

SimDesigner und SimXpert

Simulationssoftware nicht nur für den Experten

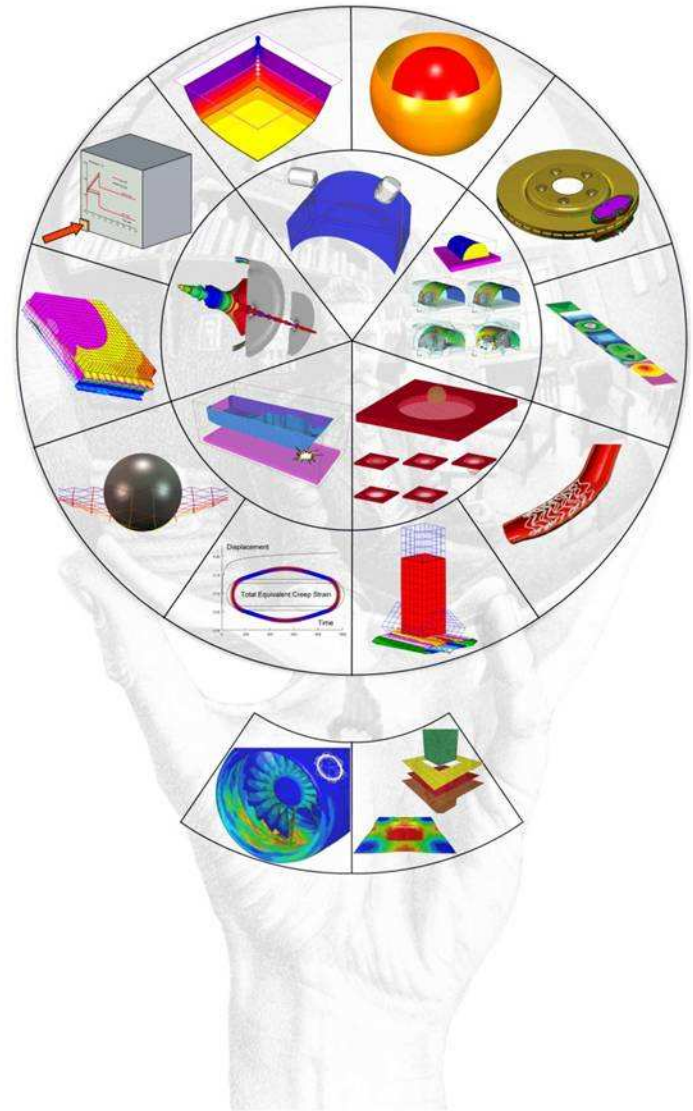
Cornelia Thieme

21. September 2011

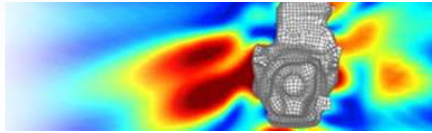


This is MSC.Software

- **MSC.Software is the Computer Aided Engineering (CAE) industry's original leader, growing from "the Nastran company" into a true market and technology leader for simulation software**
- **MSC.Software solutions range from CAD-integrated simulation tools, independent finite element analysis (FEA) and multibody simulation, to simulation data and process management**
- **MSC.Software is a private company, founded in 1963, and belonging to Symphony Technology Group (STG)**



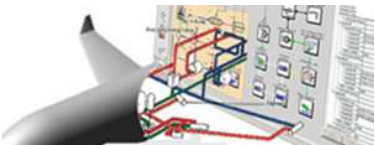
MSC.Software Product Portfolio



Actran – Acoustic Simulation



Adams – Multibody Dynamics Simulation



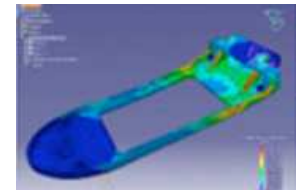
Easy5 – Controls Simulation

Marc – Advanced Nonlinear and Multiphysics

MSC.Fatigue – Fatigue Simulation

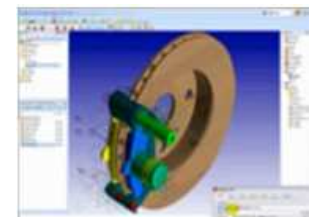
MSC.Nastran – Integrated, Multidisciplinary FE-Solver

Patran – FE Modeling and Pre-/Postprocessing



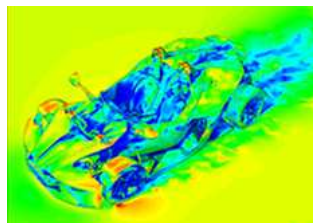
SimDesigner – CAD-Embedded Multidiscipline Simulation

SimXpert – Pre-/Postprocessor with integrated Multidiscipline Simulation



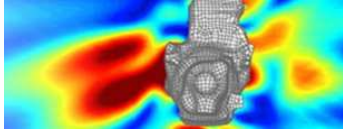
SimManager – Simulation Data and Process Management

XFlow – Mesh-Free CFD



MSC.Software Product Portfolio

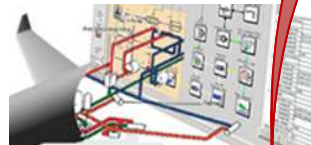
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Adams – Multibody Dynamics Simulation

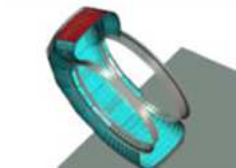


Easy5 – Controls Simulation



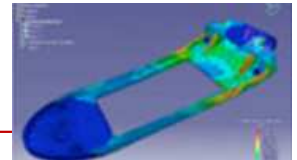
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MSC.Nastran – Integrated, Multidisciplinary FE-Solver

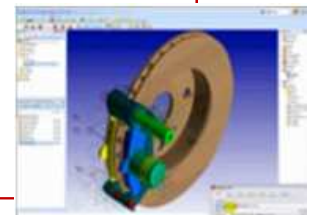
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SimDesigner – CAD-Embedded Multidiscipline Simulation

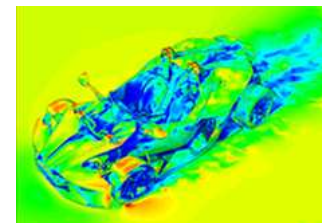


SimXpert – Pre-/Postprocessor with integrated Multidiscipline Simulation



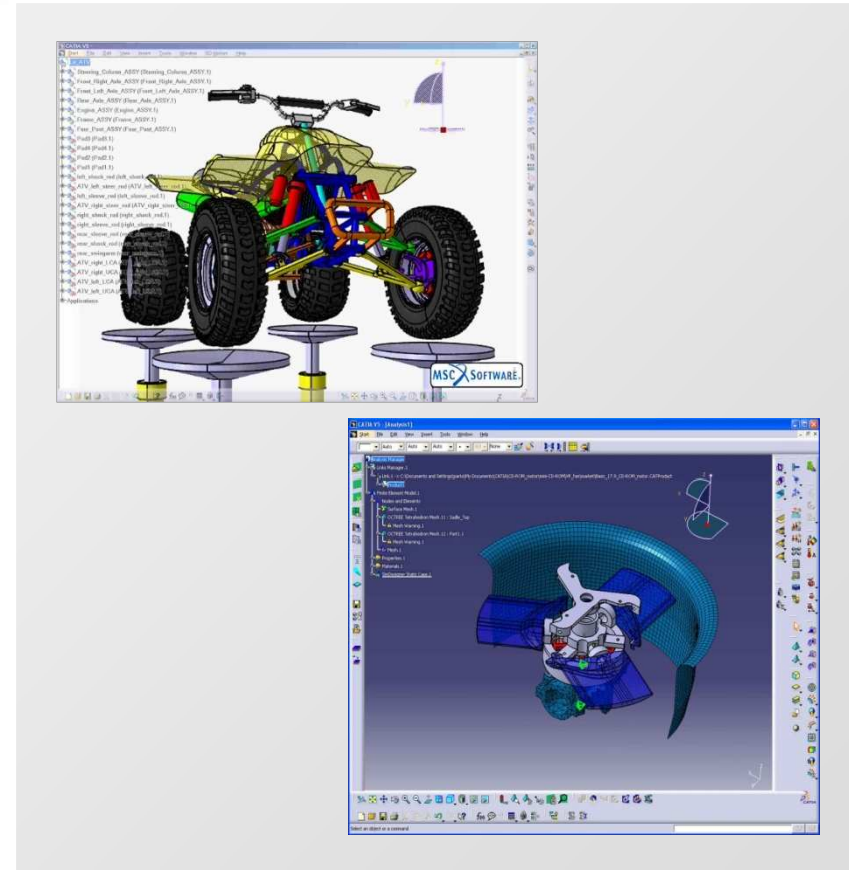
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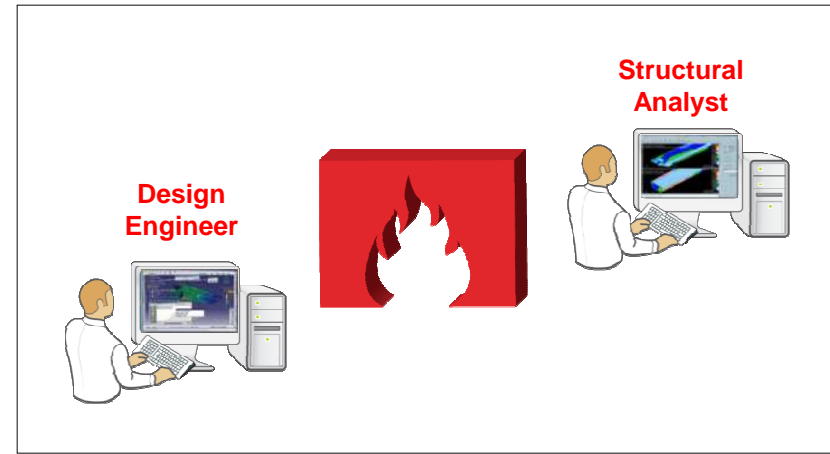
What is SimDesigner?

- **Complete solution for the design-engineer**
 - CATIA based & complete user interface integration
 - Linear capability of leading MSC.Nastran Solver
 - Nonlinear and thermal functionality of Marc Solver
 - Motion capability of Adams Solver
 - Generative: Native geometry & associativity assured



Product Development Challenges – Why CAD Integrated Analysis?

- **New product development**
 - Compressed product cycles
 - Design flaws occurring late in development
 - Time-to-market pressures
 - Increased product complexity
- **Resource and technology**
 - Overworked analysis teams
 - Analyst wants access to native CAD
 - Corporate initiatives to give designer simplified tools upfront

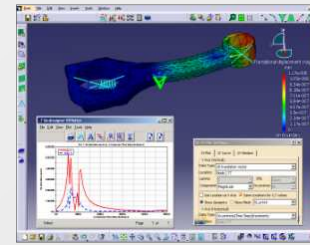


Multidiscipline Integration

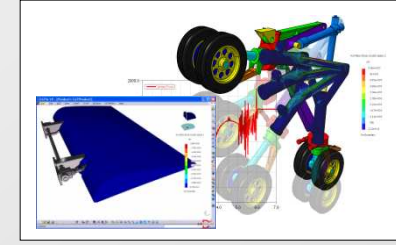
Workbenches

- **Workbench Integrated with CATIA V5**
 - Structures Workbench (Nastran for Linear, Marc for Nonlinear)
 - Motion Workbench (Adams)
 - Thermal Workbench (Marc)
 - Crash Gateway (LS-DYNA)*
- **CATIA Friendly GUI**
- **Automatic Meshing**
- **Results Post-Processing**
- **Export True Analysis Input Decks**

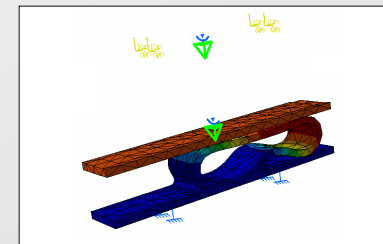
* Does not include solver.



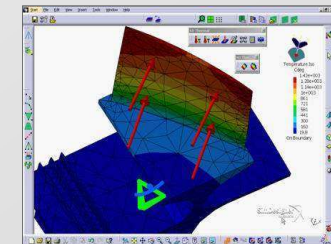
Linear Structures



Motion - Flex



Thermal

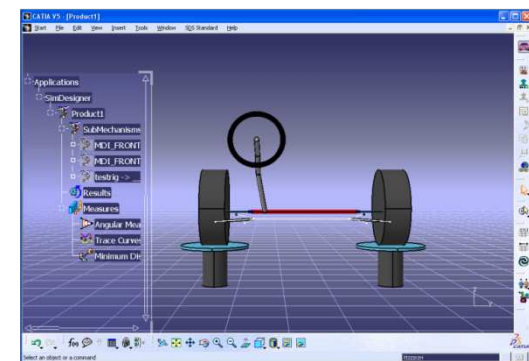
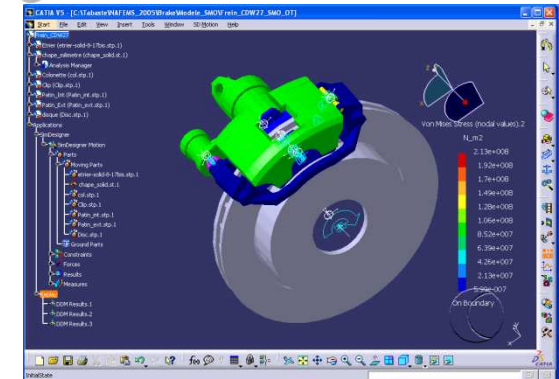
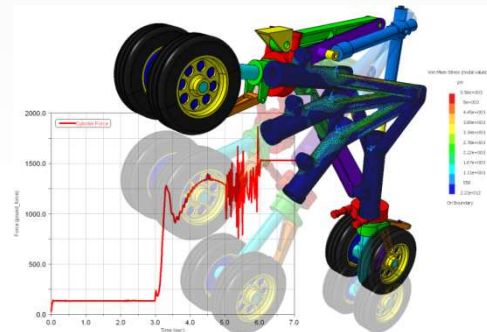


Non-Linear

Motion Workbench

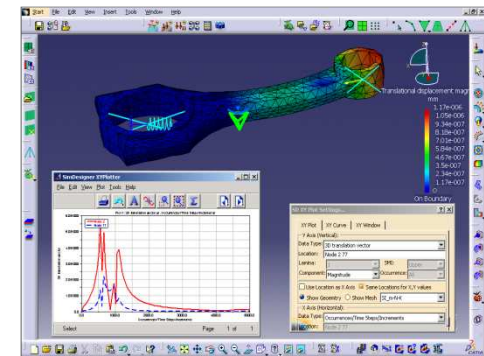
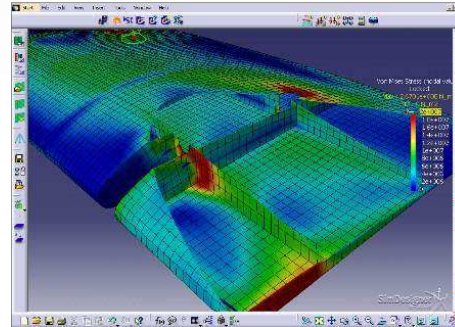
- Dynamic motion simulation on V5 assemblies and kinematics
- Automatic conversion of CAD assembly to a motion model
- Simulate mechanism with contacting parts
- Rigid and flexible bodies
- Seamless integration with Adams Solver
- Load transfer to structures
- View animations and XY plots of resulting motion

Vertical Application: SimDesigner Suspension for Simulation of Suspension Assemblies; interoperable with Adams/Car



Structures Workbench – Linear

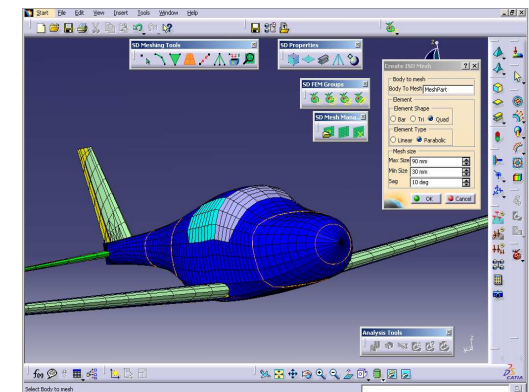
- **Generative linear analysis capabilities within V5**
 - Linear Static
 - Normal Modes
 - Buckling
 - Eigenvalue
 - Frequency Response
- **Embedded MD Nastran Solver**
- **Automeshing capabilities**
- **Single graphical user interface for modeling and post-processing results**



Add-On: Composites Module

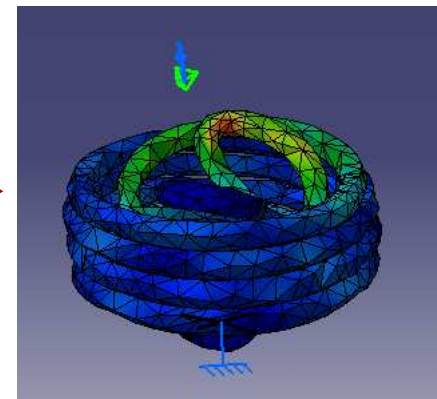
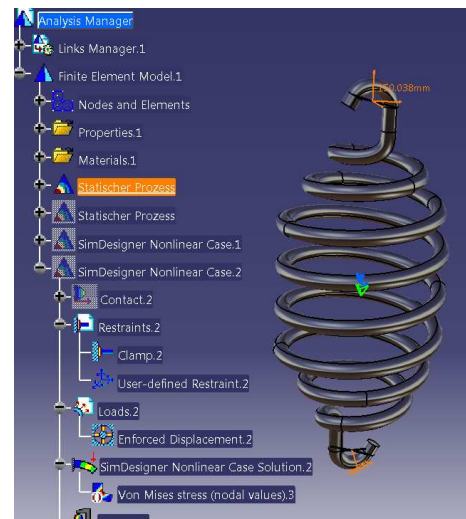
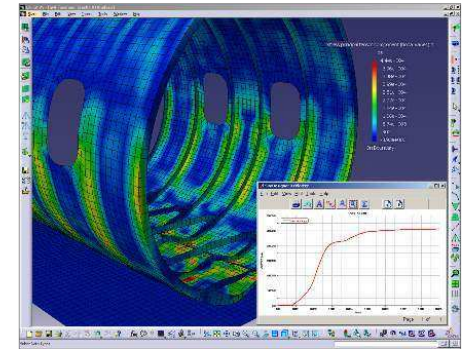
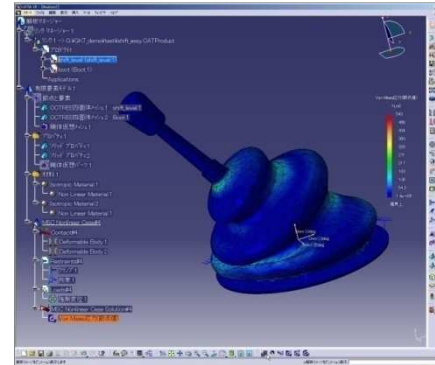
Specify the laminate characteristics such as material properties, fiber orientation, and thickness of each lamina

Interface to CATIA Composite Part Design (CPD)



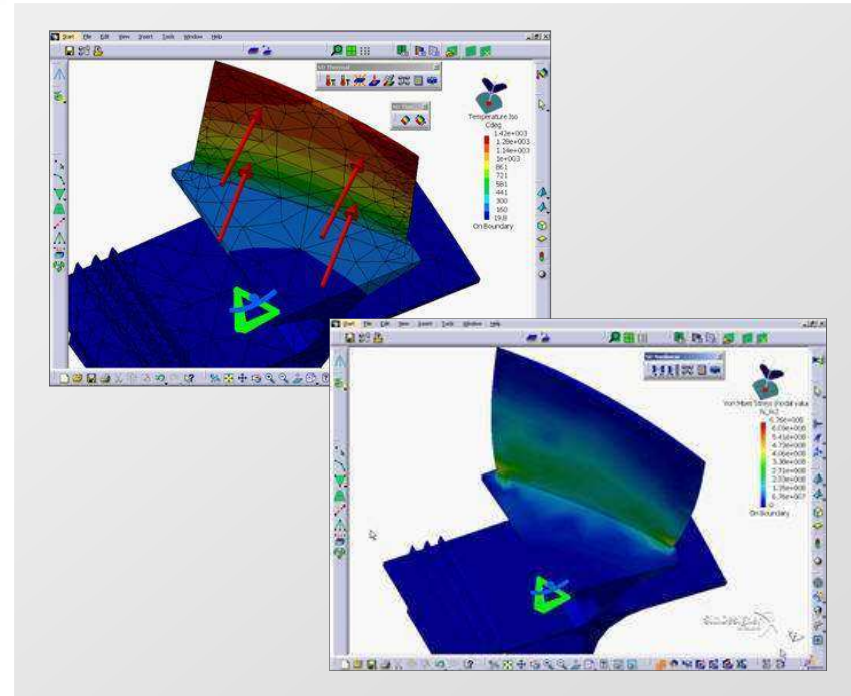
Structures Workbench – Nonlinear

- Generative nonlinear analysis capabilities within V5
- Embedded Marc Solver
- Contact and large deformation
- Geometric nonlinearity
- Material plasticity
- Thermo-mechanical coupling

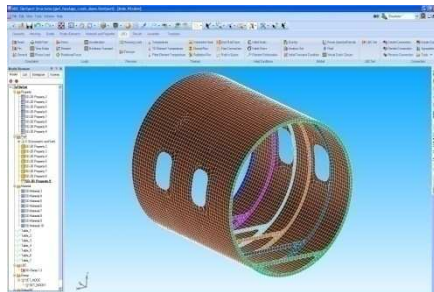


Thermal Workbench

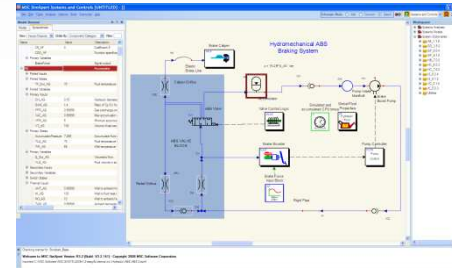
- **Generative heat transfer capabilities within V5**
- **Embedded Marc solver**
- **Steady-state or transient analysis**
- **Thermo-mechanical coupling**
- **Simulate heat-transfer due to conduction, convection and flux**
- **Temperature distribution for subsequent use in structural analysis**



What is SimXpert?

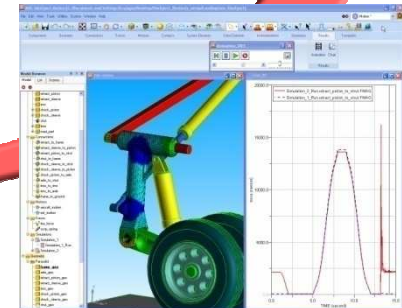


**Structures &
Thermal**

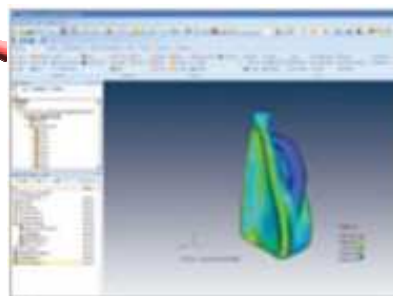


System & Control

Motion



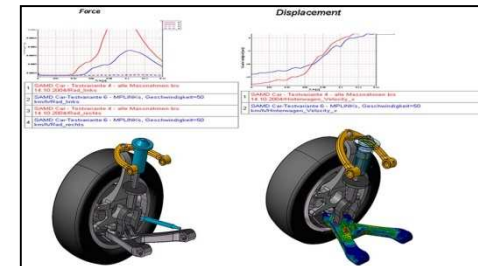
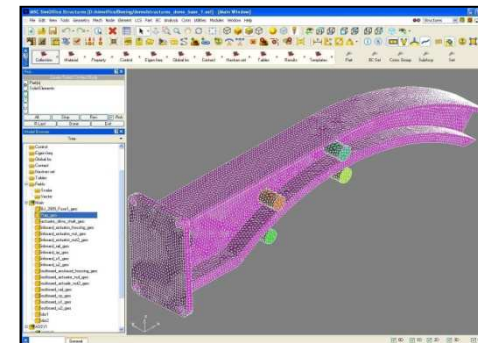
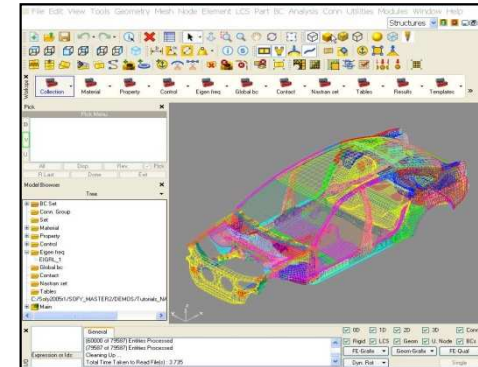
Explicit



Complete Solution for the Analyst
Multi-Discipline Environment
High-Productivity GUI
Automation by Templates

SimXpert Structures Workspace

- **Complete linear, nonlinear structural FEA modeling**
 - Geometry modeling/cleanup tools
 - Meshing, mesh editing, mesh morphing
 - Loads, materials and boundary conditions
- **Analysis**
 - Linear
 - Nonlinear
 - Statics
 - Normal modes
 - Buckling
 - Frequency response, transient response
 - Contact (2D, 3D, rigid bodies, flexible bodies)
 - Coupled structural – thermal
 - Analysis chaining
- **Review**
 - FE post-processing
 - State plots and XY charting
 - Custom reports



SimXpert Motion Workspace

- **Solver: Adams**

- **Modeling**

Creation of components/ construction objects

- Ground part, rigid moving, flexible moving part
- Creating hardpoints, hardpoint pair
- Location, orientation

Set up Connectors – Connections toolbox:

- Joint couplers, bushing
- Rigid joints / flexible connectors
- Contacts toolbox – (define contact incidents – curve-to-curve, point-to-curve, body-to-body)
- Translational and torsional springs/dampers

Forces toolbox

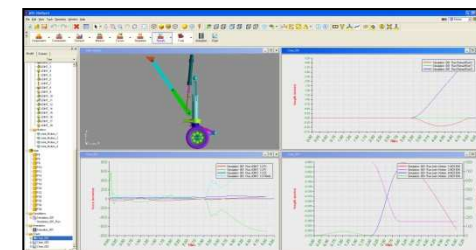
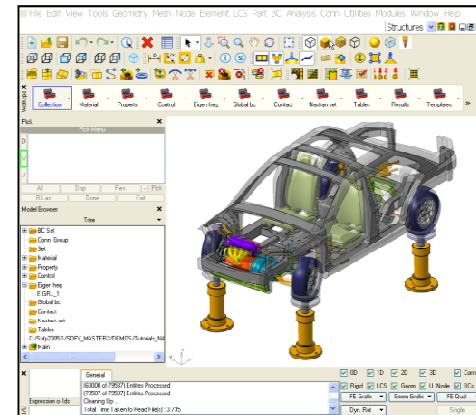
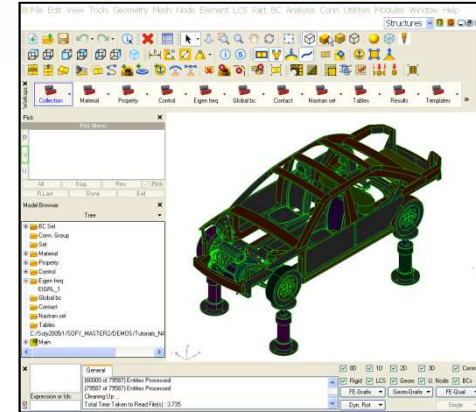
- Applied force, torque,
- Rotational spring-damper, translational spring-damper

- **Analysis**

- Kinematics
- Gravity
- Full system Dynamics
- Static
- Quasi-static

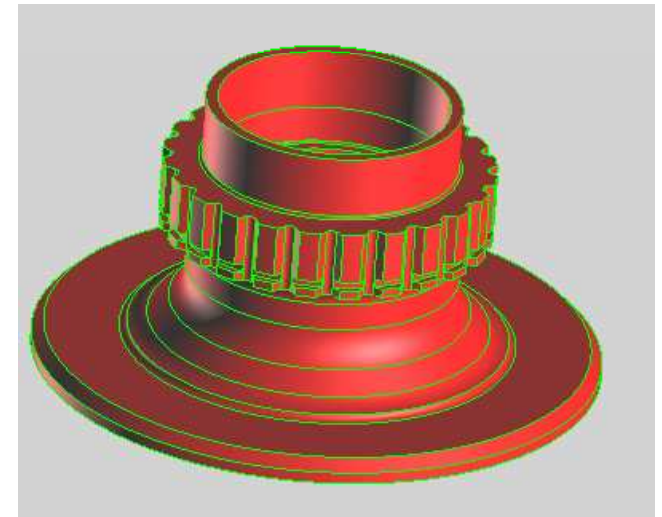
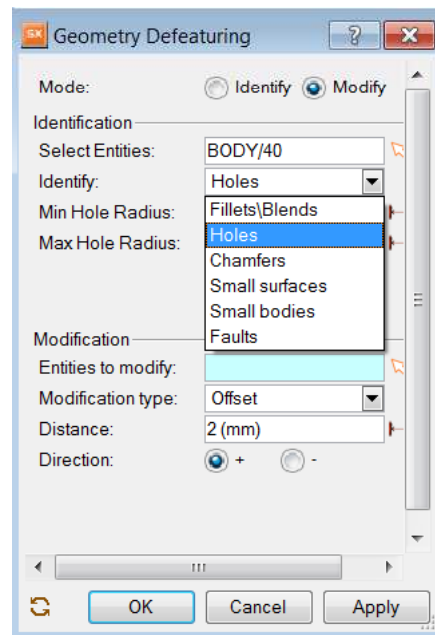
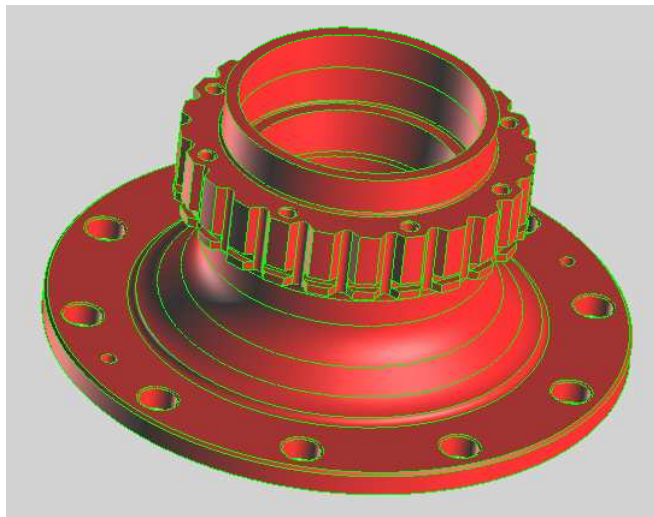
- **Review**

- Animation
- Charts
- Can be displayed together - by changing window layout



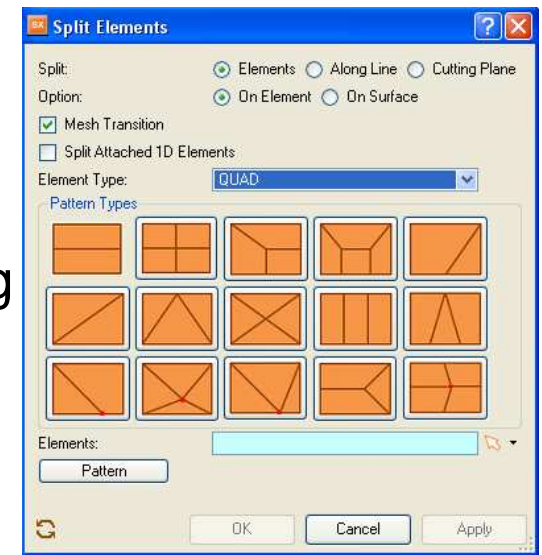
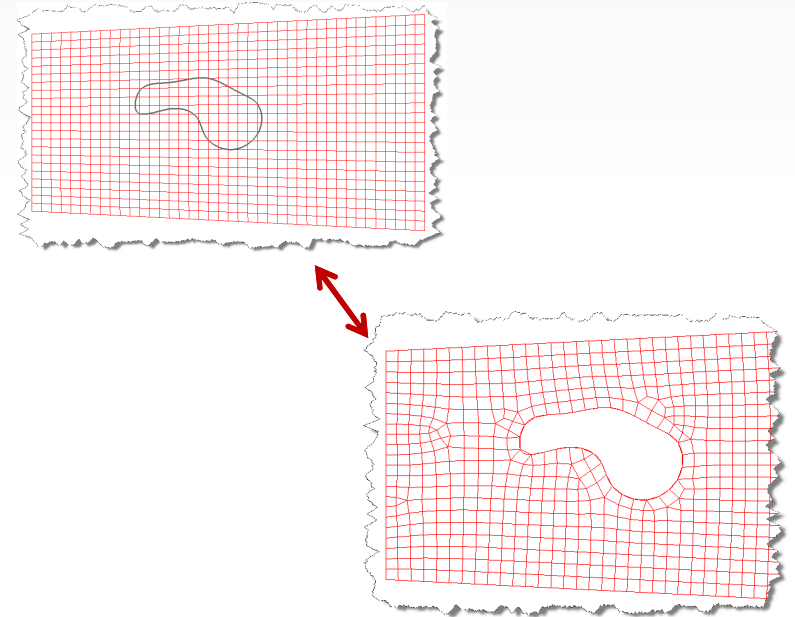
Some Useful Geometry Tools

- Virtual topology – suppress edges during meshing
- Midsurface creation
- Surface extend
- Solid defeaturing: delete features, move faces, filter by diameter, ...



Some Useful FEM Tools

- Create or remove hole / cutout
- Many quad – split options, transition to surrounding mesh
- Split mesh at selected node
- Interactive mesh size (geometry based)
- Penetration checking
- Mesh morphing
- Manual quality enhancement
- New Tet10 Mesher: less elements, better quality
- Improve bad elements already during solid meshing
- Nastran Geomcheck, Tet10 linearization

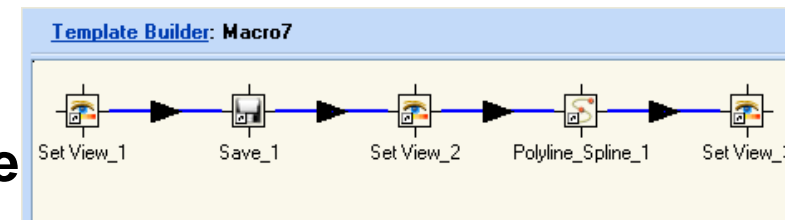


Automation with Templates

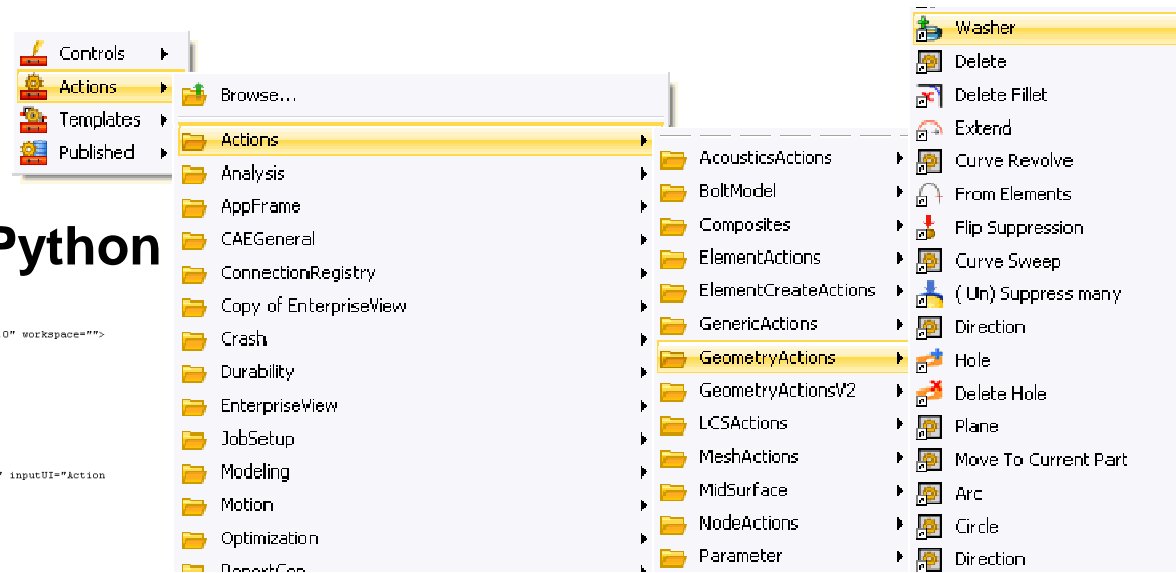
- **Macro record**



- **Create or edit macro in flowchart mode**
- **Build process using standard actions**



- Or write own actions in Python



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Automation with Templates

Examples:

- Seamweld and bolt creation
- Excel reporting
- Word reporting
- Create own postprocessing output

