SimXpert 2010
Welcome to SimXpert 2010

This latest release of SimXpert from MSC.Software includes enhancements in CAD support, usability, solver support and performance making this best release yet.

Usability

- Easy to use view manipulation: Easier to master and consistent with common CAD packages helps you feel at ease quickly in manipulating the model.
- Easier Dialog Interaction: Designed to reduce mouse travel and number of clicks.
- Template Builder: New authoring GUI to improve user experience.

CAD Support and Geometry

- Updated CAD Support: Native CAD import available for CATIA R19, Pro/E Wildfire 4 and Unigraphics NX 6. Added flexibility of coexistence of parasolid models with native CAD imported geometry.
- Geometry Cleanup: Several new cleanup tools introduced related to vertices, small curves and surfaces and sliver surface to produce geometry better suited for FEA mesh.
- Edit/Create Geometry: New geometry entity creation and editing tools to help users make necessary modifications to imported CAD geometry.

Meshing

- Improved performance and robustness: New Tet meshing capability for consistent, better quality meshes.
- Geometry checks and fixes for improved meshes: Geometry checks and automatic fixes to help create improved mesh and provide better mesh controls
- Enhanced element quality checks: Automatic detection and merging of undesirable elements helps improve mesh quality and controls along with tools like mesh seeding and hard curves.

FE Solver Support

- Analysis Chaining: Easy to set-up, automated job runs for improved modeling efficiency.
- RC Network: Support for this efficient nonlinear thermal solver of MD Nastran.
- Coupled thermo-mechanical analysis: Coupled analysis capability for more accurate results along with temperature dependent material properties.
- Contact Analysis: Enhancements like thermal contact, contact visualization and contact table usability provide more flexibility and modeling functionality.
- OpenFSI: Support for the newly introduced capability of MD Nastran 2010, helps you analyze interaction between nonlinear structures and fluids.
- Occupant Safety and Airbag Deployment: Dummy positioning, seatbelt routing and various contact definitions help simplify modeling crash analyses.
- Fluid-Structure Interaction in Crash/Explicit Workspace: Ease of enhancements to support MD Nastran's SOL700 capability helps users solve FSI problems with relative ease.

Motion Workspace

- MD Adams Solver Support: Support for comprehensive set of contact capabilities for modeling accurate contact behavior. Introduction of Adams2Nastran for interface export of linearized MD Nastran model from the motion workspace.
- Flexible Body Improvements: Advanced modeling of flexible parts with transformation options and more efficient generation of flexible parts from Nastran database make it easier to include and work with flexible components in your assembly.
- Clearance Object and post-processing: Clearance objects are dynamically drawn during animation and custom templates can be created to automatically animate and chart clearance results.

The newly introduced Systems & Controls Workspace supports the full capability set of Easy5 within SimXpert. Within this workspace, users can model, simulate and design multi-domain dynamic systems characterized by differential, difference and algebraic systems, which include electrical, thermal, hydraulic, gas dynamics, digital/analog control systems and much more.

SimXpert 2010 enhancements are designed to enhance user productivity while providing a user friendly environment. Numerous issues identified in the earlier releases and customer requests have been addressed in this release. Please review the Release Guide and documentation for more details on this release.

Thank you very much for your continued support of SimXpert.

The MSC.Software Product Team
Usability

View Manipulation
The new view manipulation scheme is easier to learn and master as it is now based on the convention of dragging the middle mouse button for rotating the model, with panning and zooming enabled by keyboard modifiers. If you are familiar with any of the common CAD packages, you will feel at ease quickly with SimXpert performing view manipulations.

Easier Dialog Interaction
The dialog boxes are designed to reduce the amount of mouse travel and number of clicks. With Auto-Advance, the dialog’s focus automatically moves forward once a selection is completed and with Auto-Apply, the dialog is automatically invoked once all selections are made. In addition, clicking the middle mouse button will advance the focus without having to directly interact with the dialog. With persistent data and Auto-Highlighting, it is now easy to keep or modify a previous selection, or to make a new one.

Entity Selection Enhancements
The dialog boxes are designed to reduce the amount of mouse travel and number of clicks. With Auto-Advance, the dialog’s focus automatically moves forward once a selection is completed and with Auto-Apply, the dialog is automatically invoked once all selections are made. In addition, clicking the middle mouse button will advance the focus without having to directly interact with the dialog. With persistent data and Auto-Highlighting, it is now easy to keep or modify a previous selection, or to make a new one.

Python Debugger
The embedded Python debugger enables users to analyze and debug Python Scripts and Templates consisting of Python Actions using a standard debugging environment. This improves usability of the scripting environment and significantly reduces time and effort to create, troubleshoot and implement automation solutions.

Enriched Actions
Custom action environment has been enriched with several improvements like:
• Enhanced Action authoring to define Tabs, Radio groups, and Booleans
• String table support for localization
• Alternate Custom Data Type list representation
• Edit in place – just controller code or entire action definition

These enhancements improve the sophistication level of auto generated Action GUI and reduce the development/maintenance cost for Workspace teams.

Template Builder Enhancements
The new authoring GUI improves user experience through several enhancements.
• Template/Action versioning
• Embedded sub-template
• Various new options like Reset on Apply
• Option to hide individual inputs
• Bill of Materials Report
CAD Support and Geometry

Updated CAD support

SimXpert 2010 supports CATIA R19, Pro/E Wildfire 4 and Unigraphics NX 6 for native CAD import. In addition, this version allows import of points, vectors and planes from CATIA model, which can be used for intersection and other construction methods. The import of Publications also enables users use the tagged entities in the CAD model in SimXpert.

Coexistence of Native CAD and Parasolid Geometry

This release offers the flexibility of importing Parasolid models into the model that already has geometry from native CAD import. The CAE geometry tools are also available after the import allowing you to make any changes to the Parasolid geometry. This augmented capability provides users with additional flexibility while dealing with Parasolid and Native CAD geometry.

Create/Edit Geometry

Several new geometry entity creation and editing tools have been added in this release. With these powerful capabilities, users can now make necessary changes to their CAD geometry from within SimXpert saving you significant time during model creation. The new ribbon layout and tools reorganization and consolidation along with picking enhancements are designed to enhance user experience.

The new imprint capability enables users to imprint curves or surfaces on surfaces using Parasolid kernel. This lets users to easily and quickly modify geometry for application of loads or to create congruent mesh regions. Mid-surface extraction features are consolidated and expanded in this release and the process is more automated. This robust, enhanced tool set enables you to create shell models from the mid-surfaces of solid models.

Geometry Cleanup

New capabilities have been added to clean up the geometry and create a model that is well suited for FEA. Several clean up options related to vertices, small curves and surfaces and also sliver surface have been added and improved in this release. Other features include non-manifold enhancements that allow non-manifold stitching allowing creation of topologically congruent models for meshing, and imprint.

The enhanced, robust capabilities are also easy to use and help you prepare the imported CAD geometry for analysis in less time.
Meshing
Performance and Robustness
New tet meshing capability based on geometric construction order is implemented resulting in consistent, better quality meshes. New mesh quality fix techniques like node smoothing, moving nodes and shortening long edges and splitting of longest edges are also implemented providing compliance with MD and MSC Nastran mesh metrics. Other options in meshing include quality enhancements to fix bad elements that fail quality check, geometry clean up to remove small features prior to meshing, which provide improved and robust mesh quality. With the new option of user controlled start node and element IDs, users can customize the mesh IDs for assemblies.

Geometry Check and Fixes
Quality of meshes and efficiency of meshing process depends significantly on the quality of the geometry. SimXpert 2010 offers several capabilities to increase robustness of meshing. These include:

- Since small features in geometry tend to cause problems during meshing, these features are checked for prior to meshing, improving efficiency of the meshing algorithm.
- Suppression undesired vertices of edges improves mesh control by detection and removal of undesirable features like small edges, faces or angles.
- Automatic merging of faces for simplified meshing by helping create a cleaner geometry.
- Detection of small edges based on mesh size.
- Automatic fixing of small angles in sliver surfaces and narrow regions.

Meshing
In addition to fixing the geometry for better meshes, SimXpert offers features to improve element quality during meshing process. These include:

- Automatic detection and merging of undesirable elements.
- Automatic merging of geometry faces for simplified meshing.
- Mesh quality improvement in narrow sections and around small holes reducing the number of diamond shape quad-elements and triangular element transition for more orthogonal mesh flow for quad-meshing.
- With the use of mesh seeds on partial, overlapping and duplicate hard curves on a surface, users have better control of the mesh on the curves and associated surfaces.
- With the use of ‘Washer around small hole’ option, SimXpert can create multiple layers of washer-type elements around a hole so that the meshing in these areas meets minimum quality requirements.
- Check quality of the mesh, which could include both solid and shell elements in a single click as per Nastran’s quality metrics to ensure that mesh related solver errors can be eliminated.

FE Workspaces
Structures
Patran Database Support
SimXpert 2010 supports direct import of Patran databases. In the past the import was achieved through the use of Nastran bulk data file (bdf), this new option removes the additional step for Patran users. The bulk data file import, however, is available to users who have only the bdf file available.

Engineering Abstraction
With increased use of engineering abstraction, SimXpert offers terminology that is more sensible to engineers than use of solver keywords. This saves considerable training resources for new users. Selection of any of the various Nastran material cards is also automated without the need for in-depth knowledge of solver keywords, while avoiding selection of illegal model combinations. This simplifies selection and input of materials, while saving time for all the users.
Modeling Tools Enhancements

In order to enhance the user experience in modeling structural assemblies, new capabilities have been introduced and existing ones enhanced.

- Several new connectors are supported in this release and joints also have been added. With the more comprehensive connectors and fasteners and also better visualization and verification, SimXpert enables users to model structural assemblies with ease.
- Element offsets for nonlinear shells and beam elements are commonly used in aerospace and automotive industries for simplified modeling. This newly added feature of MD Nastran 2010 is now supported for ease of use and also to improve accuracy of solutions.
- Modeling of pre-stressed bolts used in structural assemblies is simplified for faster modeling and improved accuracy.

Mesh Editing Tools

Existing mesh creation and editing tools are consolidated to streamline the model creation process. Several new mesh creation and editing tools have been added to the current version. This includes:

- Single or multi-element split for local mesh refinement.
- Automatic split of bars on element edges, when the 2D element edges are split.
- Automatic update of material orientation.
- Split 2D elements with remesh.
- Create a new mesh on existing shell mesh without removing features or connected rigid elements.

Analysis Support

Support for several analysis capabilities of MD Nastran is added in this release:

- Analysis Chaining and Perturbation: Ease to set-up, improved automation for this MD Nastran SOL400 capability, whereby users can sequentially run jobs of multiple disciplines. This saves pre-processing time, while improving efficiency of the solution.

- RC Network Thermal Solver: This capability of MD Nastran 2010 SOL400, which provides an efficient nonlinear thermal solver, is now supported by SimXpert. With this capability, users can more efficiently set up and solve problems as varied as automotive exhaust systems, fuel cells, silicon wafer processing and spacecraft, aircraft, missiles and solar energy systems.
Coupled Thermal-Mechanical Analysis: Coupled analysis available in MD Nastran provides accurate thermal and stress/strain results for problems that involve plastic work or heat generation due to friction. This new functionality is supported in current version along with temperature dependency of material properties. This enables users to set up and solve models like brake pads, electronic packaging, forging and ring rolling.

Contact Analysis: The contact capabilities have been enhanced to support steady state and transient heat transfer and also nodal based friction with heat generation, improving modeling efficiency. Contact visualization and contact table usability has also been enhanced and simplified with smart use of defaults in basic set up, while providing flexibility with Advanced Parameters option.

OpenFSI for Fluid-Structure Interaction
SimXpert can now be used to support set up of fluid-structure interaction simulations using MD Nastran’s OpenFSI capability. Using this capability, users can analyze interaction between nonlinear structures and fluids. By facilitating communication between structures modeled in MD Nastran and fluids modeled using an external CFD code, you can accurately account for interaction between structural and fluid domains and solve problems that were beyond reach of analysis capabilities until now.

Crash/Explicit
Properties and Boundary Conditions
Support for new properties and various boundary conditions would help users with ease of modeling and improved accuracy. This includes properties of seat belt, spring and damper, and spot weld for general purpose explicit dynamics simulation. Section properties for smooth particle hydrodynamics can also be defined in this release. Input of properties for beams, shells and solids, and composites and Euler elements helps extend the scope of MD Nastran SOL700 models supported by SimXpert. With these new capabilities, users can stay within the GUI environment to solve broader classes of problems.

Fluid Structure Interaction
Combination of Dytran’s Eulerian solver and LS-Dyna’s Lagrangian solver embedded into MD Nastran’s SOL700 provides a superior technology to address some of the toughest fluid-structure interaction problems. With SimXpert’s enhanced support of this capability, users can set up these problems with ease.

User Defined Services
Frequently, a nonlinear analysis requires use of customized materials and complex loading scenario or even a newly developed specialized element. The user defined services available in MD Nastran enable you to extend its nonlinear analysis capabilities for your special needs. SimXpert 2010 provides graphical support for these services simplifying the model set up.
Charting Actions

Macro record and playback is now available for all charting attributes. This enables creation of actions and templates to create new or edit existing charts.

Occupant Safety & Airbag Deployment

Combination of Dytran’s Eulerian solver and LS-Dyna’s Lagrangian solver embedded into MD Nastran’s SOL700 provides a superior technology to address some of the toughest fluid-structure interaction problems. With SimXpert’s enhanced support of this capability, users can set up these problems with ease.

Post-Processing

Rigid Body Support

Several enhancements in SimXpert 2010 post processing make it easy to query and visualize results. Users can display the rigid body within a post processing plot. Rigid body definition can be imported from the analysis results file and enable contact animations of combinations of rigid and flexible bodies for self and body-to-body contact.

Color Spectrum Enhancements

Color spectrum enhancements provide more clear understanding of the analysis results and contact region with clear rendering of rigid and flexible contact bodies.

Motion Workspace

Design Variables and Expressions

SimXpert Motion 2010 introduces parametric modeling with the use of design variables and design-time parametric expressions. Design variables let you organize the critical parameters in your design into a concise list of values that you can easily review and modify. Design variables can be referenced in any property editor input or in expressions. You can specify modeling data as an expression that can change its value based on other objects and values in your model. Design-time parametric expressions persist with the model and are python based.
MD Adams Solver Support

Support for several analysis capabilities of MD Adams Solver is added in this release. With the addition of new contact capabilities that include flexible edge, point-to-plane, curve-to-plane, and sphere-to-plane, SimXpert 2010 provides a comprehensive set for modeling contact behavior. Support for Adams/Linear allows engineers to linearize their models about any operating point. The new Adams2Nastran interface with support for dynamic operating points and an option to export graphics allows export of linearized MD Nastran model from MD Adams.

Clearance Simulation and Post-processing

New enhancements in SimXpert 2010 allow engineers to easily calculate and monitor the clearance between moving parts. Rather than a pure post-processing feature, since the clearance is calculated at solve time, users can include sensors and/or controllers during the calculation. Clearance can be defined between any two rigid or flexible parts and a threshold support allows specification of a maximum distance for which the clearance calculations will not be computed. Clearance objects are dynamically drawn during animation and custom templates can be created to automatically animate and chart clearance results.

External Solver Support

SimXpert 2010 provides the option to run simulations using the external MD Adams solver. In prior releases, users were limited to the internal solver or had to export solver input files. Engineering teams can better leverage investments in existing installations and schedule jobs independent of the user interface.

Flexible Body Improvements

Several enhancements in the area of flex-body support have been introduced in SimXpert 2010. More efficient generation of flexible parts is possible directly from the MD Nastran Database (.MASTER) file without having to create the modal neutral file (MNF). Modeling with flexible components is made easier with transformation options that provide ability to mirror, rotate or translate flexible components in your assembly. With access to the MNF toolkit from within SimXpert engineers can quickly browse the contents and optimize the flexible component.

Systems and Controls Integration

New interface object introduced in SimXpert 2010 facilitates the inclusion of Systems and Controls or Simulink® models. With streamlined connection between motion systems and controls models engineers can easily model wide range of applications including anti-lock brake systems, hybrid systems, flight controls and hydraulics.

Save Model as Python

Engineers can now export models as python scripts. This helps generate a stable ASCII text form of a model that can be further modified. Auto-generation of models from python scripts expedites model creation. Comprehensive documentation for the scripting functions creates a strong foundation for end-user customization and extension.
Systems and Controls Workspace

New to SimXpert 2010 is the Systems and Controls Workspace. The full capability of Easy5 is now available within SimXpert. This integrates geometry based motion and structures analysis with block diagram style systems and controls models more tightly than ever. Additionally, systems and controls analysts can now leverage the power of process capture and re-use inherent with SimXpert templates. And, Easy5 users can import their models, data and custom libraries to this workspace directly.

Within the Systems and Controls workspace one can model, simulate, and design multi-domain dynamic systems characterized by differential, difference, and algebraic equations. The systems that can be analyzed include electrical, hydraulic, pneumatic, thermal, gas dynamics, digital/analogue control systems and much more. Models may be assembled graphically from subsystem-level blocks such as valves, actuators, heat exchangers, gears, clutch, engines, pneumatics, flight dynamics, and many more, or from primitive functional blocks, such as summers, dividers, lead-lag filters, and integrators. Users can also create custom blocks.

Application Libraries

The System and Controls workspace features pre-built system blocks allowing one to quickly and easily model systems by connecting iconic blocks that represent pre-built systems, sub-systems and dynamics. One can select from hundreds of these pre-built system level blocks with which to construct models. They have embedded in them pre-defined models developed by dynamic analysis experts and engineers. They are packaged in eight application libraries covering a broad array of systems covering Thermal Hydraulics, Engine systems, Powertrains, Aerospace Vehicles, Gas Dynamics, Electric Systems, Fuel Cell Systems, and Multi-Phase Fluid systems. These libraries enable one to quickly build schematic models of those specific types of systems, by building at the system level with the pre-built components. Additionally users can create their own custom blocks and libraries.
Extending Easy5:
For Easy5 users the SimXpert Systems and Controls workspace offers exciting capability enhancements:

- Incorporating high-fidelity multibody dynamics models is much easier through the tight integration with SimXpert’s Motion workspace.
- Improved model data management is available through the model browser’s spreadsheet tab which allows one to centrally set model parameters with automatic model diagram sync. This workspace also features model documentation export allowing one to write out comprehensive model details to a text file or nicely formatted html.
- Models (and parts of a model) can now be exported and imported as Python code. This enables future auto-generation of models and a wealth of time-saving modeling and analysis benefits.
- The diagram editor offers much greater flexibility in formatting your “document” -- the block diagram representation -- by free positioning of objects, and in-line data assignment via “hot text”.
- Submodel connection lines are retained at the submodel boundary for simplified replacement of one submodel with another.
- A new component “replace” utility, allowing one component to be dropped on another, replacing it.
- A new Library Component Manager, to simplify the tasks associated with managing custom application libraries.
- Name filtering in the spreadsheet to simplify search for particular I/O names in the model.

SimXpert – For All Your Multidisciplinary Simulations
With your continue support, MSC.Software remains committed to the persistent enhancement of SimXpert to provide easy to use and productivity enhancing pre- and post-processing solution for our MSC’s core solver technologies. The content of this SimXpert 2010 demonstrates this commitment on multiple levels.

Customer Drive Features
We take requests. MSC commits itself to meeting customer needs and requirements. Many of the new capabilities and enhancements in this release are a direct result of customer feedback. This includes capability and solver enhancements in the areas of CAD support, meshing, solver support and ease of use.

Leading Edge Innovation
We push the envelope. MSC continues to bring exciting new capabilities to multidisciplinary simulation. Evidence in this release includes enhanced solver capabilities to support new analysis disciplines and addition of new Systems and Controls workspace to expand the range of problems that can be solved by analysts with greater accuracy.

Speed of Use
We help you go faster. MSC is focused on helping you get the job of CAE analysis done more efficiently. For many of our customers it is no longer enough to simply use simulation to accelerate product development. The process of simulation, itself, must now be accelerated. The numerous performance improvements along with ease of use automation enhancements demonstrate our focus in this front.

Thank You
MSC.Software appreciates the confidence and trust that you, our customers, have placed in our products all these years. This is also demonstrated by the customizations of the product and level of integration of our products into your CAE processes. You will continue to see more advances going into the product and we, as always, are pleased to have you as a customer and partner.