to augment their simulation capabilities.

- Sheet metal forming
- Rolling
- Ring rolling
- Open die forging
- Heat treatment
- Mechanical joining

Additional modules are available to help with die stress analysis and microstructure calculations, faster performance, additional CAD import interfaces, customization, and access to material databases.

Simufact.welding helps simulate complex welding processes that may involve multiple welding sequences and predicts distortions of the components, while considering phase transformations occurring during the process. With Simufact.welding, users gain insight into the properties of the weld seam, helping them to address problems prior to putting the process into use.

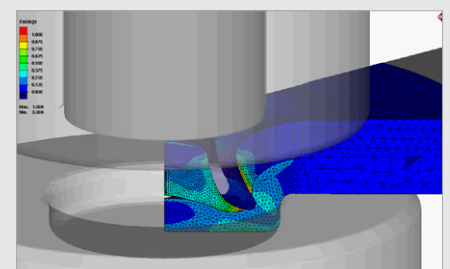
By coupling Simufact.welding with Simufact.forming, users can simulate a combination of various process chains with upstream and downstream welding processes. Easy data transfer allows not only consideration of the forming history, but also strength analysis of simulated welded seams.

Capabilities

- Simulate complex kinematics of a machine
- Model material behavior of the workpiece – elasto-plasticity as well as temperature and strain hardening related effects
- Analyze influence of friction and contact between tools and forming parts
- Investigate folds during forming
- Analyze the thermodynamics of the forming process – initial heating, heat transfer into tools and environment, temperature increase due to friction and forming energy etc.
- Create models faster with easy and intuitive Windows-like user operations and use of trade terminology
- Study various welding sequences, speeds, heat input, stop times and fastening devices
- Investigate fusion zones, heat affected zones, tensions and distortions

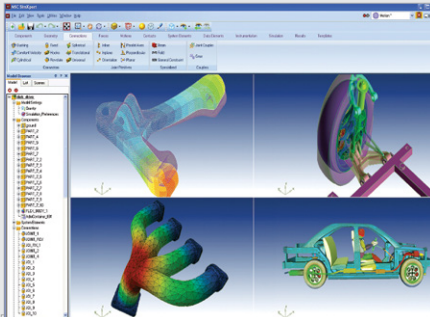
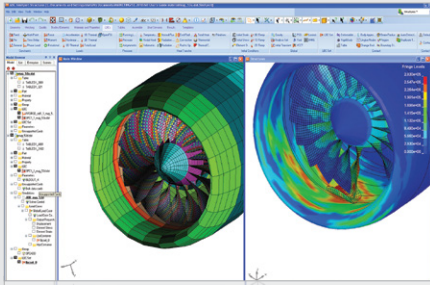
Benefits

- Achieve process stability through better knowledge of the forming or welding processes
- Reduce forming operations and optimize material usage
- Reduce costs in tool and process development
- Improve tool life and optimize machine utilization capacity



Capabilities

- Intuitive object based user interface with contextual actions
- View, manipulate, and organize your model with advanced browser functionality
- Import IGES, Parasolid, CATIA V4, CATIA V5, Pro/ENGINEER, ACIS, STEP and STL data for FE modeling
- Interactive CAD cleaning and healing with auto curve, shell, and solid meshing
- Define simulation properties using engineering terms for use across all workspaces
- Contact creation and setup through easy to use and intuitive contact tables
- Visualize and manipulate all CAE entities
- User configurable toolsets and menus to streamline the modeling process



INTEGRATED SOLUTIONS

SimXpert®

Fully Integrated Multidiscipline Simulation

SimXpert is a fully integrated simulation user environment for product simulation that brings together end-to-end multidiscipline simulation capabilities and best practice methodology capture and deployment technologies in a unified environment. This approach closes the collaboration gap that exists between analysts and designers, enabling them to share critical information across disciplines without duplicating work and allows them to deploy their best practices to the extended enterprise. This improved process enables manufacturers to accelerate the speed and accuracy of simulation, increase design productivity, and bring better products to market faster.

- **CAD Import and Superior Meshing Tools:** Import CAD files using any of the multiple formats supported, including IGES, Parasolid, CATIA V4, CATIA V5, Pro/ENGINEER, ACIS, STEP and STL. Create desired, high quality meshes with automatic and manual tools, along with modeling inputs for material data, boundary and loading conditions and contact interactions.
- **Multiple workspaces to tackle engineering problems:** Engineers can choose from various workspaces like Structures, Thermal, Explicit, Motion, and Systems and Controls to address problems experienced during the life of a product. Integrated with state-of-the art solvers in Finite Element Analysis, Multibody dynamics, and Controls, these workspaces provide all the tools required to complete all the stages of the simulation process – from pre-processing and modeling, solving, to post-processing, results manipulation and reporting.
- **Multidiscipline Analysis for Greater Accuracy:** Perform integrated multidisciplinary analyses on virtual prototypes ranging from components to complex systems. By passing the data across the multiple workspaces, improve the accuracy of the models with real-world loading and environmental conditions, including the complex interactions between engineering disciplines, without the inefficiencies of deploying multiple incompatible technologies or relying on costly physical prototypes.
- **Template Builder for Automation:** Automate the CAE process by reducing the number of steps in modeling and post-processing with the help of easy to use Template Builder. Take full advantage of the templates and expand the reach of the analysis tools while maintaining uniform, proven methods across the organization.

SOLVER SOLUTIONS

MSC Nastran™

Multidisciplinary Structural Analysis

MSC Nastran is a multidisciplinary structural analysis application used by engineers to perform static, dynamic, and thermal analysis across the linear and nonlinear domains, complemented with automated structural optimization and award winning embedded fatigue analysis technologies, all enabled by high performance computing.

Engineers use MSC Nastran to ensure structural systems have the necessary strength, stiffness, and life to preclude failure (excess stresses, resonance, buckling, or detrimental deformations) that may compromise structural function and safety. MSC Nastran is also used to improve the economy and passenger comfort of structural designs.

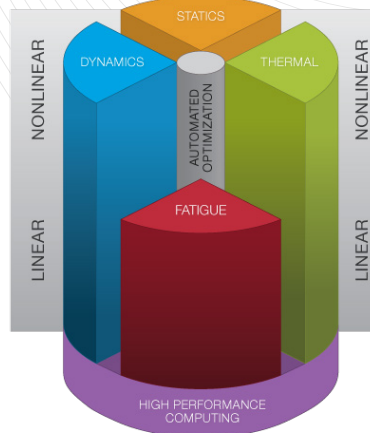
Manufacturers leverage MSC Nastran's unique multidisciplinary approach to structural analysis at various points in the product development process. MSC Nastran may be used to:

- (1) Virtually prototype early in the design process, saving costs traditionally associated with physical prototyping;
- (2) Remedy structural issues that may occur during a product's service, reducing downtime and costs;
- (3) Optimize the performance of existing designs or develop unique product differentiators, leading to industry advantages over competitors.

MSC Nastran is based on sophisticated numerical methods, the most prominent being the Finite Element Method. Nonlinear FE problems may be solved either with built-in implicit or explicit numerical techniques. A number of optimization algorithms are available, including MSCADS and IPOPT. The fatigue capability in MSC Nastran has been developed jointly by nCode International Ltd. and MSC Software.

MSC Nastran Advantages

- **Multidisciplinary Structural Analysis:** To build up a comprehensive level of engineering analysis capability, multiple software solutions must be acquired, and users must be trained with each new tool. MSC Nastran features multiple analysis disciplines, enabling customers with one structural analysis solution for a wide variety of engineering problems.
- **Structural Assembly Modeling:** One structural member is rarely analyzed independently. Structural systems consist of numerous components, and must be analyzed as a whole. MSC Nastran features a number of methods to join multiple components for system level structural analysis.
- **Automated Structural Optimization:** Design optimization is a critical element in product development, but is often very iterative and requires a great deal of manual effort. MSC Nastran includes optimization algorithms that automatically seek optimal configurations in an allowed design space.



Capabilities

Multidisciplinary Structural Analysis

- Use one platform to perform linear or nonlinear analysis for the following disciplines: static, dynamic (NVH & Acoustics included), thermal, and buckling, and reduce the dependency on multiple structural analysis programs from various vendors
- Perform fatigue analysis with embedded fatigue technologies and reduce the time usually associated with fatigue life determination
- Assess the behavior of advanced composites and fiber reinforced plastics with built in Progressive Failure Analysis and User Defined Services for Mean-field Homogenization coupling with Digimat

Structural Assembly Modeling

- Expedite meshing with Permanent Glue, enabling you to connect incongruent meshes that would traditionally require time consuming mesh transitions
- Save time constructing assemblies that consists of welds or fasteners via specialized connector elements
- Speed up the re-analysis of large assemblies by constructing Superelements, and optionally, share Superelements with other manufacturers while concealing confidential design information
- Perform contact analysis and determine contact stresses and contact regions in multi-component designs

Automated Structural Optimization

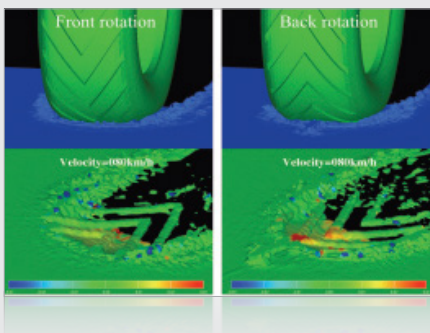
- Optimize for stress, mass, fatigue, etc. while varying design variables such as material properties, geometric dimensions, loads, etc.
- Enhance the shape or profile of structural members with shape optimization
- Find optimal composite laminate ply thicknesses with topometry optimization
- Determine optimal bead or stamp patterns for sheet metal parts with topography optimization
- Remove excess and unnecessary volume with topology optimization
- Simultaneously optimize multiple models across disciplines with Multi Model Optimization

Capabilities

- Advanced, explicit nonlinear solver technology for simulating and analyzing extreme, short duration dynamic events.
- Robust and efficient three-dimensional contact and coupling algorithms using Lagrangian finite element method for structural analyses and Eulerian finite volume method for fluids and multi-material flow analyses.
- Complete finite element model library that includes beams, shells, solids, springs, and dampers with large displacement formulation.
- Full range of nonlinear material models for metals, composites, soils, foam rubber, liquids, and gases.
- Distributed Memory Parallel (DMP) support for Eulerian solver and coupling surface computation

Benefits

- Minimize the costs of physical prototyping and eliminate redundant test cycles through Dytran's streamlined modeling flow and most advanced fluid-structure interaction (FSI) simulation capabilities.
- Quickly obtain detailed insight into the nonlinear, dynamic behavior of real-world problems that cannot be easily solved with other simulation tools.
- Model complex scenarios and perform "what-if" analyses earlier in the design cycle within a single analysis package and simulation environment.
- Apply results from Dytran to improve the quality of your products and minimize the probability of failures and costly redesigns.



SOLVER SOLUTIONS

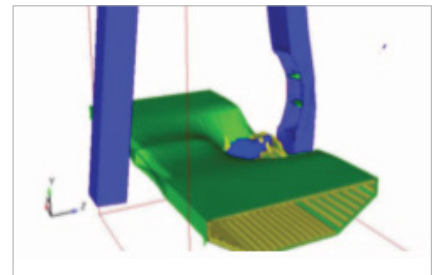
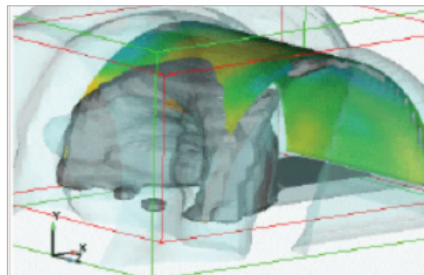
Dytran™

Explicit Dynamics & Fluid Structure Interaction

Dytran is an explicit finite element analysis (FEA) solution to simulate short-duration events like impact and crash, and to analyze the complex nonlinear behavior that structures undergo during these events. Dytran enables engineers to study the structural integrity of designs to ensure that final products meet customer safety, reliability, and regulatory requirements.

Dytran delivers a structural, material flow and coupled FSI analysis capabilities in a single package. Using a unique coupling feature that enables integrated analysis of structural components with fluids and highly deformed materials in one continuous simulation, Dytran provides realistic solution to complex problems.

- **Transient Structural Analysis:** Using explicit solver technology, Dytran provides faster solution to large, complex transient dynamic problems. Users can use from a wide variety of elements that include solid, shell, beam, membrane, connectors and rigid elements, to model the structures.
- **Nonlinear Materials:** Select from a wide range of material models to model the nonlinear response and failure. The available material models include linear elasticity, yield criteria, equations of state, failure and spall models, explosive burn models and composite materials to name a few.
- **Contact Analysis:** Model interaction between multiple parts and assemblies with robust contact analysis capability. The interaction may include frictionless contact, sliding with frictional effects and separation. Single surface contact can also be used to model buckling of structures where structures may fold onto themselves.
- **Fluid-Structure Interaction:** Analyze fluid behavior and its effects on structural response in a single model with the help of a combination of Lagrangian and Eulerian solvers in Dytran. Interaction between the fluids and structures is achieved through a coupling surface created on structures.
- **High Performance Computing:** Achieve higher productivity by taking advantage of the latest numerical methods and high performance computer hardware. Analyses can be run on a broad range of machines including desktop computers to supercomputers. Users can also benefit from the parallel processing capabilities to achieve faster solutions.



SOLVER SOLUTIONS

MSC Fatigue™

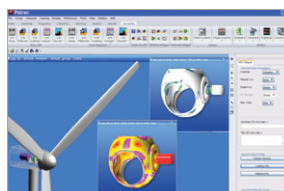
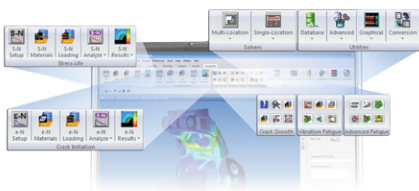
FE-Based Durability Simulation

MSC Fatigue enables durability engineers to quickly and accurately predict how long products will last under any combination of time-dependent or frequency-dependent loading conditions. With Finite Element (FE) based durability and damage tolerance capabilities, MSC Fatigue enables users with minimal knowledge of fatigue to perform comprehensive durability analysis. High-cycle fatigue, low-cycle fatigue and crack growth problems can all be addressed in a single environment. Results post-processing gives insight into, and identification of, fatigue problem areas allowing for in-depth understanding of model response to changes in fatigue design parameters.

Modules

MSC Fatigue is provided with multiple modules that you can choose from based on your analysis needs.

- **Basic stress life and strain life:** Use stress/strain results from FE models, variations in loading, and cyclic material properties to estimate life-to-failure using total life method, also known as the stress-life (S-N) method, or the crack initiation method, also known as the local strain-life (e-N) method.
- **Strain Gauge:** Create virtual software strain gauges within MSC Nastran FE model to produce analytical response time histories under the effect of multiple time varying loads.
- **Multiaxial:** Estimate life to failure using non-proportional, multiaxial stress state as opposed to the usual uniaxial or proportional loading states. The crack initiation (e-N) and total life (S-N) methods are used in the life prediction and safety factor analyses, respectively.
- **Vibration Fatigue:** Predicts fatigue life of structures subjected to random vibration loads in frequency domain using either direct external response PSDs or computed PSDs from within MSC Fatigue.
- **Fracture:** Estimate crack propagation rates and times using FE model data and results. Stress results can be nominal or far field stress, and can be defined as a single location or averaged from an area on the model.
- **Welds:** Predict the fatigue life of welded connections using static or dynamic FE results with the total life (S-N) method.
- **Wheels:** Conduct fatigue analyses on wheels for a sequence of loading conditions, which is applicable to any rotating body where the applied loads “travel” around the periphery of the body.



Capabilities

- High-cycle fatigue, low-cycle fatigue and crack growth analysis
- Stress life (S-N), strain life (e-N) and linear elastic fracture mechanics (LEFM) methods
- No limit on number of nodes or elements analyzed
- Modifiable materials database with comprehensive set of S-N, E-N, Cyclic and Component curves
- Static, transient and quasi-static loading
- Supports simultaneous application of up to 500 load cases
- Modifiable loads database with standard time histories
- Support for RPC, DAC and ASCII load files
- Non-proportional, multiaxial stress states
- Frequency-domain analysis via PSD
- Compliance function library including numerous crack geometries
- Spot and seam weld analysis

Benefits

- Reduced prototype testing
- Fewer product recalls
- Lower warranty costs
- Increased confidence designs will pass required test schedules

Prerequisites

- Patran

Capabilities

- Use an intuitive RC network approach to build thermal models
- Set up advanced thermal problems involving nonlinear materials, radiation, and other complex boundary conditions
- Integrate with a variety of pre-post processors and radiation codes to utilize existing models, reduce learning time, and increase total project cohesion
- Provide unique programming logic to analyze any number of “what-if” situations
- Easily set up parametric analysis such as sensitivity, optimization, and test correlation to increase understanding of thermal consequences to design changes
- Use a proven tool in the aerospace and high tech industries with a quarter century track record
- Select from 25 steady state and transient solvers to converge almost any solution quickly and accurately
- Includes Thermal Studio; a Windows based GUI for creating and running models and reviewing the results in tabular reports of x-y plots
- Integrate into Patran, THERMICA, Visio or Excel

Benefits

- Model terrestrial heating for solar loads on Airplanes, Automobiles, Solar Power Plants, Civilian Structures, and more
- Analyze ablation of thermal electric devices and heat pipes
- Improve product life with optimized cooling
- Enhance user comfort and safety with better thermal management

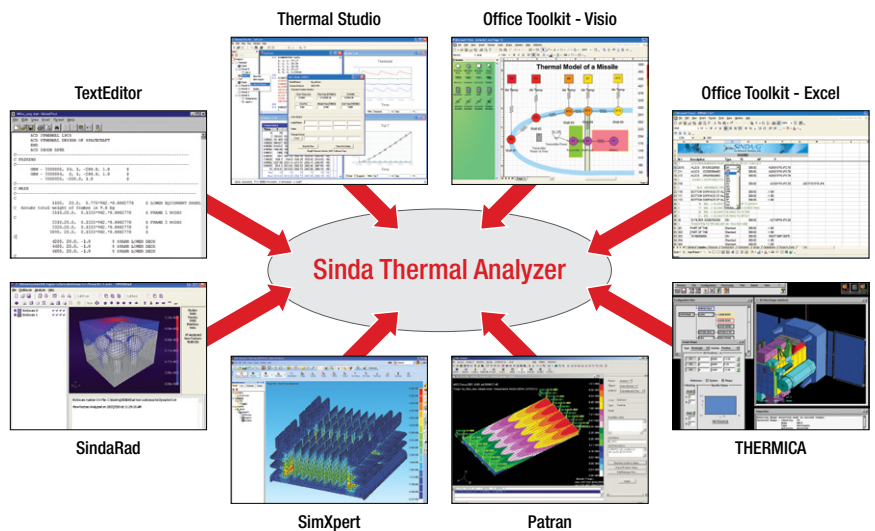
SOLVER SOLUTIONS

Sinda™

Advanced Thermal Simulation Solution

Sinda is a world class advanced thermal solution with a proven track record in the aerospace and high tech markets. It uses a conductor-capacitor network representation approach which is well suited to solve large thermal problems that may include various material and boundary condition nonlinearities. Iterative schemes make Sinda more efficient in time and memory requirements than traditional finite element solvers. With industry proven efficient solver technology, users can simulate complex thermal models that may include conduction, convection, advection and radiation along with thermal contacts.

Sinda goes beyond other generic thermal solvers with a thermal programming language allowing users to continuously add customized capabilities to their thermal model. Any degree of logic from simple convection equations to entire subroutines can be added to the thermal model, and parameters, loads, and materials can be changed “on the fly” from various user interfaces. The flexibility of Sinda is extended even more with integration to a wide number of thermal modeling tools including Patran, SimXpert, SindaRad, THERMICA, Thermal Studio and Visio.



MID-SIZED BUSINESS SOLUTIONS

MSC Nastran Desktop™

Multidiscipline Simulation for the Desktop

MSC Nastran Desktop makes MSC Nastran, the leading structural FEA solution, accessible to worldwide innovative industries and engineers with diverse high-end simulation technology needs and increasing cost pressure challenges. Designed specifically for suppliers and medium-sized manufacturers, MSC Nastran Desktop provides flexible, low-cost access to MSC Nastran's extensive and powerful solution capabilities through SimXpert's scalable and integrated easy to use interface. Any industry or company, independent of its size, can benefit from modular access to the most powerful multidiscipline simulation technology in the world through tailored solutions. Engineers can start with the MSC Nastran capabilities that fit their current FEA needs and easily move up to more advanced functionality while remaining in the same user environment, leading to accelerated productivity and shorter learning curve. Each MSC Nastran Desktop solution is available at affordable prices, and backed by MSC Software's best-in-class technical support and engineering partnership.

MSC Nastran Desktop delivers the power of MSC Nastran through a modularized approach. Listed below are the various modules:

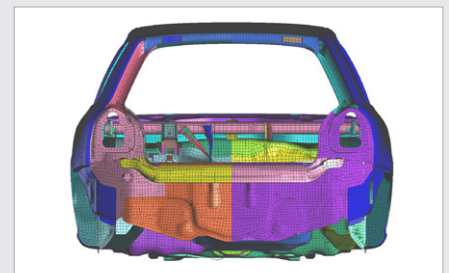
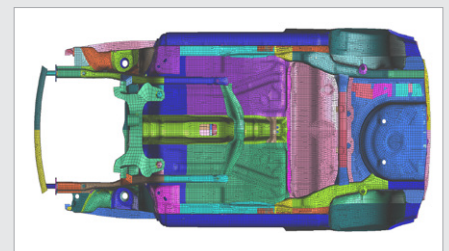
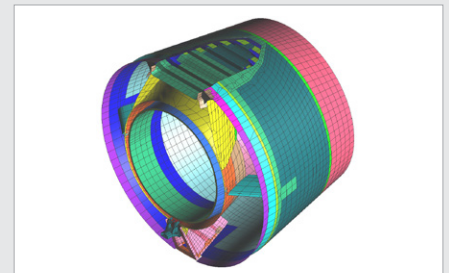
- **MSC Nastran Desktop Structures:** Tailored to stress engineers working on components, assemblies and structures subjected to static and dynamic loads. Engineers can analyze any structural component with ease, determine if the structure is going to buckle or yield, and ensure the design performs within tolerance limits.
- **MSC Nastran Desktop Structures & Motion:** Helps structures and motion engineers study the true functional performance of systems using the multibody dynamics (MBD) and kinematics capabilities engine of Adams together with the power of MSC Nastran.
- **MSC Nastran Desktop Advanced Dynamics:** Helps structural dynamics & acoustics engineers virtually simulate designs that are subjected to advanced dynamic loading conditions.
- **MSC Nastran Desktop Advanced Structures:** Tailored to structural engineers simulating nonlinear and multiphysics problems including nonlinear materials, contact, large strain and displacement behaviors, and thermo-mechanical coupling.
- **MSC Nastran Desktop Advanced Structures & Motion:** Helps structural and systems engineers study the true functional performance of systems using the multibody dynamics (MBD) and kinematics capabilities engine of Adams together with the advanced structural and nonlinear capabilities of MSC Nastran.

Capabilities

- Use advanced CAD defeaturing and meshing tools
- Analyze the behavior of complex components and assemblies by using an extensive set of finite element analysis capabilities available in MSC Nastran
- Study the interaction of dynamic systems with multibody dynamic and kinematic capabilities available in Adams
- Construct templates to perform multi level automated processes
- Organize numerous virtual prototype iterations for future traceability

Benefits

- Increase productivity through a unified and simple user environment
- Reduce physical test costs by maximizing the performance of each virtual prototype
- Save time organizing and managing large FEM assemblies

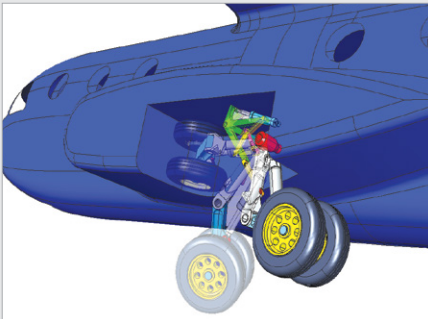


Capabilities

- Supports CATIA V5
- Execute SimXpert templates directly from CAD environment enabling designers to perform expert guided structural and motion analyses on CAD geometry.
- Post-process structures and motion simulation template results directly within CAD environment.
- Utilize SimManager to manage simulation template runs, data revision control, release status, and data pedigree and audit trail.

Benefits

- Drive simulation earlier in the design process to lower the cost of design changes and improve product quality and manufacturability.
- Increase confidence in early design validation and designs iterations through template-guided simulation
- Enhance collaboration between design teams and expert analysts to promote automation and reuse of CAE best practices across the enterprise.
- Gain greater insight into design performance. Template guided analysis ensures proper modeling, simulation inputs, materials data, and CAE best practices are being followed by CAD users.
- Control data access and share data with other designers, engineers, managers and executives across the enterprise.



MID-SIZED BUSINESS SOLUTIONS

SimDesigner™

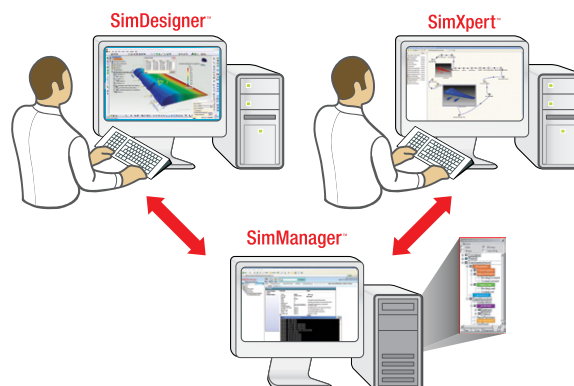
CAD-Embedded Multidiscipline Simulation

SimDesigner makes linear and nonlinear FEA, thermal analysis, and motion analysis capabilities from MSC Nastran, Marc, and Adams available within the CATIA V5 CAD environment. Many manufacturers want to bring simulation forward in their product development process to have functional performance analysis lead design, rather than simply validate design. This can be challenging in organizations that have a sequential process, as CAE engineers wait for detailed drawings to get started on even the basic analysis, and in turn, design engineers wait for CAE to be completed. Worse yet, changes made late in the design cycle can increase costs by several orders of magnitude and significantly delay time-to-market.

SimDesigner enables designers or analysts to perform analysis early by providing powerful linear FEA, nonlinear FEA, and multi-body dynamics solver technology inside of the CATIA V5 user environment. The benefits of providing easy to use analysis functionality within the familiar CAD environment include elimination of CAD translation & fixing, enabling simulation earlier in the design process, and correcting design flaws before products are ever seen by customers.

SimDesigner Capabilities include:

- **Motion Workbench:** Benefit from the power of the leading multibody dynamic solver, Adams, to simulate mechanisms including contact and friction. Compute part deflections and stresses due to motion and component interaction.
- **Structures Workbench:** Perform linear statics, normal modes, and modal frequency response studies using MSC Nastran solver technology. Conduct nonlinear studies with the capability to simulate large deformations, plasticity, and nonlinear contact between components.
- **Thermal Workbench:** Conduct steady-state and transient thermal analysis due to conduction, convection and flux, and use the temperature distributions for subsequent use as boundary conditions in structural analysis.
- **Enterprise Gateways:** Attain bidirectional access server-side simulation tools on high-performance computational hardware, with export of ready-to-run solver input decks and import of simulation results without leaving CATIA V5 environment.



MODELING SOLUTIONS

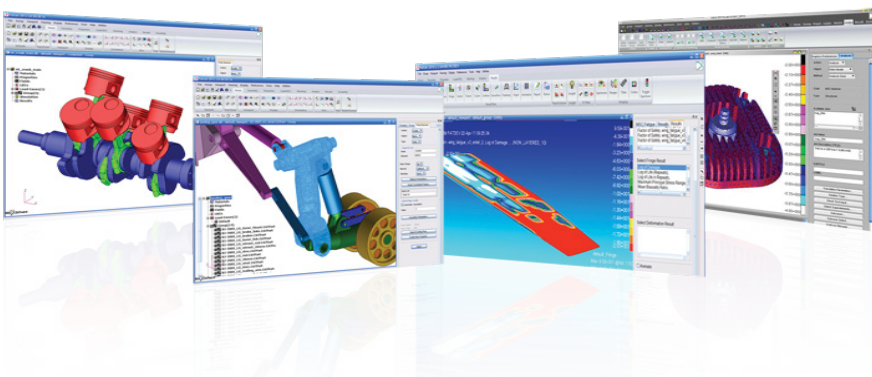
Patran®

Complete FEA Modeling Solution

Patran is a comprehensive pre- and post-processing environment for finite element analysis, helping engineers to conceptualize, develop and test product designs. Used by the world's leading manufacturing companies as their standard tool for the creation and analysis of simulation models, Patran links design, analysis, and results evaluation.

Patran provides a rich set of tools that streamline the creation of analysis ready models for linear, nonlinear, explicit dynamics, thermal, and other finite element solutions. From geometry cleanup tools that make it easy for engineers to deal with gaps and slivers in CAD, to solid modeling tools that enable creation of models from scratch, Patran makes it easy to create FE models. Meshes are easily created from 1-D, 2-D or 3-D CAD entities using fully automated meshing routines, manual methods, or combinations of both giving users the flexibility and the ease of use. Finally, with support for material properties, loads, boundary conditions data input, and analysis setup for most of the popular FE solvers, Patran reduces the need for multiple modeling environments in organization.

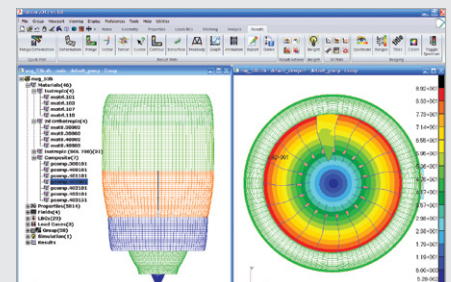
Patran's graphical interface is built to be fully customizable to your organization's unique engineering processes. With Patran Command Language (PCL), engineers can supplement the powerful modeling and analysis capabilities with their own, customized applications, commands, and menus. Patran users can easily iterate and evaluate different design decisions and reuse existing designs and results without the time consuming manual clean-up and re-creation of data.

**Capabilities**

- Use an intuitive graphical interface with direct access of CAD geometry with automatic/interactive feature recognition
- Access multiple MSC Software and third-party solvers
- Utilize robust automatic surface and solid mesh generation with advanced surface mesh-on-mesh capability
- Model connectors and bolts with pre-loads
- Easily define full 3D general contact scenarios for nonlinear analyses
- Optimize your designs by setting up MSC Nastran optimization tasks
- Define superlements to analyze large FE models
- Create coupled analysis cases for Marc
- Use numerous post-processing tools to review your results
- Implement results standardization through results templates
- Customize your user interface through Patran Command Language (PCL)

Benefits

- Increase productivity of your design and development process
- Reduce development costs through increased use of simulation technologies
- Improve productivity and accuracy with multidiscipline analysis and optimization

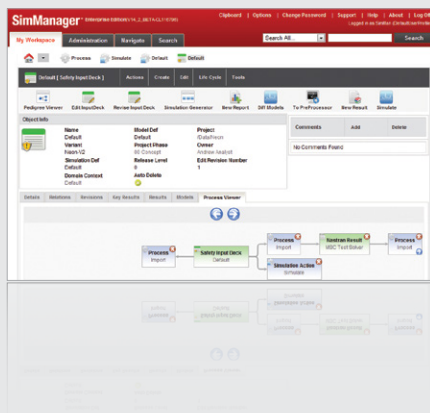


Process Management and Automation

- Automation reduces manual execution of intensive, repetitive simulation tasks and processes
- Work request and workflow notification keep projects on track and enable management oversight
- Dashboards enable quick evaluation of studies and scenarios relative to design targets
- Built-in job queue interface optimizes execution of simulation processes and solver runs
- Simulation processes, input and output are documented via Audit Trail
- Open support of tools and applications, including MSC, 3rd party, and in-house applications
- Leverages existing hardware and software infrastructure
- Web-based configuration enables fast deployment

Enterprise Integration

- Integrated access to SimManager from MSC applications
- Web-browser access to 3rd party simulation applications and other popular engineering tools
- PDM integration using PROSTEP OpenPDM technology
- Integration with Requirements Management systems
- Fully compatible with job queuing and submission systems including MSC Analysis Manager, LSF, Sun Grid Engine, and PBS Pro
- Test Data integration and comparison



ENGINEERING LIFECYCLE MANAGEMENT

SimManager™

Simulation Process and Data Management

SimManager is a Simulation Process and Data Management system that manages all aspects of CAE simulation. It is focused on meeting the sophisticated data management and processing needs specific to the simulation community. Our customers appreciate our deep understanding of CAE issues and how insights gained from experiences can be captured using SimManager to help them achieve higher efficiency. MSC Software provides a complete solution that brings together people, process, and technology to streamline simulation operations.

Implementing the discipline of Simulation Process and Data Management gets simulation activities completed efficiently and effectively, gaining the best return on all resources. Implemented on a web-based platform, SimManager manages all simulation data and processes from project initiation through final report generation in a user-friendly manner.

Competitive advantages that scale from a small workgroup to company-wide use include:

- Increased Productivity
- Improved Quality
- Standardization and Establishment of Best Practices
- Effective Collaboration
- Integrated Teamwork
- Shorter Product Development Times
- Accelerated Process and Product Innovation



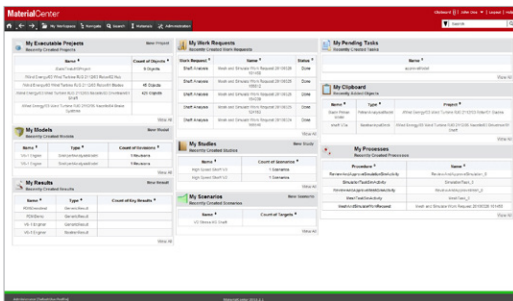
ENGINEERING LIFECYCLE MANAGEMENT

MaterialCenter™

Materials Lifecycle Management

MaterialCenter is a Materials Lifecycle Management System designed to link material specialists to mechanical simulation. A process and data management system, MaterialCenter automatically captures the data from integrated processes ensuring full traceability across the enterprise and throughout the product lifecycle and addresses the unique requirements of exponential growth of complex materials in driving product innovation (plastics, composites). MaterialCenter works directly with many commercial CAE products including many of MSC's leading simulation products, MSC Nastran, MSC Fatigue, Marc, Digimat, and Fatigue Testing Services.

MaterialCenter serves as the single point of entry for all of the materials related activities including physical test data entry and reduction, multi-scale materials modeling, approval workflow and the export of simulation ready data to analysis. This guarantees that engineers are using a consistent source of approved materials derived from traceable integrated processes. The result is improved simulation fidelity, reduced data loss and elimination of tedious manual data management activities; empowering engineers to focus on driving new and innovative products. Proven scalability to 100,000's of processes and petabytes of data ensures that MaterialCenter continues to meet the needs of material and simulation engineers alike for many years to come.



Capabilities

- Dashboards enable quick evaluation of materials data management projects and management oversight
- Work request and approval workflow keep projects on track
- All materials-related processes, input and output are documented via Audit Trail
- Process-oriented, automation approach to data management implemented to minimize manual data entry activities
- Robust and intuitive interface for data search, retrieval and comparison for all data types – tabular, curves, images, etc.
- Web-based interface to data management processes enables distributed data authoring and maintenance
- Built-in job queue interface optimizes execution of materials simulation processes
- Integration with Excel, Digimat, and 3rd party applications that support materials data processing
- Bi-directional REST API supports integrated access to MaterialCenter from MSC applications, and other 3rd party applications
- PDM integration using PROSTEP OpenPDM technology
- Auto-capture of all data transactions
- Web-based configuration that enables fast deployment
- Configurable to support multiple global locations

Benefits

- Fast deployment and lower IT support costs
- Reduced data related inefficiencies through use consistent source of approved materials derived from traceable integrated processes
- Rapid deployment methodology to ensure immediate productivity gains
- Scalable solution that adapts to changing organizational needs results in lower maintenance and IT costs



You can depend on the MSC Global Engineering Services Staff to:

- Save you time
- Automate your CAE processes
- Perform project-based simulations
- Train your staff
- Mentor and support your staff
- Correlate and validate CAE results with test data
- Transfer knowledge



Global Engineering Services

Delivering Certainty by Helping You Simulate Reality

Industry Experience

The MSC Global Engineering Services organization is a team of engineers and scientists with expertise across a wide range of engineering disciplines and industries. MSC has a 50 year history of real world hands-on practical experience.

Engineering Expertise You Can Trust

If you want results you can trust and the flexibility of working with extremely skilled engineers who know Computer Aided Engineering (CAE) and how it's applied to engineering problems like yours, MSC is a team you can rely on to improve your product development process.

The MSC Global Engineering Services team helps companies in a variety of ways:

- Quick Start Projects
- Knowledge Transfer
- Mentoring; on-site or over the web
- Staff Augmentation
- On-site support
- Simulation Projects
- Customization and Process Automation
- Methods Development
- Solution Toolkits
- Simulation Process and Data Management
- Training

Flexible Services Offerings

We provide consulting support based on your specific needs and requirements. This could range from performing analysis for you on a project basis; one or two times a year, or providing full time staff members to help you create repeatable processes in-house.

Request a Quote Today!

Go to www.mscsoftware.com/services

Training

MSC offers basic and specialized training in the use of our simulation tools to maximize your investments in our software. Whether you need an introduction to our simulation tools or expert instruction in specialized applications, we offer the courses you want, with the expertise you deserve.

Flexible Training Offerings

To further meet your specific requirements, we offer the following options for live instruction.

- **Public Classroom Training*** – Choose from our wide selection of courses conveniently offered at sites throughout the world.
- **Public Online Training** – The convenience of on-line learning with the interactivity and depth of a traditional classroom setting – no travel required. The entire instructor-led course is live and online on your own computer. Live Online Training is an efficient, cost effective and convenient way to gain skills in the use of our MSC simulation software.
- **Training at Your Facility** – If you have a number of employees who need training, we offer the cost effective option of bringing our class to your facility. This eliminates employee travel costs, minimizes time away from work, and can be arranged at your convenience.
- **Custom Courses** – If our standard seminar offerings do not meet your training requirements, MSC can develop a course or set of courses tailored to your specific needs. A custom course might include a combination of topics from several standard courses or specialized material not found in any of our standard seminars. MSC will work with your staff to design the course you need.

MSC can deliver custom and private courses live or via the web. We can also help ensure that you have the adequate hardware and software licenses available for private courses.

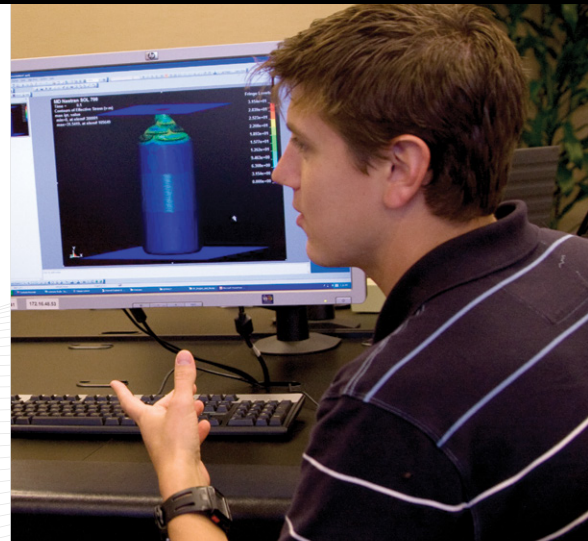
The table on the next page lists the standard courses offered. Please refer to the MSC Software training website for detailed course descriptions and dates offered at sites throughout the world.

***Go to www.mscsoftware.com/training to access our Global Training Schedule.**

MSC Learning Center

MSC Learning Center for eLearning – MSC offers several training courses in an interactive format with audio from subject matter experts. With the complete training content that includes lectures, workshops, demos, and workshop review questions in a format that you can complete in a self-paced and self-directed manner, you can keep up and improve the simulation skills helpful to your work.

***Go to www.mscsoftware.com/msc-learning-center to access our training courses.**



Our MSC application engineer comes out at least once a month to see how we are doing and help us with any issues. In fact this plane would have been impossible to model without the phone support, on-site visits and consulting services provided by the MSC support team"

Dana Taylor, AeroVironment





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