

SIEMENS

NX Advanced FEM (Version NX 5)

Aims

- ▶ There are 225 slides in this file, it is **NOT** the expectation that you show all of them to the prospect/customer
- ▶ The aim here is to provide a deck of slides that you can choose to “pick and mix” from to show a workflow or solution that is appropriate to your requirements
- ▶ These slides describe the **“Core” functionality**. I have skipped some icons/functions as they are only applicable for one of the add-on applications.
- ▶ These can be used as the build up for a presentation on one of the add-on applications like Laminates, Response Simulation, Thermal, Flow etc
- ▶ As these slides are all built to a consistent style, doing a “pick and mix” will still result in a clean looking presentation
- ▶ Please note that after the Solver Language Environment slides, everything is NX Nastran specific
- ▶ Please provide any enhancements or suggestions to
Guy.Wills@Siemens.com (+44 1462 44 5029)

Slides 2 – 6 are not intended for Public use

Slide Organisation (1)

- ▶ NX Advanced FEM File Organization
 - ▶ Basic file structure
 - ▶ Idealize and Multiple FEM's
 - ▶ Multiple SIM's – Physical Property Override
 - ▶ Multiple SIM's – Physical Property & Thickness Override
 - ▶ Multiple Solutions and subcase's
 - ▶ Variations

- ▶ Model Interaction
 - ▶ Simulation Navigator – File View
 - ▶ Simulation Navigator – Easy Management
 - ▶ Simulation Navigator – Resource Bars
 - ▶ Interaction – RMB Over Screen Model
 - ▶ Mirror Display
 - ▶ Model Interaction – Show Only
 - ▶ Model Interaction – Show Adjacent
 - ▶ Model Interaction – Node Display
 - ▶ Model Interaction – Mesh Display
 - ▶ Model Interaction – Mesh Control Display

- ▶ Solver Language Environment
 - ▶ Solver Language Environment
 - ▶ "NX Nastran Environment" – UI Based on Solver/Solution
 - ▶ "ANSYS Environment" – UI Based on Solver/Solution
 - ▶ "ABAQUS Environment" – UI Based on Solver/Solution

- ▶ Master Part
 - ▶ Master Part
 - ▶ Material Property – Library
 - ▶ Material Properties

- ▶ Idealize Part
 - ▶ Part Idealize Part
 - ▶ Uses of the Idealize part
 - ▶ Idealize Part – Idealize
 - ▶ Idealize Part – Defeature Geometry
 - ▶ Idealize Part – Partition
 - ▶ Idealize Part – Midsurface
 - ▶ Idealize Part – Subdivide Faces
 - ▶ Idealize Part – Additional Modelling
 - ▶ Idealize Part – Direct Modelling
 - ▶ Idealize Part – Material Properties

Slides 2 – 6 are not intended for Public use

Slide Organisation (2)

- ▶ FEM Part
 - ▶ FEM Part
 - ▶ NX Advanced Simulation : CAE Topology
 - ▶ NX CAE Topology – Geometric Abstraction and Meshing
 - ▶ NX CAE Topology
 - ▶ NX CAE Topology – Auto Heal
 - ▶ NX CAE Topology – Split Edge
 - ▶ NX CAE Topology – Split Face
 - ▶ NX CAE Topology – Merge Edge
 - ▶ NX CAE Topology – Merge Face
 - ▶ NX CAE Topology – Match Edge
 - ▶ NX CAE Topology – Collapse Edge
 - ▶ NX CAE Topology – Face Repair
 - ▶ NX CAE Topology – Reset
 - ▶ NX CAE Topology – Mesh Updates
 - ▶ Physical Properties
 - ▶ Mesh Collectors
 - ▶ Node & Element Sets
 - ▶ Mesh Append
 - ▶ Mesh Import
 - ▶ Mesh Connections – Mesh Mating
 - ▶ Mesh Connections – Edge-Face Connection
 - ▶ Mesh Connections – Edge Contact Mesh
 - ▶ Mesh Connections – Surface Contact Mesh
 - ▶ Meshing – Mesh Points
 - ▶ Datum Coordinate Systems
 - ▶ Mesh Size Selection
- ▶ FEM Part (cont)
 - ▶ Mesh Controls
 - ▶ Meshing – OD Mesh
 - ▶ Meshing – 1D Element Cross Sections
 - ▶ Meshing – 1D Mesh
 - ▶ Meshing – 1D Mesh – Element Attributes
 - ▶ Meshing – 2D Dependant Mesh
 - ▶ Meshing – 2D Mapped Mesh
 - ▶ Meshing – 2D Mesh
 - ▶ Meshing – 2D Mesh Seeding for 3D Mesh
 - ▶ Meshing – 3D Swept Mesh
 - ▶ Meshing – Solid from Shell Mesh
 - ▶ Meshing – 3D Tetrahedral Mesh
 - ▶ Meshing – Node Create
 - ▶ Meshing – Node Between Nodes
 - ▶ Meshing – Node on Curve/Edge
 - ▶ Meshing – Node Translate
 - ▶ Meshing – Node Rotate
 - ▶ Meshing – Node Reflect
 - ▶ Meshing – Node Drag
 - ▶ Meshing – Node Align
 - ▶ Meshing – Node Displacement CSYS
 - ▶ Meshing – Node Re-Numbering
 - ▶ Meshing – Node Modify Coordinate
 - ▶ Meshing – Node Deletion
 - ▶ Meshing – Node & Element Information
 - ▶ Meshing – Node Displacement CSYS
- ▶ FEM Part (cont)
 - ▶ Meshing – Element Create
 - ▶ Meshing – Element Extrude
 - ▶ Meshing – Element Revolve
 - ▶ Meshing – Element Translate & Copy
 - ▶ Meshing – Element Copy & Project
 - ▶ Meshing – Element Copy & Reflect
 - ▶ Meshing – Shell Split
 - ▶ Meshing – Combine Tris
 - ▶ Meshing – Move Mode
 - ▶ Meshing – Element Re-label
 - ▶ Meshing – Element Connectivity
 - ▶ Meshing – Element Deletion
 - ▶ Meshing – Node & Element Information
 - ▶ Meshing – Mesh Unlock
 - ▶ Model Checking – Element Shape
 - ▶ Model Checking – Element Outlines
 - ▶ Model Checking – Duplicate Nodes
 - ▶ Model Checking – Element Normals

Slides 2 – 6 are not intended for Public use

Slide Organisation (3)

- ▶ SIM Part – Pre-Processing
 - ▶ Modeling Objects – Manager
 - ▶ Modeling Objects – Contact Set Parameters
 - ▶ Modeling Objects – Strategy Parameters
 - ▶ Modeling Objects – Real Eigenvalue, Lanczos & Householder
 - ▶ Modeling Objects – Forcing Frequencies – Direct & Modal
 - ▶ Modeling Objects – Time Step
 - ▶ Modeling Objects – Structural Output Requests
 - ▶ Modeling Objects – Solution Parameters
 - ▶ Modeling Objects – System Cells
 - ▶ Surface to Surface – Contact
 - ▶ Surface to Surface – Glue
 - ▶ Loads – Force
 - ▶ Loads – Bearing
 - ▶ Loads – Torque
 - ▶ Loads – Moment
 - ▶ Loads – Pressure
 - ▶ Loads – Hydrostatic Pressure
 - ▶ Loads – Gravity
 - ▶ Loads – Centrifugal
 - ▶ Loads – Constant Temperature
 - ▶ Loads – Nodal Force Location
 - ▶ Constraints – User Defined
 - ▶ Constraints – Enforced Displacement
 - ▶ Constraints – Fixed, Translation & Rotation
 - ▶ Constraints – Simply Supported

- ▶ SIM Part – Pre-Processing (cont)
 - ▶ Constraints – Slider
 - ▶ Constraints – Pinned
 - ▶ Constraints – Cylindrical
 - ▶ Constraints – Roller
 - ▶ Constraints – Symmetric
 - ▶ Constraints – Anti-Symmetric
 - ▶ Constraints – Velocity
 - ▶ Constraints – Acceleration
 - ▶ Constraints – Automatic Coupling
 - ▶ Constraints – Manual Coupling
 - ▶ Constraints – Enforced Motion Location
 - ▶ Boundary Condition Symbol Display Controls
 - ▶ Physical Property Overrides
 - ▶ Custom Units & Units Converter
 - ▶ Unit Selection
 - ▶ Boundary Condition Magnitude – Table Field
 - ▶ Boundary Condition Magnitude – Function Field
 - ▶ Solution
 - ▶ Solution – Containers and Re-using Data
 - ▶ Solution – Subcase Management
 - ▶ Solution – Attributes
 - ▶ Solution – Parameters
 - ▶ Solution – Comprehensive Check
 - ▶ Solution – Report Before Solve
 - ▶ Solution – Solve the Active Solution

Slides 2 – 6 are not intended for Public use

Slide Organisation (4)

- ▶ SIM Part – Post-Processing
 - ▶ NX – Integrated Post Processing
 - ▶ Results – Selection
 - ▶ Results – Animation
 - ▶ Results – Post View Display
 - ▶ Results – Post View Color Bar
 - ▶ Results – Post View Edges & Faces
 - ▶ Results – Identify
 - ▶ Results – Annotation Markers
 - ▶ Results – Previous / Next Mode or Iteration
 - ▶ Results – Post Views & Templates
 - ▶ Results – Multiple Viewports
 - ▶ Results – Post View Overlay
 - ▶ Plotting Paths
 - ▶ Graph Style
 - ▶ Graph Probing
 - ▶ Graph Windowing
 - ▶ Solution Report – After Solve
 - ▶ Export Visualisation Files

- ▶ Simulation Customer Defaults
 - ▶ Customer Defaults – General
 - ▶ Customer Defaults – Model Preparation
 - ▶ Customer Defaults – Mesh Display
 - ▶ Customer Defaults – Node & Element Display
 - ▶ Customer Defaults – Mesh Controls
 - ▶ Customer Defaults – Boundary Condition Display
 - ▶ Customer Defaults – Threshold Values Nastran
 - ▶ Customer Defaults – Meshing
 - ▶ Customer Defaults – Analysis
 - ▶ Customer Defaults – Post Processor

Slides 2 – 6 are not intended for Public use

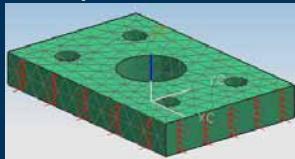
SIEMENS

NX Advanced FEM File Organisation

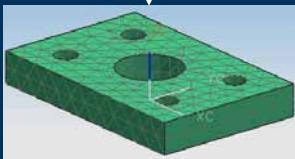
Basic file structure

- ▶ Working in a concurrent environment
- ▶ Efficient use of model and data re-use
- ▶ Efficient use of local memory – not all files need to be loaded

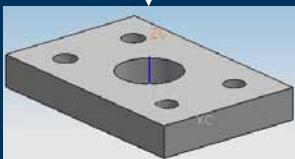
Simulation part



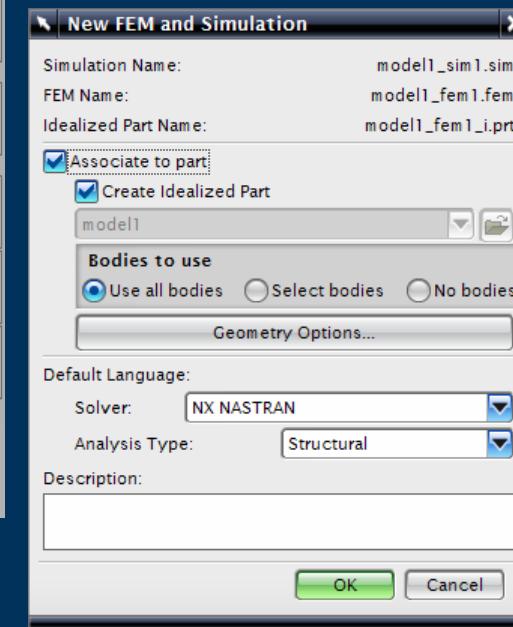
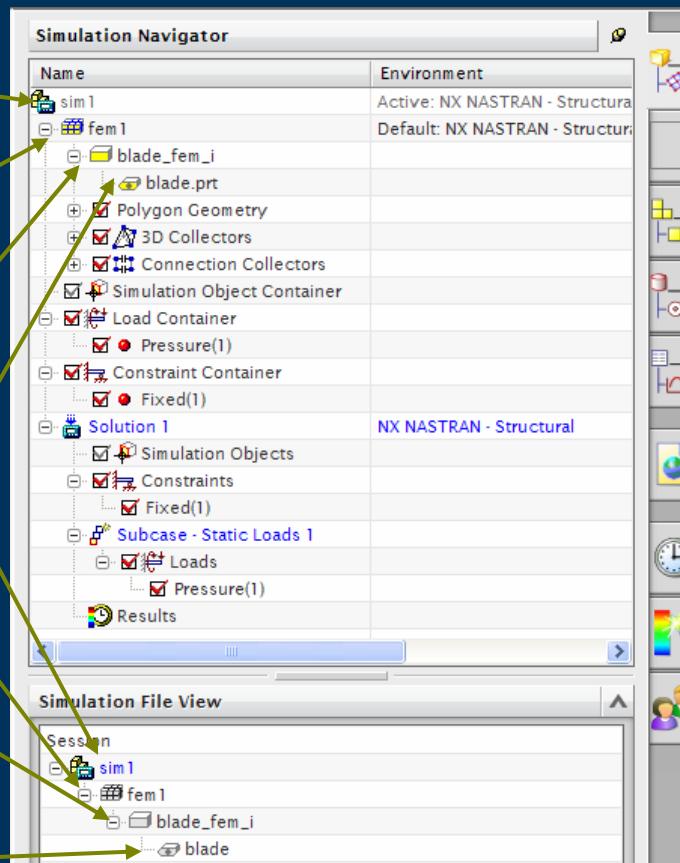
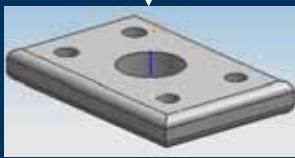
FEM Part



Idealize Part



Master Part

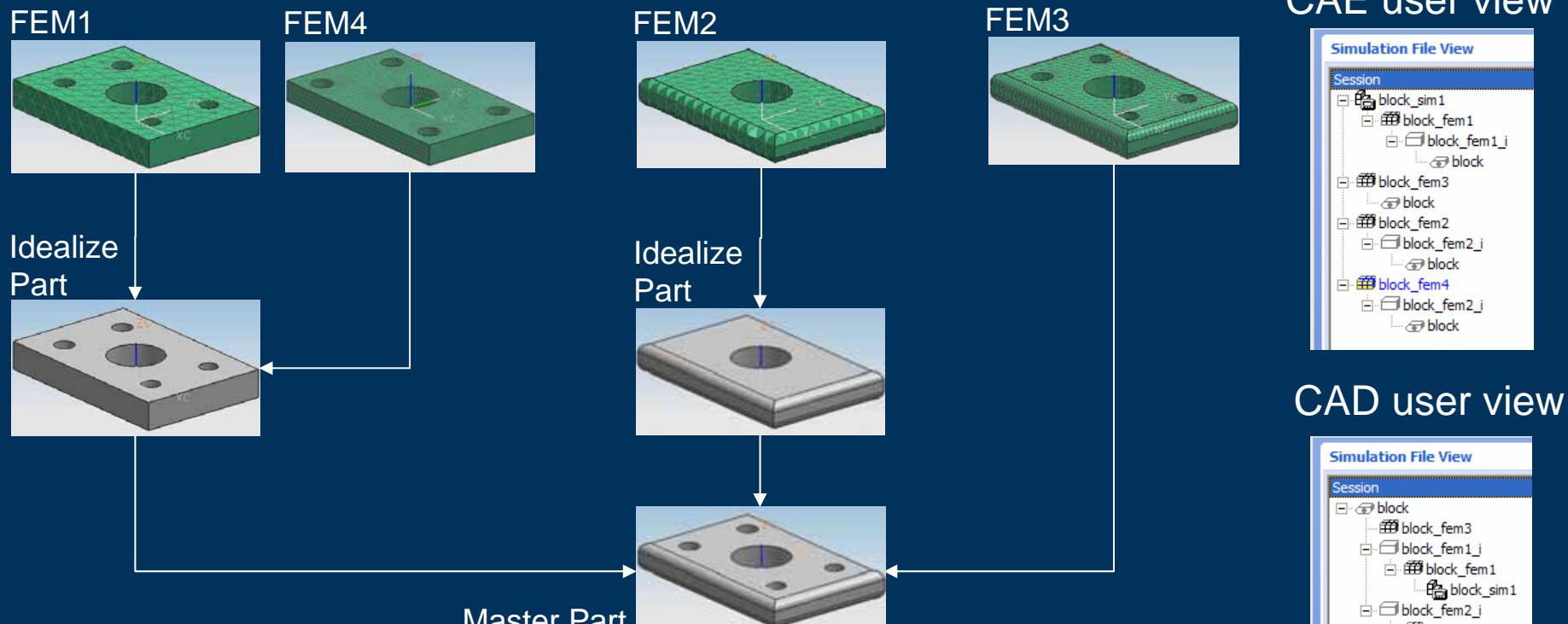


Note – Write Access to Master Part is not required

Multiple Idealize and Multiple FEM's

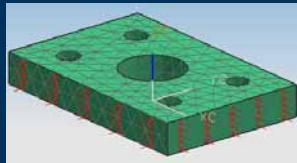
Benefits

- ▶ Multiple analyses for same CAD part
- ▶ Multiple representations for different analysis needs from same CAD part

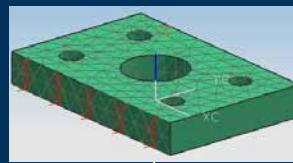


Multiple SIM's – Physical Property Override

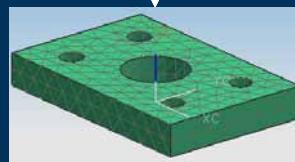
SIM1 – Generic Steel
(Inherited from Master Part)



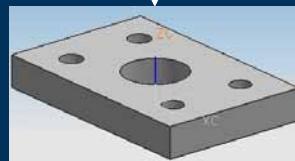
SIM2 – AISI_STEEL_1008+HR



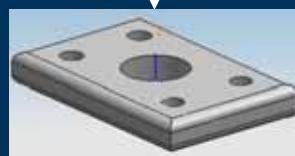
FEM1



Idealize Part

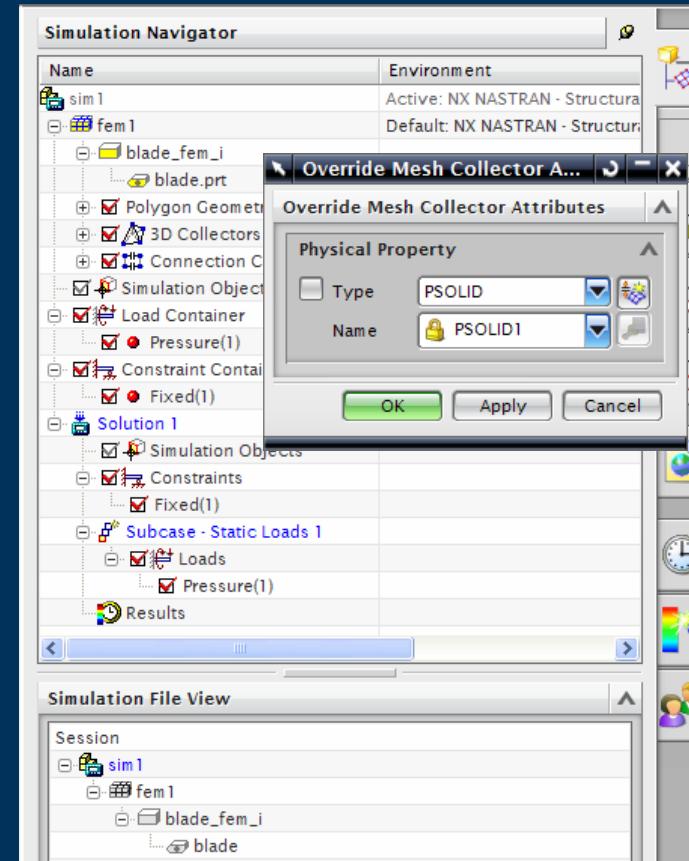


Master Part



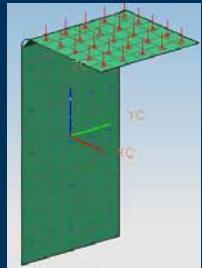
Benefits

- ▶ Quickly and easily explore effects of different materials
- ▶ “What if” and sensitivity studies

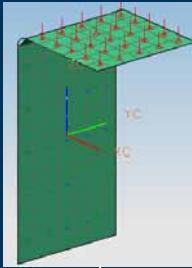


Multiple SIM's – Properties & Material Override

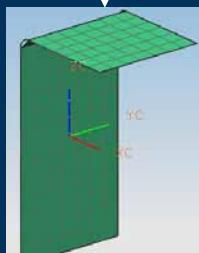
SIM1 –Inherited Properties



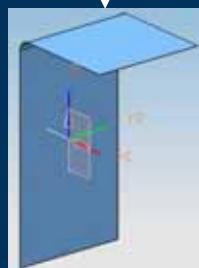
SIM2 – Properties & Material Overrides



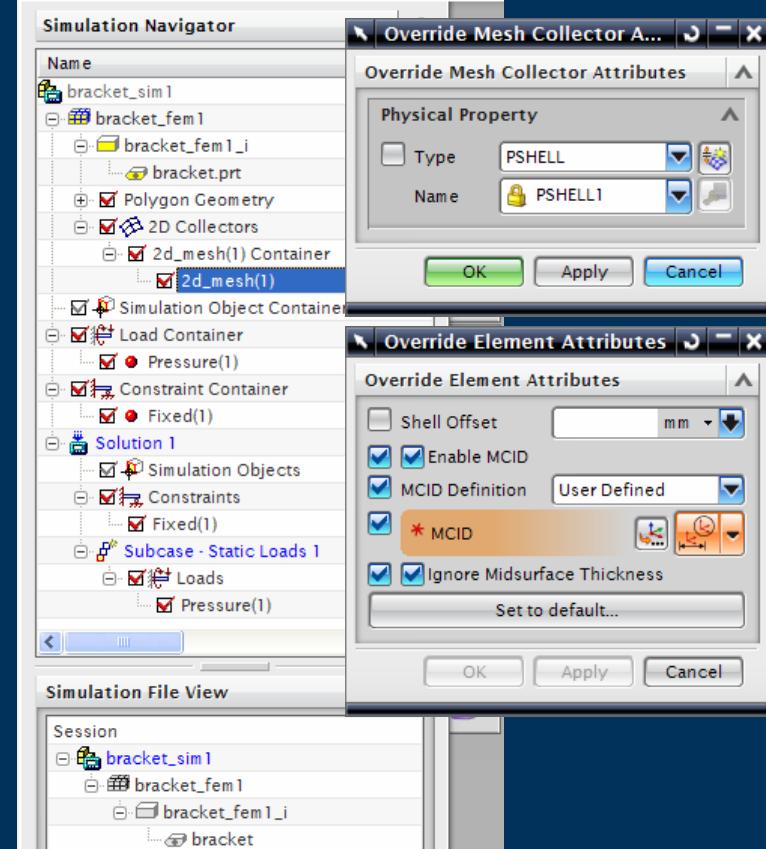
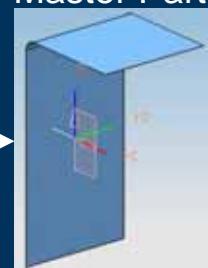
FEM1



Idealize Part



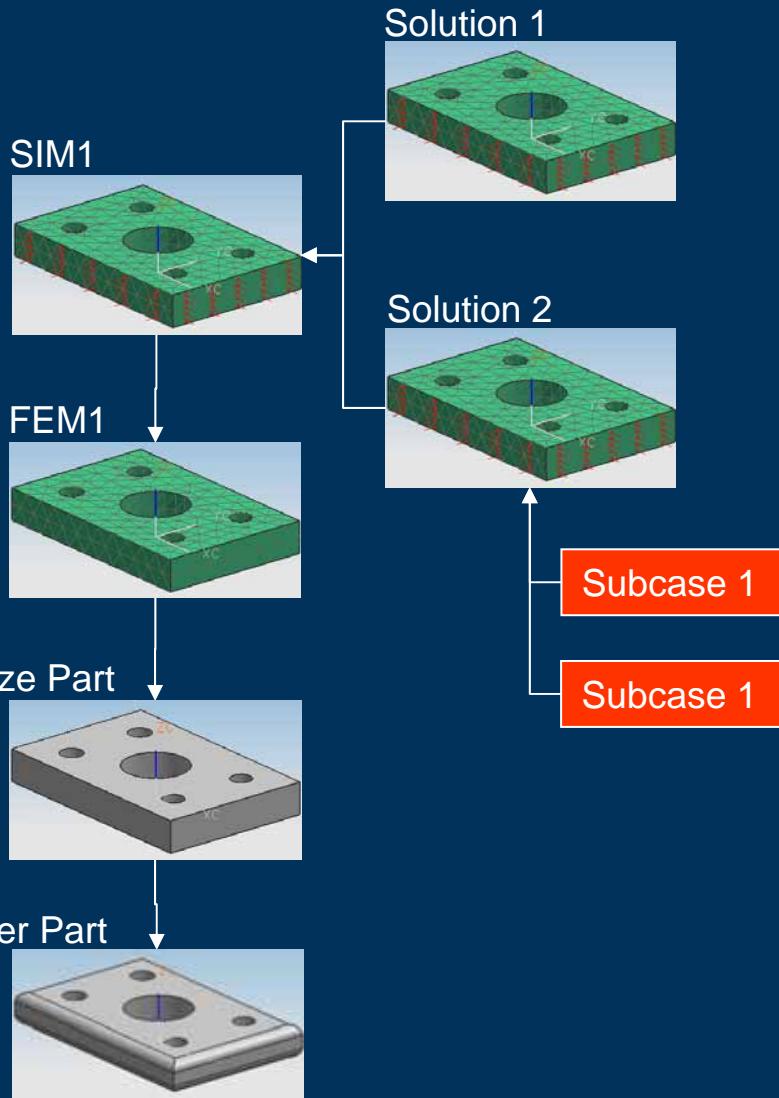
Master Part



Benefits

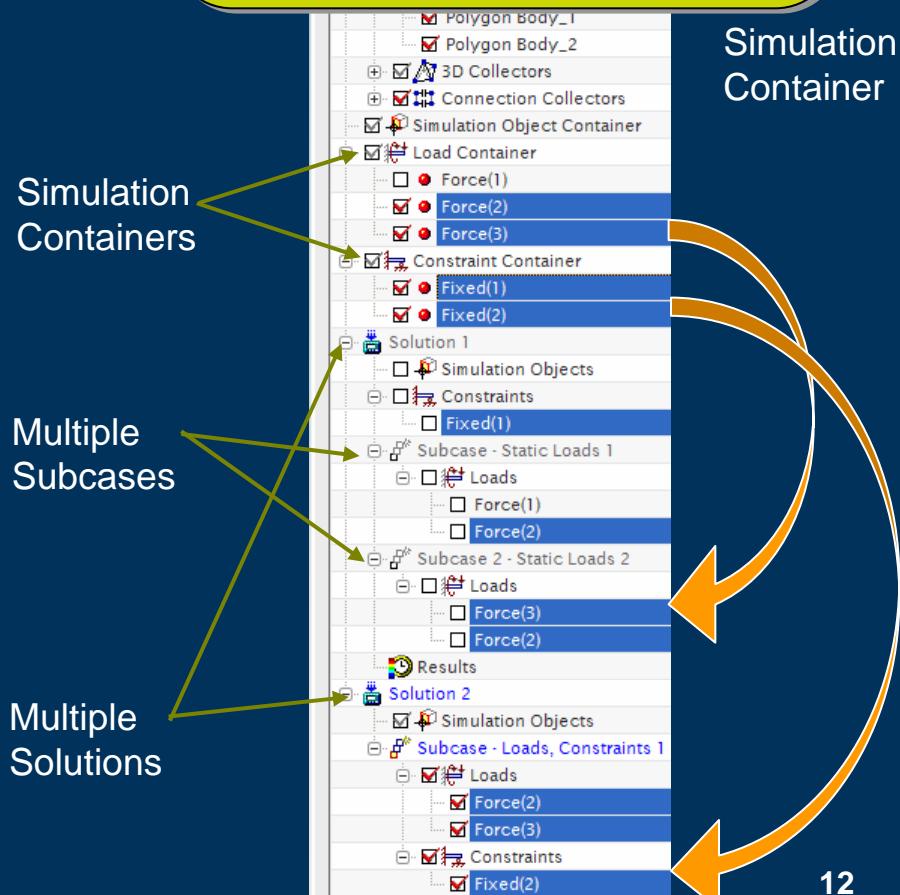
- ▶ Quickly and easily explore effects of different materials, thicknesses, shell offsets etc
- ▶ “What if” and sensitivity studies

Multiple Solutions and Subcase's



Benefits

- ▶ Quickly and easily explore effects of different loading conditions
- ▶ Efficient analysis in complex environments

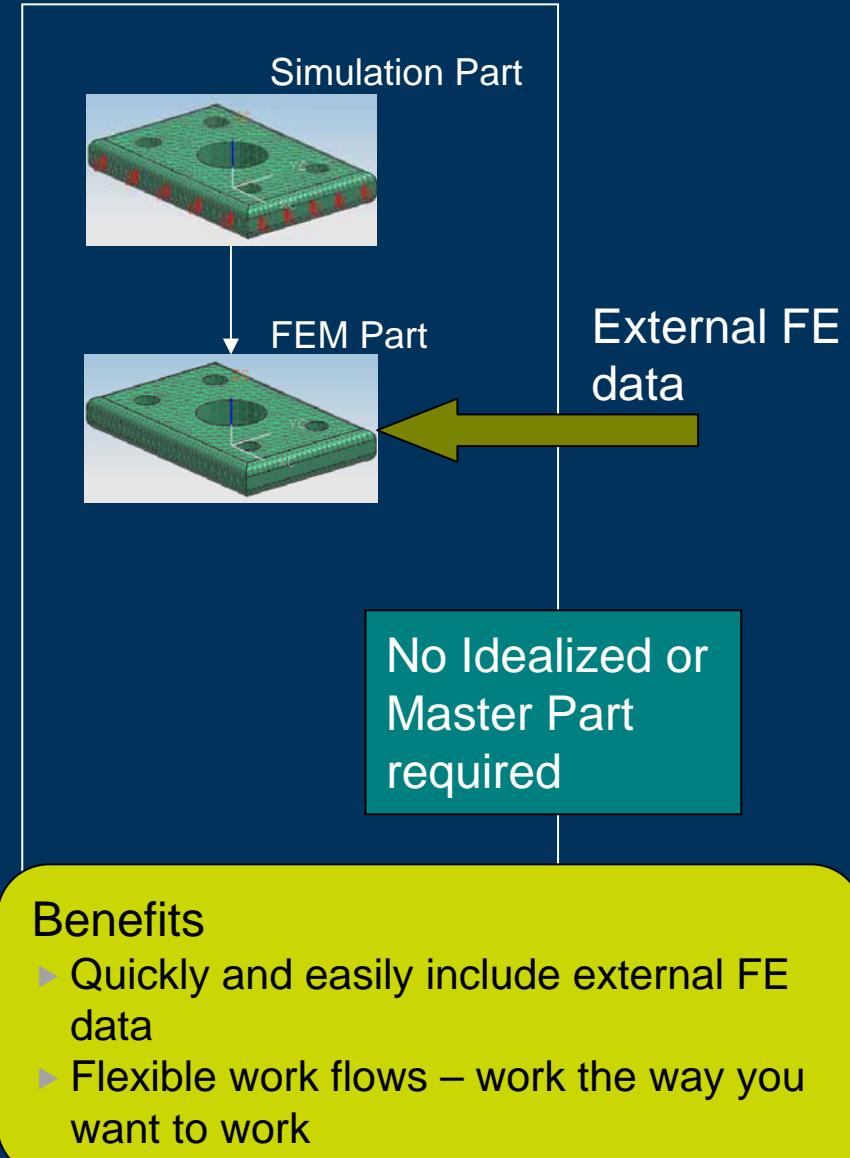
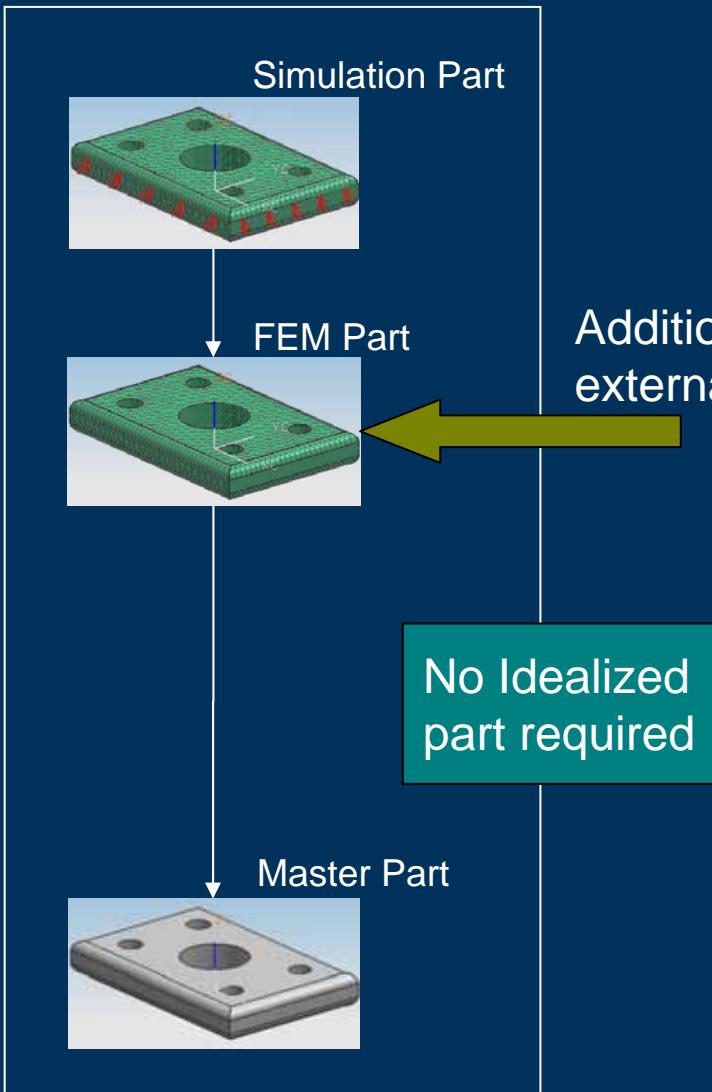


Simulation Containers

Multiple Subcases

Multiple Solutions

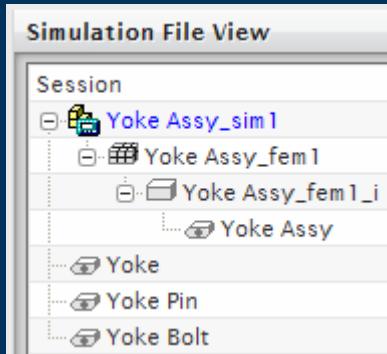
Variations



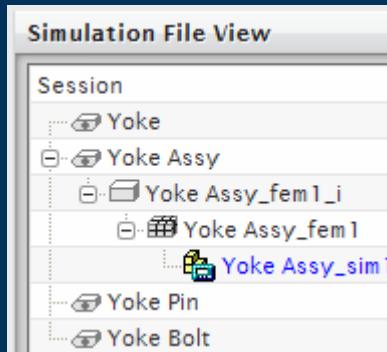
SIEMENS

Model Interaction

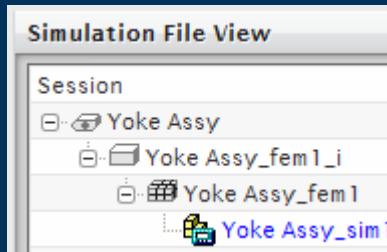
Simulation Navigator – File View



Simulation
Centric View

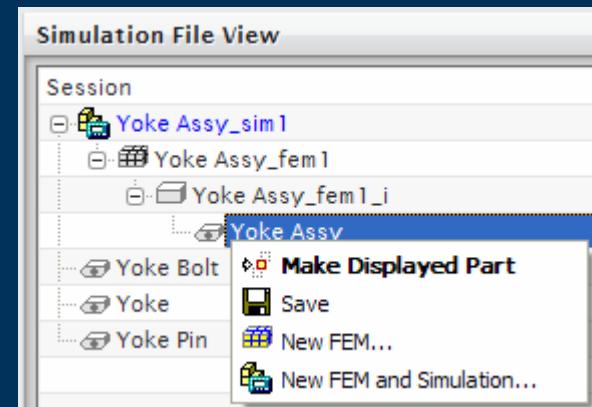


Design Part
Centric View



Design Part
Centric View
with Unused
Parts Hidden

- ▶ Simulation File View
 - ▶ Simulation Centric View for the analysts
 - ▶ Design Part Centric View for the inverted view
 - ▶ Active File shown in Blue
 - ▶ Optionally any unused and open parts can be hidden
- ▶ Easy to understand the file relationships
- ▶ Fast method of “Switching” active file – Double Click
- ▶ Fast method to create new Simulation files



Simulation Navigator – Easy Management

Simulation
Centric File
View

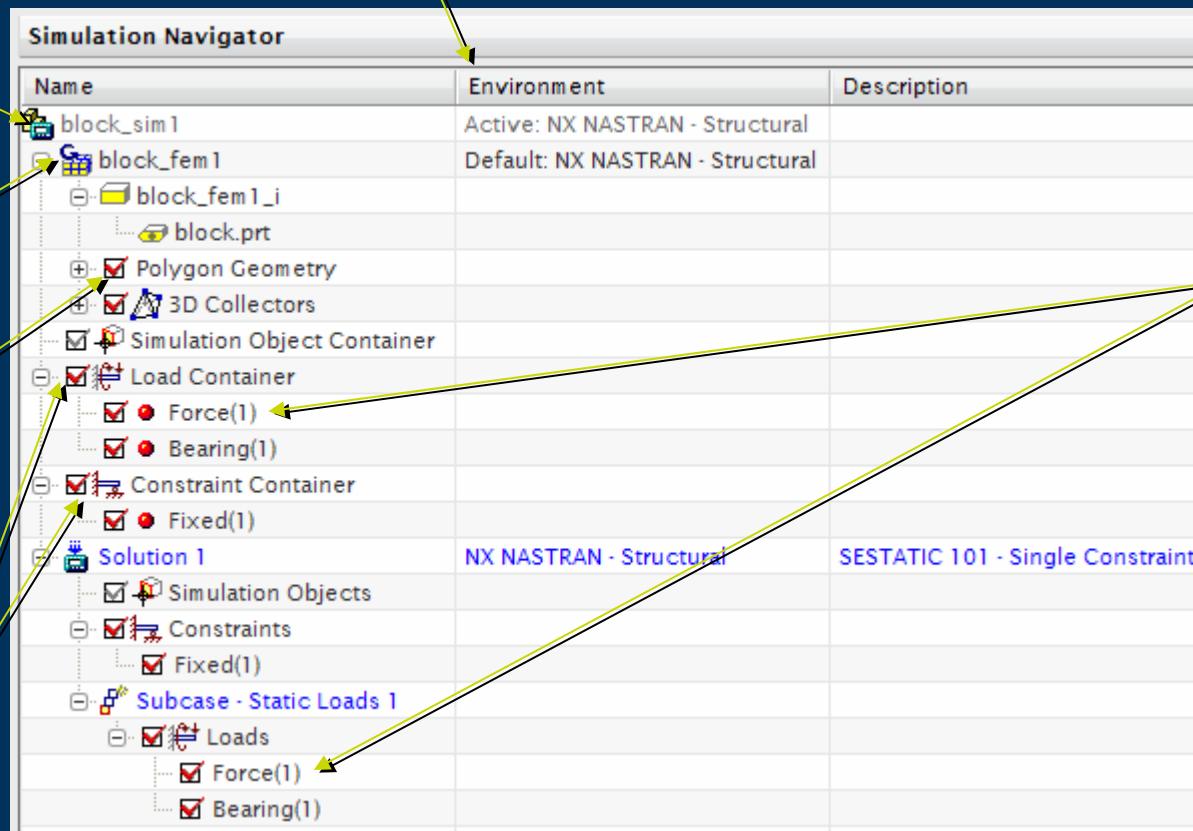
Mesh Out-of-
Date Symbol

Hide/Show of
Polygon
models and
Meshes during
selection

Containers to
Organise related
CAE Data

Active Solver
Environment

Drag ‘n’
Drop from
Containers
to Solution



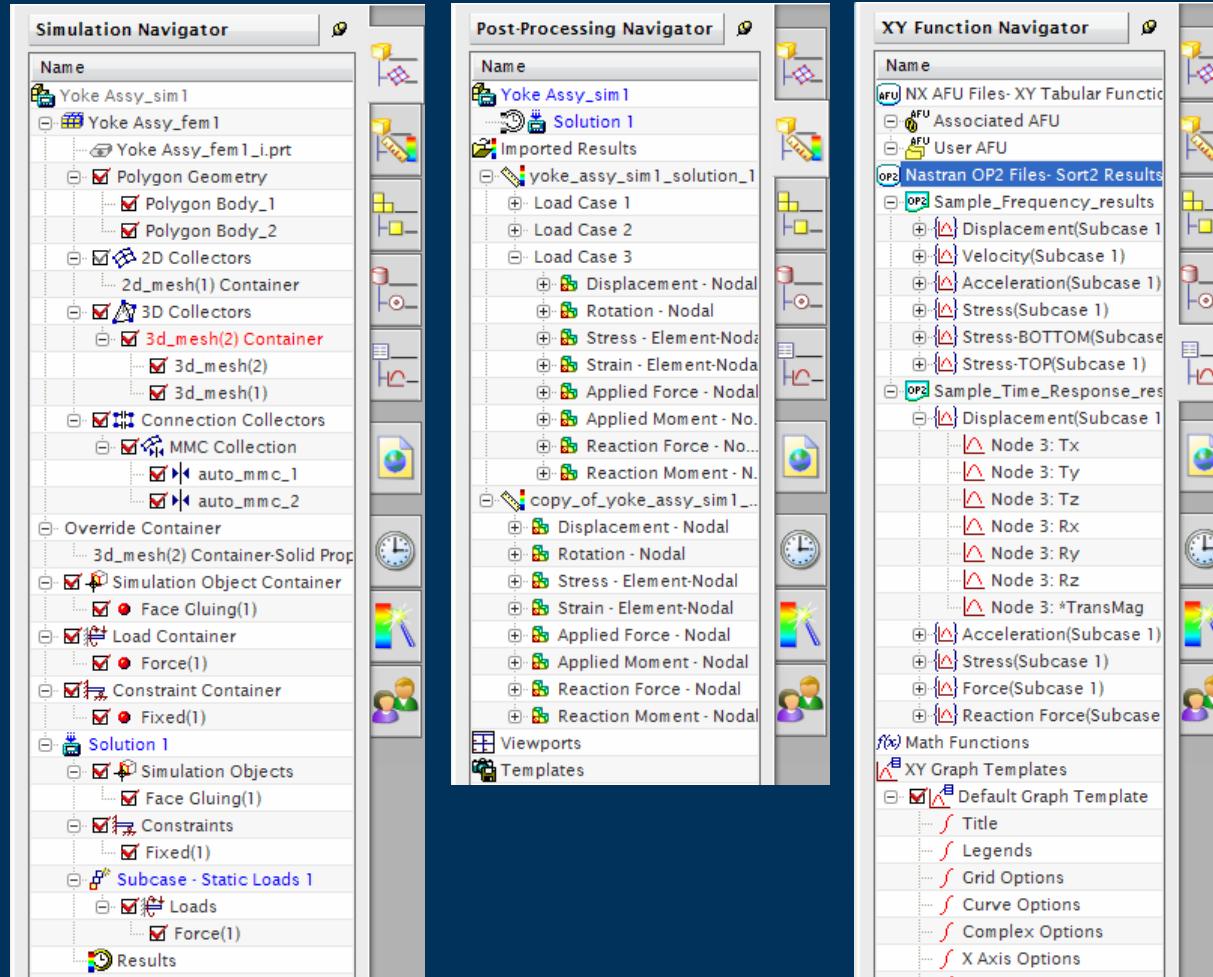
Simulation Navigator – Easy Management

► RMB Operations Directly from Navigator

The screenshot displays several windows of the Siemens Simulation Navigator interface, illustrating the use of Right-Button Menus (RMB) for managing simulation objects.

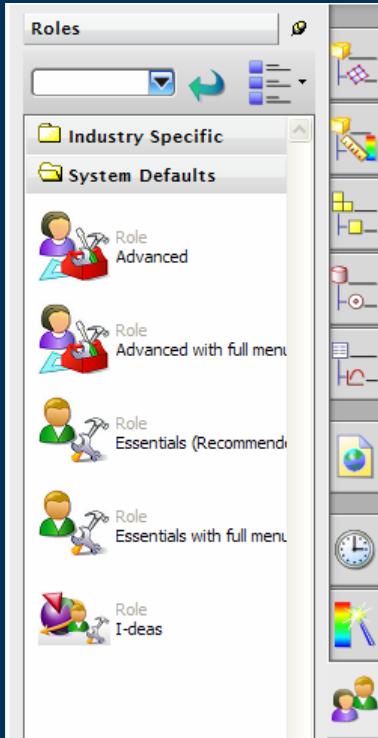
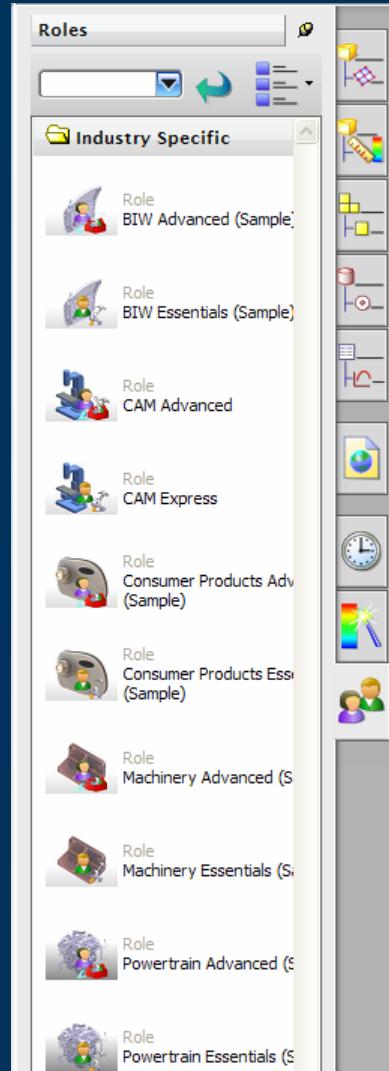
- Top Left:** A context menu is open over a "Load Container" object. It includes options like "Edit All", "Delete All", "Select All", "Information", "New Load", and a list of load types: Force, Moment, Bearing, Torque, Pressure, Hydrostatic Pressure, Gravity, Centrifugal, and Temperature Load.
- Middle Left:** A context menu is open over a "Constraint Container" object. It includes options like "Edit All", "Delete All", "Select All", "Information", "New Constraint", and a list of constraint types: User Defined Constraint, Enforced Displacement Constraint, Fixed Constraint, Fixed Translation Constraint, Fixed Rotation Constraint, Simply Supported Constraint, Pinned Constraint, Cylindrical Constraint, Slider Constraint, Roller Constraint, Symmetric Constraint, Anti-Symmetric Constraint, Automatic Coupling, and Manual Coupling.
- Bottom Left:** A context menu is open over a "Simulation Object Container" object. It includes options like "Edit All", "Delete All", "Select All", "Information", "New Simulation Object", and sub-options for "Surface-to-Surface Contact" and "Surface-to-Surface Gluing".
- Top Right:** A context menu is open over a "Solution 1" object. It includes options like "Create Subcase...", "Solution Attributes...", "Rename", "Delete", "Clone", "Comprehensive Check", "Solve...", "Create Report", "KF Adopt Object", and "Clear Result Out of Date Status".
- Middle Right:** A context menu is open over a "Load Container" object. It includes options like "Edit", "Style", "Rename", "Delete", "Clone", and "Properties".
- Bottom Right:** A context menu is open over a "Results" object. It includes options like "Open", "Delete", and "Combined Loadcases...".
- Bottom Center:** A context menu is open over a "Load Container" object. It includes options like "Edit All", "Delete All", "Select All", "Information", "New Load", and a list of load types: Force, Moment, Bearing, Torque, Pressure, Hydrostatic Pressure, Gravity, Centrifugal, and Temperature Load.
- Bottom Left:** A context menu is open over a "Constraint Container" object. It includes options like "Edit All", "Delete All", "Select All", "Information", "New Constraint", and a list of constraint types: User Defined Constraint, Enforced Displacement Constraint, Fixed Constraint, Fixed Translation Constraint, Fixed Rotation Constraint, Simply Supported Constraint, Pinned Constraint, Cylindrical Constraint, Slider Constraint, Roller Constraint, Symmetric Constraint, Anti-Symmetric Constraint, Automatic Coupling, and Manual Coupling.
- Bottom Right:** A context menu is open over a "Simulation Navigator" object. It includes options like "Collapse All", "Expand All", "Export to Browser", "Export to Spreadsheet", "Columns", and "Properties".

Simulation Navigator – Resource Bars



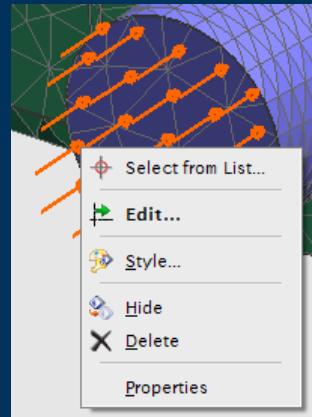
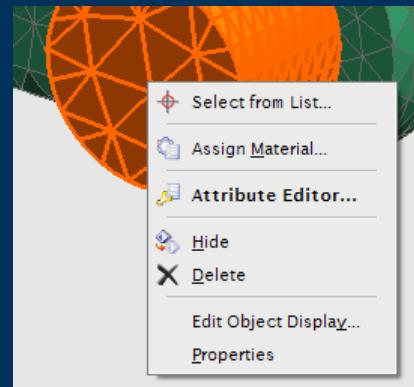
- ▶ Resource Bars for Simulation
 - ▶ Simulation
 - ▶ Post Processing
 - ▶ XY Functions

Simulation Navigator – Resource Bars

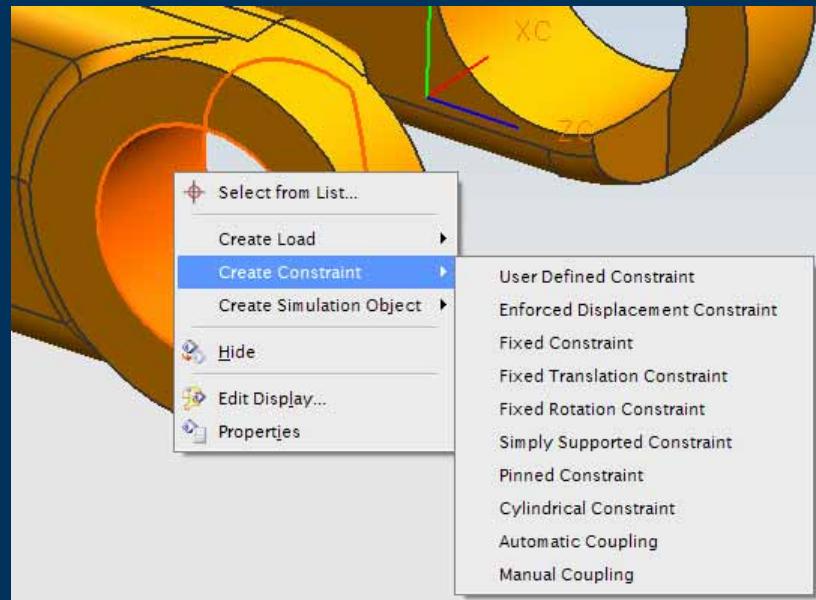
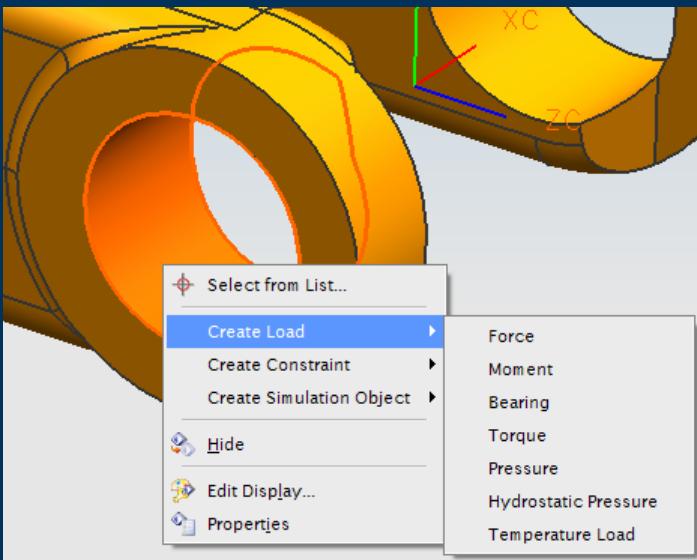


- ▶ Roles
 - ▶ Industry Specific
 - ▶ Advanced & Essentials
- ▶ General
 - ▶ Assembly Navigator
 - ▶ Part Navigator
 - ▶ History
 - ▶ Internet Explorer
 - ▶ On-Line Help

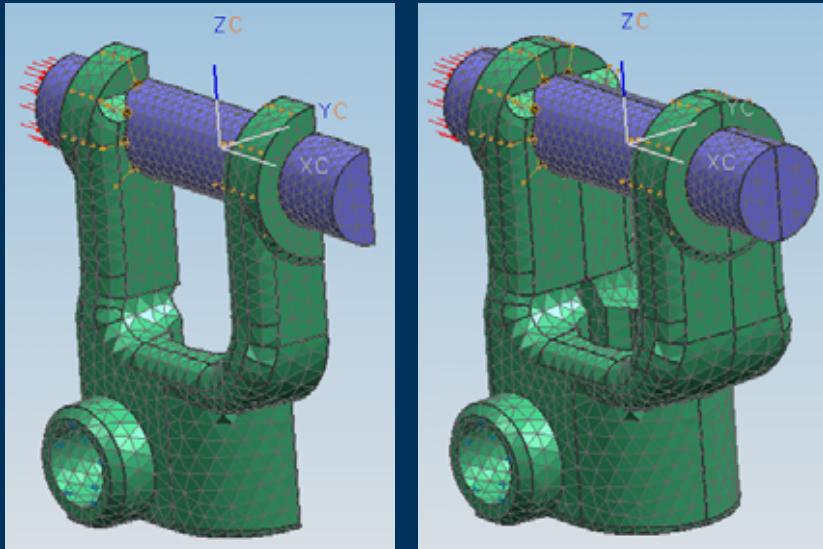
Interaction – RMB Over Screen Model



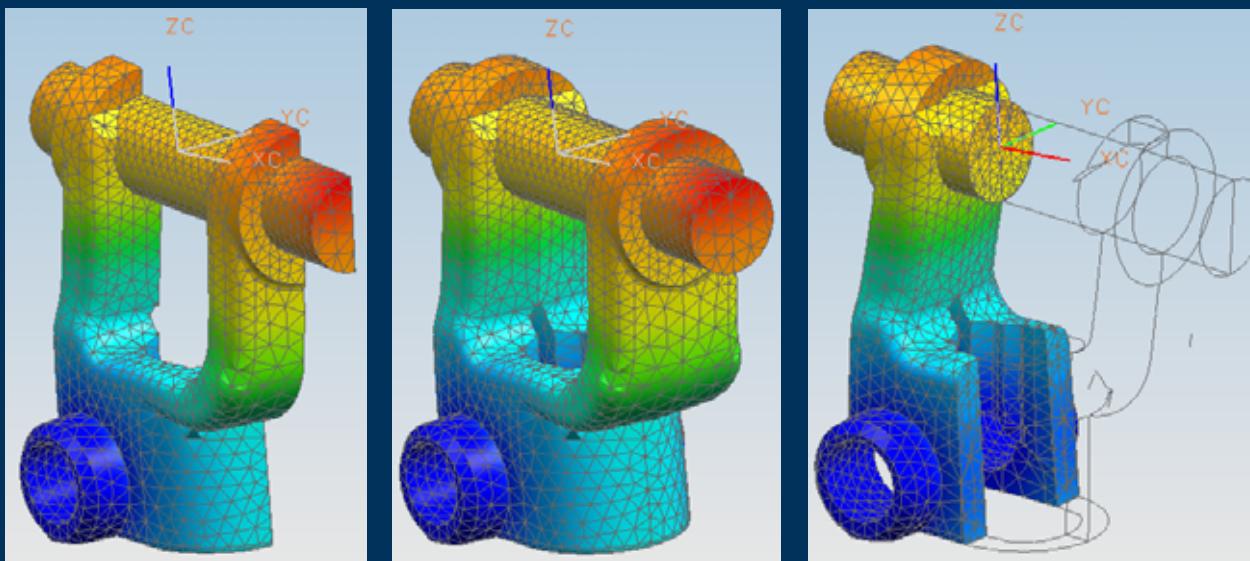
- ▶ RMB Over Screen Entities enables fast access to functionality applicable to the highlighted item



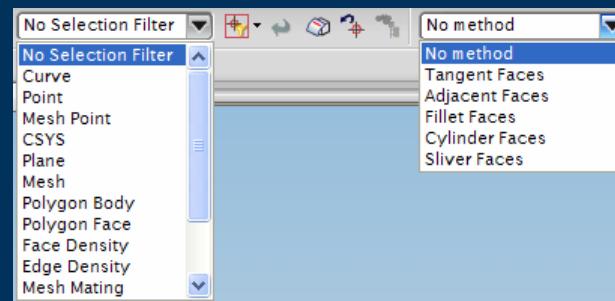
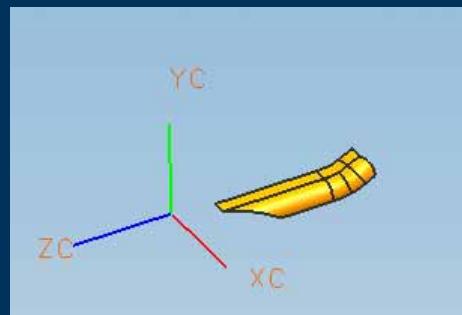
Mirror Display



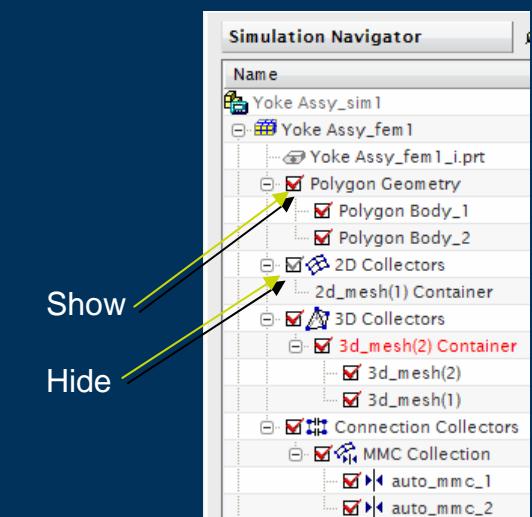
- ▶ Mirror Display is powerful for visualising Symmetric models
- ▶ Mirror Plane can be set anywhere
- ▶ Post View Settings work with the Mirror Display



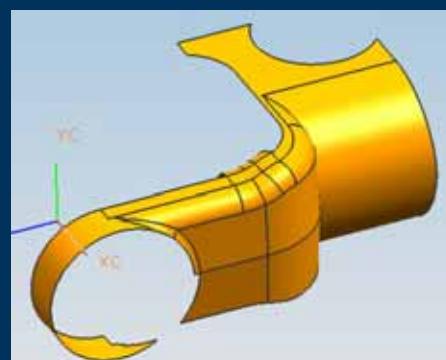
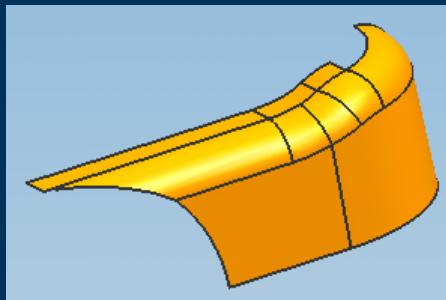
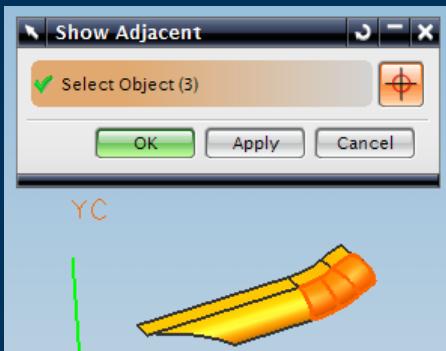
Model Interaction – Show Only



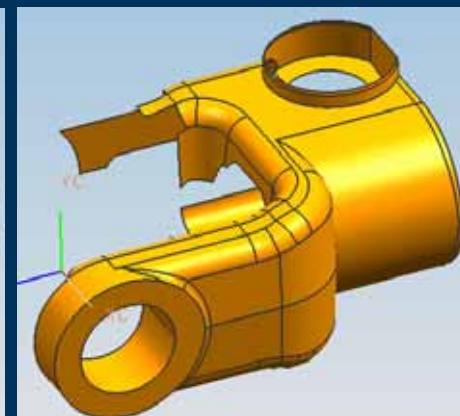
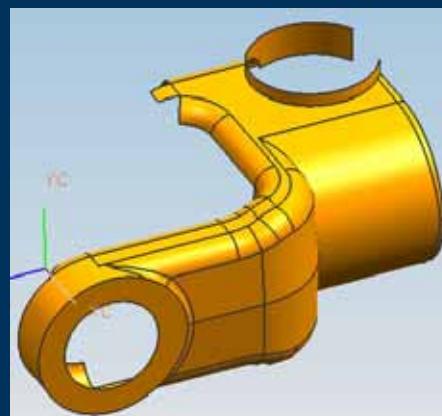
- ▶ Reduce the complexity of geometry on the screen
- ▶ Focus on a sub-set of the model
- ▶ Selection Methods
 - ▶ Tangent Faces
 - ▶ Adjacent Faces
 - ▶ Fillet Faces
 - ▶ Cylindrical Faces
 - ▶ Sliver Faces
- ▶ Hide/Show from the Simulation Navigation
 - ▶ Used during other commands to simply the screen



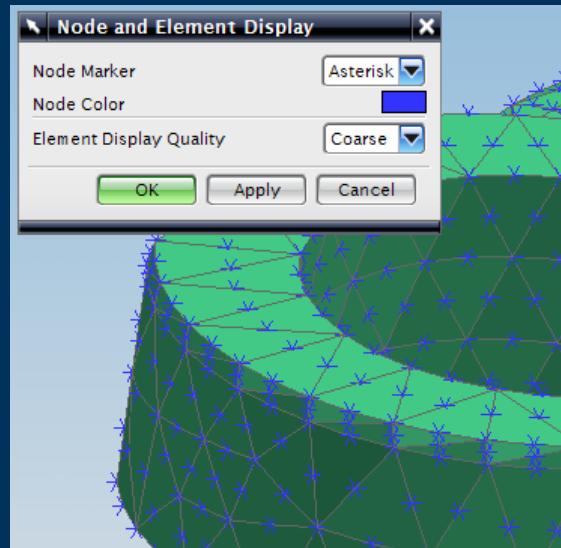
Model Interaction – Show Adjacent



- ▶ Show Adjacent to “grow” visible related geometry
- ▶ Selection Methods
 - ▶ Tangent Faces
 - ▶ Adjacent Faces
 - ▶ Fillet Faces
 - ▶ Cylindrical Faces
 - ▶ Sliver Faces

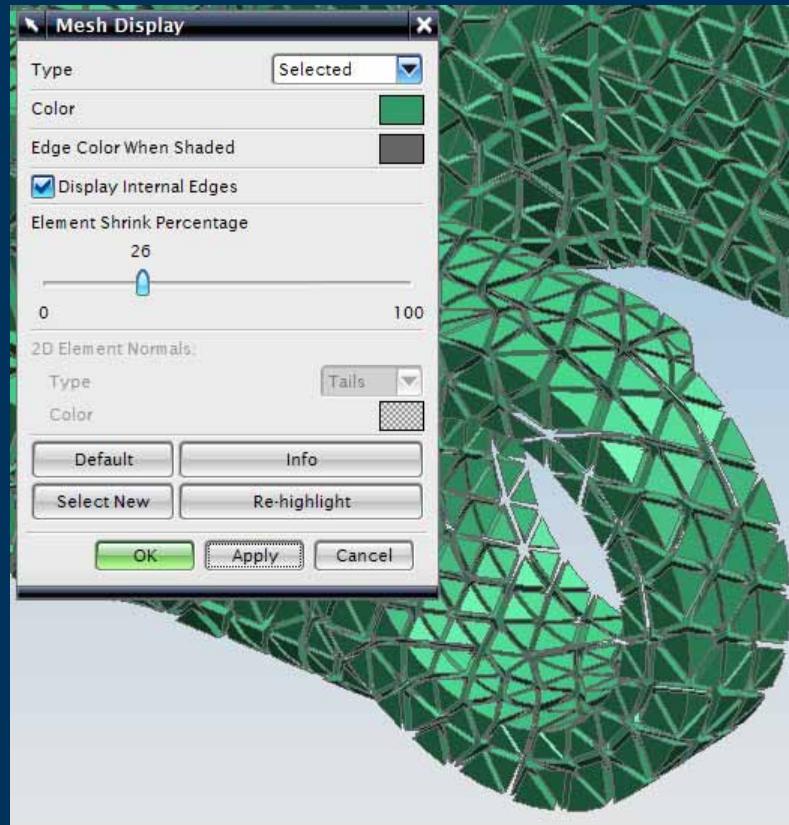
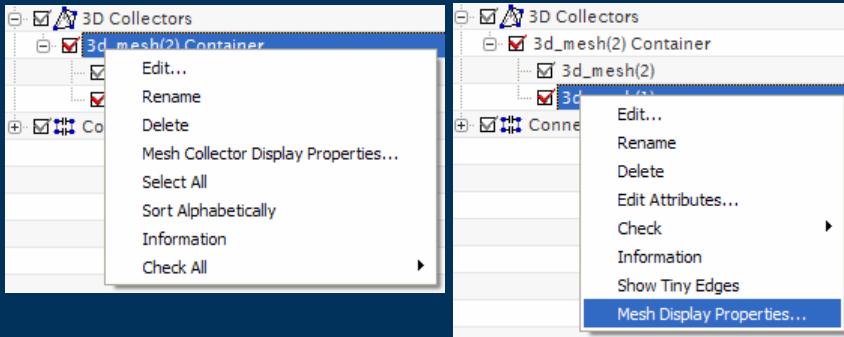


Model Interaction – Node Display

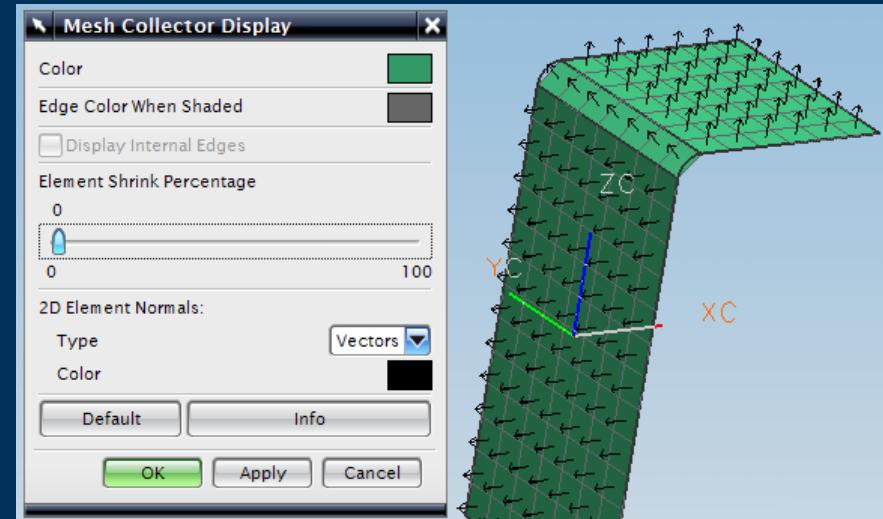


- ▶ Node Display options
 - ▶ None (default)
 - ▶ Dot
 - ▶ Asterisk
 - ▶ Color
- ▶ Element Display options
 - ▶ Coarse (default)
 - ▶ Medium
 - ▶ Fine

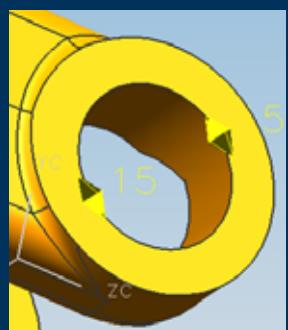
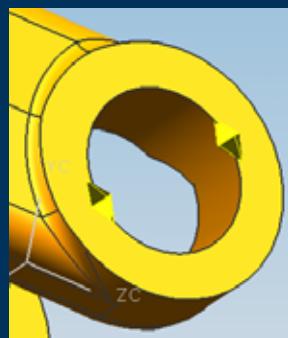
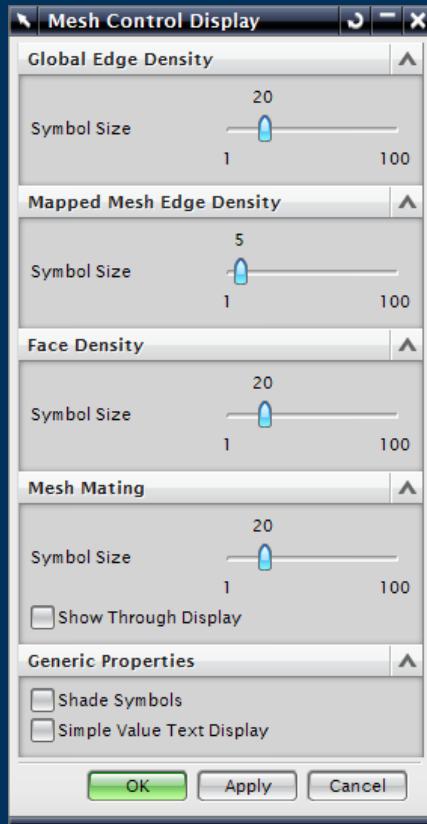
Model Interaction – Mesh Display



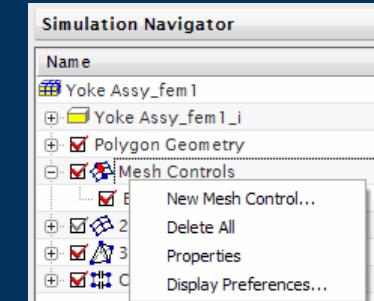
- ▶ Mesh Display
 - ▶ By Collector
 - ▶ By Mesh
- ▶ Mesh Display options
 - ▶ Colour
 - ▶ Edge Colour
 - ▶ Shrink Percentage
 - ▶ 2d Element Normals



Model Interaction – Mesh Control Display



- ▶ Mesh Control Symbol display
 - ▶ Size
 - ▶ Shaded
 - ▶ With Text Value



SIEMENS

Solver Language Environment

Solver Language Environment

- ▶ PLM XML definitions enable rapid change & addition of solver languages
- ▶ All Loads, Boundary Conditions, Element Types, and Solver Inputs reflect selected solution environment

Solver	Analysis Type	Solution Type
NX Nastran	Structural	SESTATIC 101 - Single Constraint SESTATIC 101 - Multiple Constraint SEMODES 103 SEMODES 103 Response - Simulation SEBUCKL 105 NLSTATIC 106 SEDFREQ 108 SEDTRAN 109 SEMFREQ 111 SEMTRAN 112 ADVNL 601, 106 ADVNL 601, 129
	Thermal	NLSCSH 153
	Axisymmetric Structural	SESTATIC 101 - Single Constraint SESTATIC 101 - Multiple Constraint NLSTATIC 106
	Axisymmetric Thermal	NLSCSH 153
Solver	Analysis Type	Solution Type
NX Nastran Design	Structural	Linear Statics - Single Constraint Thermal Linear Buckling
	Thermal	Thermal
Solver	Analysis Type	Solution Type
NX Thermal-Flow	Thermal	Thermal Advanced Thermal
	Flow	Flow
	Coupled Thermal-Flow	Advanced Flow Thermal-Flow Advanced Thermal-Flow
	Complete	Complete
	Axisymmetric Thermal	Axisymmetric Thermal Advanced Axisymmetric Thermal
	Mapping	Thermal-Flow
	Axisymmetric Mapping	Thermal
Solver	Analysis Type	Solution Type
NX Space Systems Thermal	Thermal	Space Systems Thermal
	Mapping	Thermal
Solver	Analysis Type	Solution Type
NX Electronic Systems Cooling	Coupled Thermal-Flow	Electronic Systems Cooling Advanced Electronic Systems Cooling
	Mapping	Thermal-Flow

Solver Language Environment (cont)

- ▶ Non-UGS Solver support

Solver	Analysis Type	Solution Type
MSC Nastran	Structural	SESTATIC 101 - Single Constraint SESTATIC 101 - Multiple Constraint SEMODES 103 SEBUCKL 105 NLSTATIC 106 SEDFREQ 108 SEDTRAN 109 SEMFRQ 111 SEMTRAN 112
	Thermal	NLSCSH 153
	Axisymmetric Structural	SESTATIC 101 - Single Constraint SESTATIC 101 - Multiple Constraint NLSTATIC 106
	Axisymmetric Thermal	NLSCSH 153

Solver	Analysis Type	Solution Type
ABAQUS	Structural	General Analysis
	Thermal	Heat Transfer
	Axisymmetric Structural	General Analysis
	Axisymmetric Thermal	Heat Transfer

Solver	Analysis Type	Solution Type
ANSYS	Structural	Linear Statics Modal Buckling Nonlinear Statics
	Thermal	Thermal
	Axisymmetric Structural	Linear Statics Nonlinear Statics
	Axisymmetric Thermal	Thermal

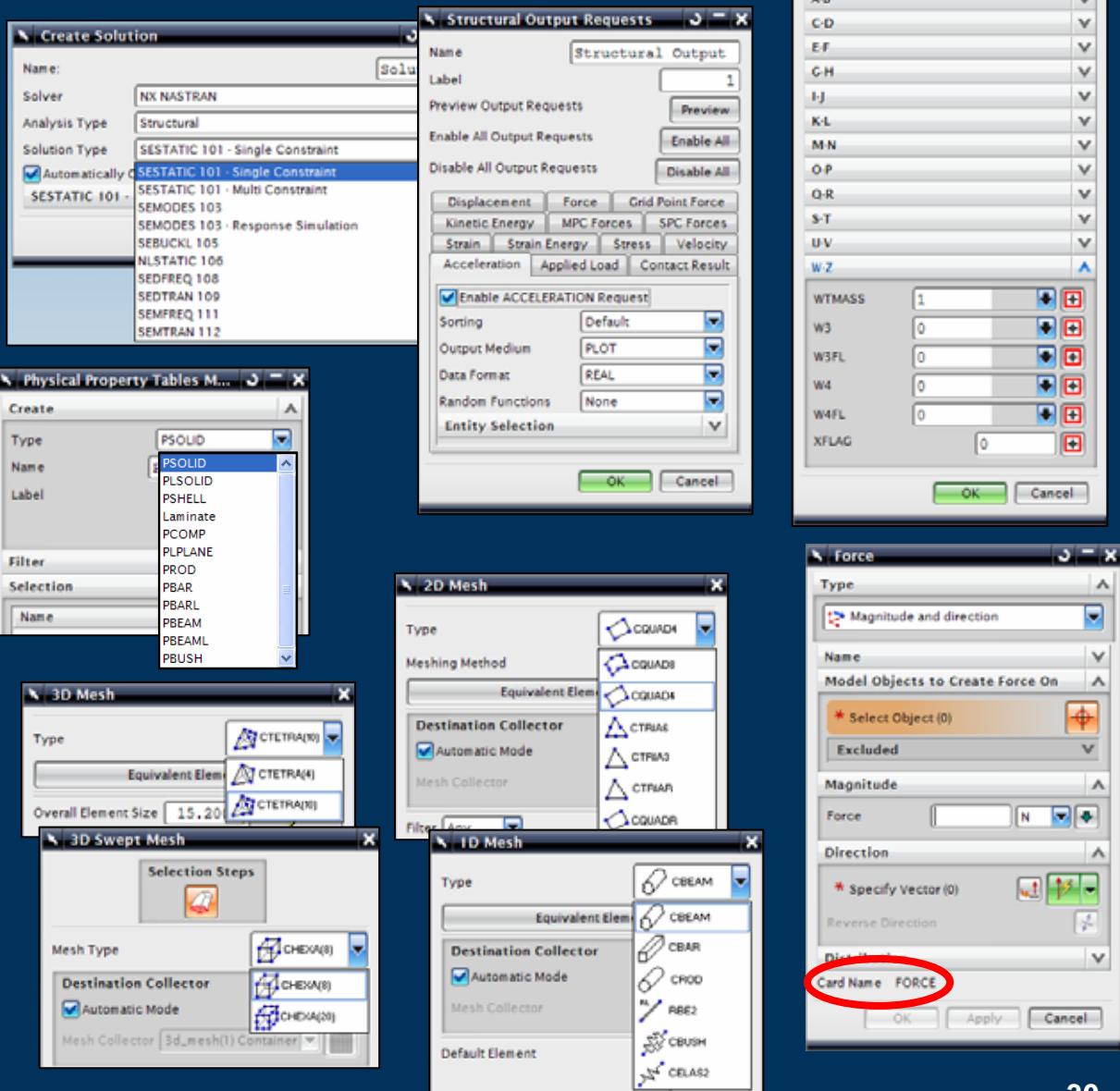
- ▶ Import of I-deas Universal file with CAE data only

Solver	Analysis Type	Solution Type
I-DEAS UNV	Universal	I-DEAS UNV

“NX Nastran Environment”

– UI Based on Solver/Solution

- ▶ Selected at FEM part file creation
 - ▶ Mesh creation
- ▶ Selected at Solution creation in SIM part
 - ▶ Solution creation and editing
 - ▶ Defines Sub-Case options



Benefits

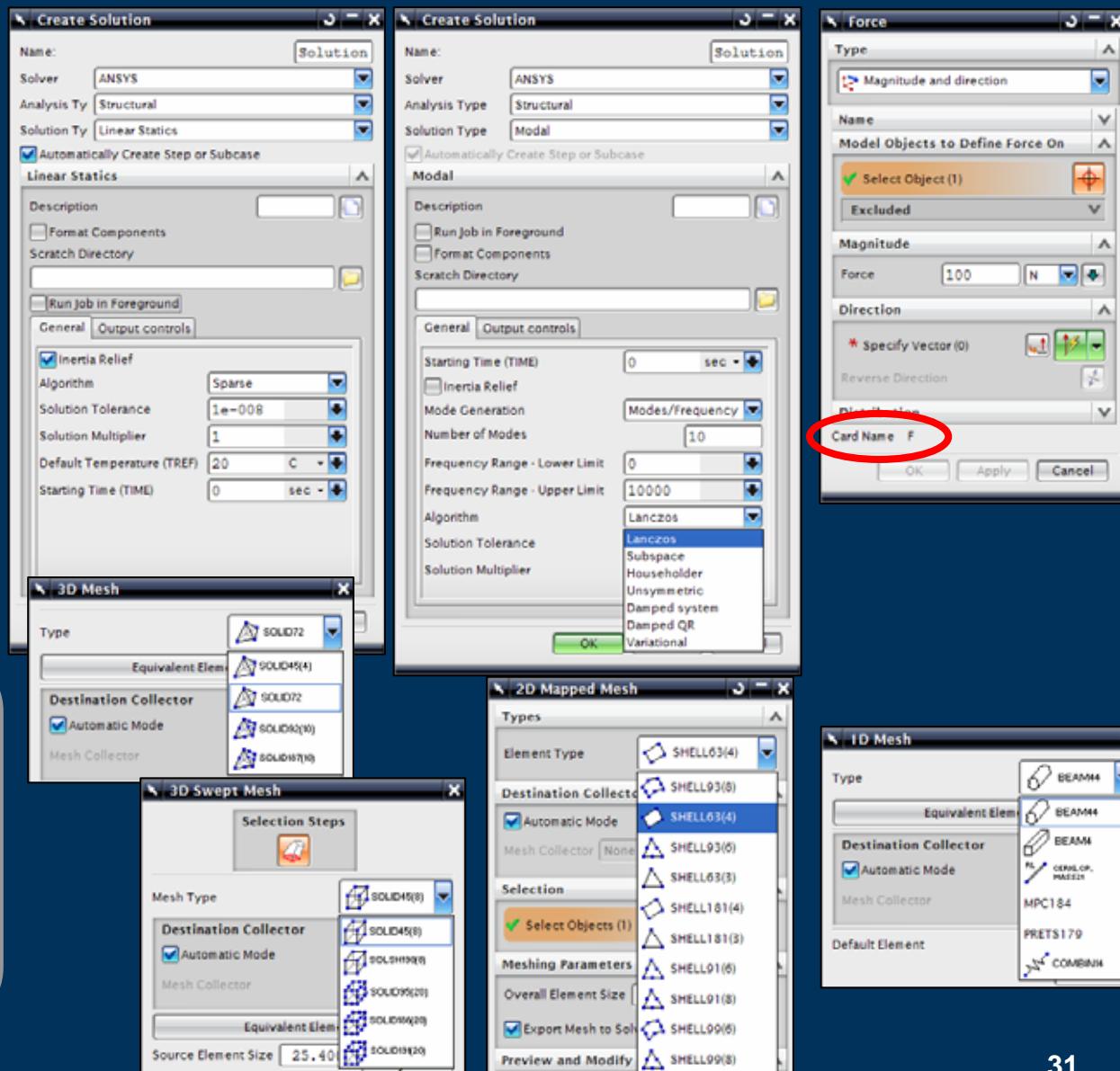
- ▶ User interface words are familiar
- ▶ Elements, Loads, Boundary Conditions etc are all in the words of the selected Solver

“ANSYS Environment”

– UI Based on Solver/Solution

SIEMENS

- ▶ Selected at FEM part file creation
 - ▶ Mesh creation
- ▶ Selected at Solution creation in SIM part
 - ▶ Solution creation and editing
 - ▶ Defines Sub-Case options



Benefits

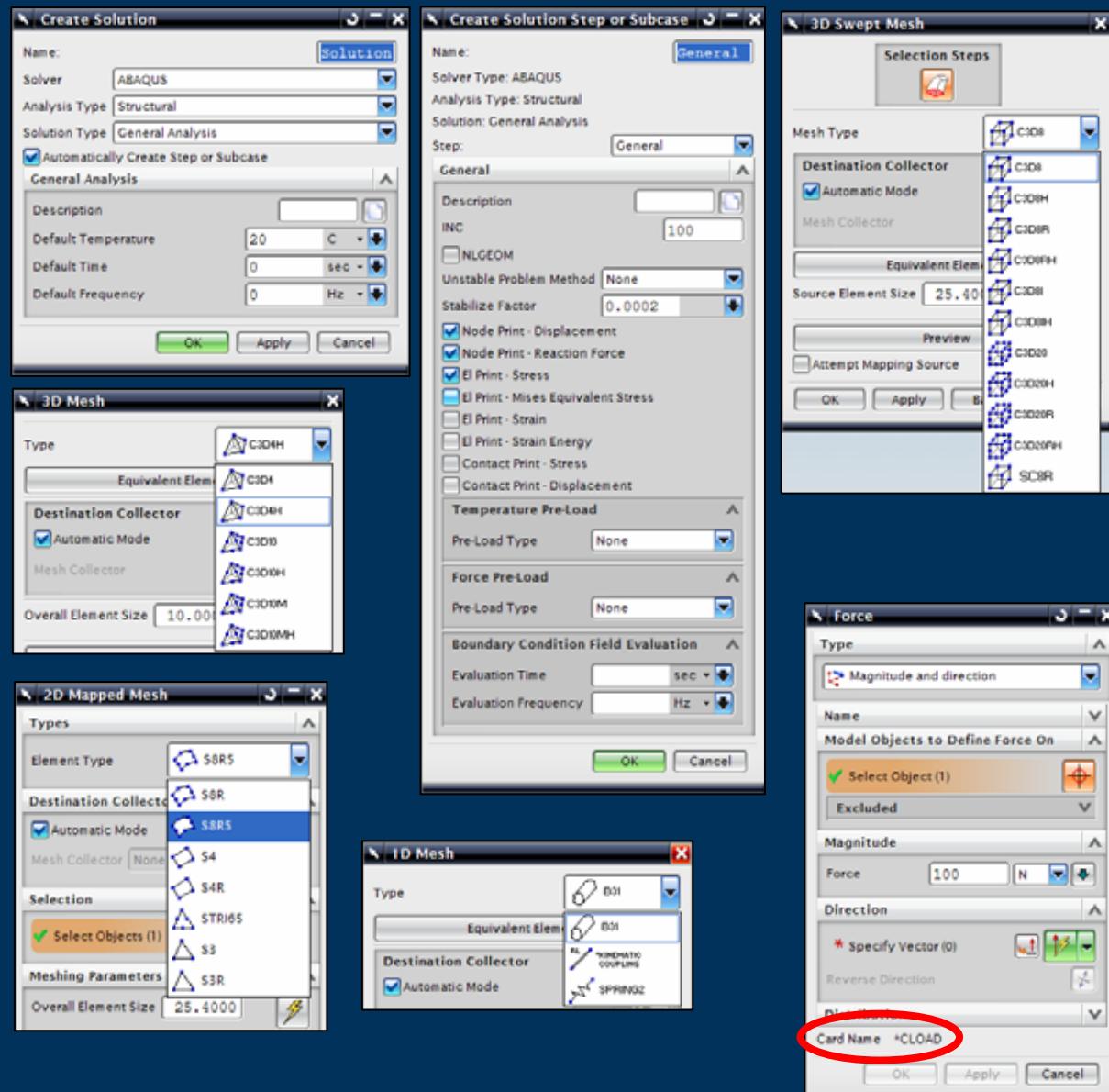
- ▶ User interface words are familiar
- ▶ Elements, Loads, Boundary Conditions etc are all in the words of the selected Solver

“ABAQUS Environment”

– UI Based on Solver/Solution

SIEMENS

- ▶ Selected at FEM part file creation
 - ▶ Mesh creation
- ▶ Selected at Solution creation in SIM part
 - ▶ Solution creation and editing
 - ▶ Defines Sub-Case options



Benefits

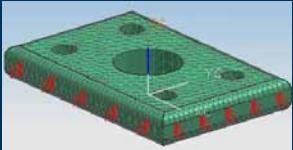
- ▶ User interface words are familiar
- ▶ Elements, Loads, Boundary Conditions etc are all in the words of the selected Solver

SIEMENS

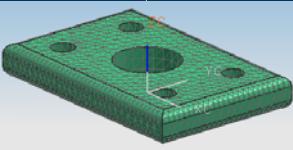
Master Part

Master Part

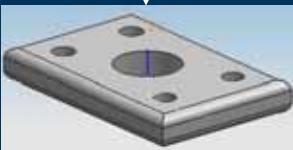
Simulation Part



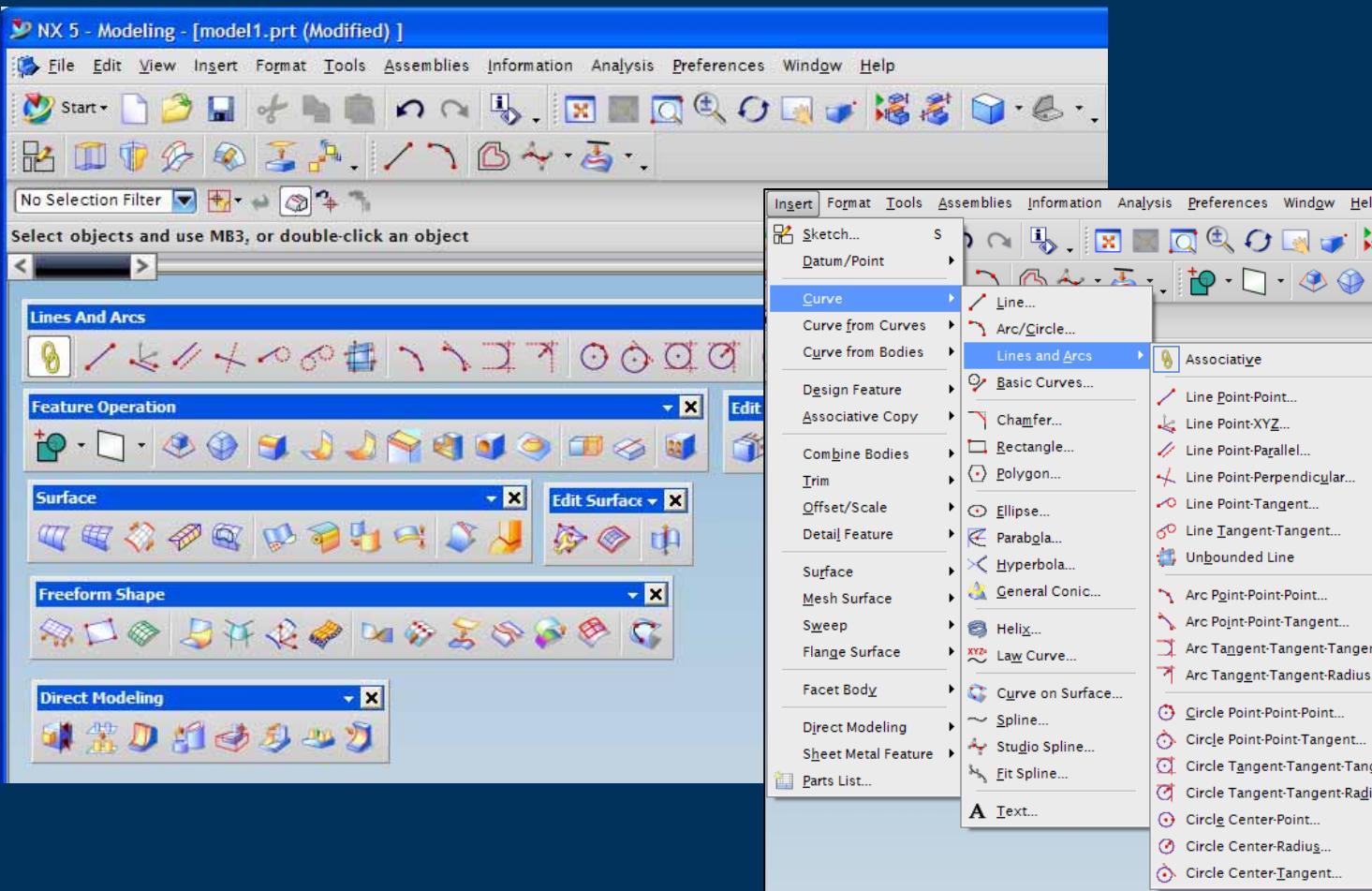
FEM Part



Master Part



- ▶ Idealized part is NOT a requirement
- ▶ Full NX CAD modelling functionality is available for building models for CAE purposes



Material Property – Library

The screenshot shows the Siemens Material Property Library interface. On the left, there's a tree view icon. The main window has a title bar 'Materials'. It contains a table for 'Category' with columns 'Material' and 'Category', listing materials like AISI_310_SS, AISI_410_SS, ALUMINUM_2014, ALUMINUM_6061, and S/STEEL_PH15-5, all categorized as METAL. Below this is a section for 'Materials Inherited' which is currently empty. To the right of the table are fields for 'Name' (AISI_310_SS), 'Category' (METAL), 'Library Reference' (18), and buttons for 'Isotropic', 'Orthotropic', 'Anisotropic', and 'Fluid'. Under 'Basic Structural' properties, there are fields for 'Mass Density' (7.92781e), 'Reference Temperature' (C), 'Young's Modulus' (TABLE), 'Poisson's Ratio' (TABLE), 'Shear Modulus' (N/mm^2(MPa)), 'Stress/Strain' (TABLE), and 'Thermal Expansion Coefficient' (TABLE). At the bottom are buttons for 'OK', 'Apply', 'Back', and 'Cancel'.



Lib Ref.	Name
2	Aluminum_2014
3	Aluminum_6061
4	Brass
5	Bronze
8	Iron_Malleable
9	Iron_Nodular
10	Iron_40
11	Iron_60
13	Steel
14	Steel_Rolled
16	S/Steel_PH15-5
17	AISI_410_SS
18	AISI_310_SS
20	Titanium_Alloy
21	Tungsten
22	Waspaloy
37	Aluminum_5086
38	Copper_C10100
39	Iron_Cast_G25
40	Magnesium_Cast
41	AISI_Steel_1008_HR
42	AISI_SS_304_Annealed
43	Titanium_Annealed
44	Aluminum_A356
45	Inconel_718_Aged
46	AISI_Steel_1005
47	AISI_Steel_4340
48	AISI_Steel_Maraging
49	Iron_Cast_G40
50	Iron_Cast_G60
51	Titanium_Ti-6Al-4V

- ▶ Import from Material Property Library
 - ▶ Metals
 - ▶ Plastics
 - ▶ Isotropic
 - ▶ Orthotropic
 - ▶ Anisotropic
 - ▶ Fluids
- ▶ Assign to Parts
- ▶ Create new based on existing materials

Material Properties

Isotropic	Orthotropic	Anisotropic	Fluid
Basic Structural			
Mass Density	7.92781e []	kg/mm^3 []	[]
Reference Temperature	<input type="text"/>	C []	[]
Young's Modulus	TABLE []	mN/mm^2(kPa) []	[]
Poisson's Ratio	TABLE []	[]	[]
Shear Modulus	<input type="text"/> []	N/mm^2(MPa) []	[]
Stress/Strain	<input type="text"/> []	[]	[]
Thermal Expansion Coefficient	TABLE []	[]	1/C []
Strength			
Thermal			[]
Electrical			[]
Durability			[]

Isotropic	Orthotropic	Anisotropic	Fluid
Thermal Expansion Coefficient TABLE []			
1/C []			
Strength			
Yield Strength	TABLE []	mN/mm ² (kPa) []	
Ultimate Tensile Strength	TABLE []	mN/mm ² (kPa) []	
Max Allowable Stress in Tension	[]	N/mm ² (MPa) []	
Max Allowable Stress in Compression	[]	N/mm ² (MPa) []	
Max Allowable In plane Shear Stress	[]	N/mm ² (MPa) []	
Max Allowable Strain in Tension	[]		
Max Allowable Strain in Compression	[]		
Max Allowable In plane Shear Strain	[]		
Tsai-Wu Interaction Coefficient (F12)	[]	mm ⁴ /N ² []	
Thermal			
Thermal Conductivity	TABLE []	microW/mm·C []	
Specific Heat	5e+008 []	microJ/kg·K []	
Latent Heat	[]	J/kg []	

	X	Y	Z	Unit
Young's Modulus	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/> N/mm ² (MPa) <input type="button" value="▼"/>
Poisson's Ratio	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Shear Modulus	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/> N/mm ² (MPa) <input type="button" value="▼"/>
Thermal Expansion Coefficient	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/> 1/C <input type="button" value="▼"/>
Thermal Conductivity	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/> W/mm·C <input type="button" value="▼"/>
Max Stress in Tension	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/> N/mm ² (MPa) <input type="button" value="▼"/>
Max Stress in Compression	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/> N/mm ² (MPa) <input type="button" value="▼"/>
Max Strain in Tension	<input type="text"/>	<input type="text"/>	<input type="text"/>	
Max Strain in Compression	<input type="text"/>	<input type="text"/>	<input type="text"/>	

Isotropic		Orthotropic		Anisotropic		Fluid				
Mass Density	<input type="text"/>	<input type="button" value="..."/>	kg/mm ³	<input type="button" value="..."/>						
Reference Temperature	<input type="text"/>		C	<input type="button" value="..."/>						
Specific Heat	<input type="text"/>		J/kg·K	<input type="button" value="..."/>						
Material Moduli	<input type="text"/> N/mm ² (MPa)		<input type="button" value="..."/>	1	2	3	4	5	6	
1	<input type="text"/>	<input type="button" value="..."/>								
2	<input type="text"/>	<input type="button" value="..."/>								
3	<input type="text"/>	<input type="button" value="..."/>	<input type="text"/>	<input type="button" value="..."/>						
4	<input type="text"/>	<input type="button" value="..."/>	<input type="text"/>	<input type="button" value="..."/>	<input type="text"/>	<input type="button" value="..."/>				
5	<input type="text"/>	<input type="button" value="..."/>	<input type="text"/>	<input type="button" value="..."/>	<input type="text"/>	<input type="button" value="..."/>	<input type="text"/>	<input type="button" value="..."/>		
6	<input type="text"/>	<input type="button" value="..."/>	<input type="text"/>	<input type="button" value="..."/>	<input type="text"/>	<input type="button" value="..."/>	<input type="text"/>	<input type="button" value="..."/>	<input type="text"/>	<input type="button" value="..."/>
Thermal Expansion Coefficient	<input type="text"/> 1/C		<input type="button" value="..."/>	1	2	3	4	5	6	
1	<input type="text"/>	<input type="button" value="..."/>	<input type="text"/>	<input type="button" value="..."/>	<input type="text"/>	<input type="button" value="..."/>	<input type="text"/>	<input type="button" value="..."/>	<input type="text"/>	<input type="button" value="..."/>
Thermal Conductivity	<input type="text"/> W/mm·C		<input type="button" value="..."/>							

Mass Density	<input type="text" value="7.92781e-05"/> kg/mm ³
Reference Temperature	<input type="text"/>
Young's Modulus	<input type="text"/> TABLE
Poisson's Ratio	<input type="text"/> TABLE
Shear Modulus	<input type="text"/>

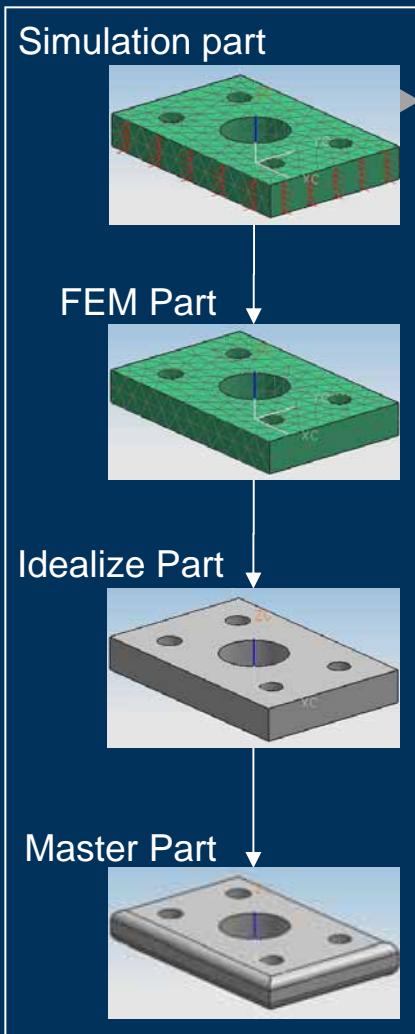
Temperature	Thermal Expansion Coefficient
93.33	1.512e-005
107.22	1.5192e-005
121.11	1.5264e-005
135	1.5336e-005
148.89	1.539e-005
162.78	1.5462e-005
176.67	1.5534e-005
190.56	1.5588e-005
204.44	1.564e-005
218.33	1.5732e-005
232.22	1.5786e-005

- ▶ Constant Values
 - ▶ Variable Values defined by a Table
 - ▶ Units selection
 - ▶ Adding new materials to the Library is documented in the on-line help

SIEMENS

Idealize Part

Idealize Part



Uses of the Idealize part

- ▶ Read only Master Part
 - ▶ Therefore can not change the Master Part geometry
 - ▶ Vital in a Managed Environment
- ▶ “What If” exploration or studies based on the same Master Part
- ▶ Geometry Reduction or Abstraction
- ▶ Additional Geometry or Datums

Benefits

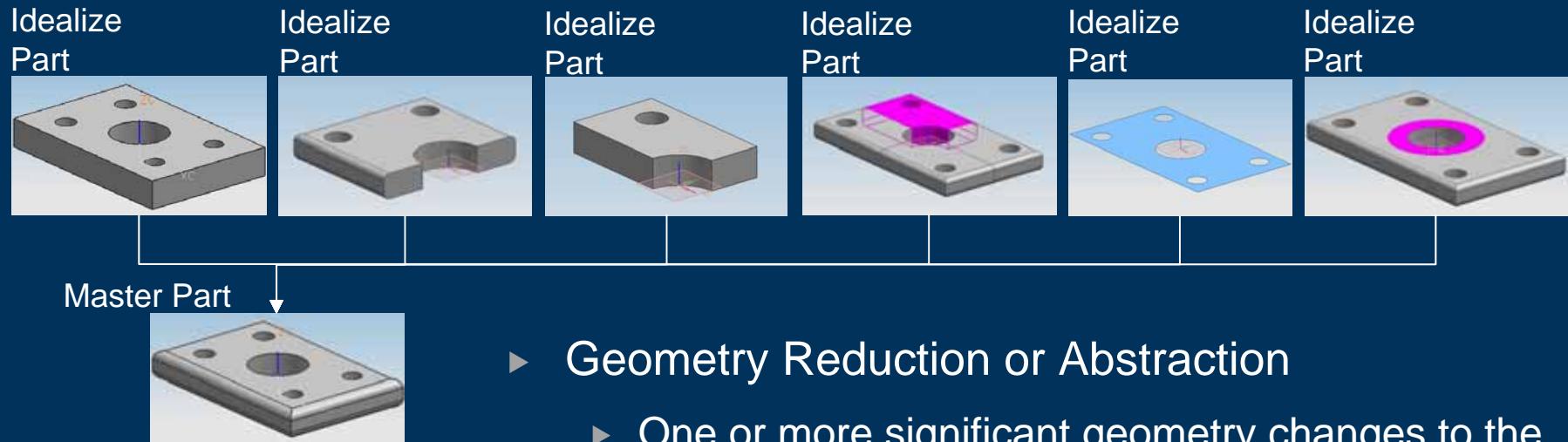
- ▶ Support Concurrent Engineering
- ▶ Associativity to Master Model

Uses of the Idealize part



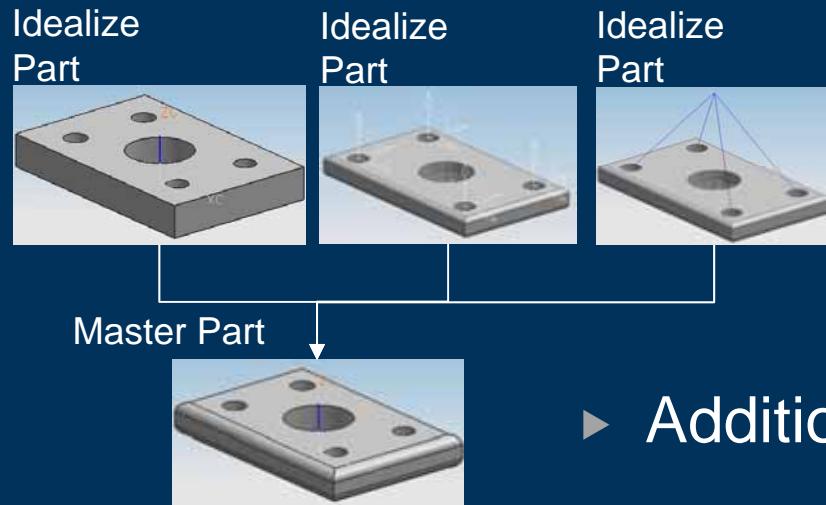
- ▶ “What If” exploration or studies based on the same Master Part
 - ▶ Removing geometry
 - ▶ By type and size – Holes and Blends
 - ▶ By selection – Auto saved methods for updates
 - ▶ Adding Additional Modelling features, holes, blends, chamfers, ribs, bosses etc
 - ▶ Different materials from the Master Part

Uses of the Idealize part



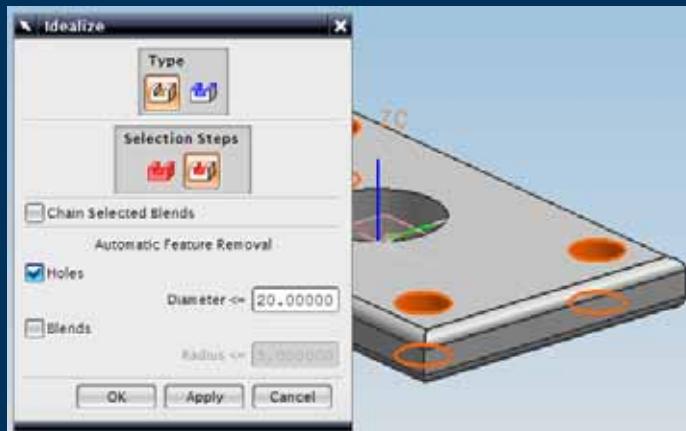
- ▶ Geometry Reduction or Abstraction
 - ▶ One or more significant geometry changes to the Master Part
 - ▶ Symmetric, Asymmetric or Axisymmetric models
 - ▶ Mid-Surface
 - ▶ Partition or Surface Splitting
 - ▶ Load/Restraint Application
 - ▶ Local mesh control
 - ▶ Mesh Mating condition – common mesh across boundary

Uses of the Idealize part

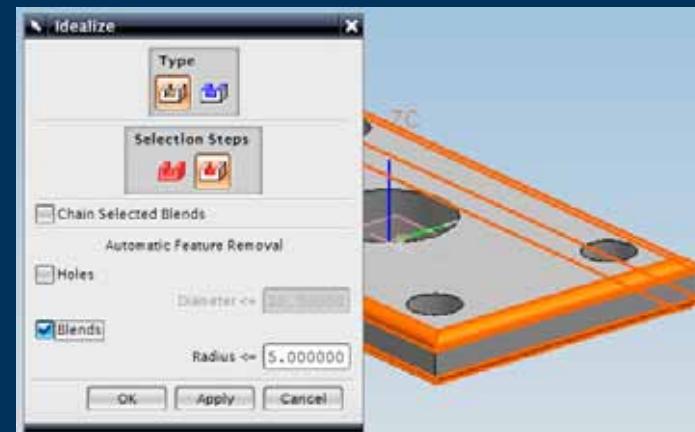


- ▶ Additional Geometry
 - ▶ Datums like Coordinate Systems
 - ▶ Curves and points to place FEM entities
- ▶ Lumped Mass
- ▶ Rigid Elements

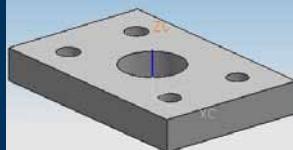
Idealize Part – Idealize



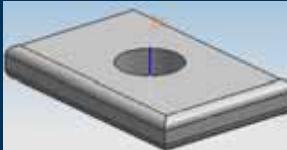
- ▶ Removing Holes and Blends
 - ▶ Based on their size
 - ▶ Manual selection



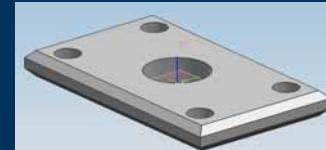
Idealize
Part



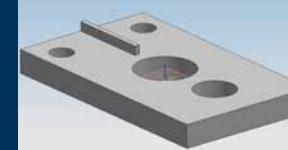
Idealize
Part



Idealize
Part



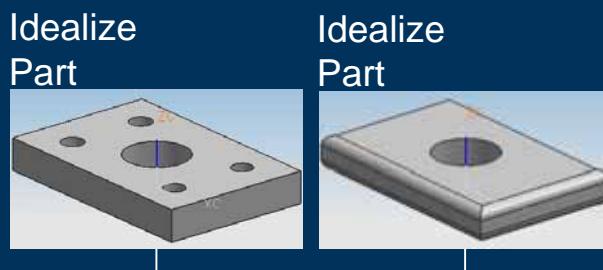
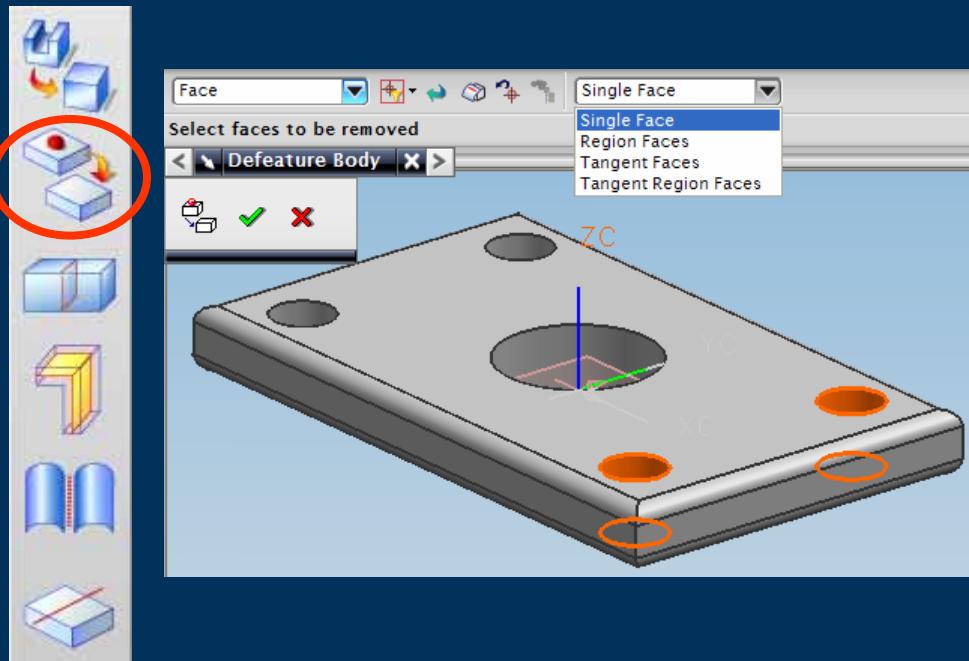
Idealize
Part



Master Part



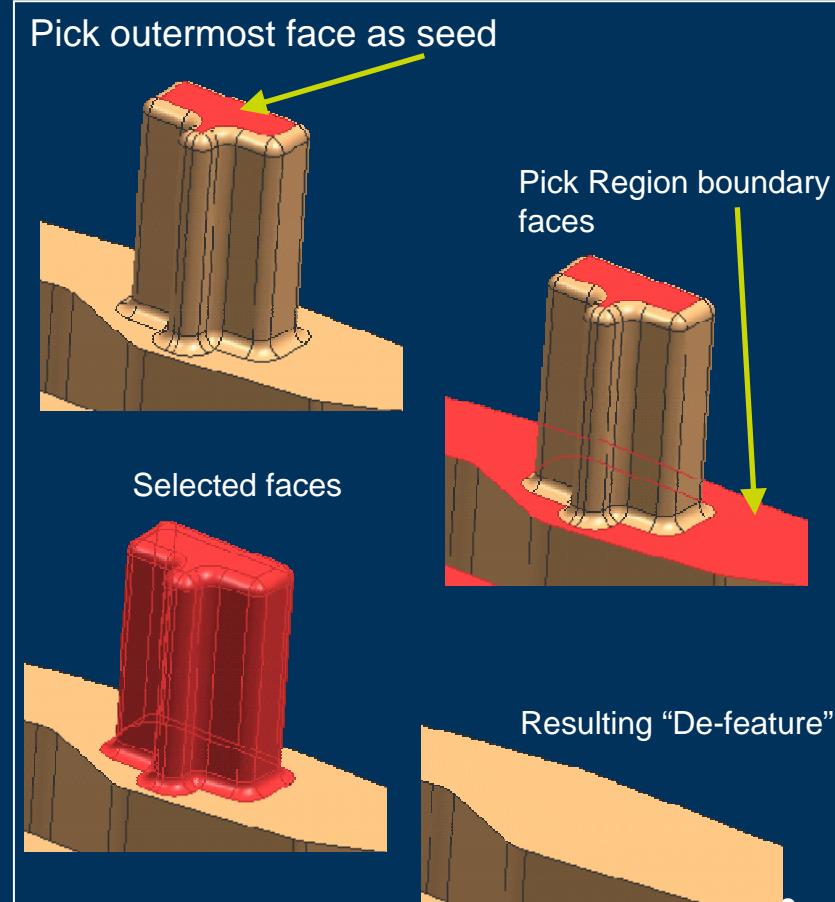
Idealize Part – Defeature Geometry



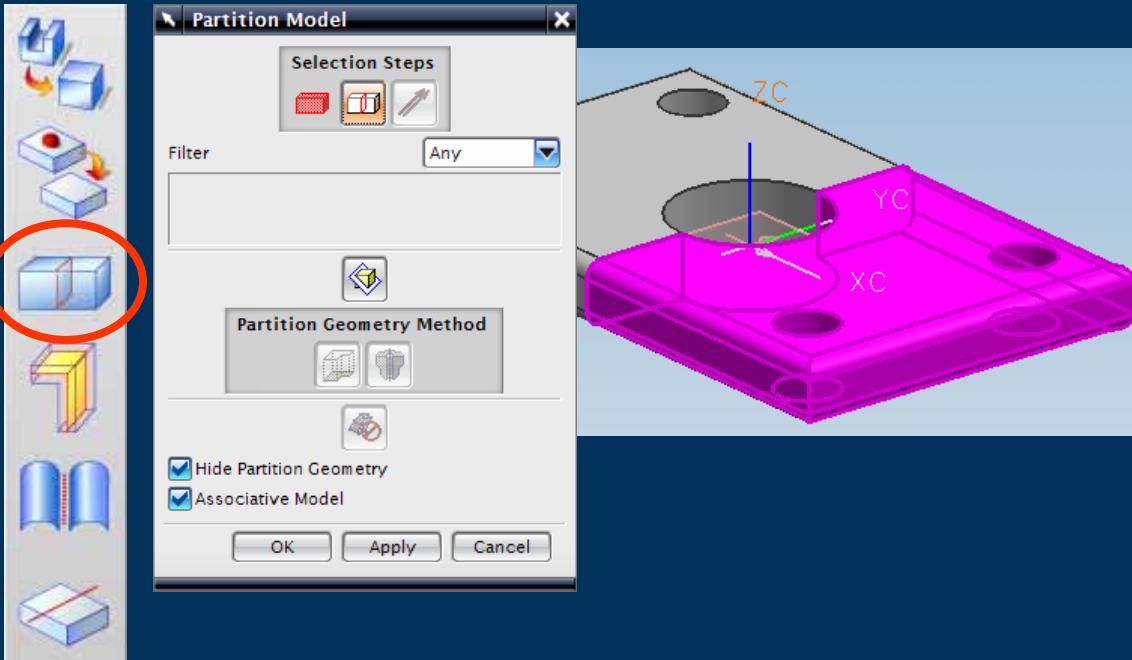
Master Part



- ▶ Removing Geometry by Selection
- ▶ Method saved for Update replays

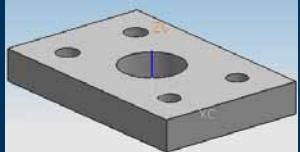


Idealize Part – Partition

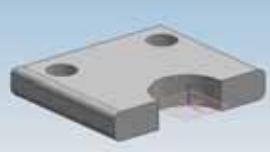


- ▶ Cutting part(s) into multiple volumes that share common faces
- ▶ Cutting part(s) into multiple surface patches that share common edges
- ▶ Load/Restraint Application
- ▶ Local mesh control
- ▶ Mesh Mating condition – common mesh across boundary
- ▶ Associative or Non-Associative to model

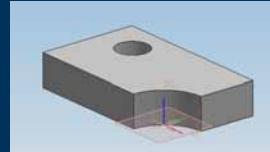
Idealize
Part



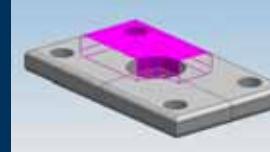
Idealize
Part



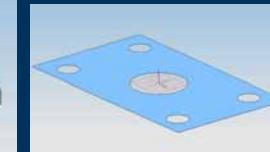
Idealize
Part



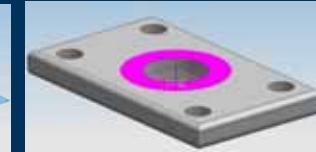
Idealize
Part



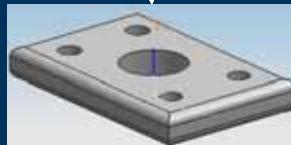
Idealize
Part



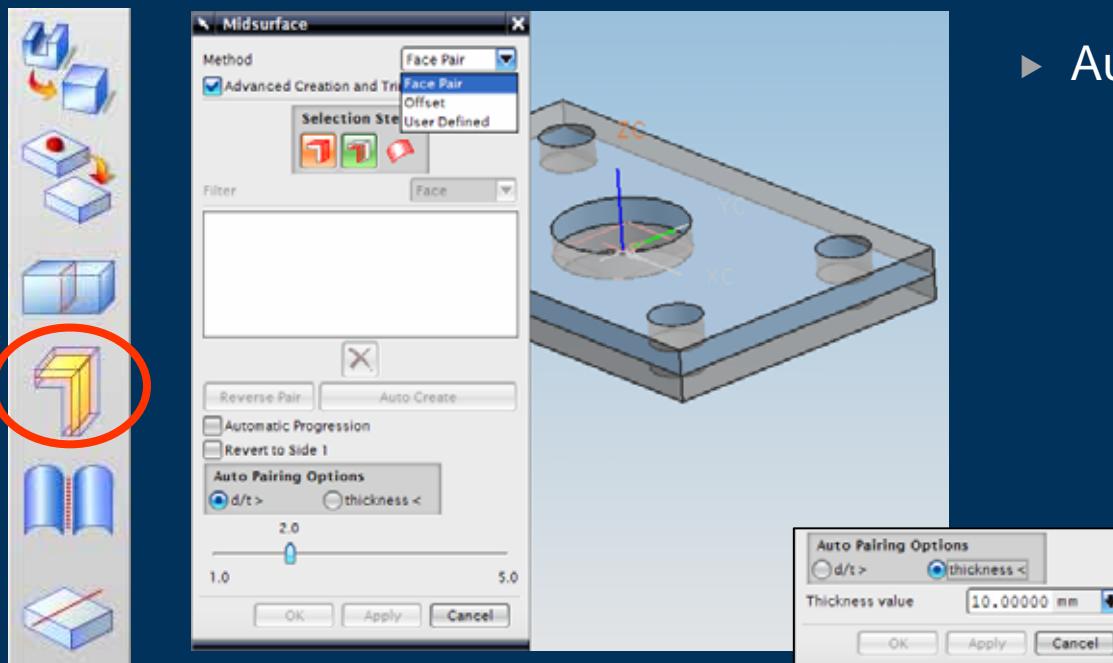
Idealize
Part



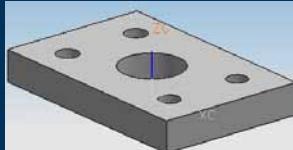
Master Part



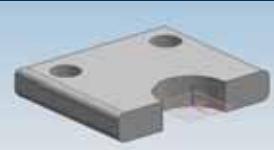
Idealize Part – Midsurface



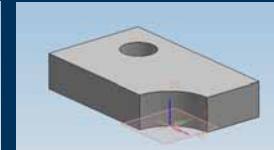
Idealize Part



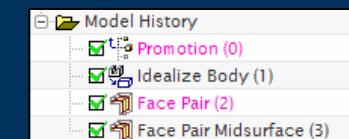
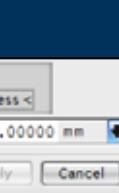
Idealize Part



Idealize Part



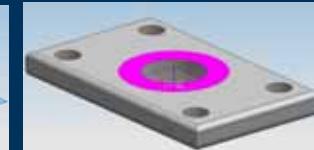
- ▶ Automatic Midsurface generation
 - ▶ Face Pair technique
 - ▶ Offset technique
 - ▶ Using another Sheet Body to define the Midsurface
 - ▶ Proportional Thickness or Specific value



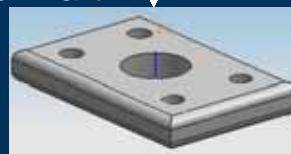
Idealize Part



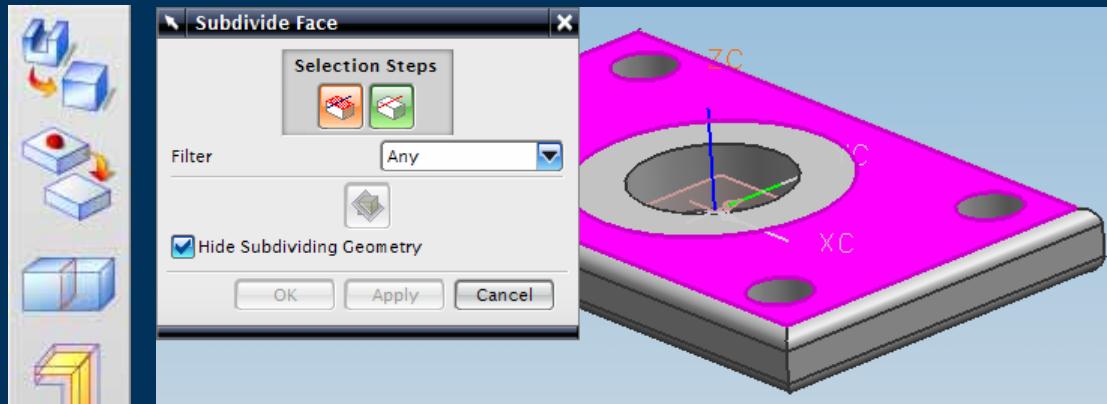
Idealize Part



Master Part

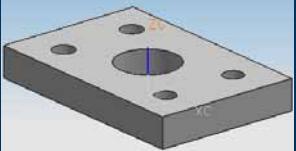
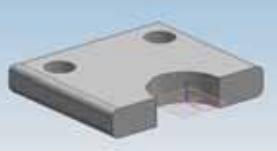
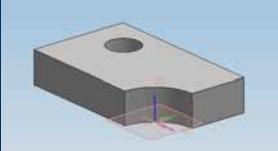
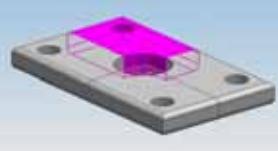
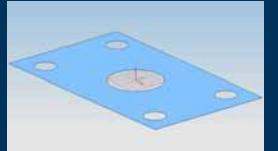
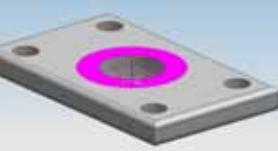


Idealize Part – Subdivide Faces



The screenshot shows the Siemens NX software interface. On the left, there is a vertical toolbar with various icons. One icon, which is a cube with diagonal lines, is circled in red. To its right, the main workspace displays a 3D model of a mechanical part. A dialog box titled "Subdivide Face" is open, showing "Selection Steps" and a "Filter" set to "Any". There is also a checked option "Hide Subdividing Geometry". The 3D model features a circular feature with a center point and coordinate axes (XC, YC, ZC) overlaid.

- ▶ Subdividing Faces
 - ▶ Intersection of Datum Planes
 - ▶ Intersection of Faces
 - ▶ Projected Curves and Edges
 - ▶ Projected Line between 2 points
- ▶ Load/Restraint Application
- ▶ Local mesh control

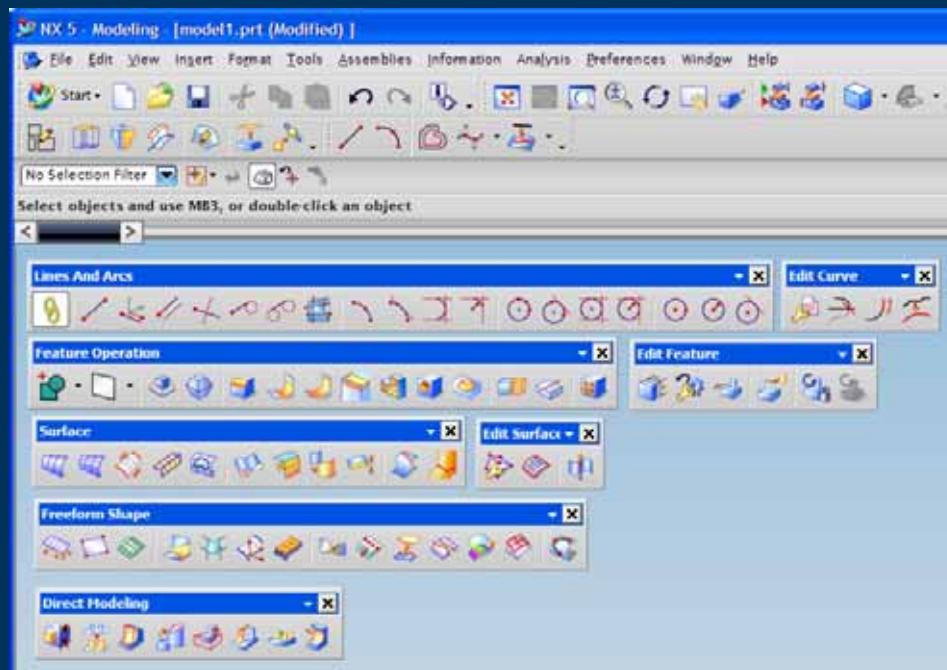
Idealize Part	Idealize Part	Idealize Part	Idealize Part	Idealize Part	Idealize Part
					

Master Part

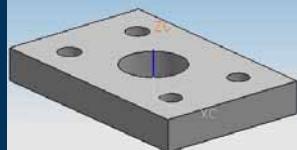


46

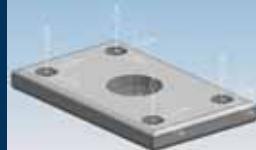
Idealize Part – Additional Modelling



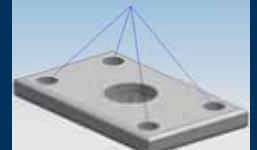
Idealize Part



Idealize Part



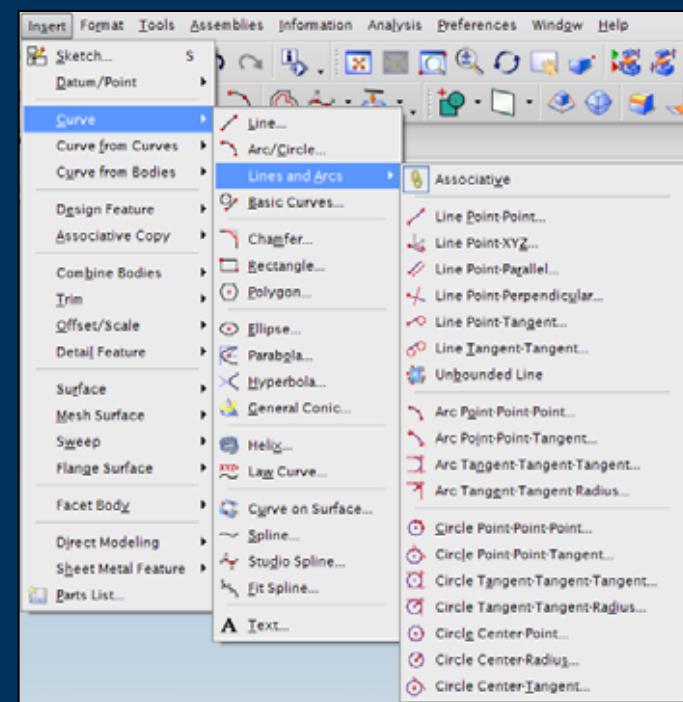
Idealize Part



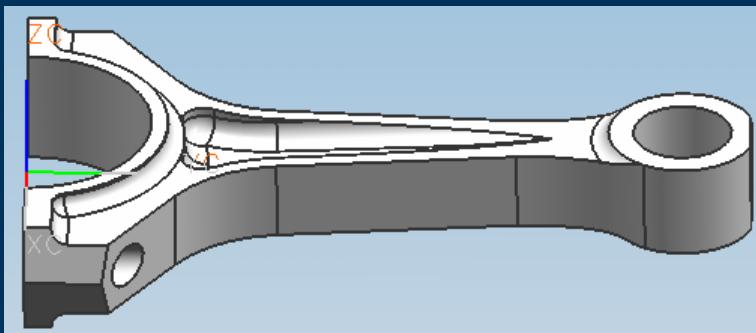
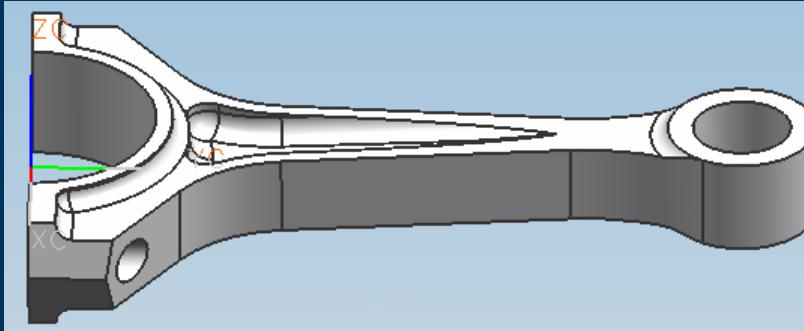
Master Part



- ▶ All modelling functionality is available
- ▶ Datums, curves, holes, blends, chamfers, ribs, bosses, surfaces, solids etc etc

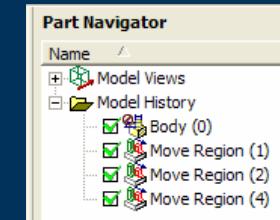
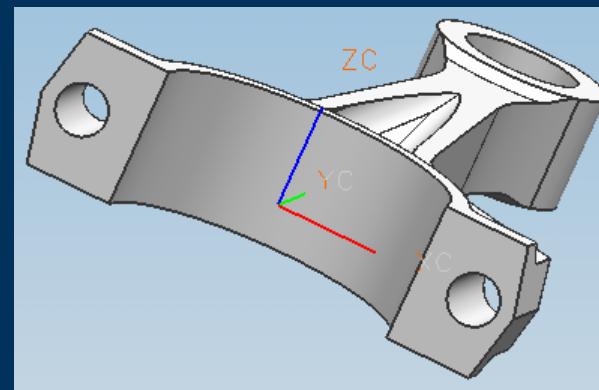
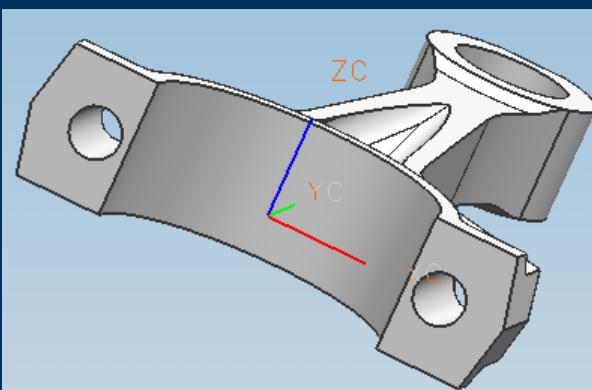


Idealize Part – Direct Modelling



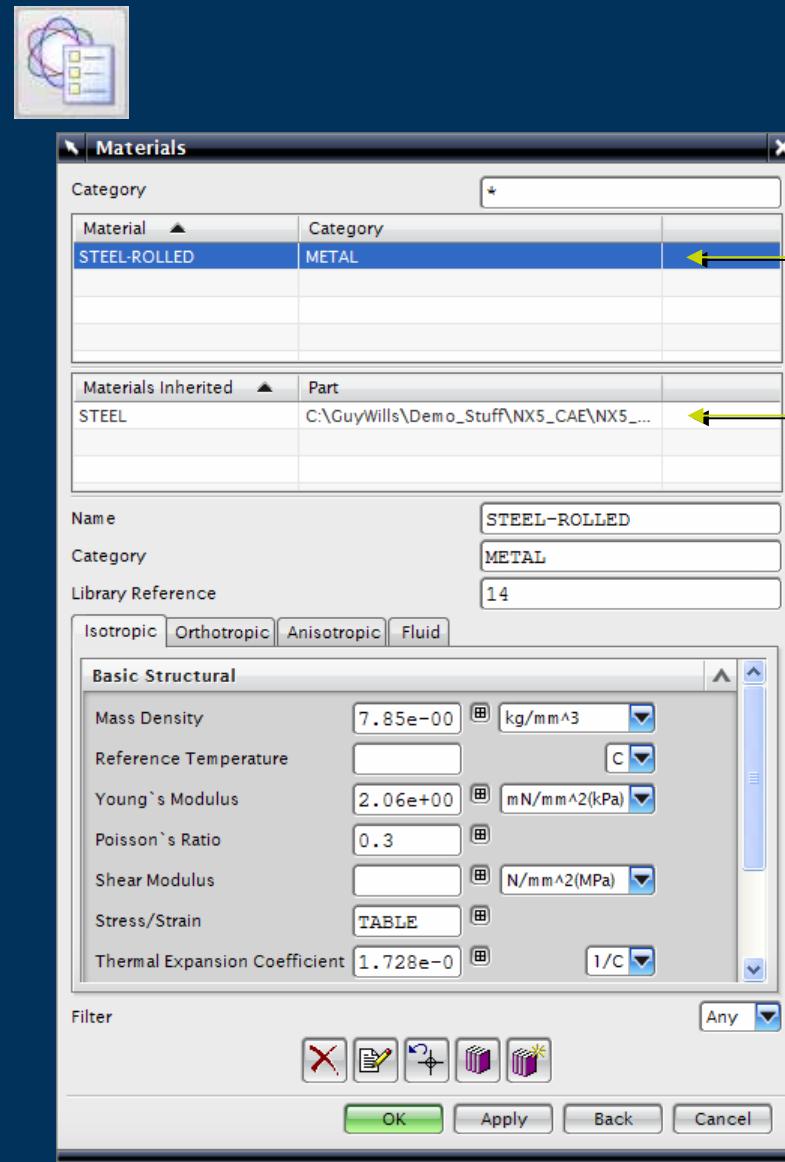
Little End Moved

- ▶ Direct Modelling (DMX)
- ▶ Editing parts with no CAD features – Imported geometry
- ▶ Surrounding BREP updated – Tangency maintained
- ▶ Surfaces Resized – Fillets
- ▶ Surfaces Replaced



Bolt Holes moved

Idealize Part – Material Properties



Override Material

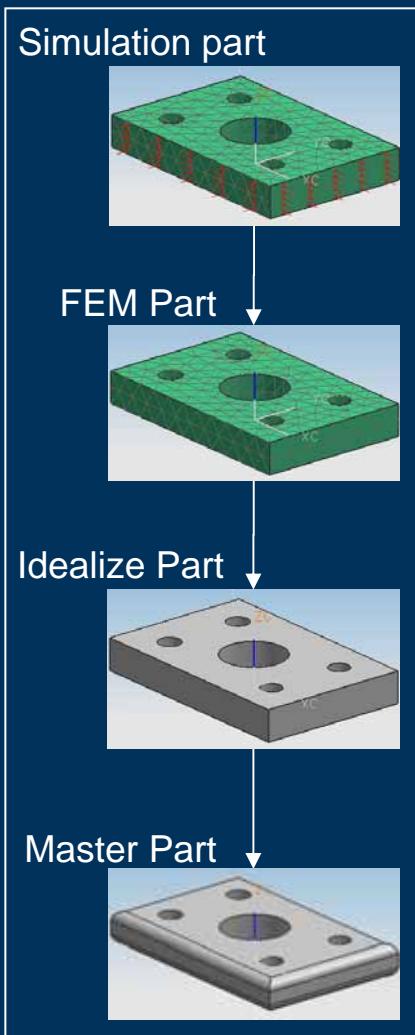
Master Part Material

- ▶ Set the Material Properties of the body(s) different from the Master Part
- ▶ “What If ” studies of different materials

SIEMENS

FEM Part

FEM Part



- ▶ Uses of the FEM part
 - ▶ Geometry Abstraction – CAE Topology
 - ▶ Model Organisation using Collectors
 - ▶ Meshing
 - ▶ Automatic
 - ▶ Manual
 - ▶ Mesh Connections
 - ▶ Model Checking

NX Advanced Simulation : CAE Topology

► CAE Topology

► What is it?

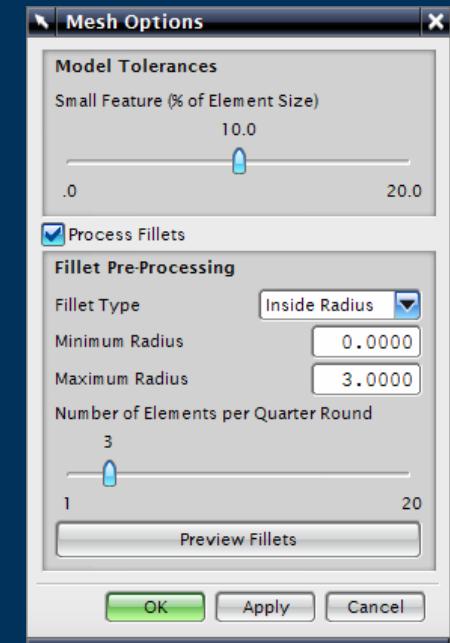
- An abstracted layer of CAE specific topology with CAE specific modeling tools, over and above that provided by CAD
- Initially one polygon face is created for each CAD face

► What does it do?

- Automatically simplifies geometry by removing irregular and tiny features to allow effective CAE meshing
- Fully Manual through to a Fully Automatic process. Best practise is a mix of Manual and Automatic simplification

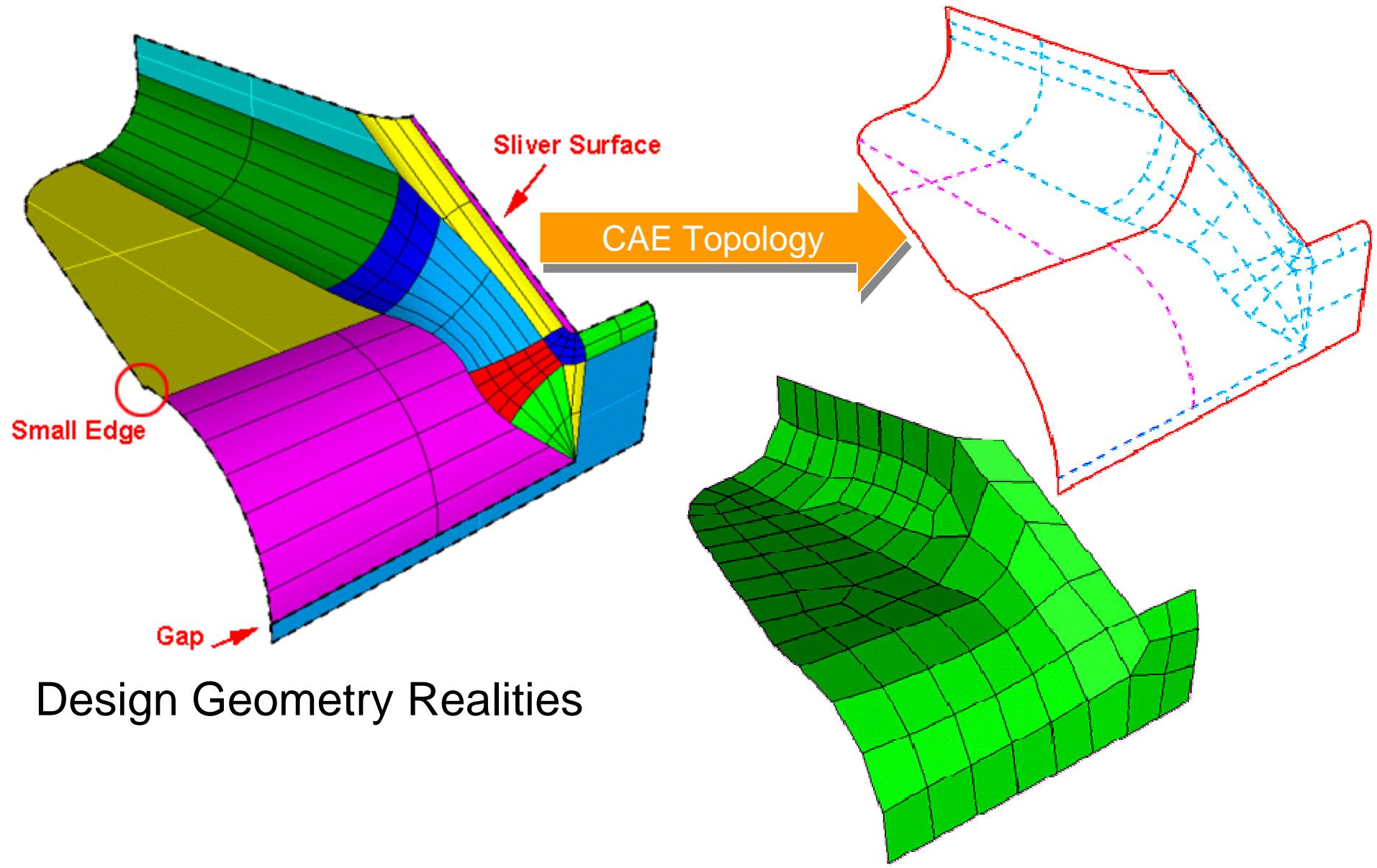
► Why is it valuable?

- Reduces the time to mesh and the number of elements generated (reducing solve time) while improving element quality and results accuracy

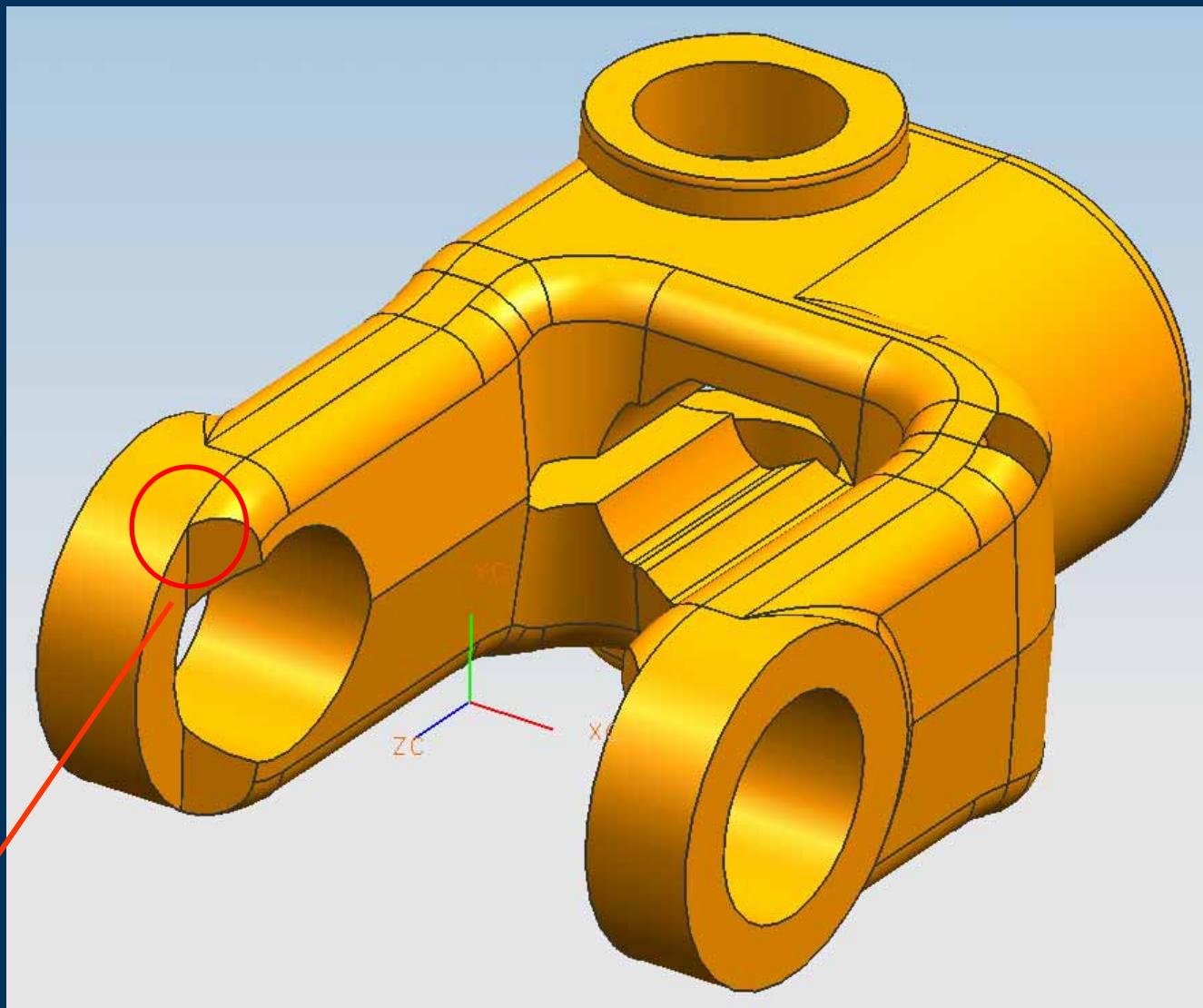


NX CAE Topology

– Geometric Abstraction and Meshing

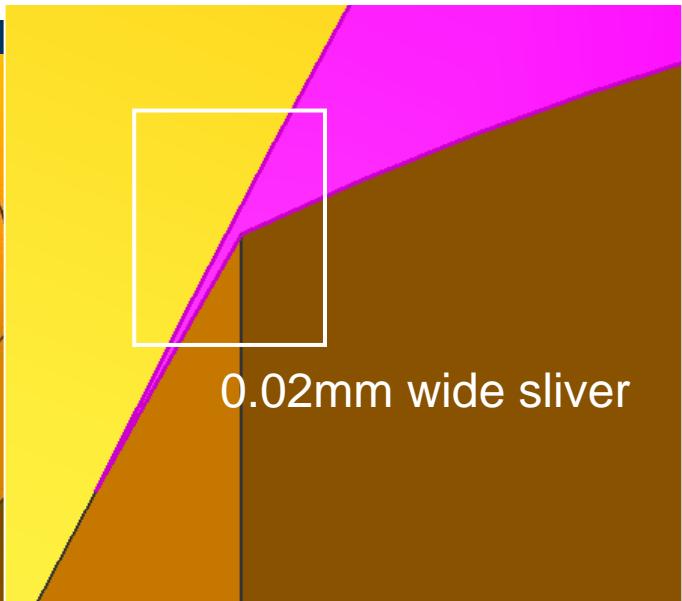
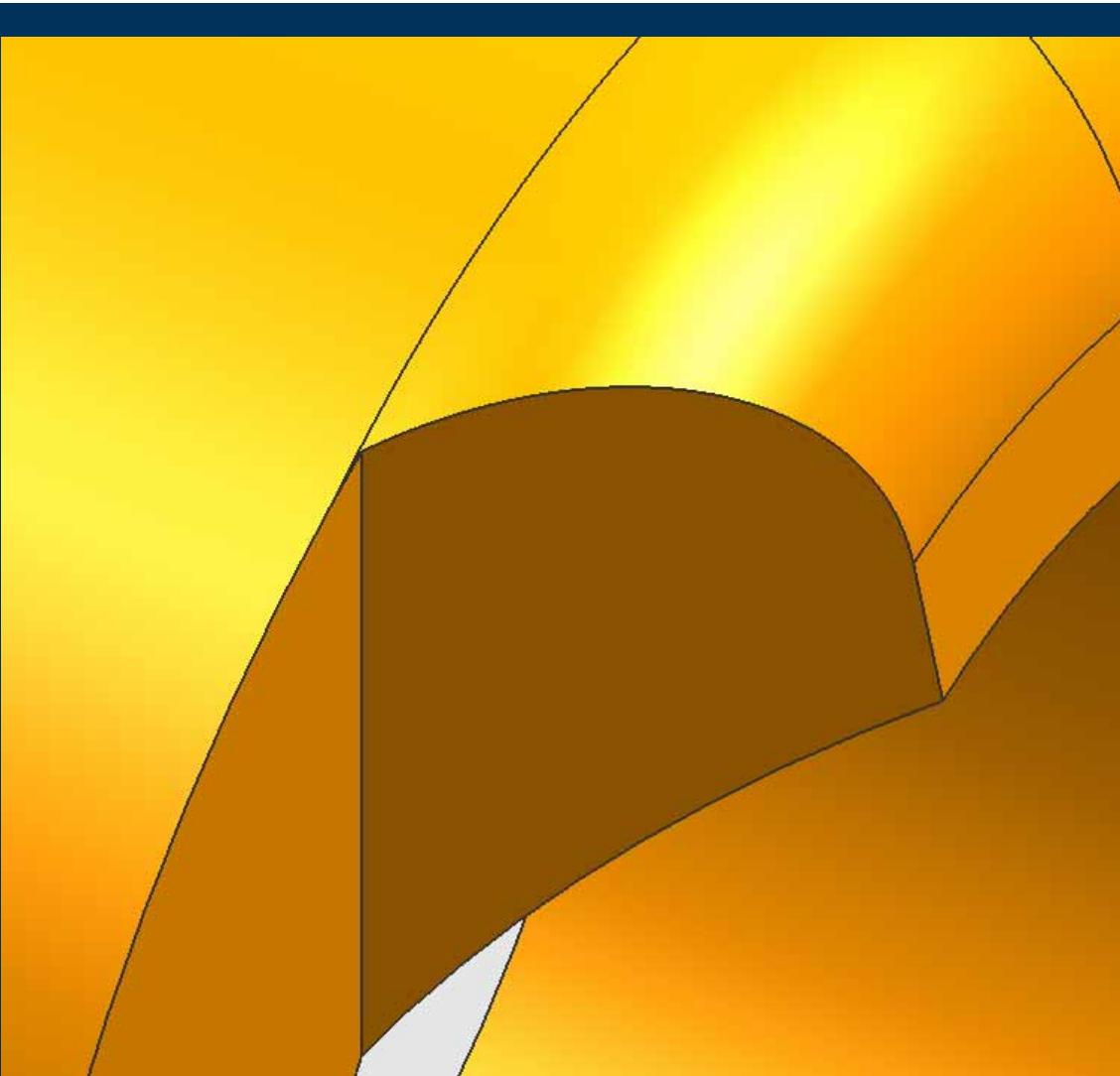


NX CAE Topology

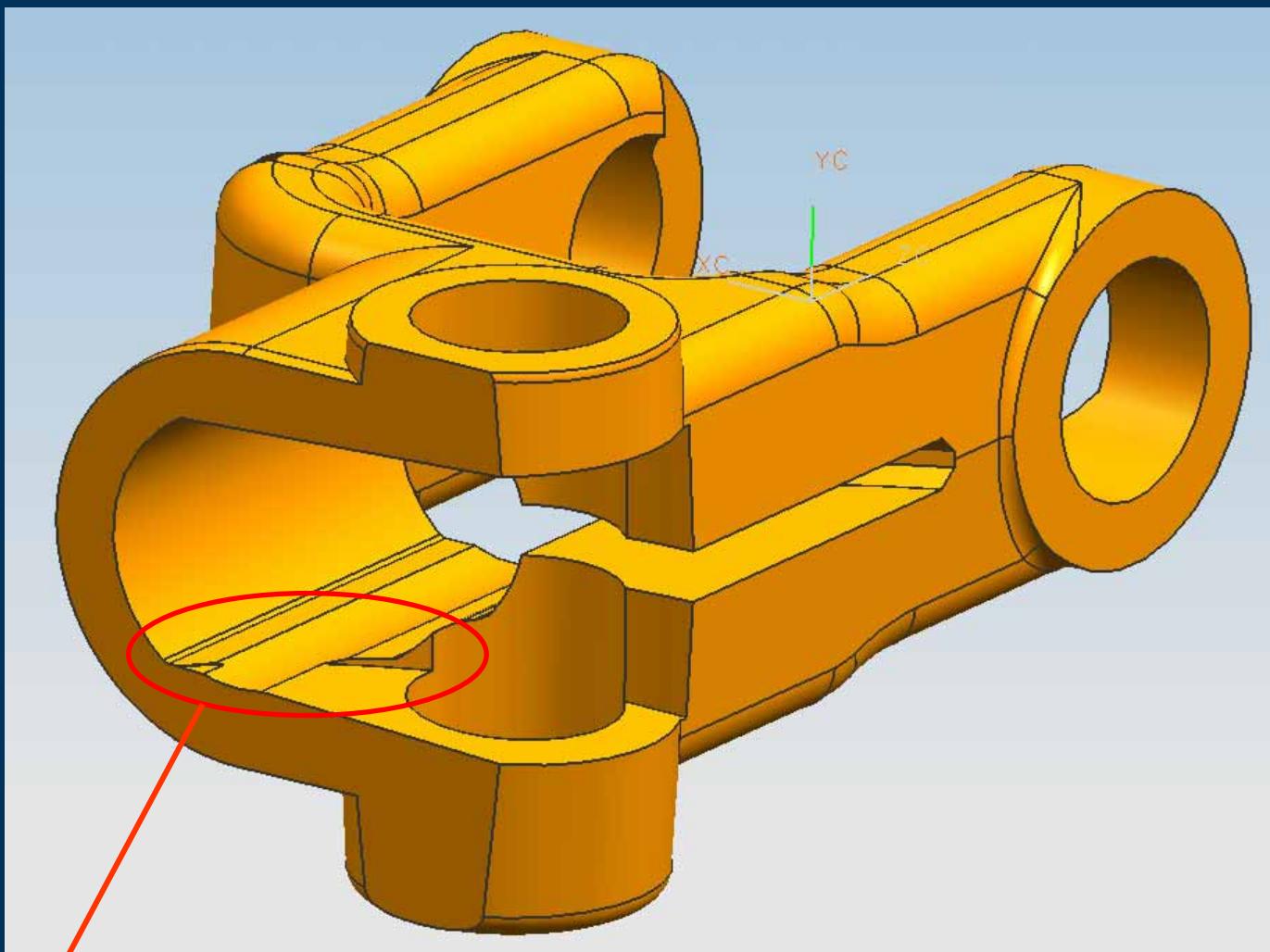


Issues

NX CAE Topology



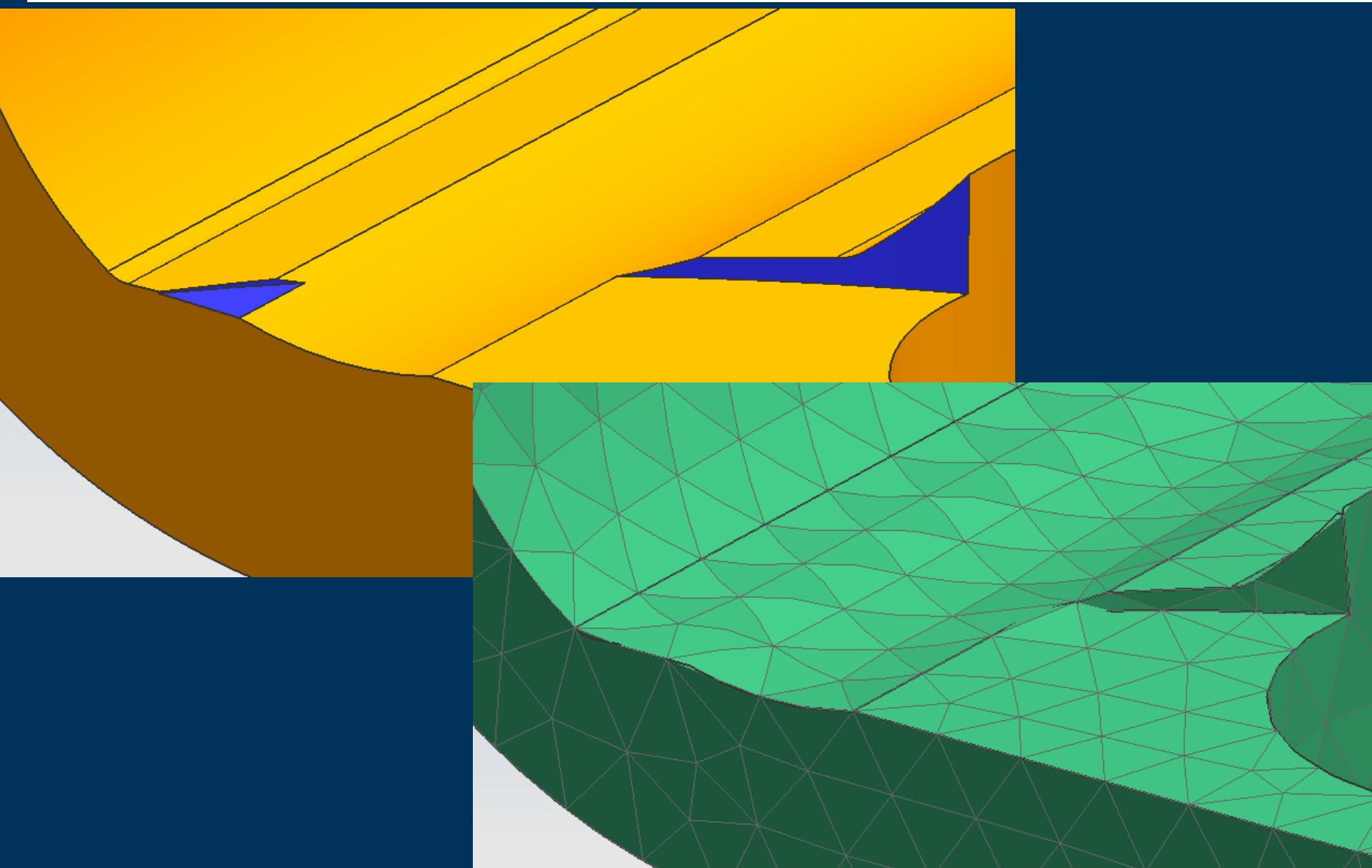
NX CAE Topology



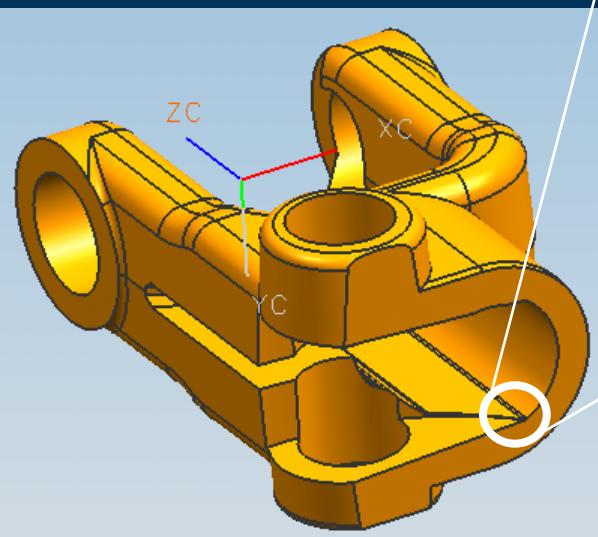
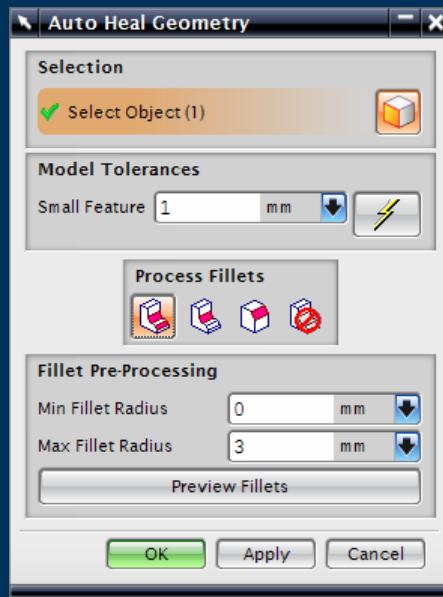
Issues

SIEMENS

NX CAE Topology



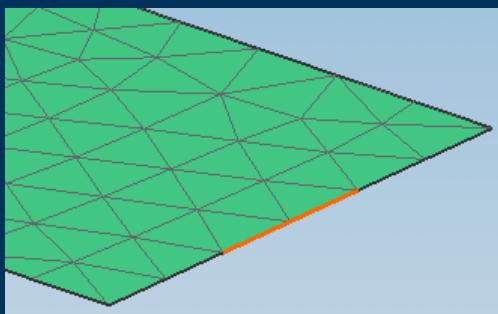
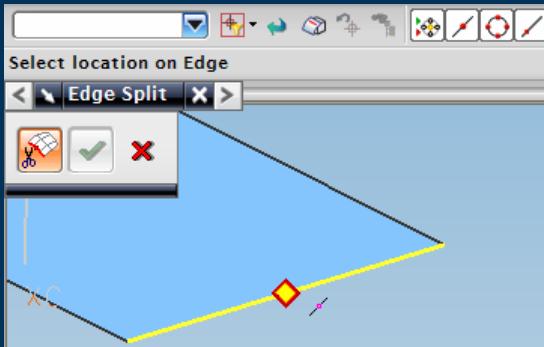
NX CAE Topology – Auto Heal



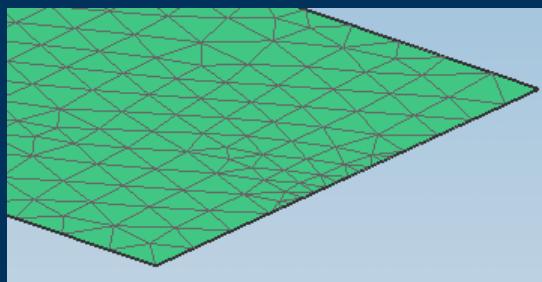
- ▶ Healing of CAE Topology
 - ▶ Selected faces
 - ▶ Complete model
 - ▶ Auto calculation of “Small Feature” value
 - ▶ Also removes sharp sliver like corners



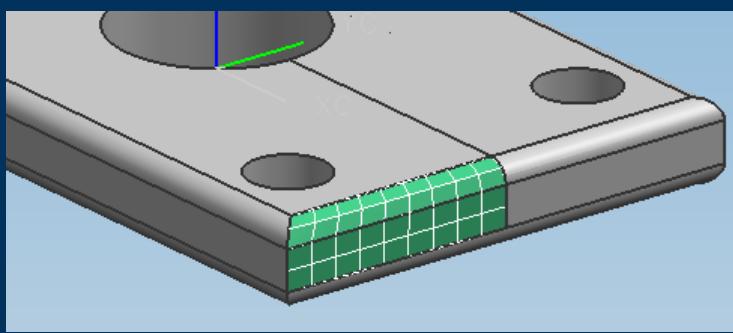
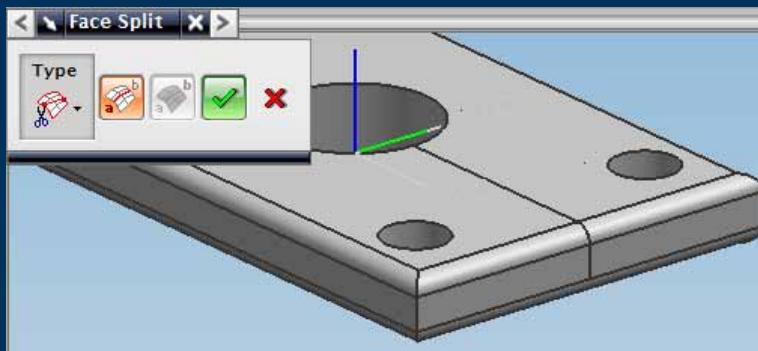
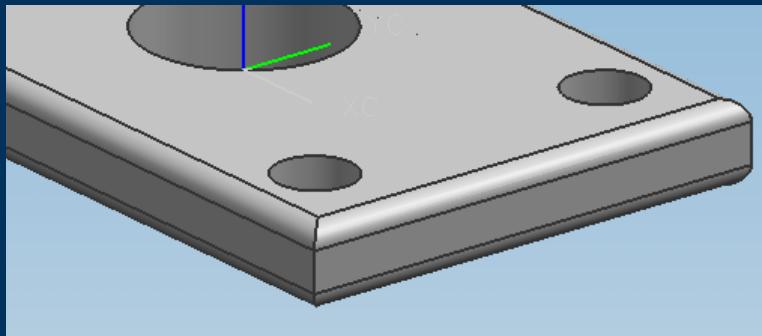
NX CAE Topology – Split Edge



- ▶ Split an Edge
 - ▶ To define separate Boundary Conditions along a Polygon edge
 - ▶ Point Selection
 - ▶ Control mesh density



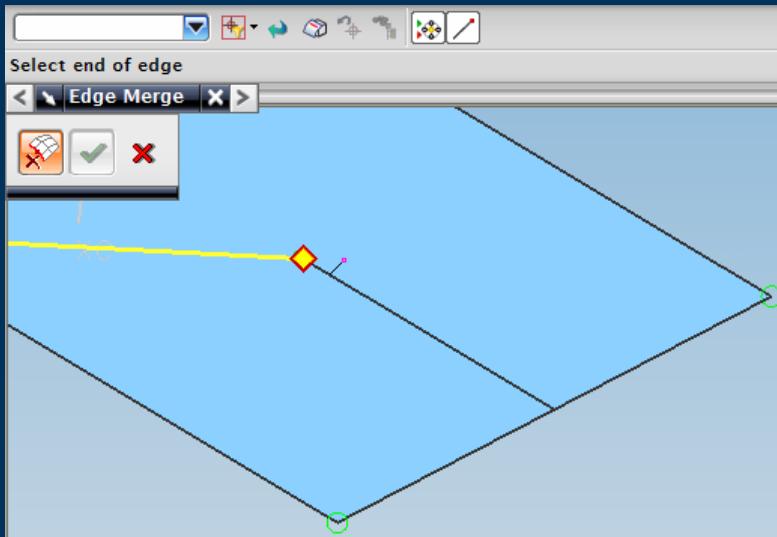
NX CAE Topology – Split Face



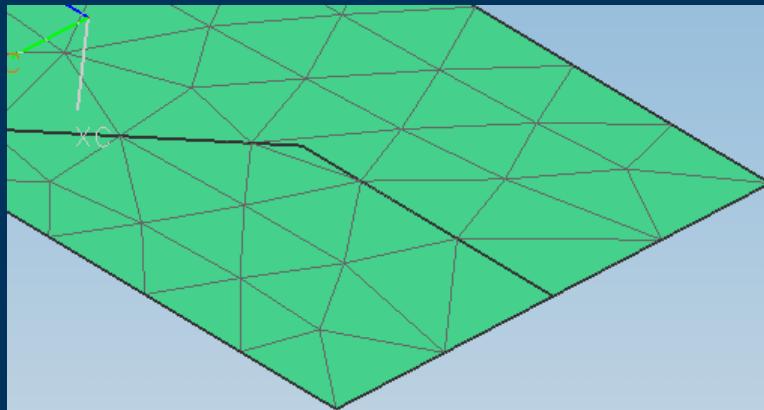
- ▶ Split Face

- ▶ Split a polygon face along a projected line
- ▶ Mesh control
- ▶ Boundary Condition control

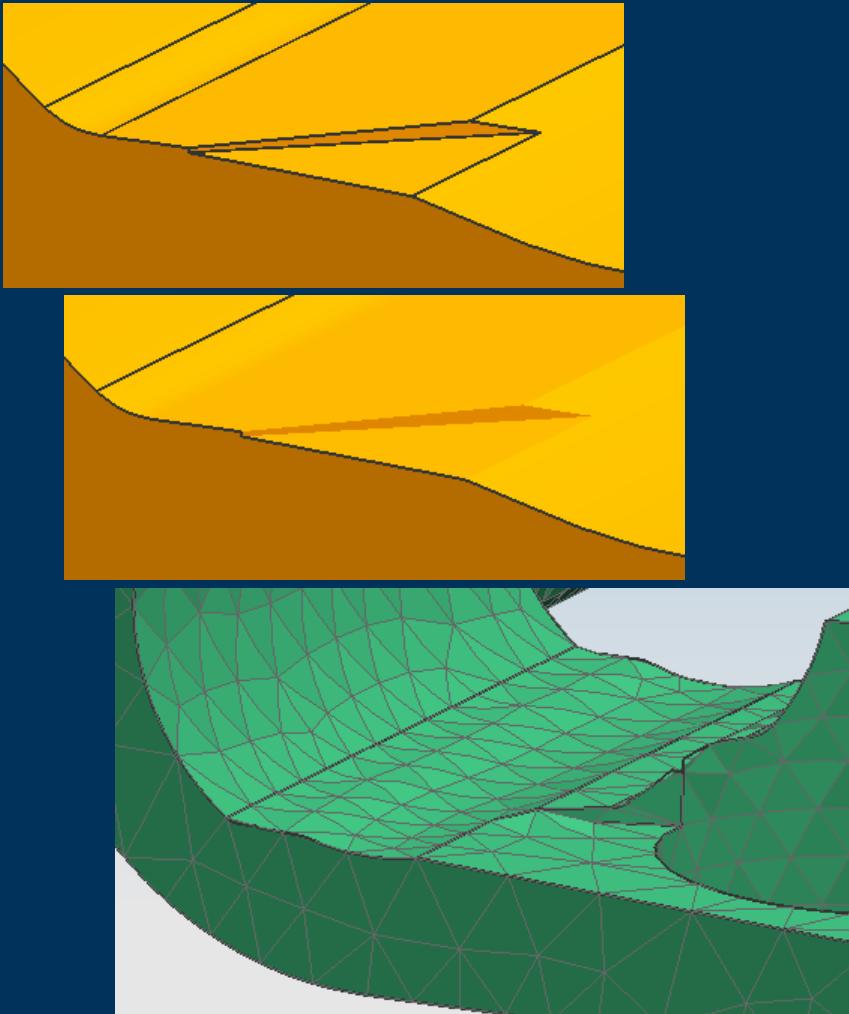
NX CAE Topology – Merge Edge



- ▶ Merge Edge
 - ▶ Merges 2 polygon edges that share a vertex into one polygon edge
 - ▶ Used to “recover” Split Edges

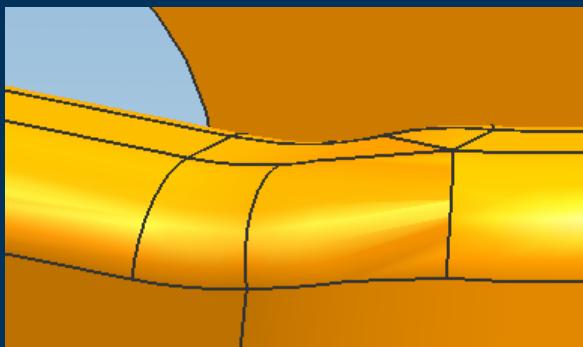
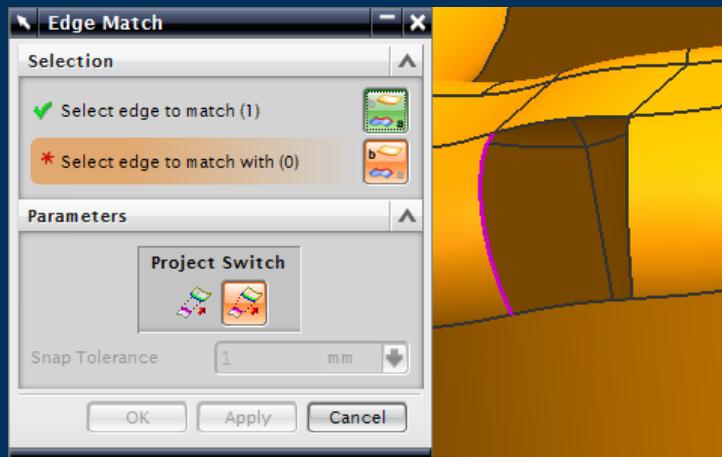


NX CAE Topology – Merge Face

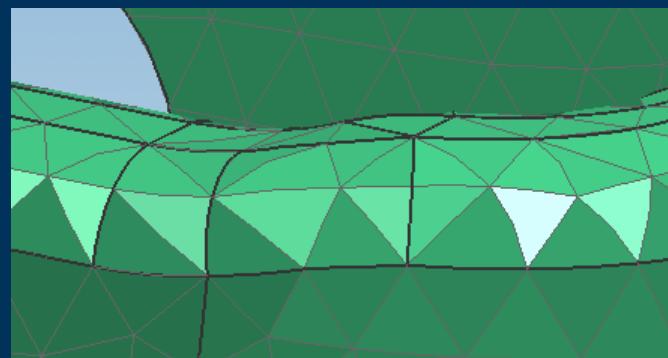


- ▶ Merge Face
 - ▶ Merge two separate polygon faces into a single polygon face along a common polygon edge
- ▶ Commonly before and after an Auto Heal
- ▶ Before or After Meshing
- ▶ Used to remove data to get a better quality mesh

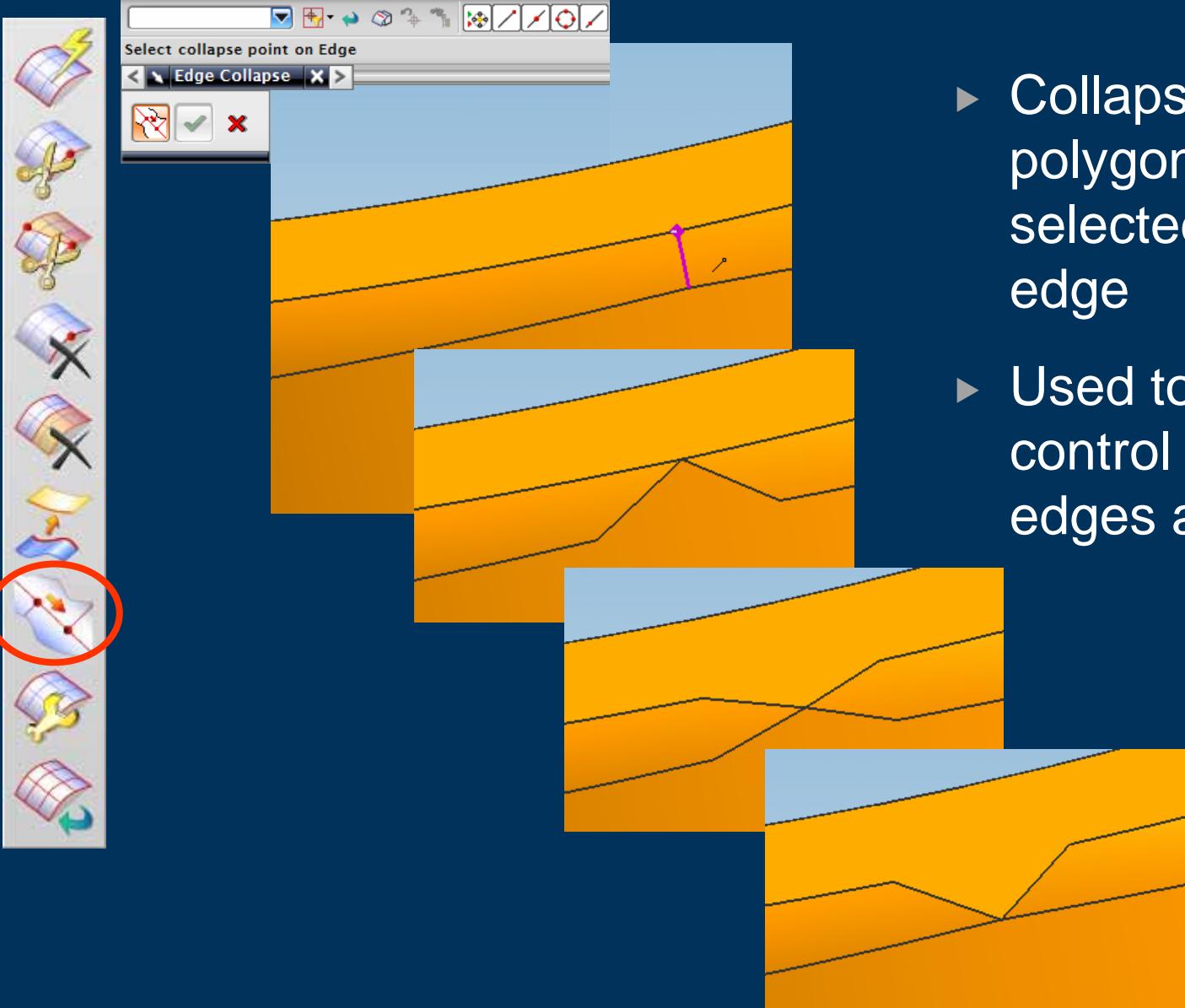
NX CAE Topology – Match Edge



- ▶ Match one polygon edge to a second polygon edge
- ▶ Result is a single polygon edge
- ▶ Used to “tidy up” or repair poor quality geometry

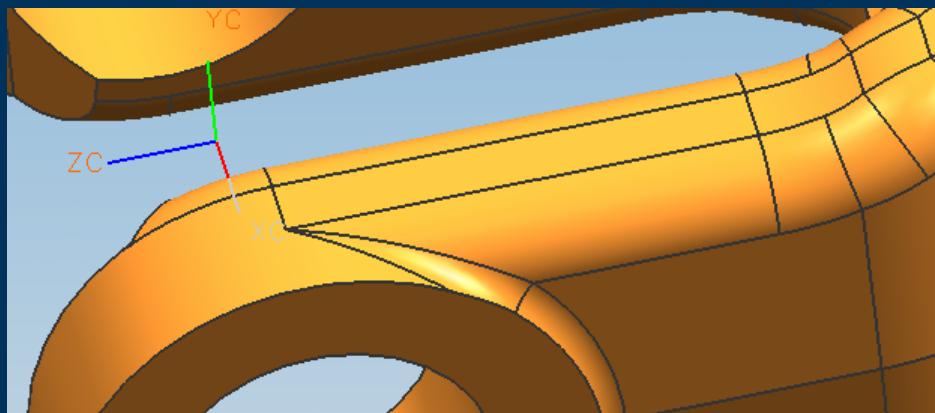
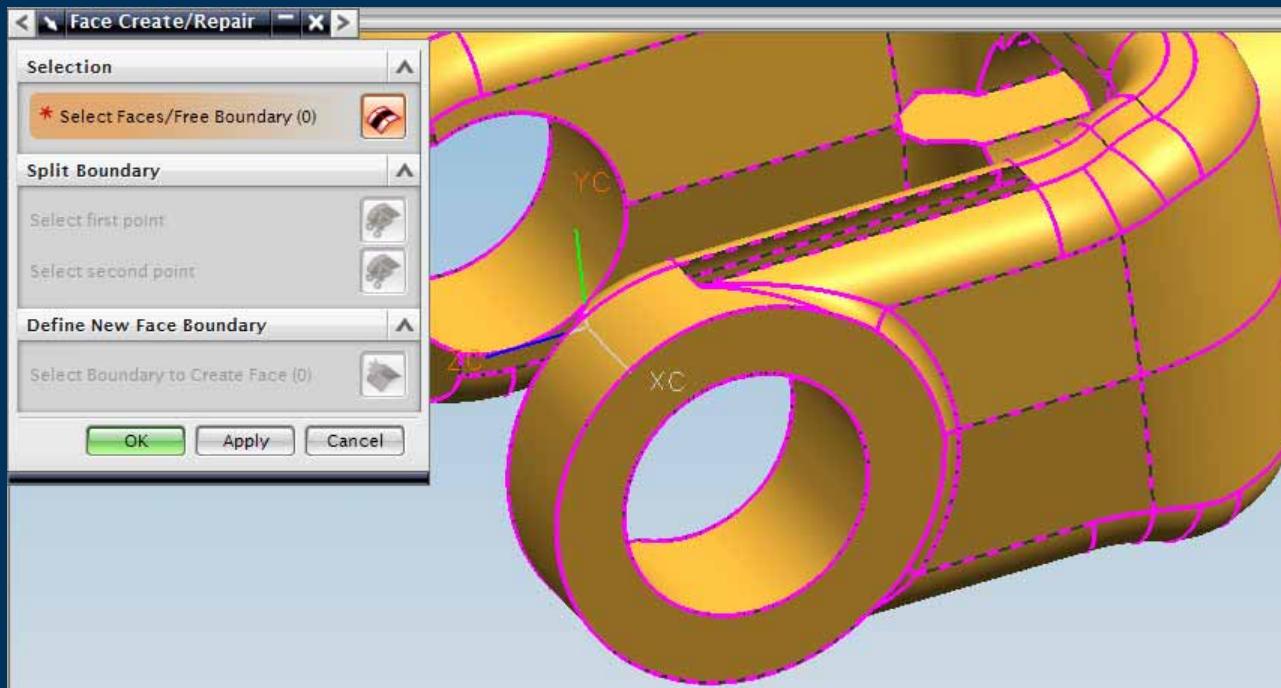


NX CAE Topology – Collapse Edge



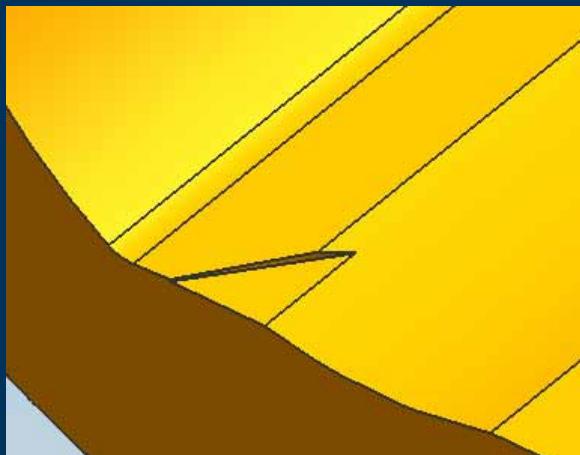
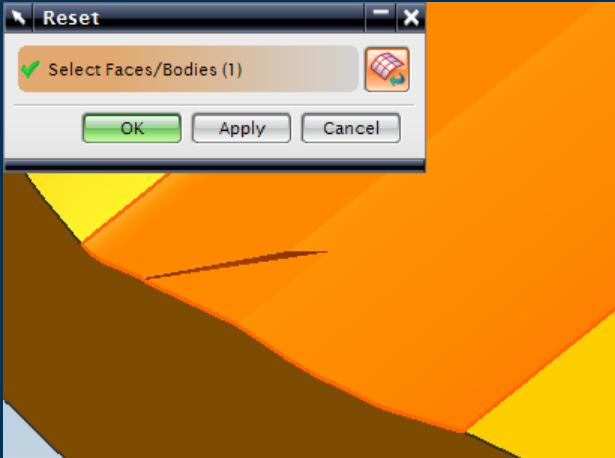
- ▶ Collapses the selected polygon edge to a selected point on the edge
- ▶ Used to get manual control over how small edges are collapsed

NX CAE Topology – Face Repair



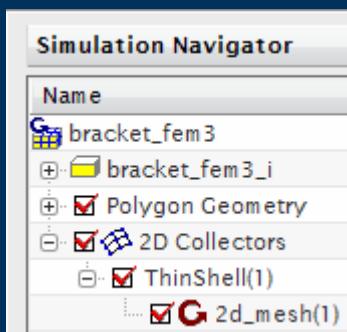
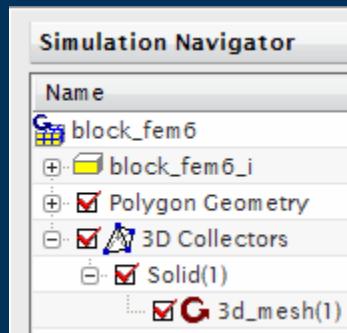
- ▶ Create a new polygon face to fill a hole
- ▶ Repair a poor quality polygon face

NX CAE Topology – Reset



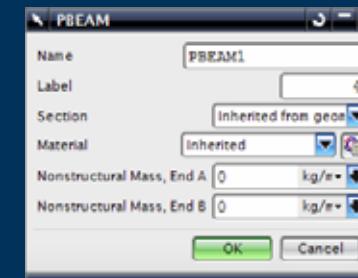
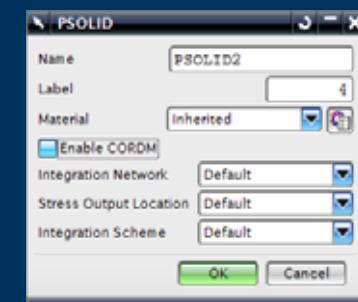
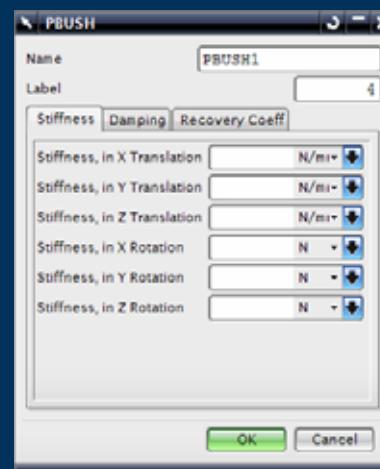
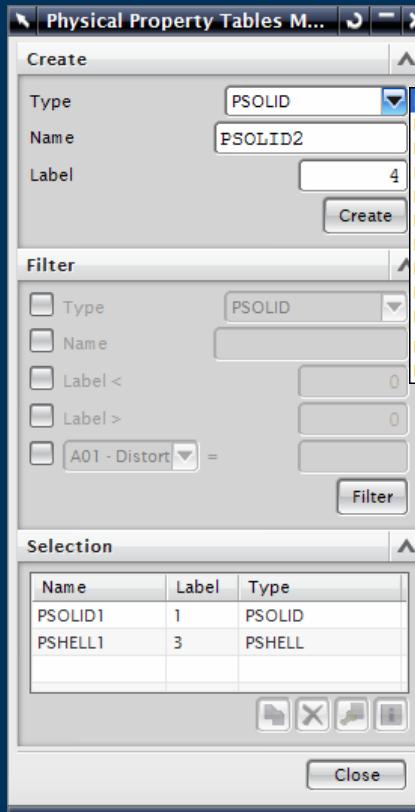
- ▶ Resets the selected polygon geometry to it's original state – ie one with the CAD surfaces
- ▶ Recover data for including in Mesh

NX CAE Topology – Mesh Updates

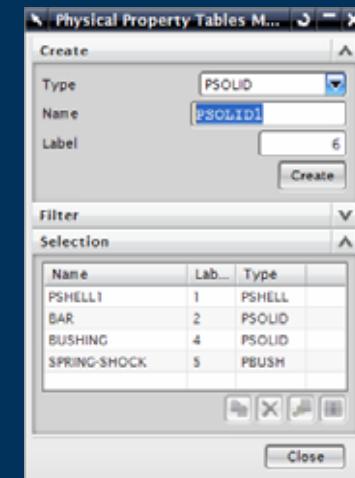


- ▶ CAE Topology changes can be done before and after Meshes are applied
- ▶ After a change (like Merge Face) the Mesh is flagged “out of date”
 - ▶ In the Simulation Navigator
 - ▶ Mesh Update icon
- ▶ Note if multiple meshes exist, only the changed ones are flagged as “out of date” and updated
- ▶ Allows for multiple CAE Topology changes and one mesh update

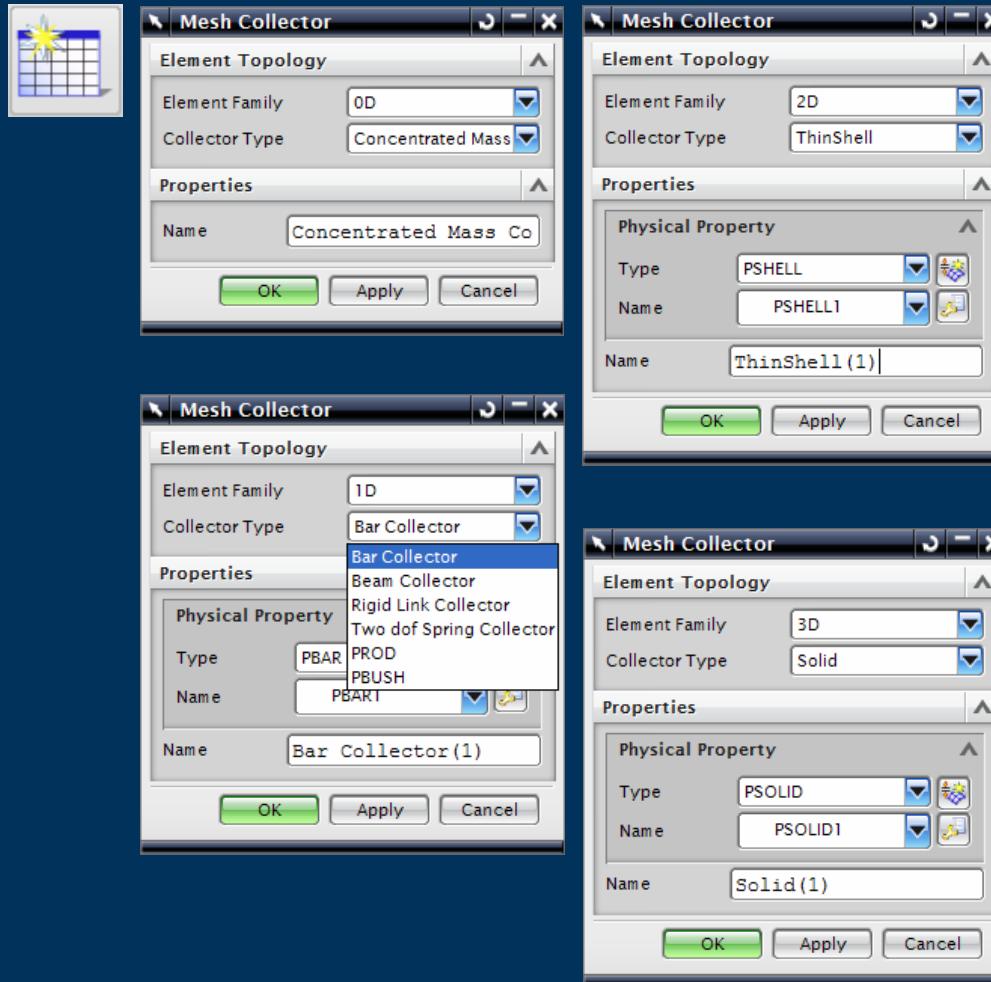
Physical Properties



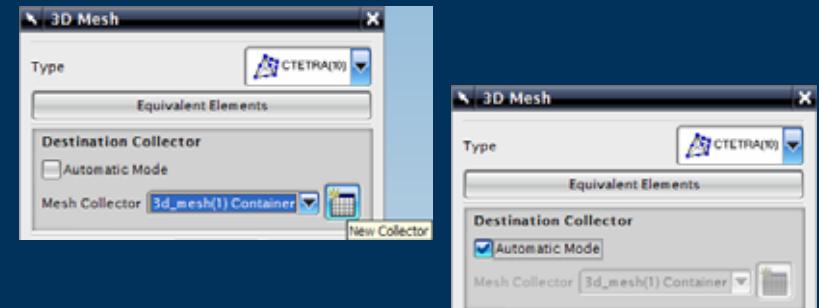
- ▶ Physical Property is Solver and Element dependant
 - ▶ Family of Elements
 - ▶ Material Reference
 - ▶ Commonly referred to as PID
 - ▶ Often used to identify different parts in an Assembly



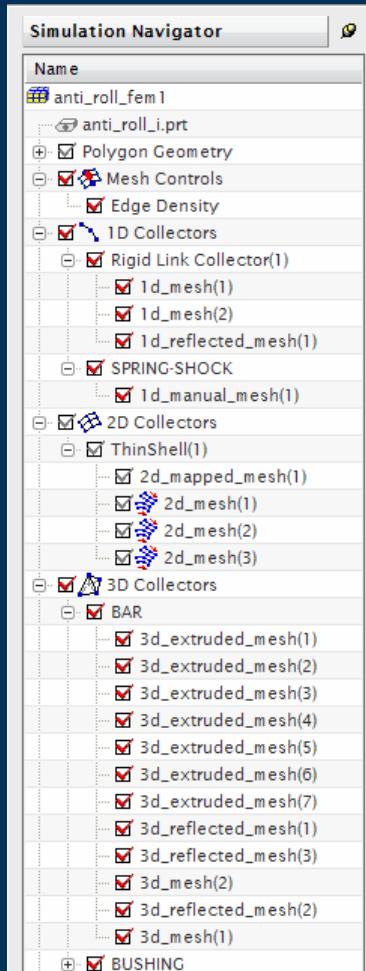
Mesh Collectors



- ▶ Mesh Collectors are a method for multiple Meshes to reference the same Material, Physical Properties and Display Properties
- ▶ Organised by
 - ▶ Element Family
 - ▶ Element Type
 - ▶ Physical Property (inc Material)
- ▶ Workflow Creation Options
 - ▶ Prior to Meshing
 - ▶ On-the-fly During Meshing
 - ▶ Post Meshing

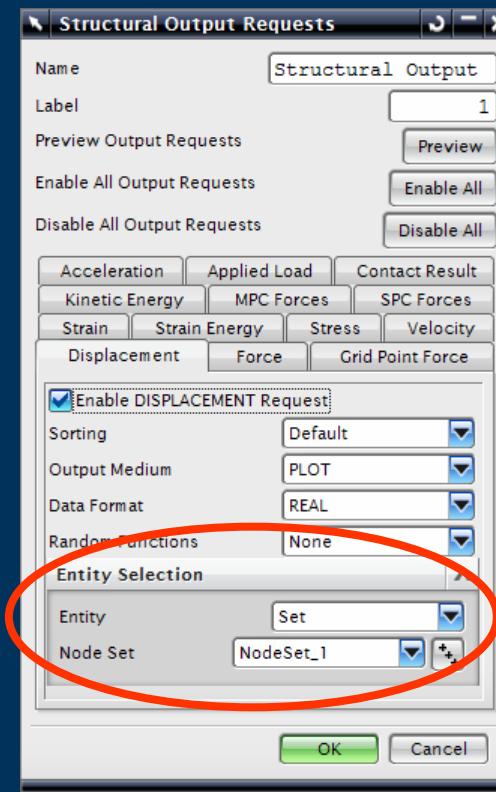
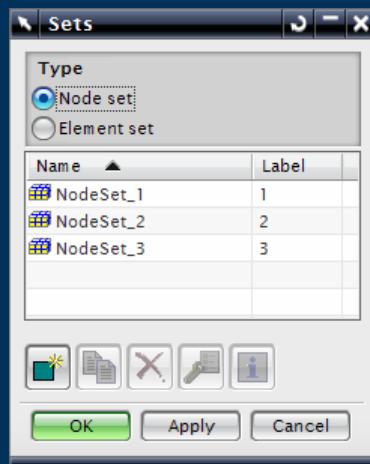
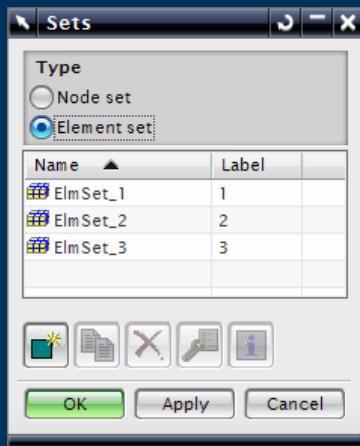


Mesh Collectors



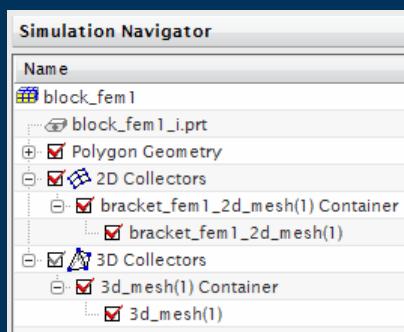
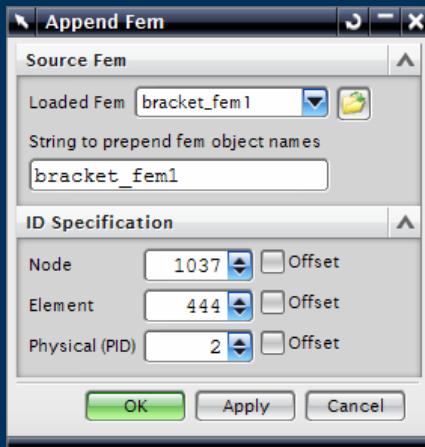
- ▶ Model Management
 - ▶ Drag 'n' Drop item between collectors
 - ▶ Mesh inherits the target Collector properties inc Physical, Material and Display
 - ▶ Display control
 - ▶ Hide/Show all Meshes in Collector
 - ▶ Hide/Show Individual Meshes
- ▶ Benefits
 - ▶ Model management
 - ▶ Visible model organization
 - ▶ Fast and easy to use for detail or global changes

Node and Element Sets



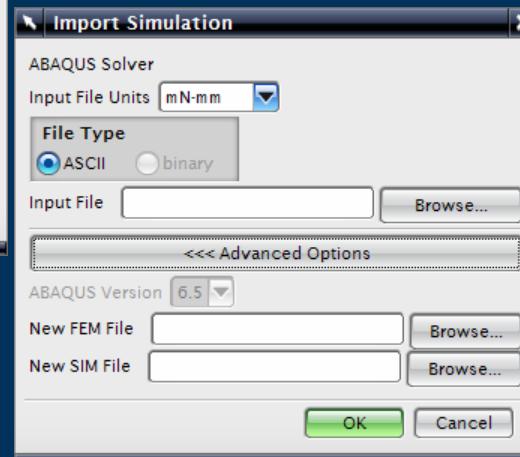
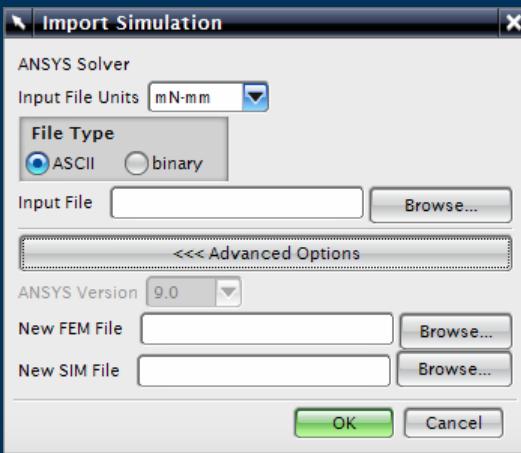
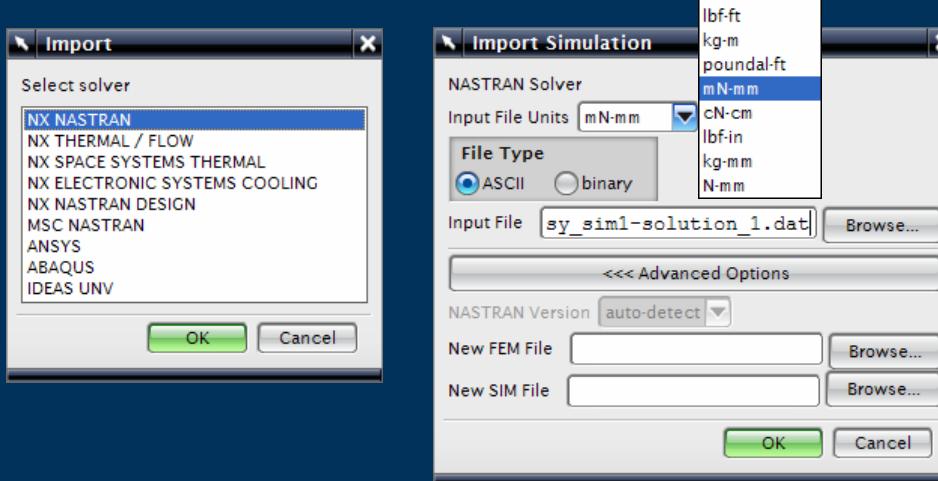
- ▶ Named Collection of Nodes or Elements
- ▶ Used for defining output for a solution
- ▶ FEM Based Sets can be used by any referencing SIM
- ▶ SIM Based Sets are only available within that SIM file

Mesh Append

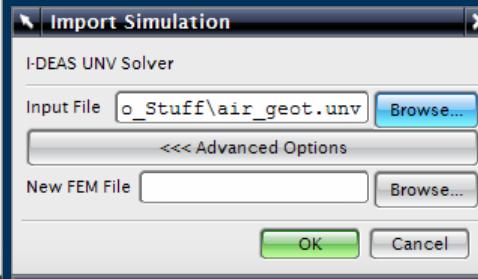


- ▶ Mesh Append copies Mesh from one FEM file into the current FEM file
 - ▶ Optional Prefix to Imported object Names
 - ▶ Node, Element & PID number Start and Offsets

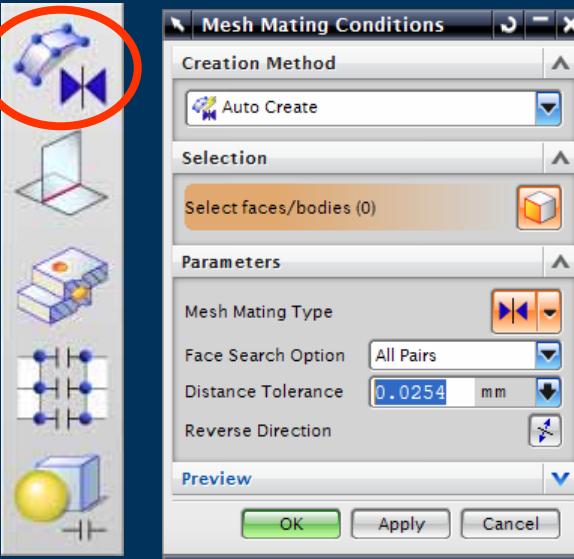
Mesh Import



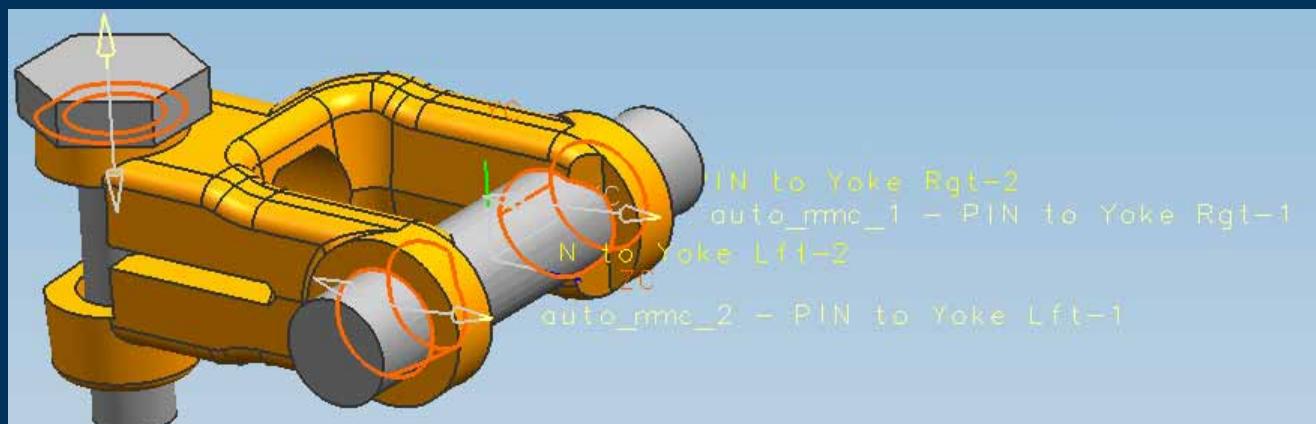
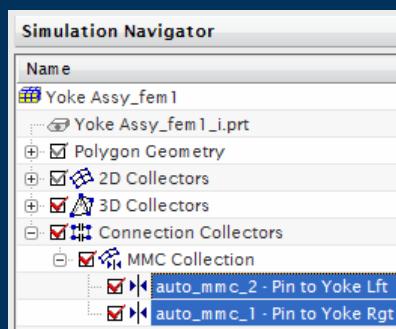
- ▶ Import of a solver deck from an External file
- ▶ Units selection for the incoming data
- ▶ Append to existing files or Create New files



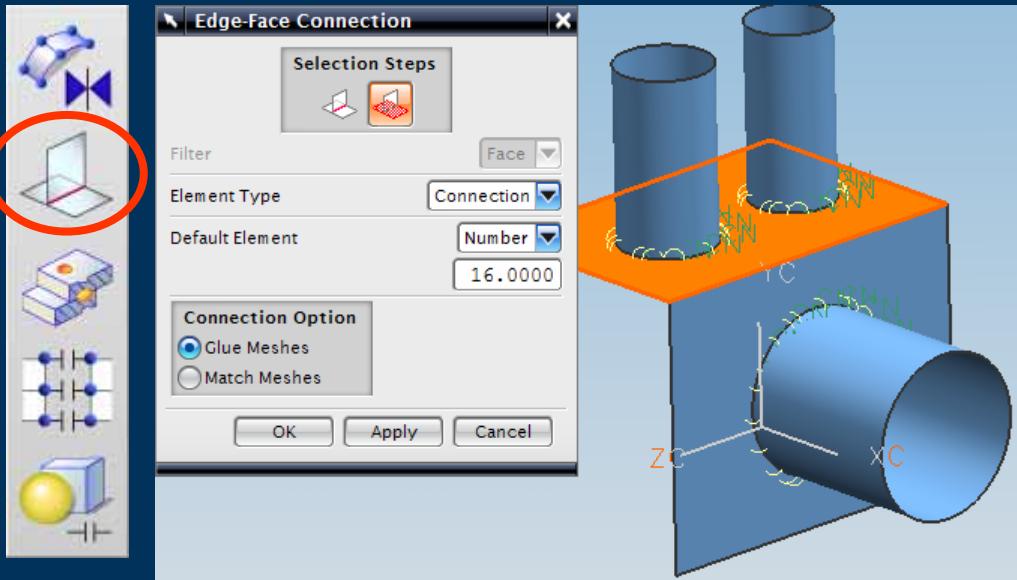
Mesh Connections – Mesh Mating



- ▶ Mesh Mating Conditions aligns the mesh on Source and Target
 - ▶ Glue Coincident condition
 - ▶ 2 faces share same nodes
 - ▶ Glue Non-Coincident condition
 - ▶ Multi-Point Constraints (MPC's) to connect the meshes
 - ▶ Free Coincident condition
 - ▶ No mesh connection
- ▶ Auto Detection or Manual Selection of mating faces
 - ▶ Search all possible pairs or only for identical pairs of faces

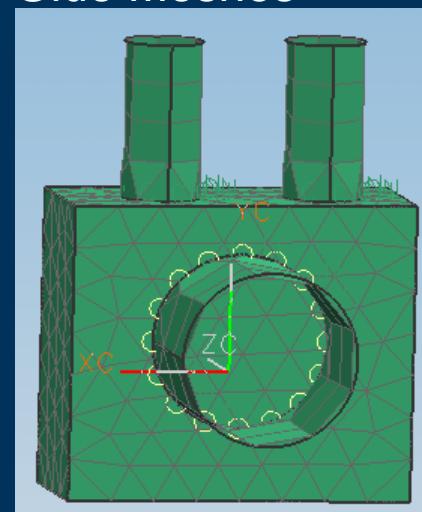


Mesh Connections – Edge-Face Connection

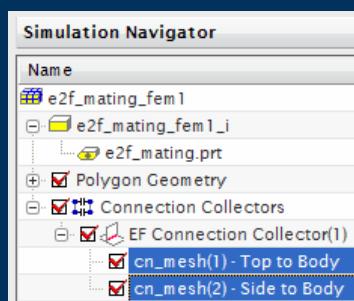
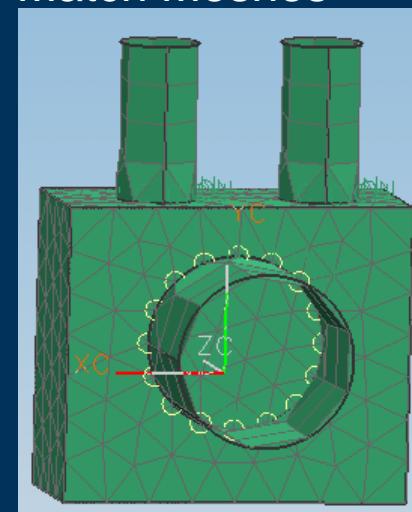


- ▶ Connection between a set of edges and a set of faces
- ▶ Contact Node drive Meshes in both sides if Match Meshes used
- ▶ Uses Rigid Links and MPC's to connect the meshes

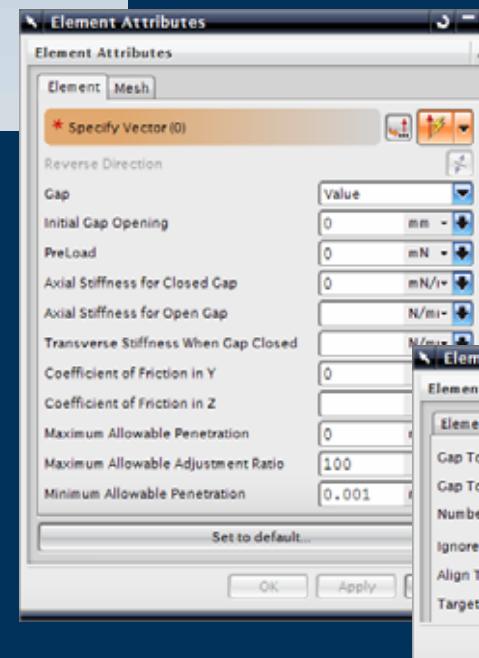
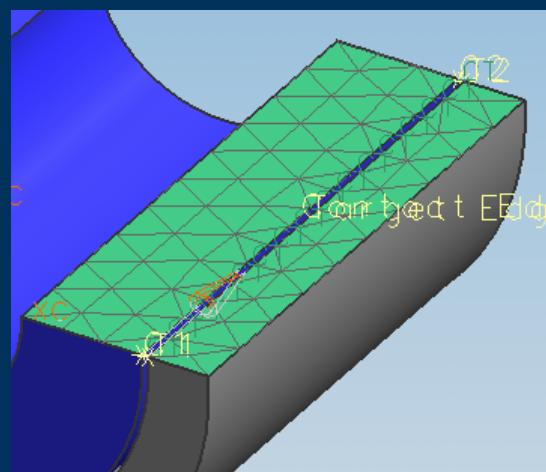
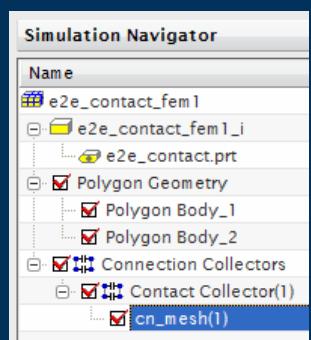
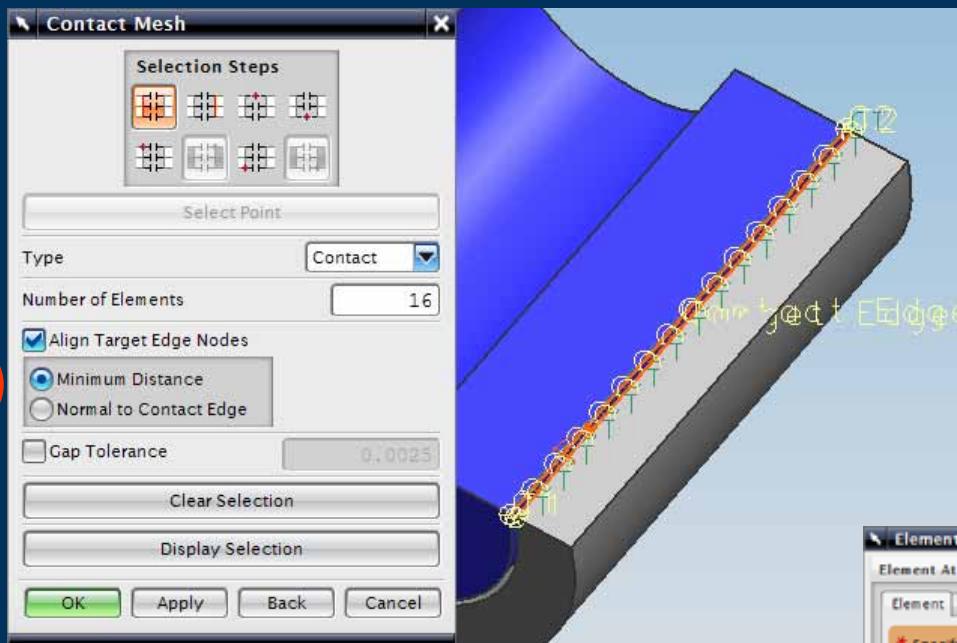
Glue Meshes



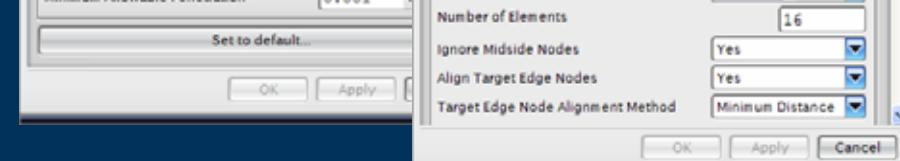
Match Meshes



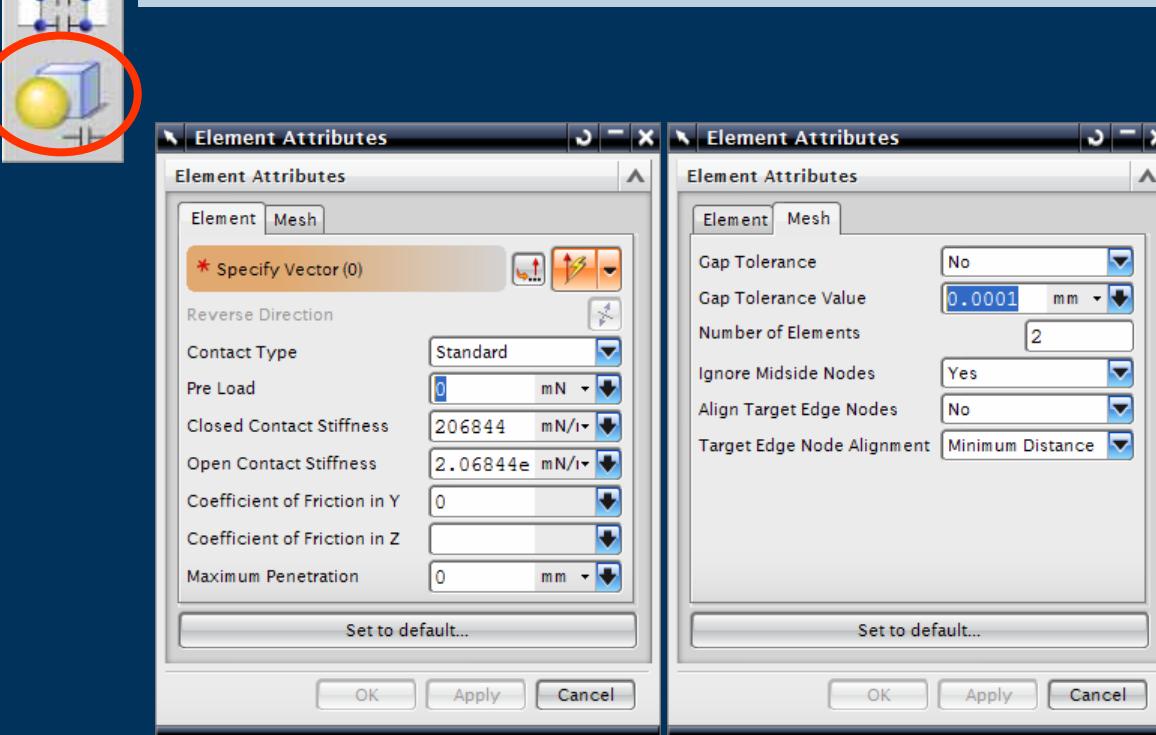
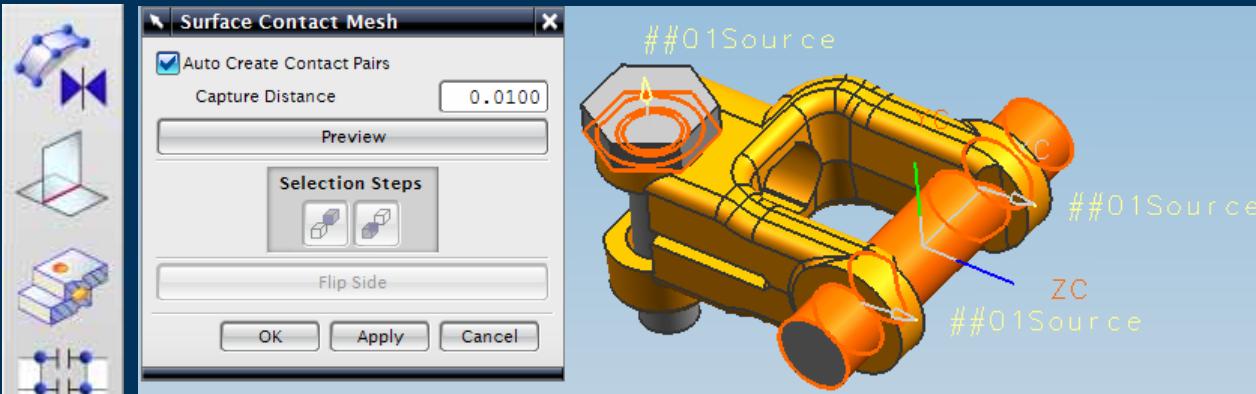
Mesh Connections – Edge Contact Mesh



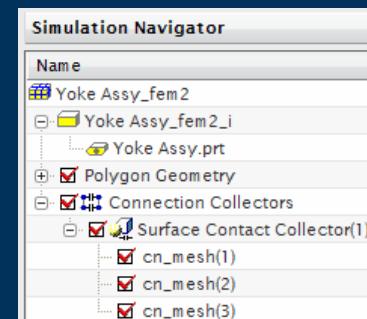
- ▶ Edge Based Contact definition
- ▶ Contact Nodes drive meshes on both sides
- ▶ Uses GAP elements to model Contact



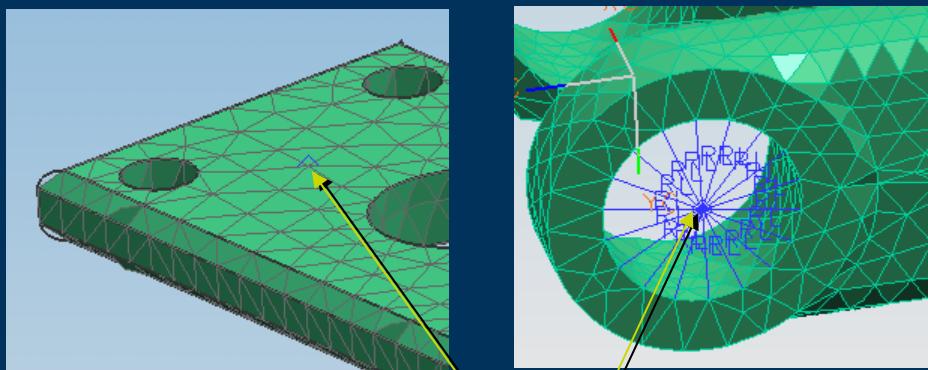
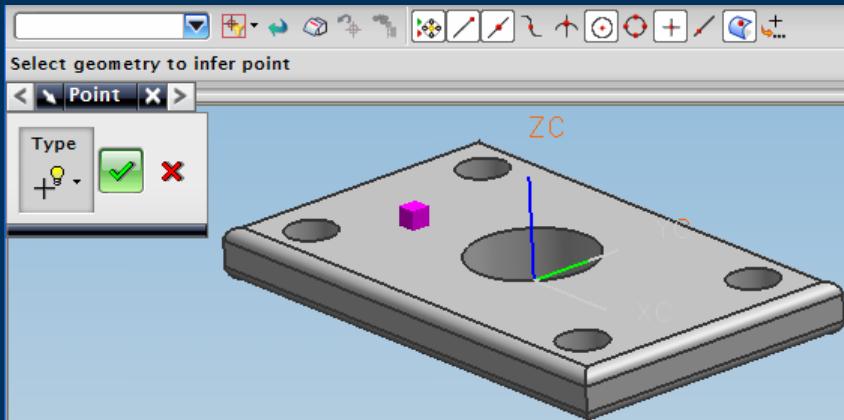
Mesh Connections – Surface Contact Mesh



- ▶ Surface Based Contact definition
- ▶ Surfaces are not auto Split or Partitioned
- ▶ Contact Nodes drive meshes on both sides
- ▶ Uses GAP elements to model Contact



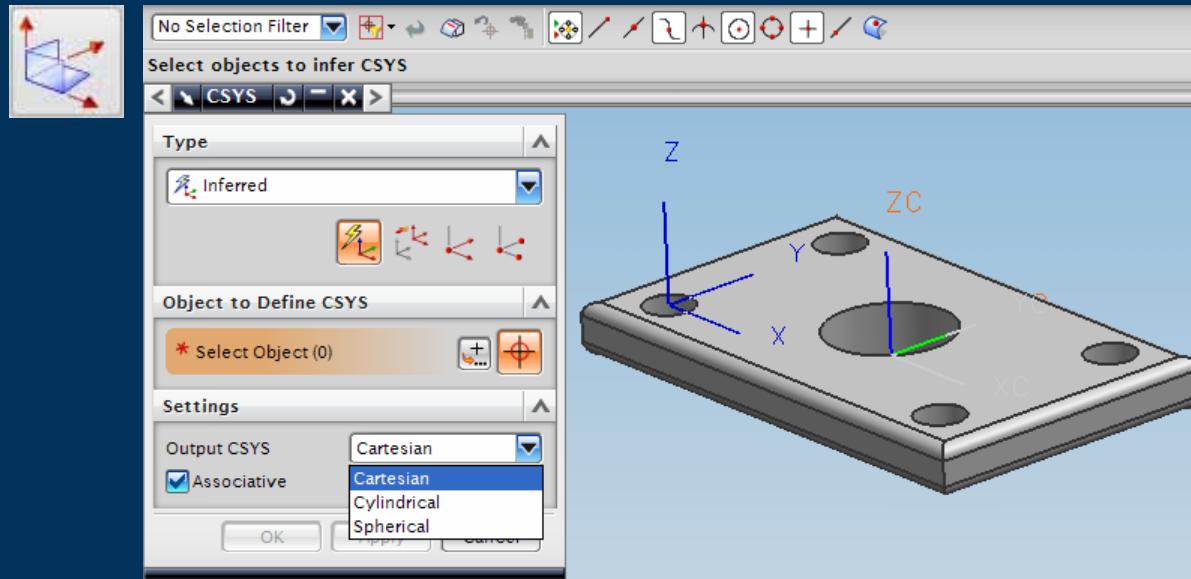
Meshering – Mesh Points



Mesh Point

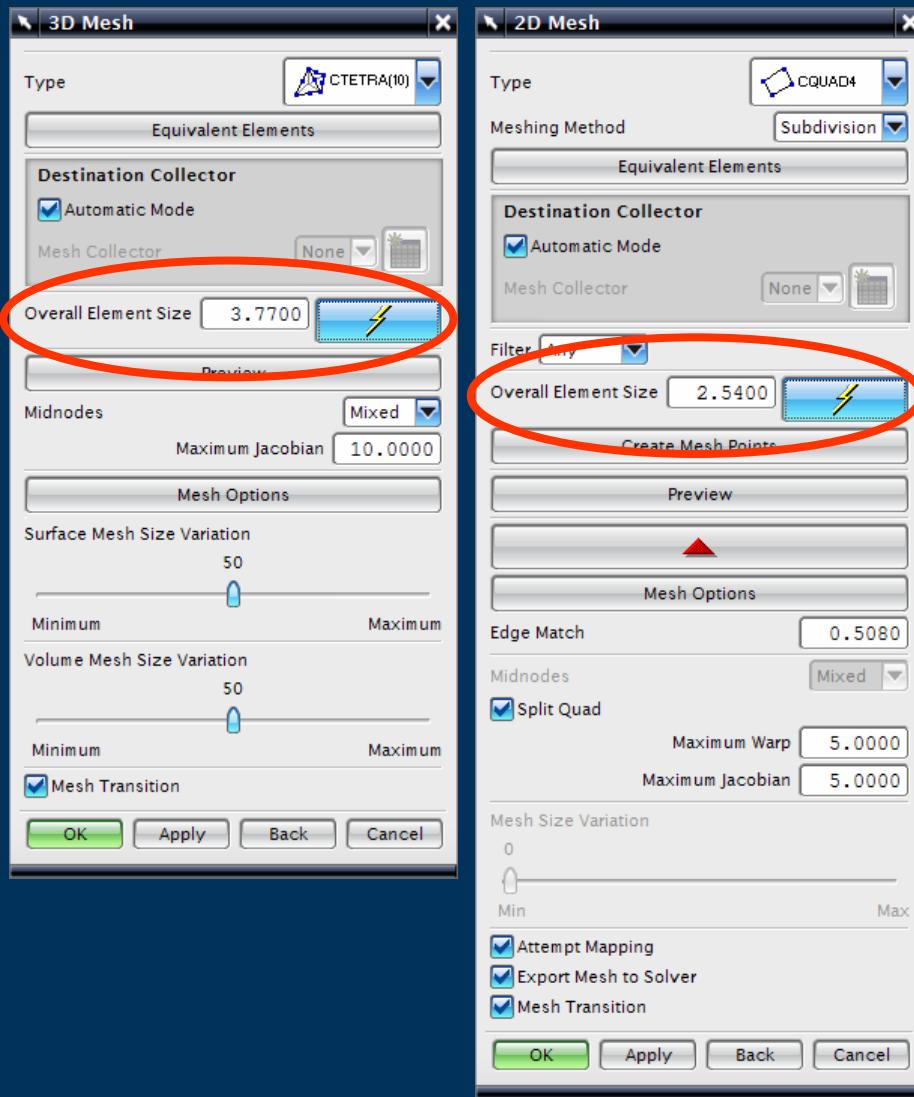
- ▶ Used to create specific location for a node, for example on an Edge or Face
- ▶ Point can Associate or Non-Associate to Geometry
- ▶ Mesh is associative to the Mesh Point
- ▶ Mesh Point location can be edited
- ▶ Used to create a location for a Load or Boundary Condition, spider for load transfer

Datum Coordinate Systems



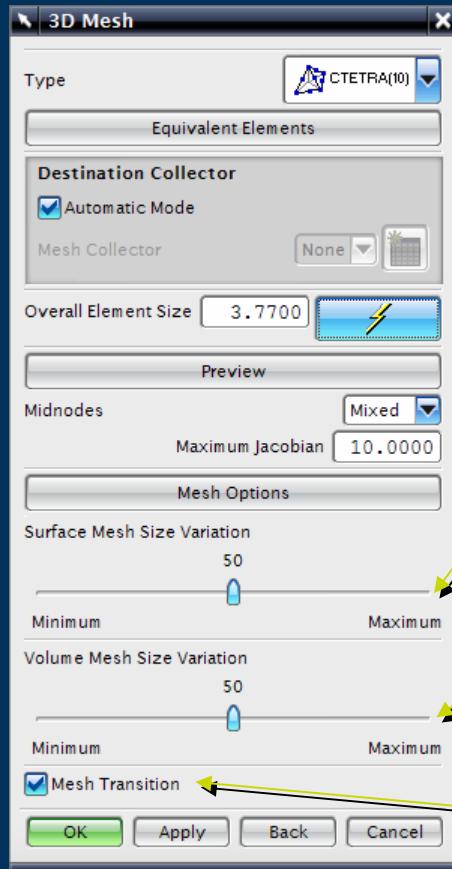
- ▶ Datum Coordinate Systems
 - ▶ Cartesian
 - ▶ Cylindrical
 - ▶ Spherical

Mesh Size Selection



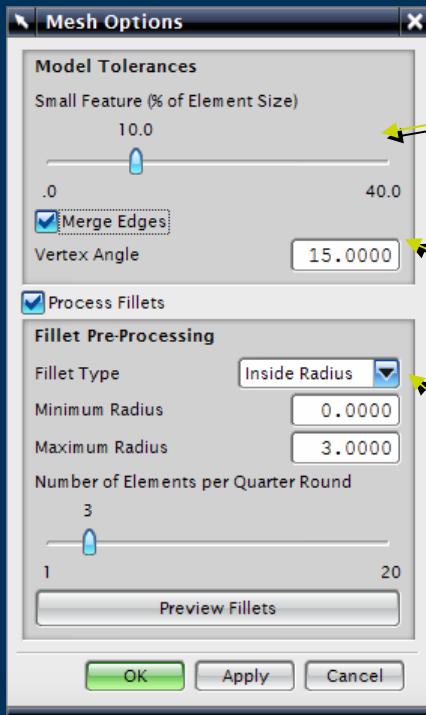
- ▶ The “Lightening” symbol will suggest an Overall Element Size based on examination of the selected geometry
- ▶ User can set a value appropriate to their task
- ▶ Default settings for everything else will give a “good mesh” for most geometry

Mesh Size Selection



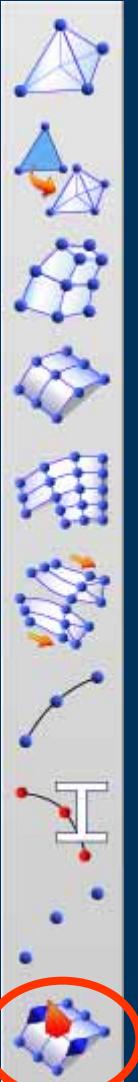
- ▶ Surface Mesh Size Variation
 - ▶ Min – less curvature refinement to follow geometry
 - ▶ Max – more curvature refinement to follow geometry
- ▶ Volume Mesh Size Variation
 - ▶ Min – elements remain approx constant in size throughout the body
 - ▶ Max – elements expand rapidly towards the center of the body
- ▶ Mesh Transition
 - ▶ Gradually transitions the size of elements in the mesh from any defined local element sizes back to the global element size

Mesh Size Selection



- ▶ Small Feature tolerance defines size of geometry that will be abstracted
 - ▶ Element size of 10mm & 10% setting will abstract out 1mm sized faces
- ▶ Merge Edges
 - ▶ Removes the Polygon edge when angle between edges is less than Vertex Angle
- ▶ Mapped Mesh control of Fillets/Blends faces
 - ▶ Filtered by Inside, Outside or Both
 - ▶ Min & Max radius

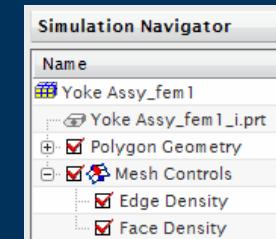
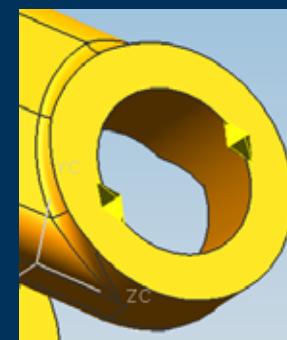
Mesh Controls



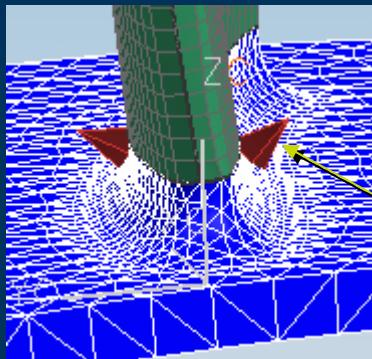
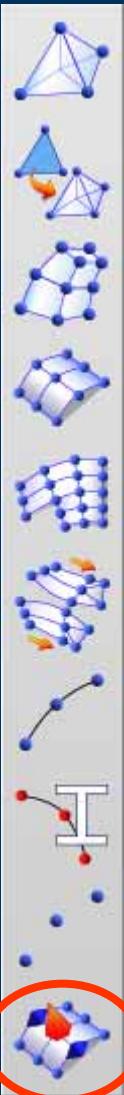
The screenshots show the 'Mesh Control' dialog box with various settings for different density types:

- Number on Edge:** Set 'Number of Elements' to 15.
- Size on Edge:** Set 'Element Size' to 5 mm.
- Chordal Tolerance on Edge:** Set 'Tolerance' to 0.01 mm.
- Biasing on Edge:** Set 'Bias Origin' to 'Start of Edge', 'Number of Elements' to 15, 'Bias Ratio' to 0.75, and 'Edge Fraction' to 1.
- Size on Face:** Set 'Element Size' to 5 mm.

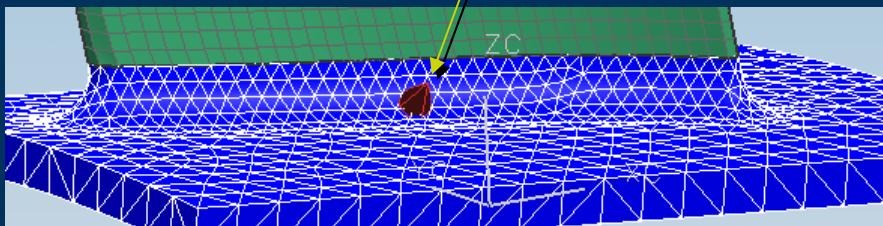
- ▶ Mesh Controls
 - ▶ Number on an Edge
 - ▶ Size on an Edge
 - ▶ Chordal Tolerance on an Edge
 - ▶ Biasing on an Edge
 - ▶ Size on a Face
- ▶ Managed by Mesh Controls Collector



Mesh Controls

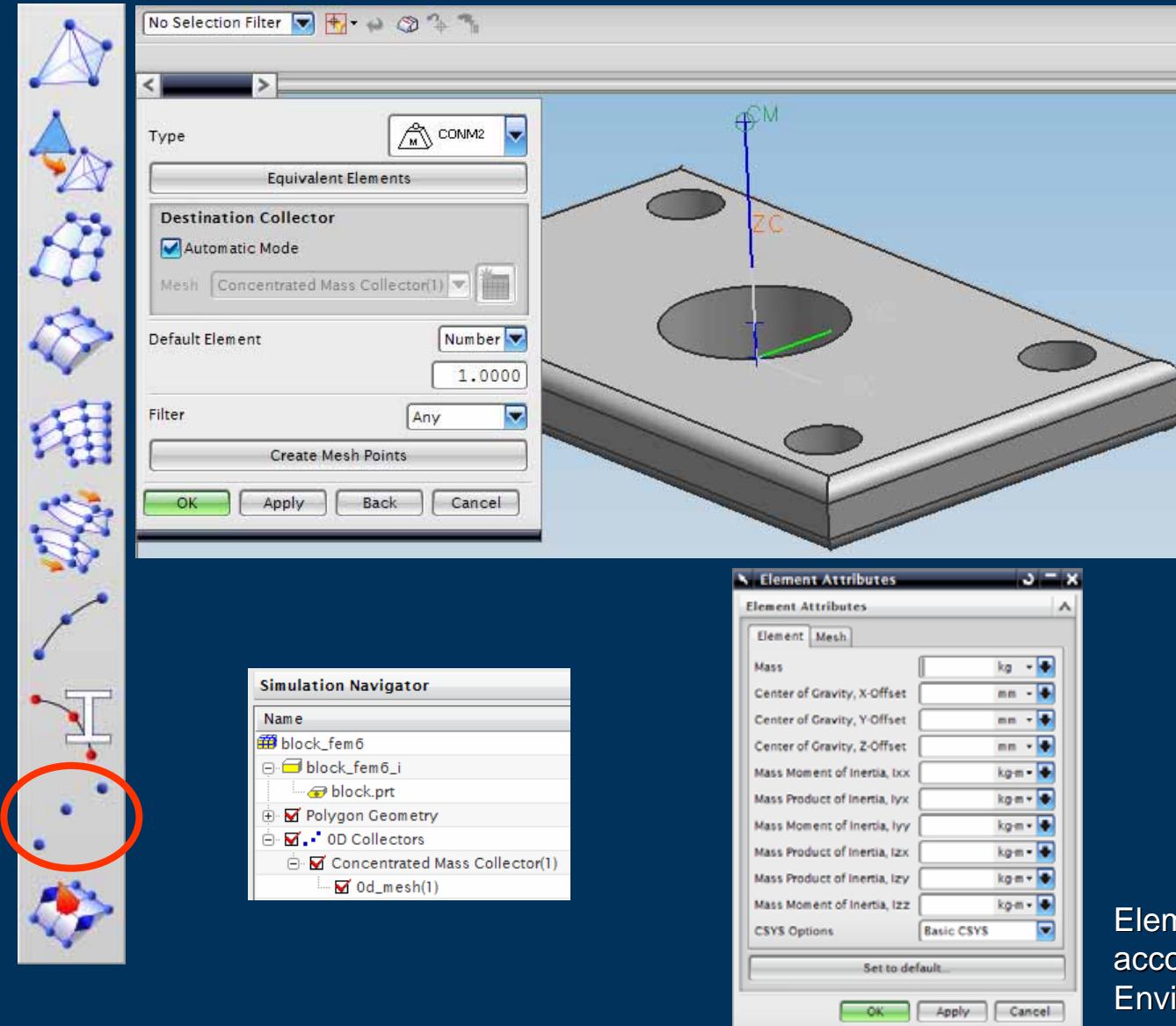


Size on Face
Mesh Control



- ▶ Used to control Mesh distribution, quality, mating etc
- ▶ Meshes associative to Mesh Controls

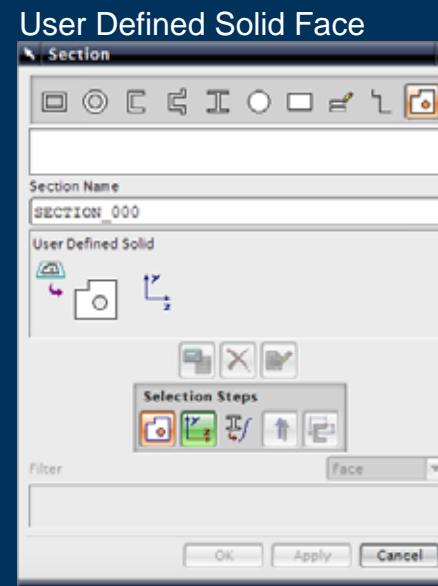
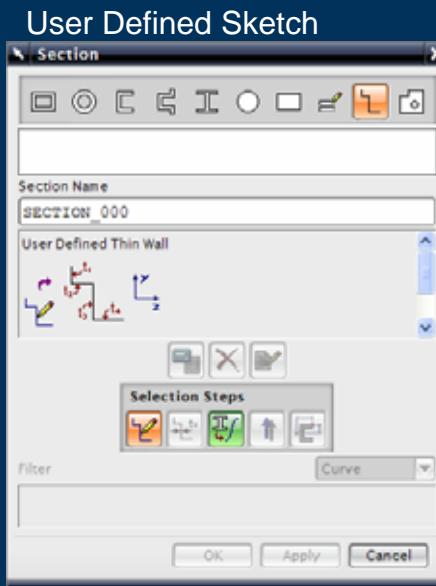
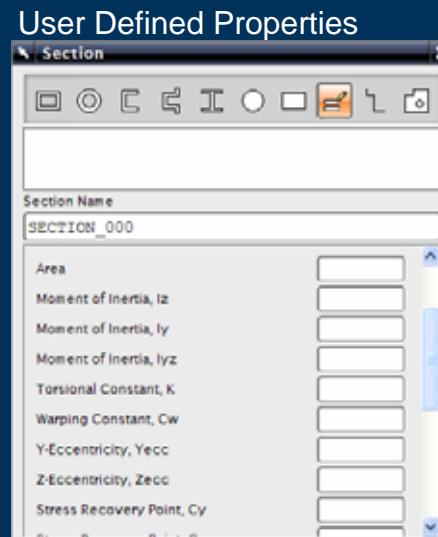
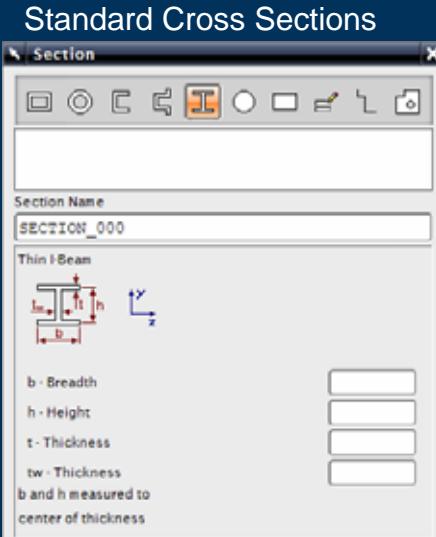
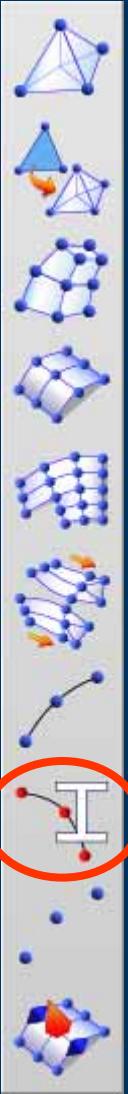
Mesher – OD Mesh



- ▶ 0D or Scalar Elements for Lumped or Distributed Mass

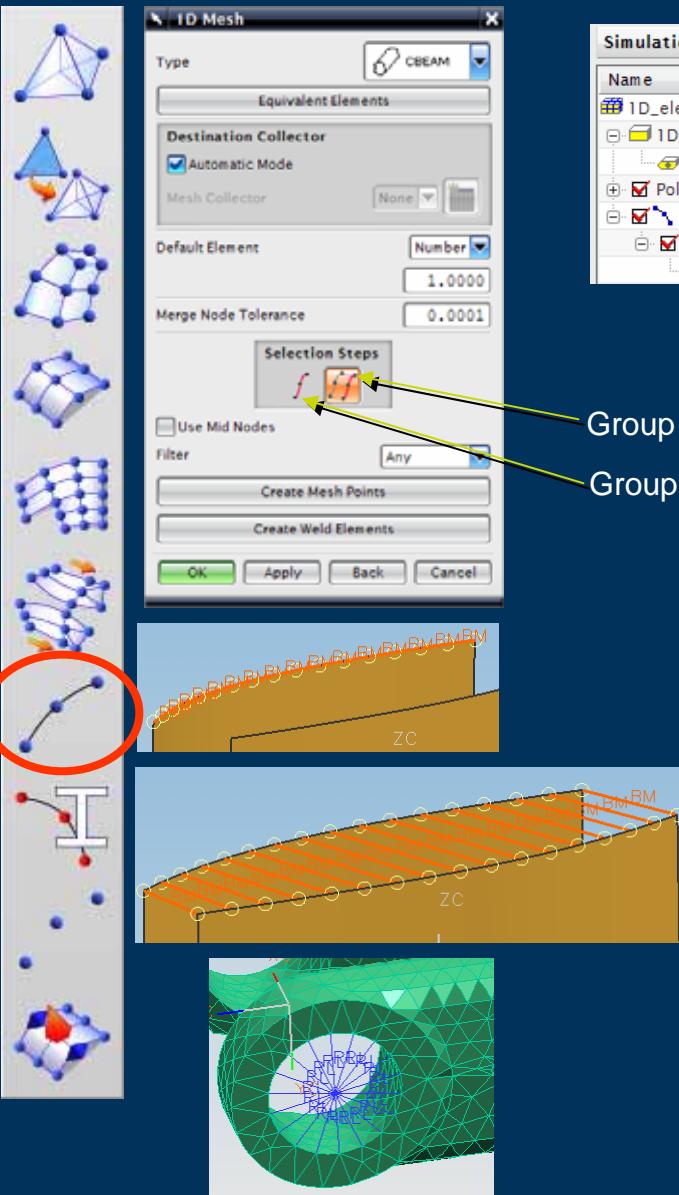
Element Attributes vary according to the Solver Environment & Element Type

Mesher – 1D Element Cross Sections

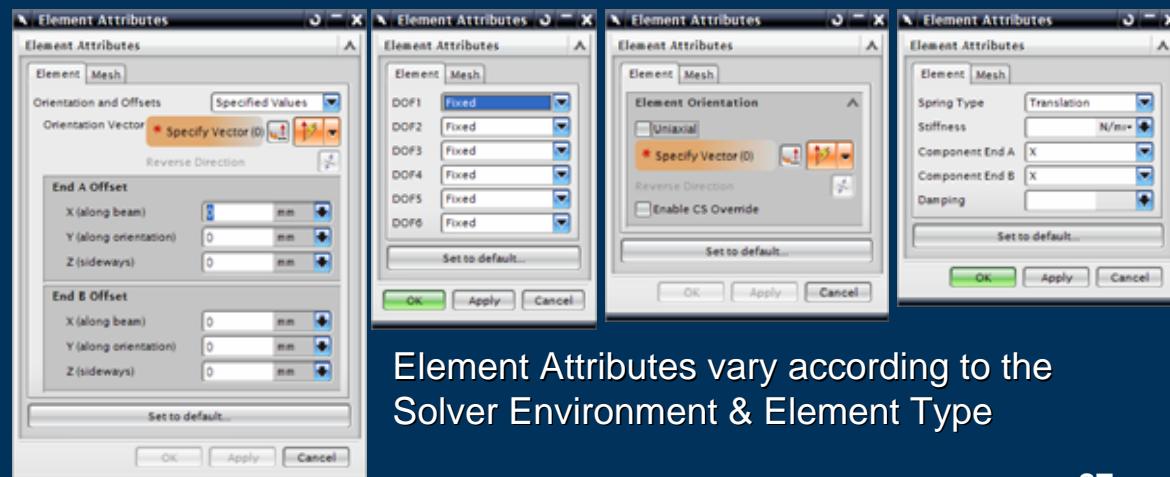


- ▶ Dialog to define and Manage Cross Sections
- ▶ 1D Element Attributes will Reference Stored Sections

Meshing – 1D Mesh

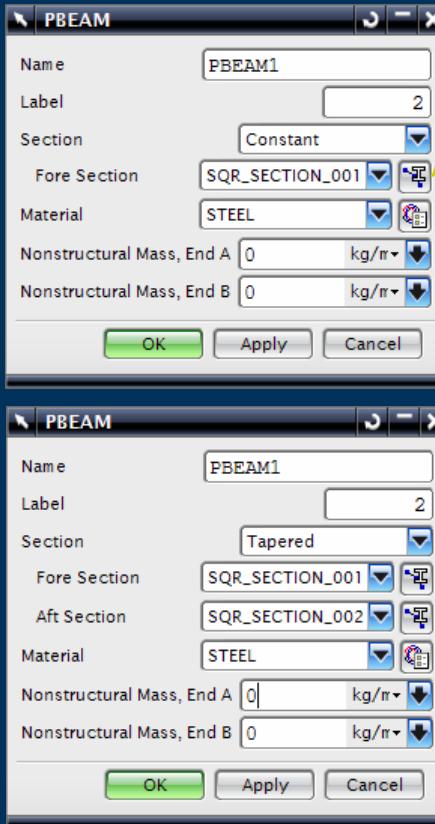
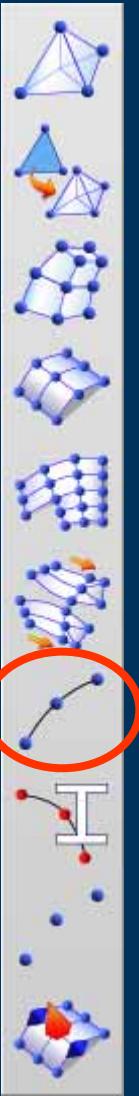


- ▶ Multiple options depending on the selection of Group 1 and 2
 - ▶ Along an edge, around a face, between curves or edges, point to curve/edge etc

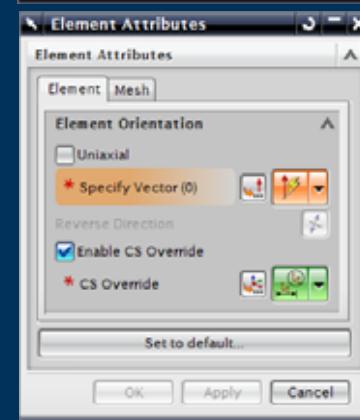
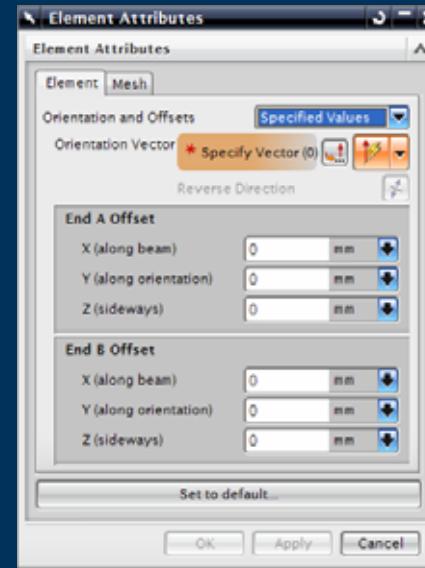


Element Attributes vary according to the Solver Environment & Element Type

Mesher – 1D Mesh – Element Attributes



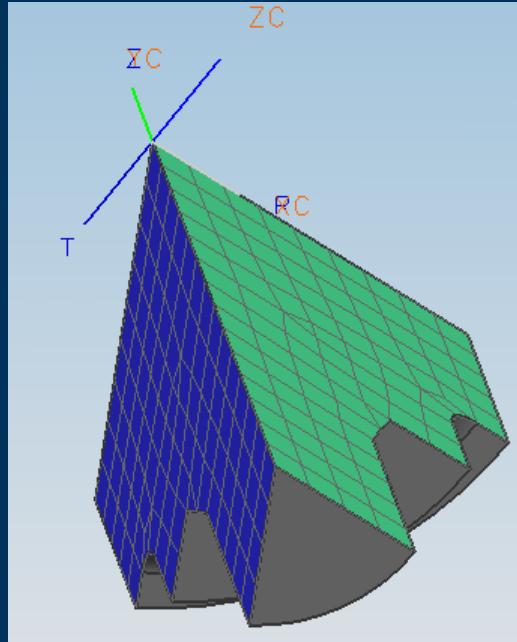
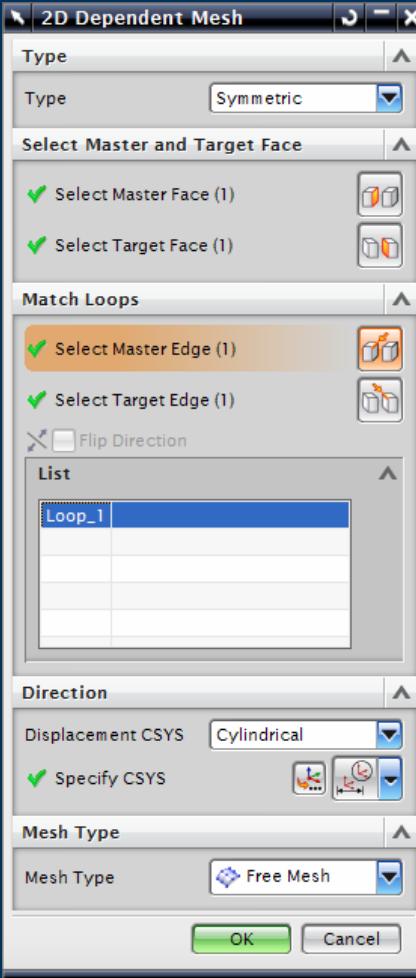
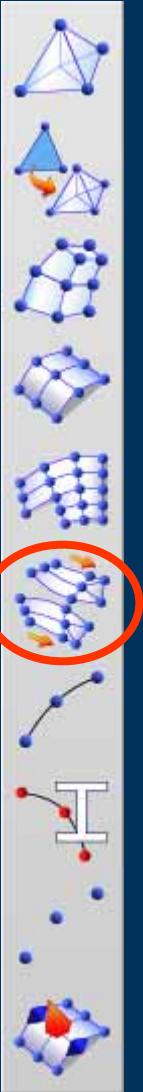
1D Element Cross Sections



- ▶ 1D Elements reference a Physical Property
 - ▶ Material
 - ▶ Section(s)
- ▶ Element Attributes for Beams, Bars and Rods
 - ▶ Beams & Bars require Orientation vector
 - ▶ Inherited from Geometry
 - ▶ Specific Values
 - ▶ Bushes require Axis Definition

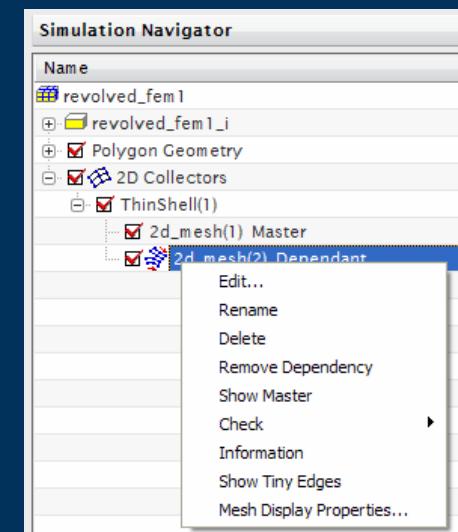
Element Attributes vary according to the Solver Environment & Element Type

Meshering – 2D Dependant Mesh

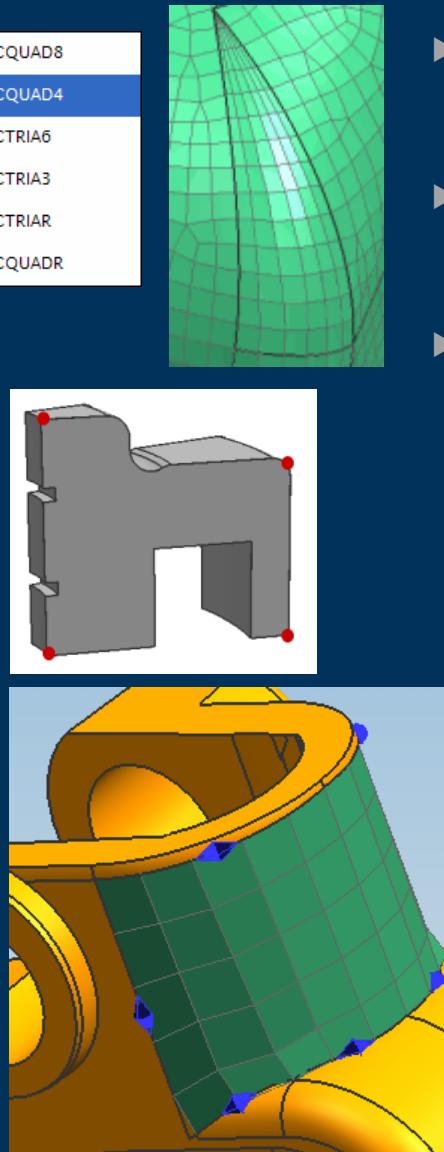
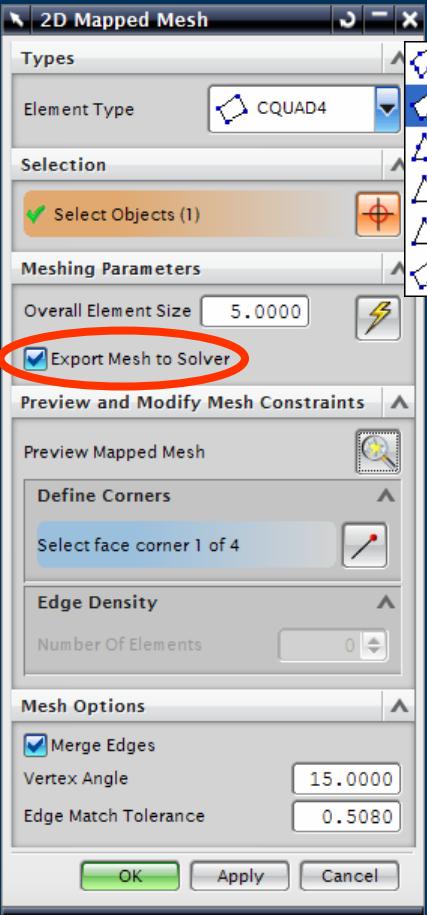
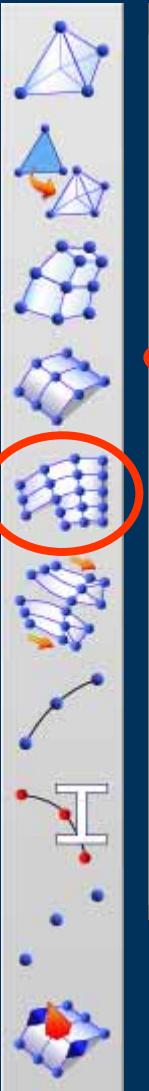


- ▶ Uses
 - ▶ Contact Regions
 - ▶ Flange Mating
 - ▶ Symmetric Faces

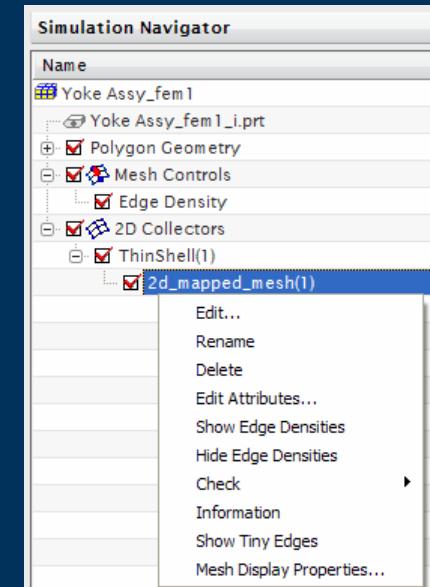
- ▶ Master & Target face selection
- ▶ Topologically Identical Faces
- ▶ Multiple Faces and Loops
- ▶ Coordinate System Selection
- ▶ Mesh Type Selection
 - ▶ Free or Mapped
 - ▶ New Mesh or Use Existing Mesh on Master Face
- ▶ Managed by 2D Collector



Mesher – 2D Mapped Mesh

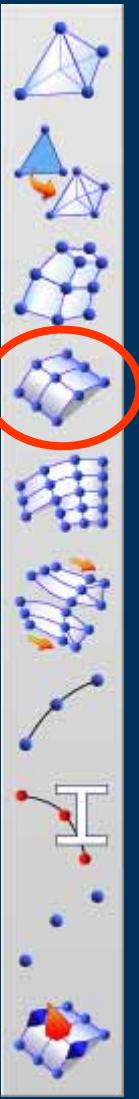


- ▶ 3 or 4 Topological Sided Face (Single Loop)
- ▶ Mesh Controls automatically added if not pre-defined
- ▶ Can be used as Seed for 3D Meshing



Element Attributes vary according to the Solver Environment & Element Type

Mesher – 2D Mesh



2D Mesh

Type: CTRIA3

Meshing Method: Subdivision

Equivalent Element: Subdivision

Destination Collector: Automatic Mode

Mesh Collector: None

Overall Element Size: 1.0000

Create Mesh Points

Preview

Mesh Options

Edge Match: 0.5080

Midnodes: Mixed

Split Quad

Maximum Warp: 5.0000

Maximum Jacobian: 5.0000

Mesh Size Variation: 0

Min: Max:

Attempt Mapping

Export Mesh to Solver

Mesh Transition

OK Apply Back Cancel

2D Mesh

Type: CQUAD8

Meshing Method: Subdivision

Equivalent Element: Subdivision

Destination Collector: Automatic Mode

Mesh Collector: None

Overall Element Size: 1.0000

Create Mesh Points

Preview

Mesh Options

Edge Match: 0.5080

Midnodes: Mixed

Split Quad

Maximum Warp: 5.0000

Maximum Jacobian: 5.0000

Mesh Size Variation: 0

Min: Max:

Attempt Mapping

Export Mesh to Solver

Mesh Transition

OK Apply Back Cancel

- ▶ Creation of 2D Shell or Plate elements on selected faces
- ▶ Mesh will be also driven by
 - ▶ Mesh Points
 - ▶ Mating Conditions
 - ▶ Contact Definitions
 - ▶ Mesh Controls

Simulation Navigator

Name: 1D_elements_fem1

- + 1D_elements_fem1_i
- + Polygon Geometry
- + 2D Collectors
- + ThinShell(1)
- + 2d_mesh(1)

Element Attributes

Element Mesh

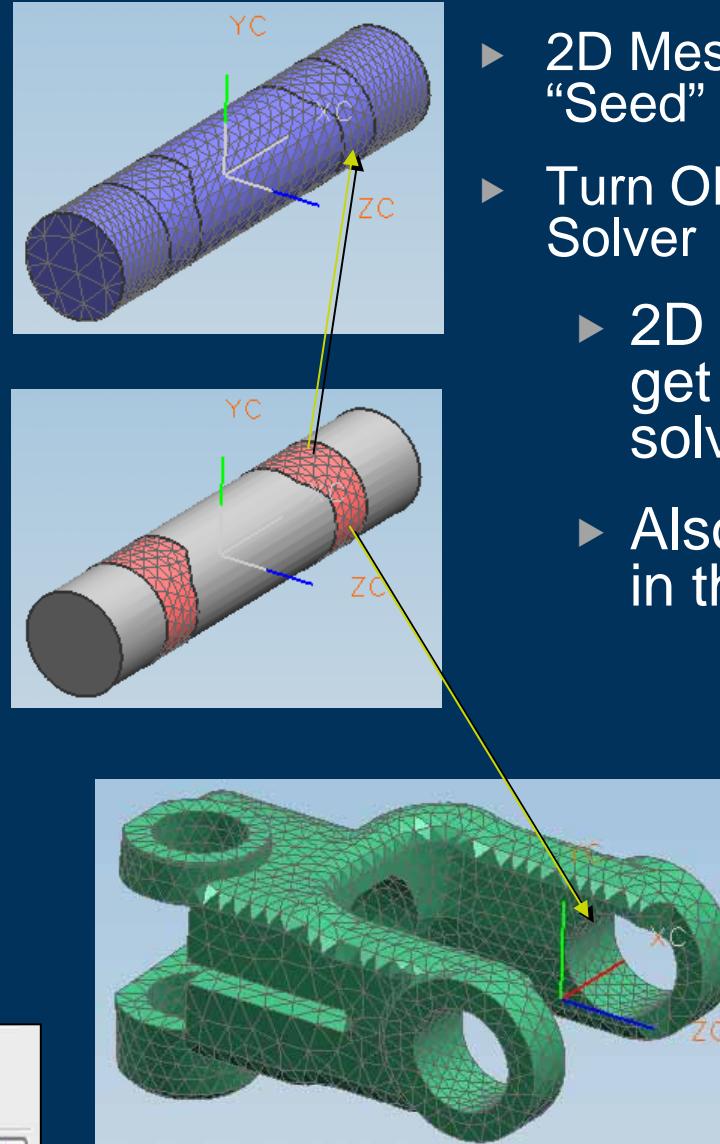
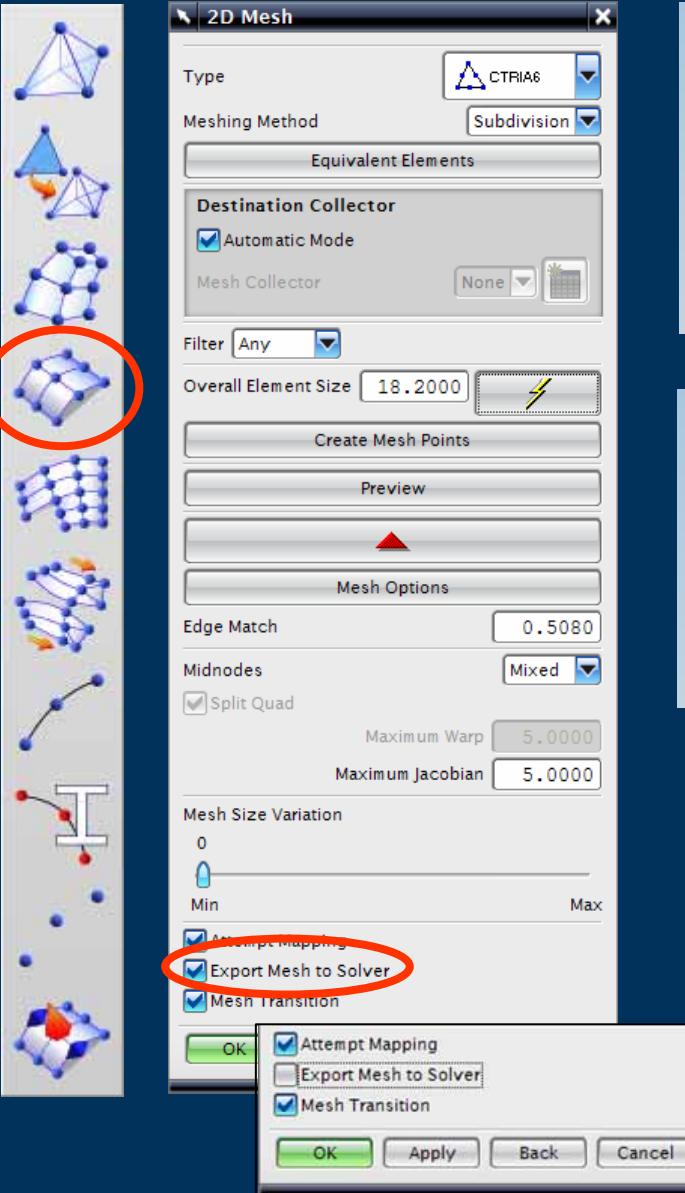
Shell Offset: 2 mm

Enable MCID

Ignore Midsurface Thickness

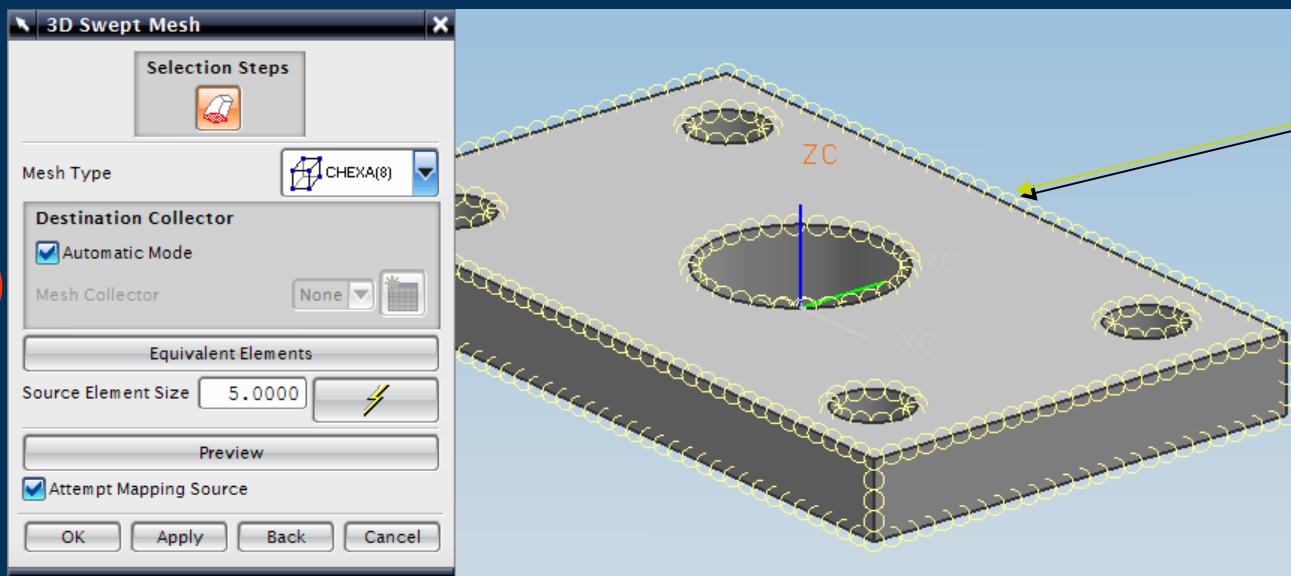
OK Apply Cancel

Mesher – 2D Mesh Seeding for 3D Mesh

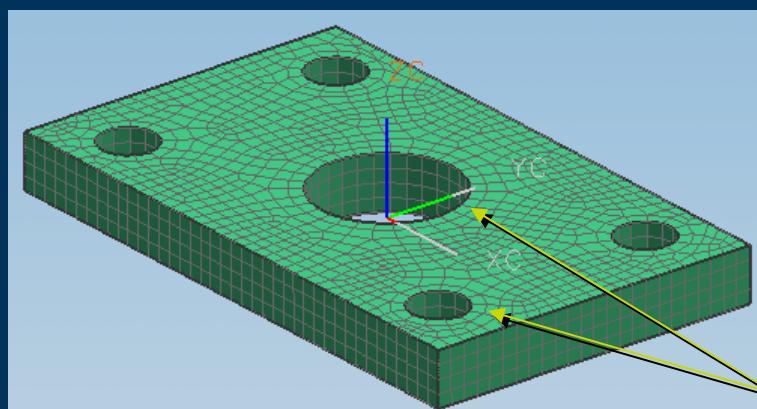


- ▶ 2D Mesh can be used to “Seed” or define a 3D Mesh
- ▶ Turn OFF Export Mesh to Solver
 - ▶ 2D Mesh does NOT get written to the solver
 - ▶ Also does not appear in the SIM file

Meshering – 3D Swept Mesh

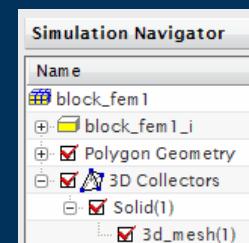


Preview of Mesh distribution along edges

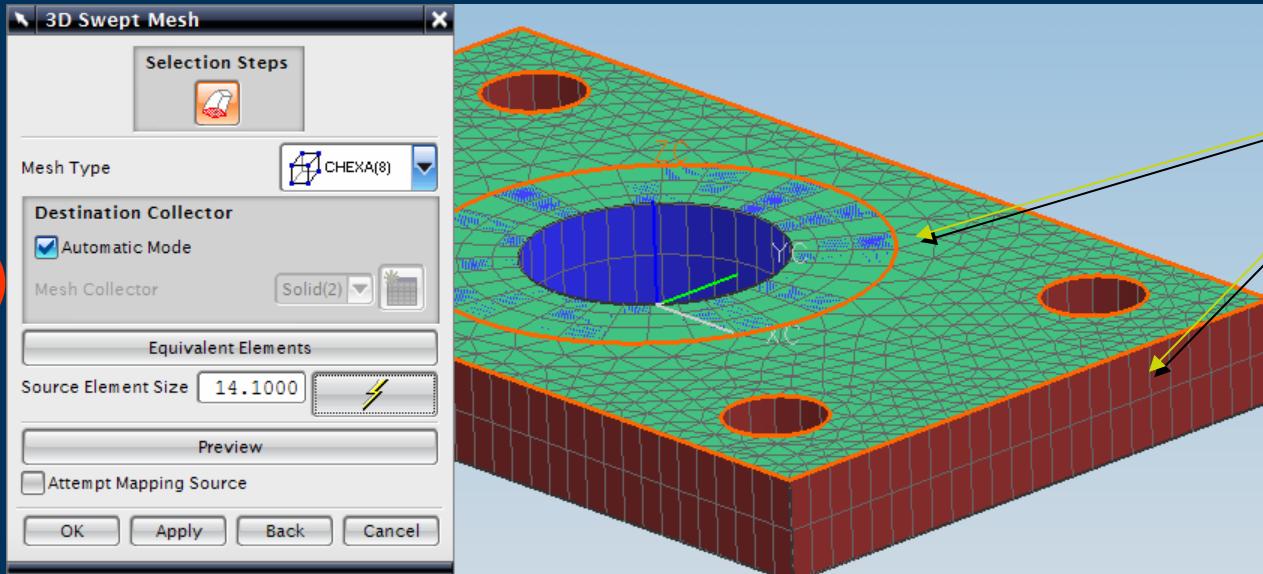


- ▶ 3D Swept Mesh requires source face selection
- ▶ This face is meshed and swept through the volume

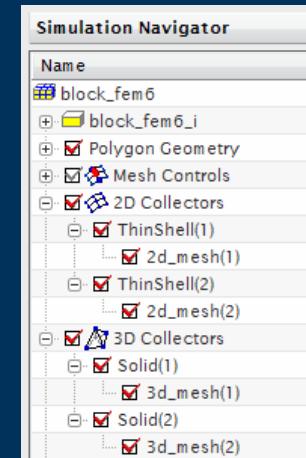
Notice Mapped meshing around holes



Mesher – 3D Swept Mesh

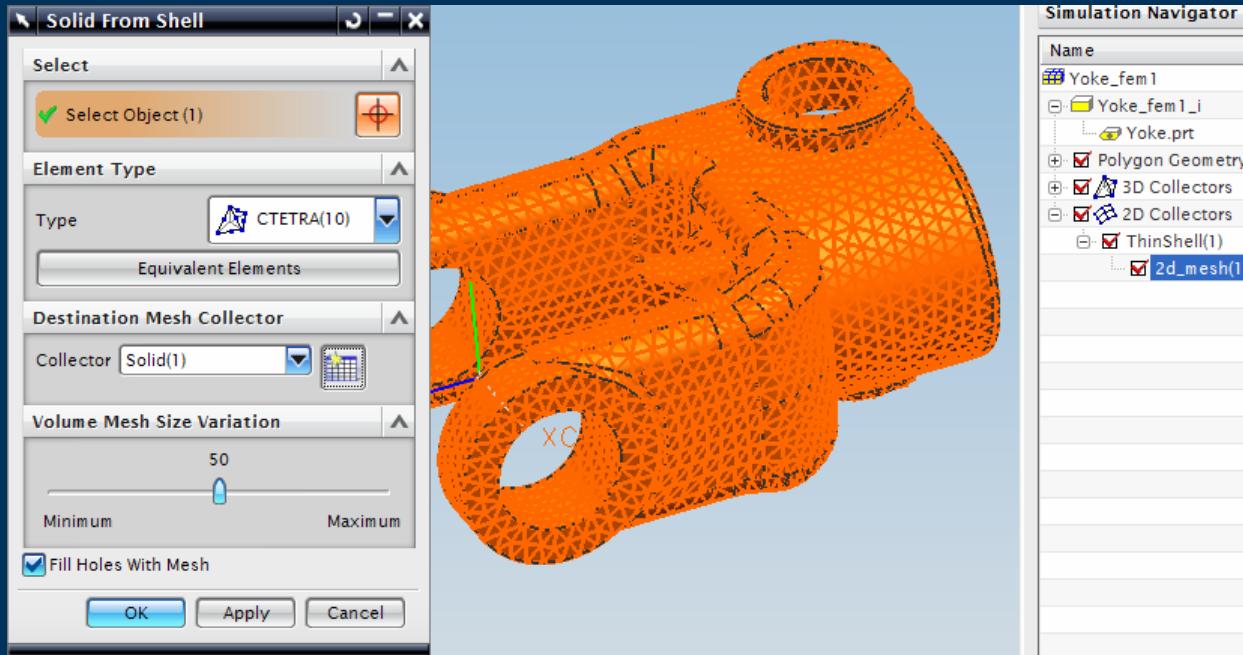
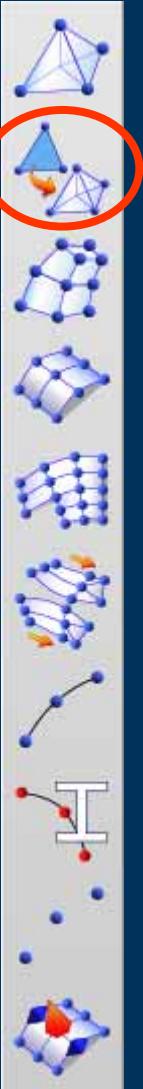


Green – 2D Seed Meshes
to define 3D Swept Mesh
Brown & Blue – 3D Swept
Meshes

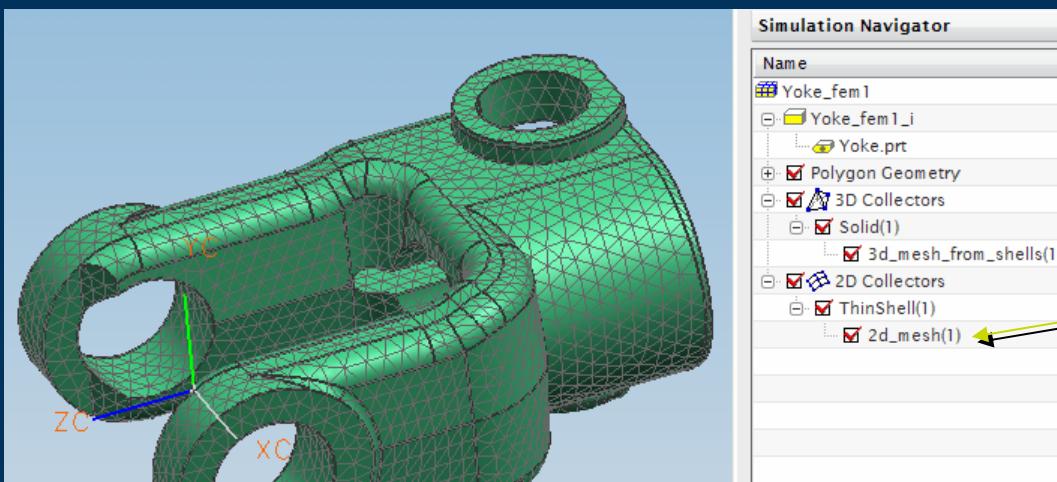


- ▶ 2D Mesh the Seed faces to control mesh type and distribution
- ▶ 2D Mesh – Turn OFF “Export Mesh to Solver” then this mesh is not written to the solver input deck
- ▶ 3D Swept Mesh starts with these Seed meshes

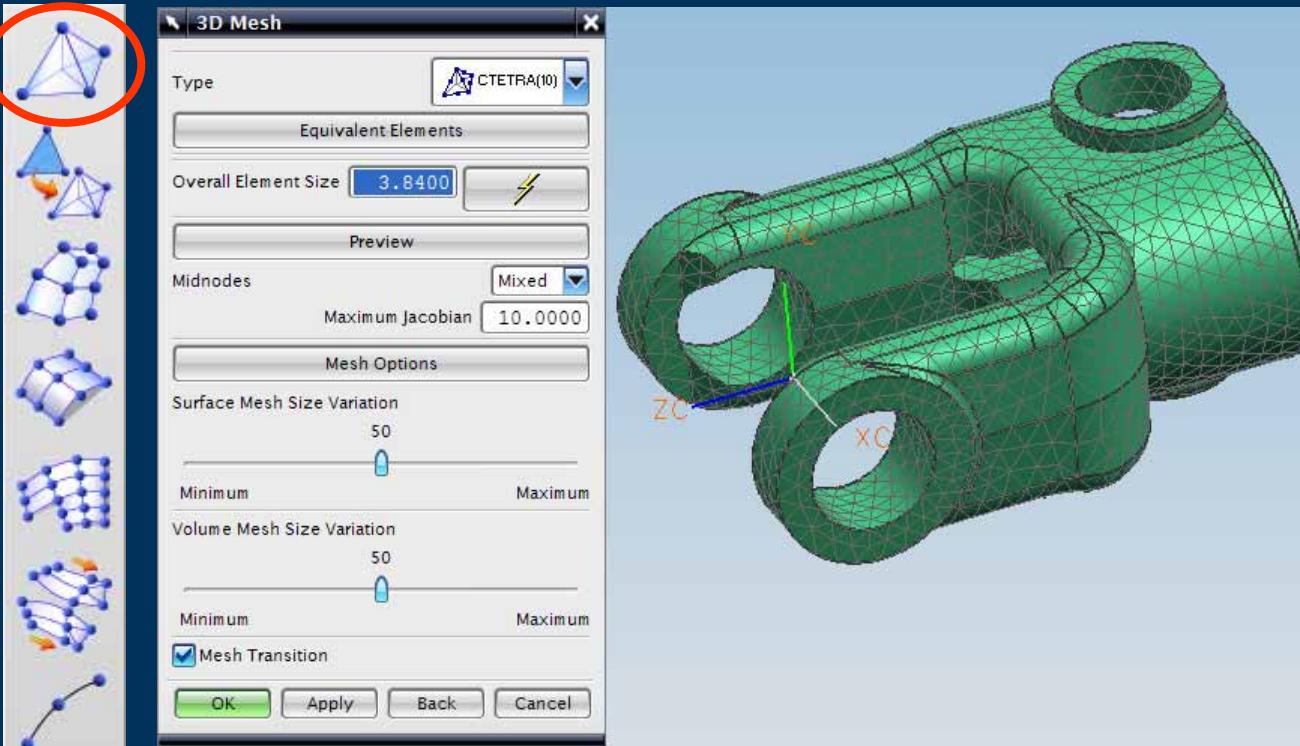
Mesher – Solid from Shell Mesh



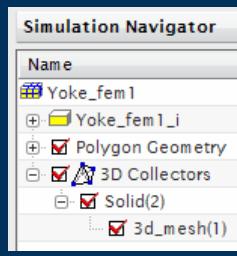
- ▶ Generates a 3D Mesh from a closed surface mesh
- ▶ Used when the imported CAD geometry is not complete and CAE topology is used to close the volume



Mesher – 3D Tetrahedral Mesh



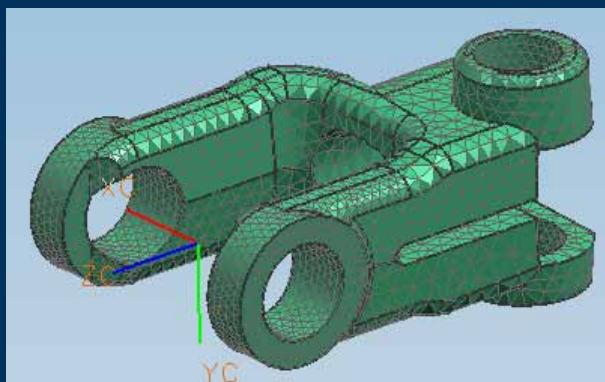
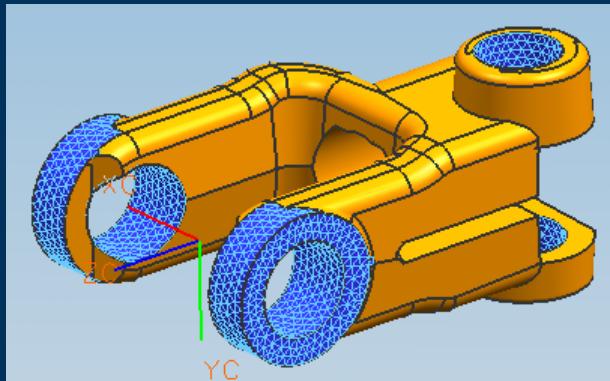
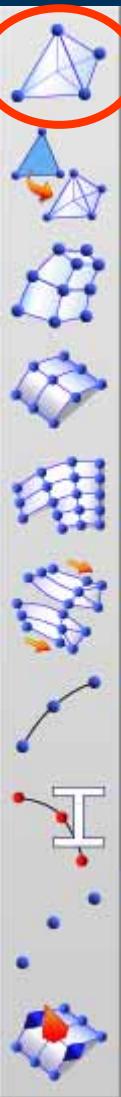
- ▶ 3D Tet Mesh
- ▶ Auto Element Size sets a good value to start the meshing process
- ▶ Same Mesh Options as 2D Mesh



Mesh quality

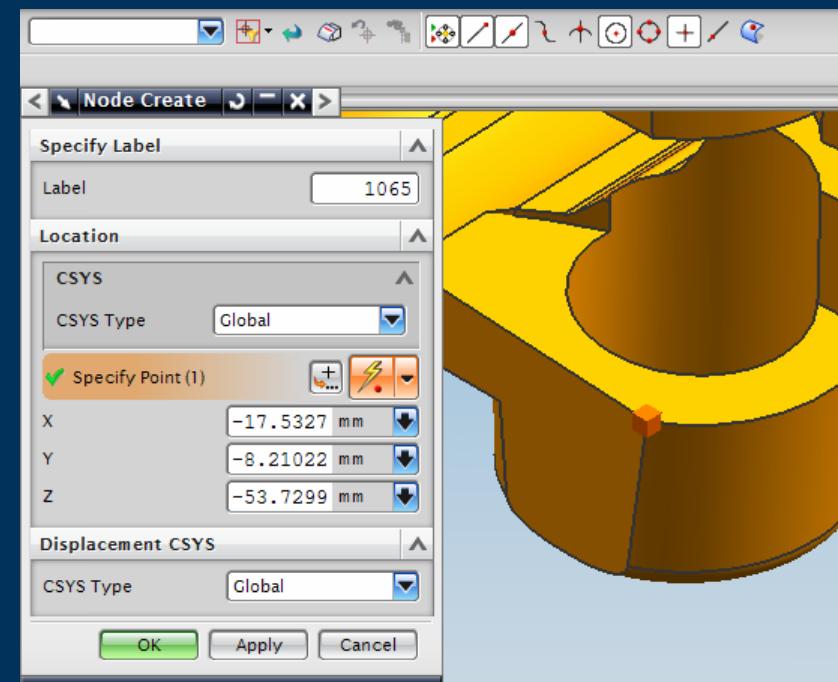
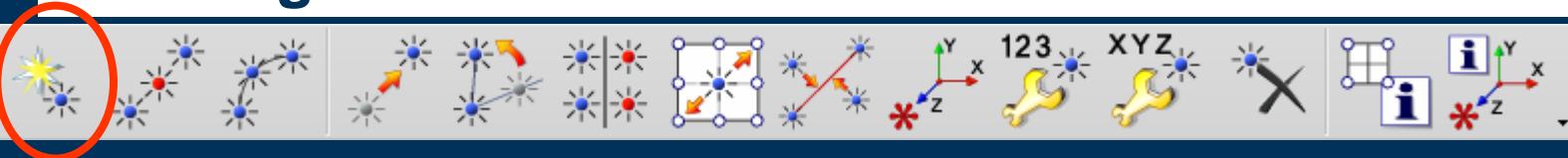
- ▶ CAE Topology Editing
- ▶ Mesh Controls
- ▶ 2D Surface Seed Meshes
- ▶ Volume Mesh Size Variation

Meshering – 3D Tetrahedral Mesh

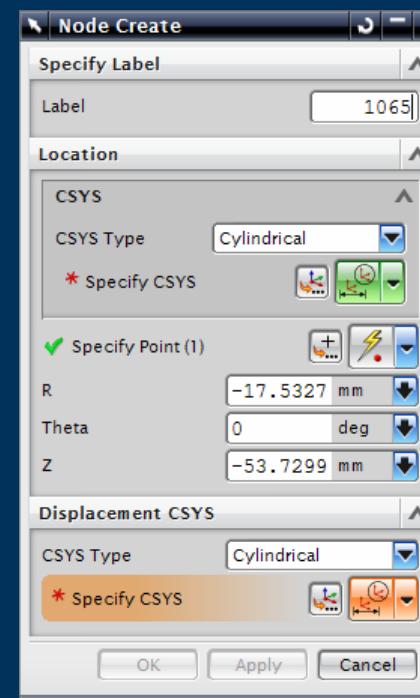


- ▶ Good technique is to “seed” the mesh by applying 2D Mesh to selected faces
- ▶ Add refinement and detail control where required

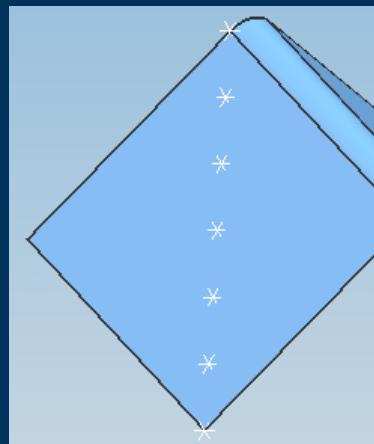
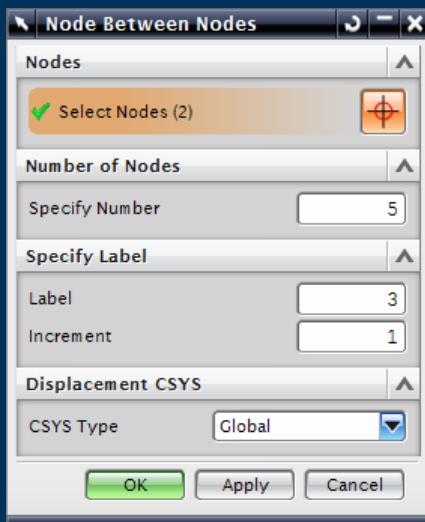
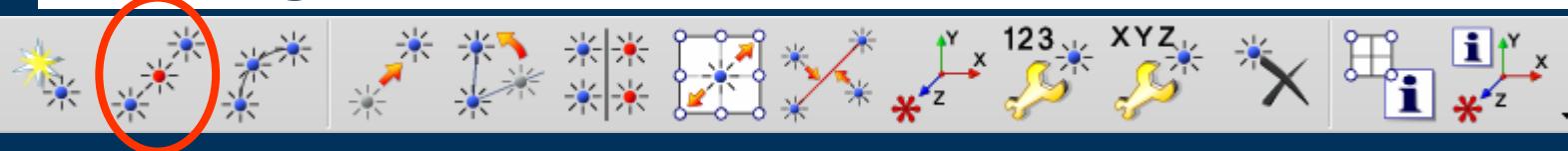
Meshering – Node Create



- ▶ Location & Displacement by Global or Selected CSYS

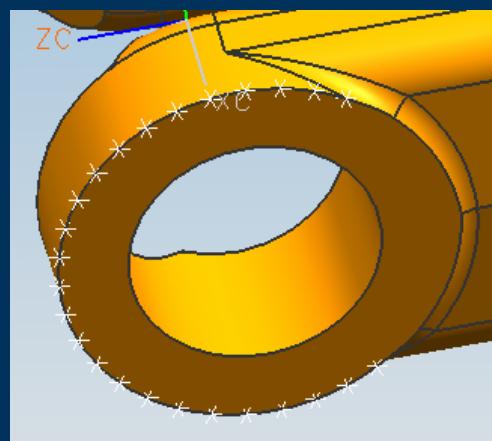
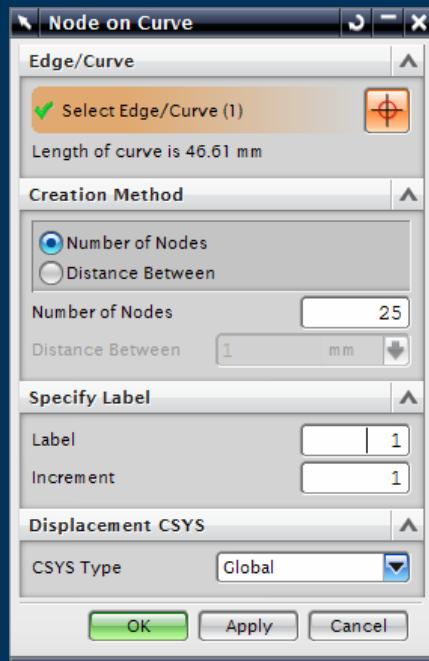


Meshing – Node Between Nodes



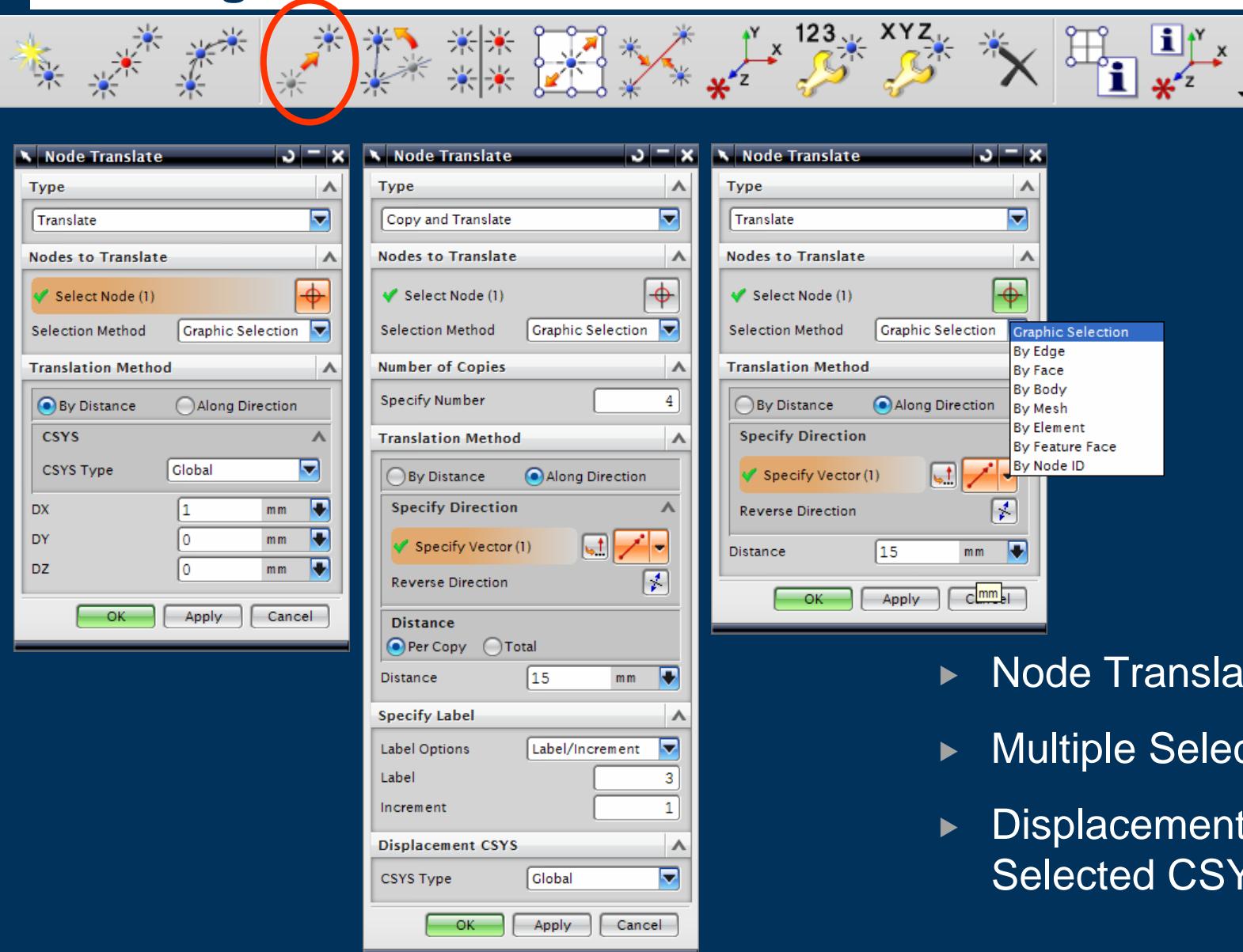
- ▶ Place Nodes equidistant between 2 selected Nodes
- ▶ Geometry independent ie does not track surface(s) between Nodes
- ▶ Displacement by Global or Selected CSYS

Meshing – Node on Curve/Edge



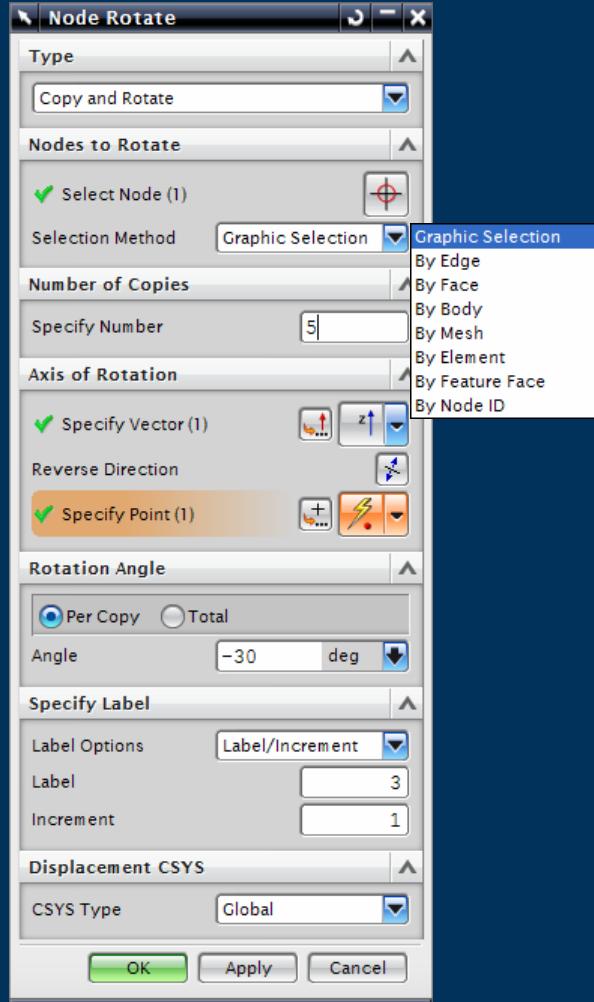
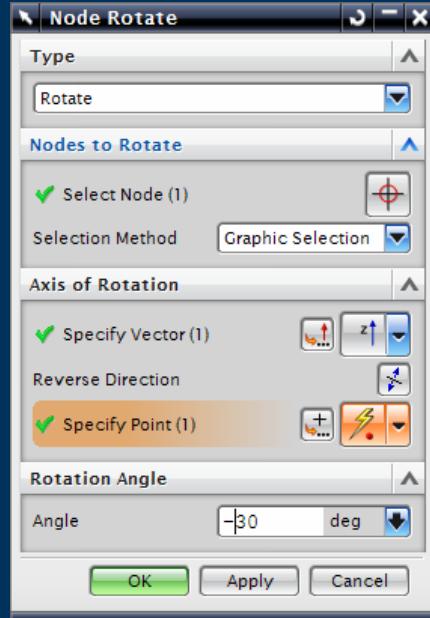
- ▶ Place Nodes equidistant along a selected Edge/Curve
- ▶ Number of Nodes or Distance between Nodes
- ▶ Displacement by Global or Selected CSYS

Meshering – Node Translate



- ▶ Node Translate/Copy
- ▶ Multiple Selection Methods
- ▶ Displacement by Global or Selected CSYS

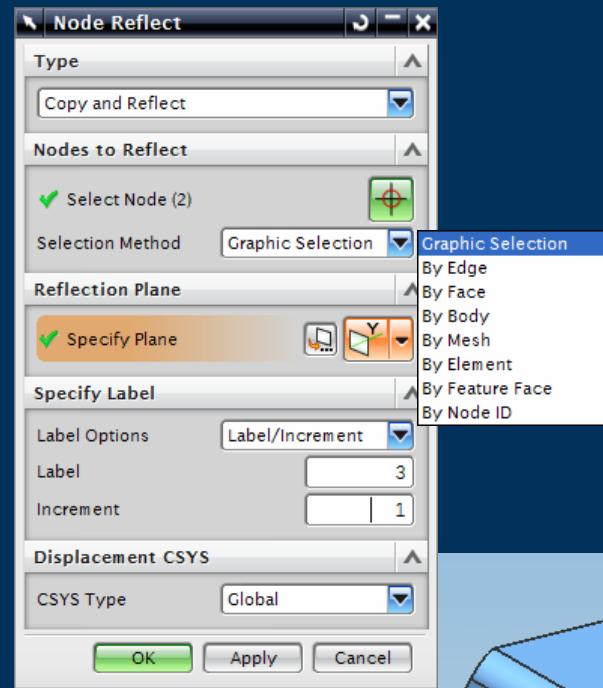
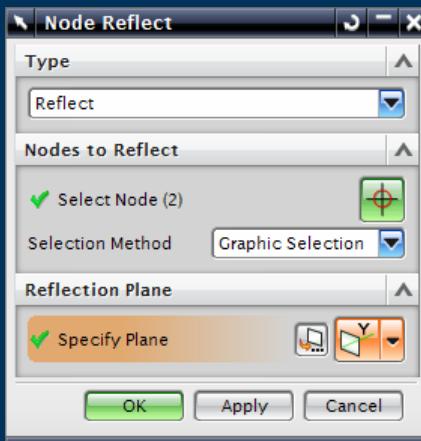
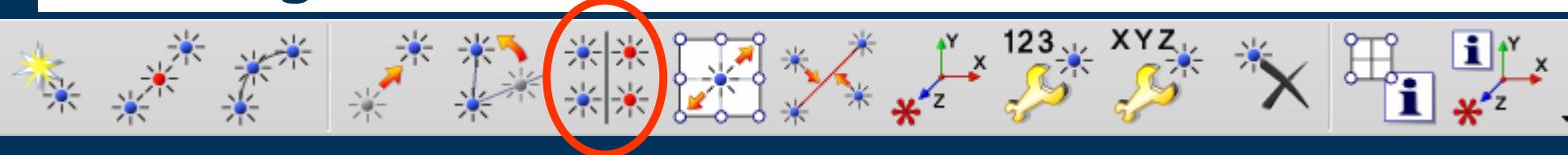
Mesher – Node Rotate



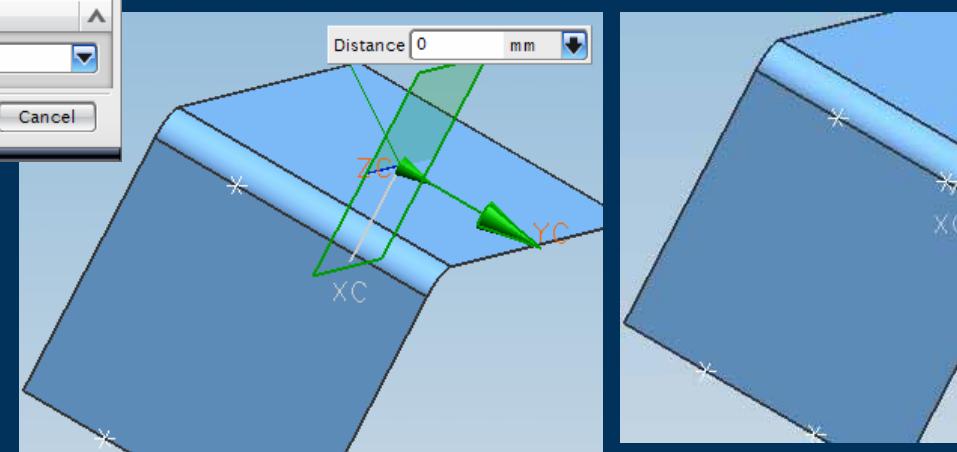
- Node Rotate/Copy
- Multiple Selection Methods
- Displacement by Global or Selected CSYS



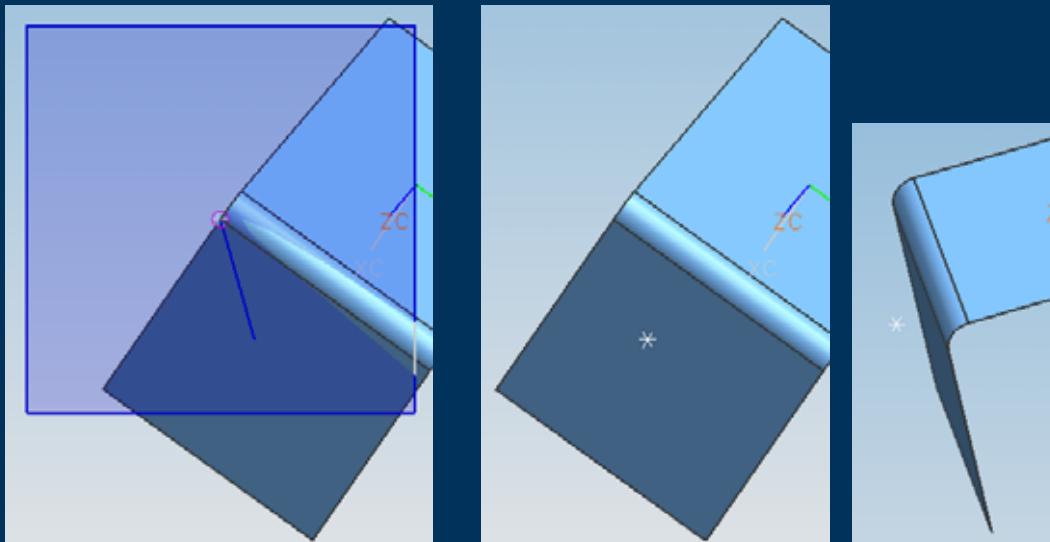
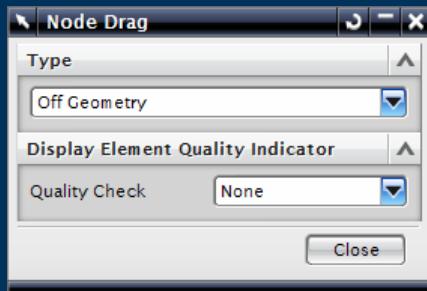
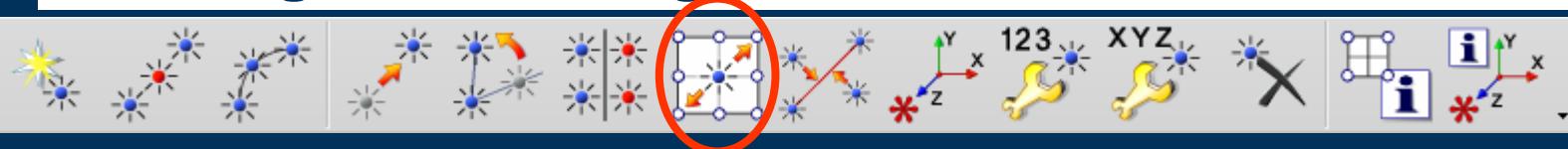
Meshering – Node Reflect



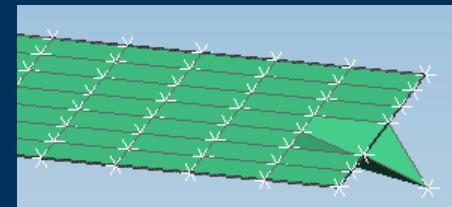
- ▶ Node Reflect/Copy
- ▶ Multiple Selection Methods
- ▶ Displacement by Global or Selected CSYS



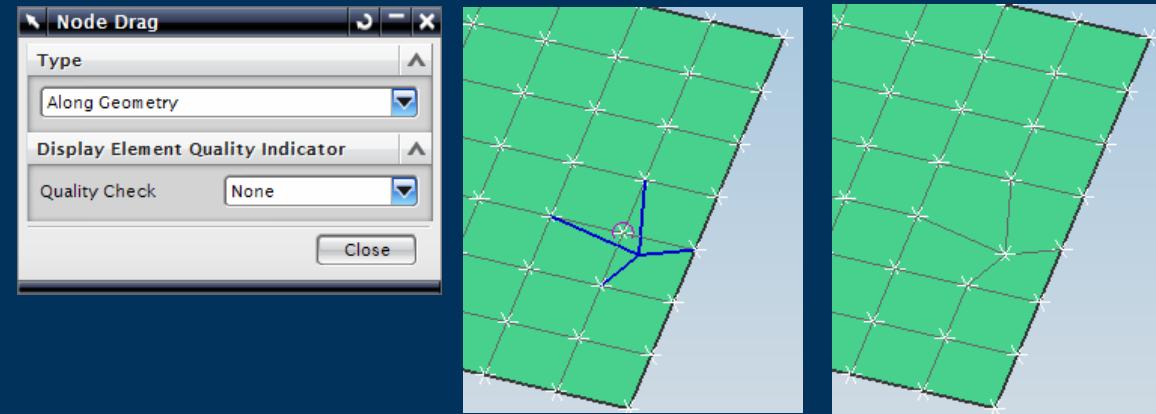
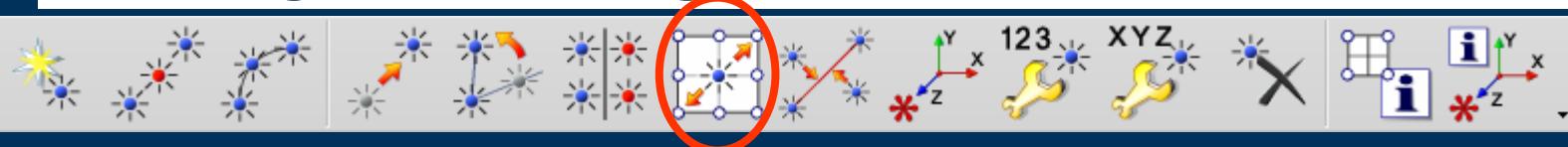
Meshing – Node Drag



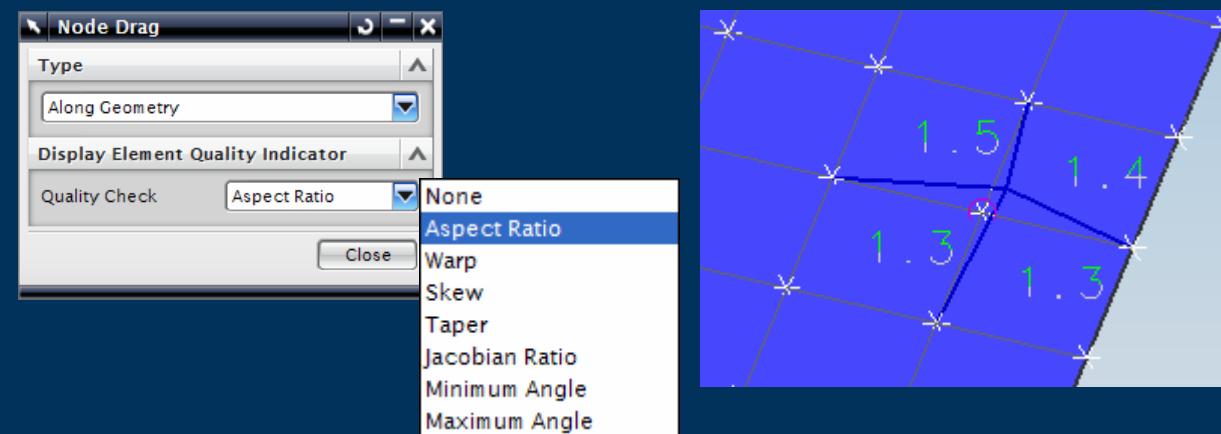
- ▶ Node Dragging Off Geometry
 - ▶ Drags in a plane parallel to screen through start node location



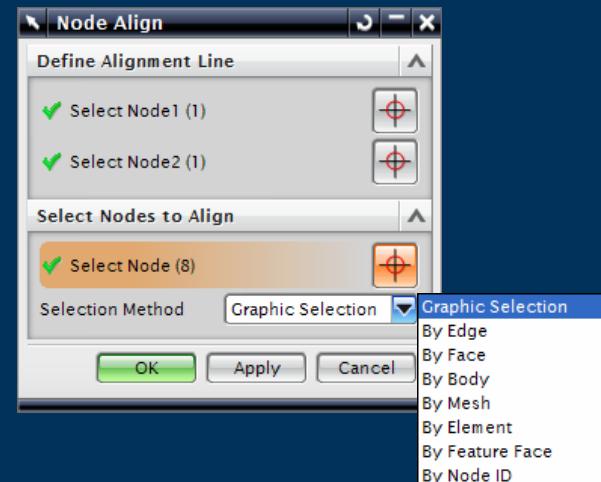
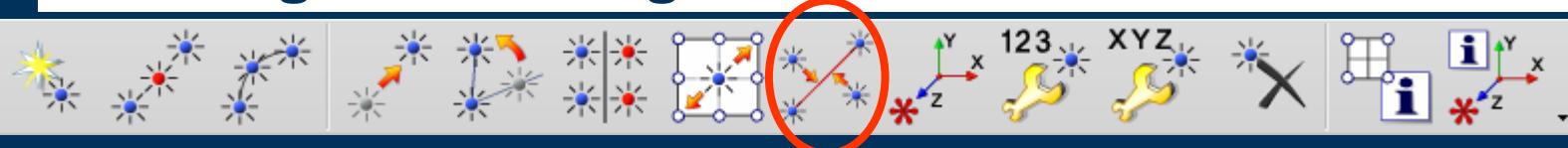
Meshing – Node Drag



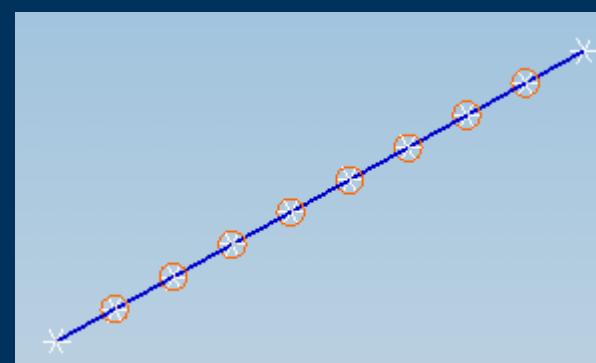
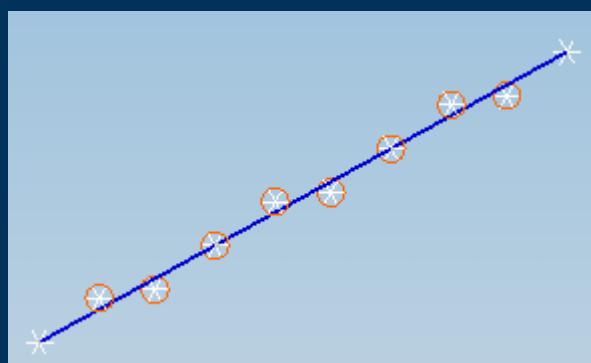
- ▶ Node Dragging On Geometry
- ▶ Drags on associated geometry
 - ▶ Edge
 - ▶ Face
- ▶ Dynamic Display of Element Quality Check



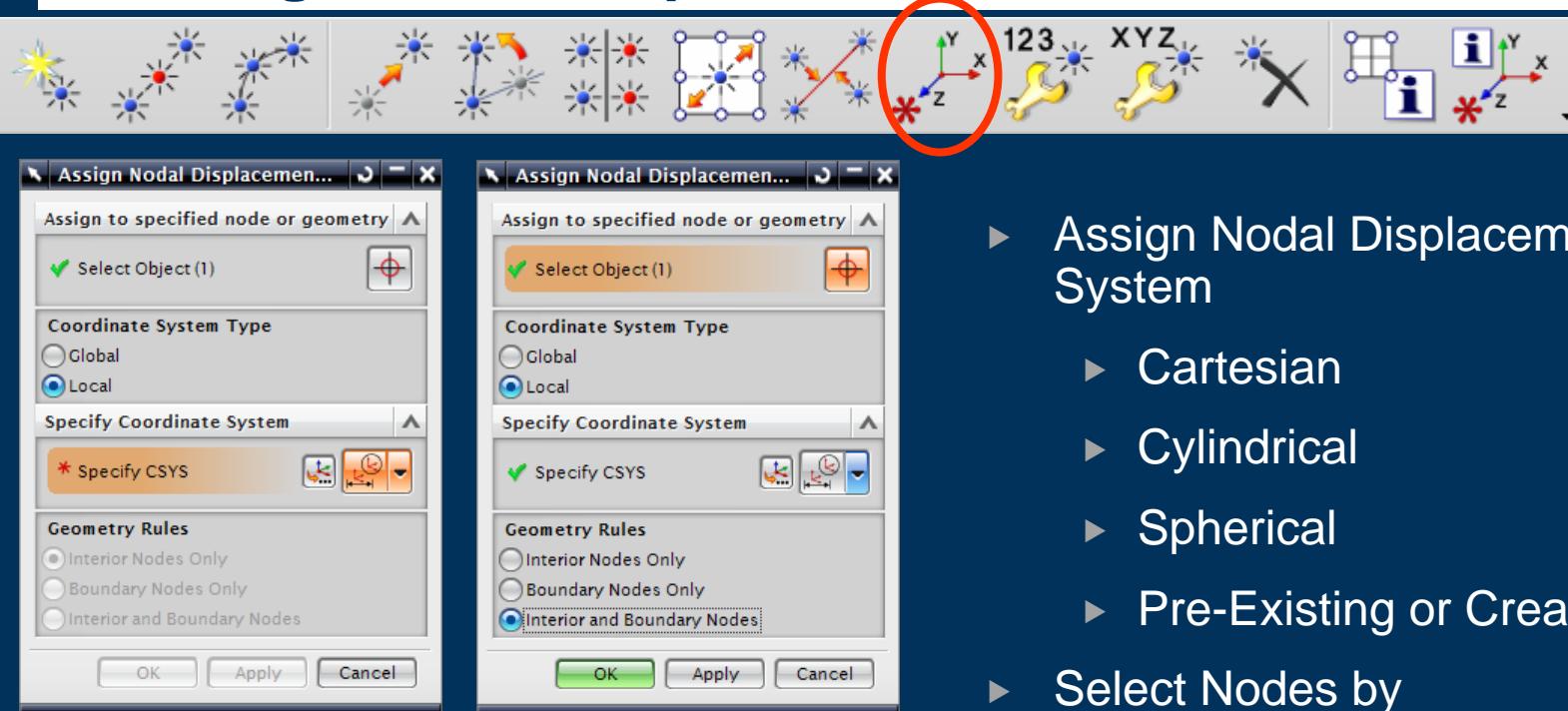
Meshering – Node Align



- ▶ Move selected Nodes onto Vector between 2 Nodes
- ▶ Multiple Selection Methods

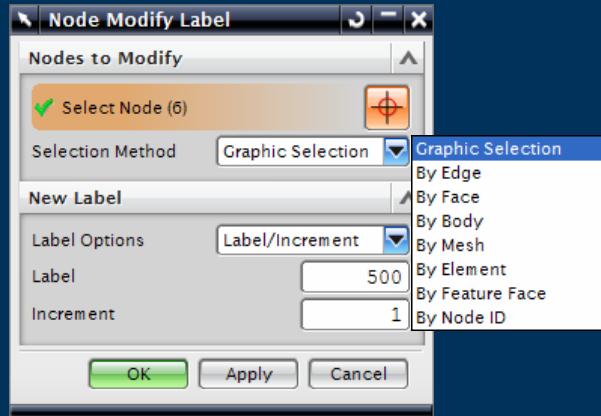
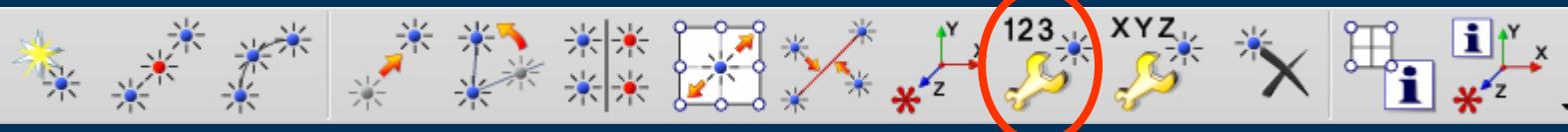


Mesher – Node Displacement CSYS

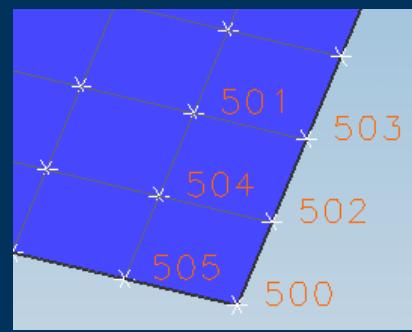


- ▶ Assign Nodal Displacement Coordinate System
 - ▶ Cartesian
 - ▶ Cylindrical
 - ▶ Spherical
 - ▶ Pre-Existing or Created on-the-fly
- ▶ Select Nodes by
 - ▶ Edge
 - ▶ Face
 - ▶ Body
 - ▶ Individual Selection

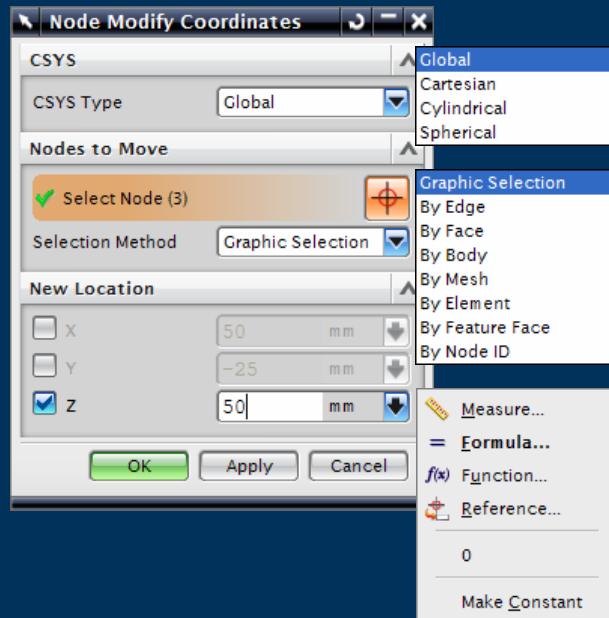
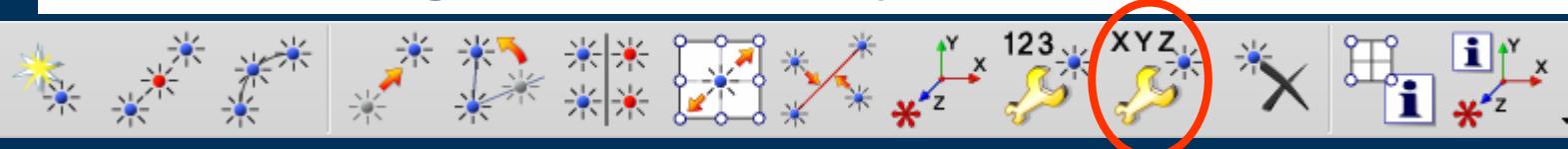
Meshering – Node Re-Numbering



► Modify Node Numbering/Label

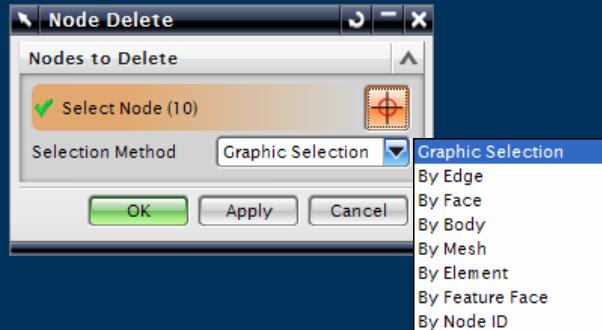
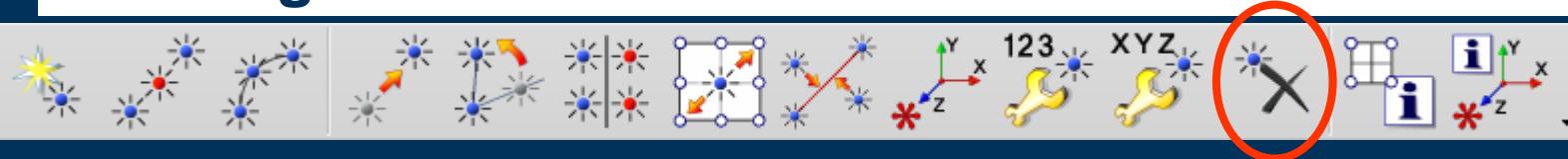


Meshing – Node Modify Coordinates



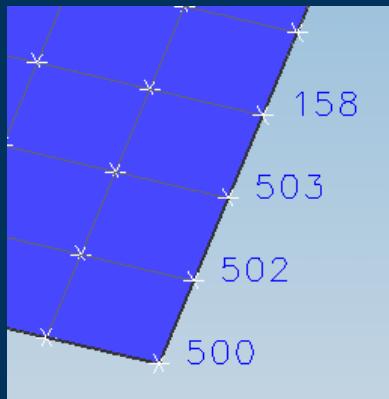
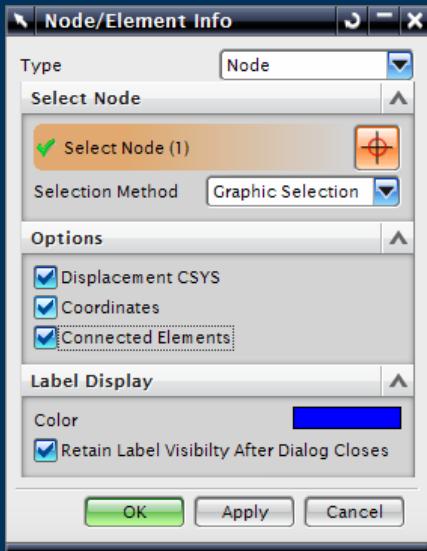
- ▶ Modify the Coordinate(s) of selected Nodes
- ▶ Global or Selected CSYS
 - ▶ X, Y, Z
 - ▶ R, Theta, Z
 - ▶ R, Theta, Phi

Mesher – Node Deletion



- ▶ Delete Nodes
- ▶ Only Nodes not attached to Elements will be deleted

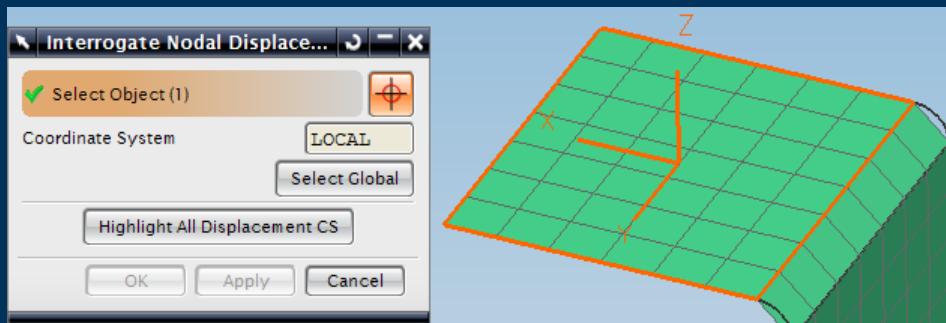
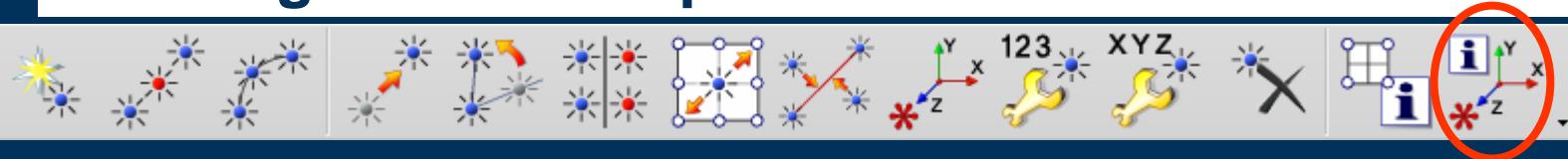
Meshting – Node & Element Information



NODE INFORMATION		
<hr/>		
Label 158	Displacement CSys	: GLOBAL
	Global coordinates	: 50.0000 -3.5714 50.0000
	Connected elements	: 130 131
<hr/>		
Label 500	Displacement CSys	: GLOBAL
	Global coordinates	: 50.0000 -25.0000 50.0000
	Connected elements	: 128
<hr/>		
Label 502	Displacement CSys	: GLOBAL
	Global coordinates	: 50.0000 -17.8571 50.0000
	Connected elements	: 128 129
<hr/>		
Label 503	Displacement CSys	: GLOBAL
	Global coordinates	: 50.0000 -10.7143 50.0000
	Connected elements	: 129 130

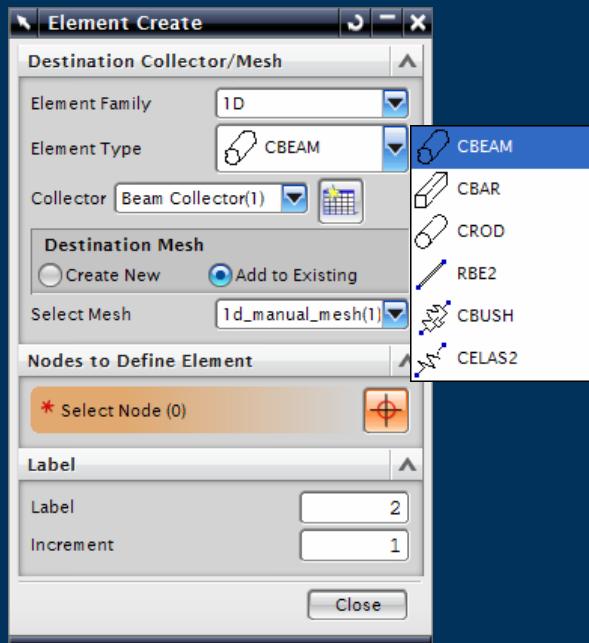
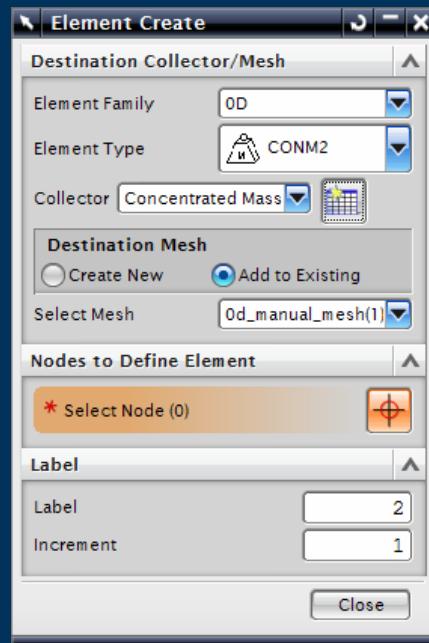
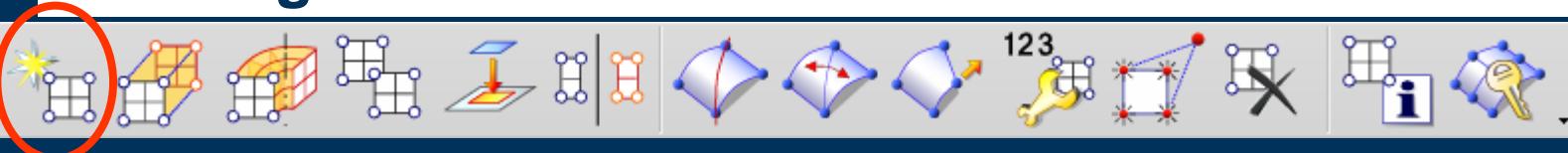
- ▶ Node Information
- ▶ Displacement CSYS
- ▶ Coordinates
- ▶ Connected Elements

Meshing – Nodal Displacement CSYS



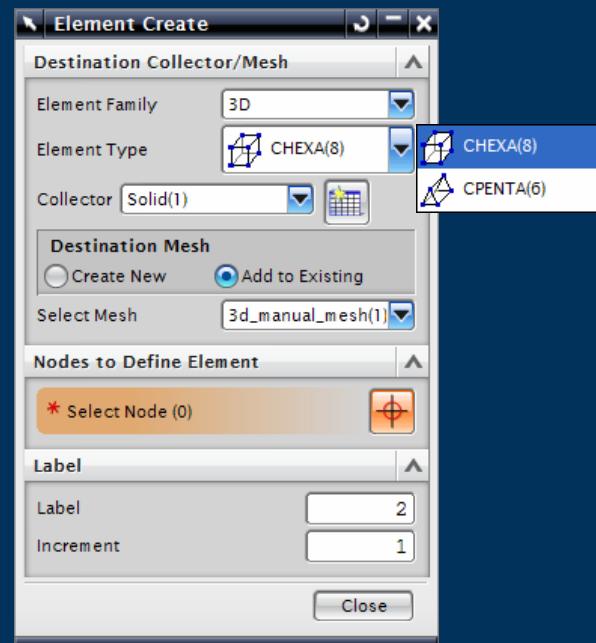
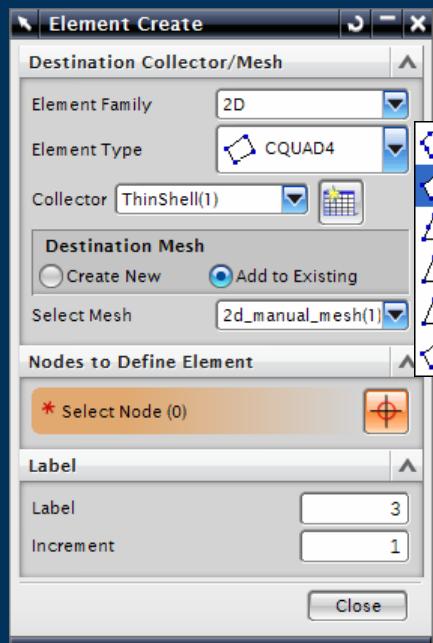
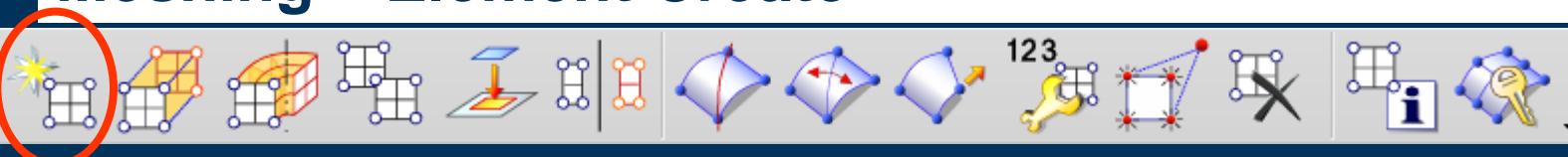
- ▶ Display Assigned Displacement Coordinate System for selected Nodes
- ▶ Display Related Nodes or Geometry to a Displacement Coordinate System

Mesher – Element Create



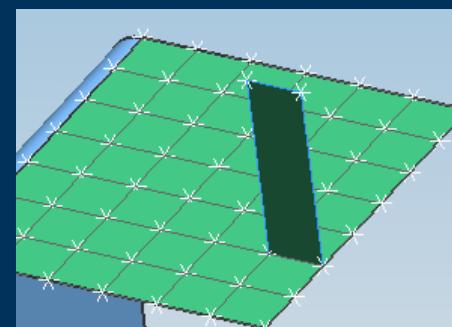
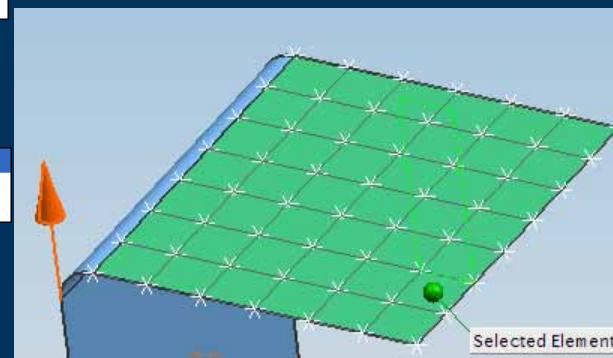
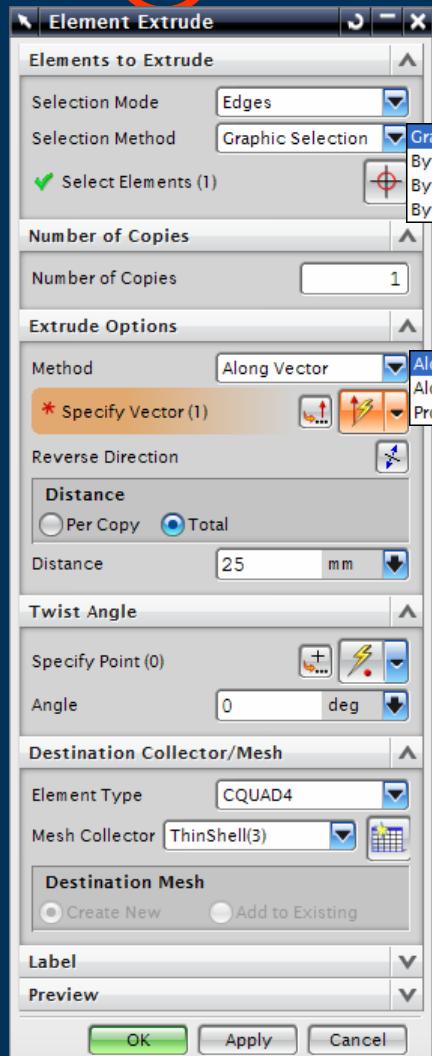
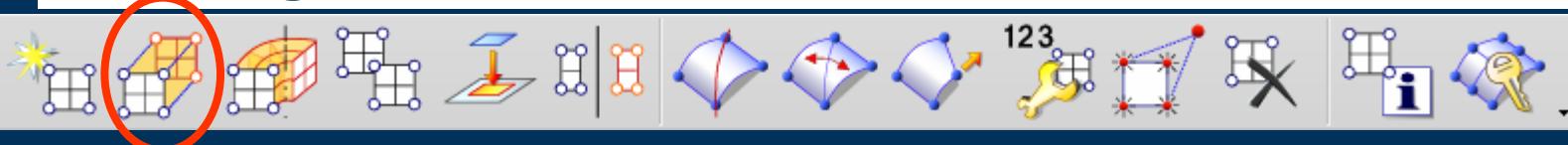
- ▶ Element Creation attached to existing Nodes
- ▶ Mesh Collector selection or Creation on-the-fly
 - ▶ New Mesh
 - ▶ Add to Existing Mesh

Mesher – Element Create

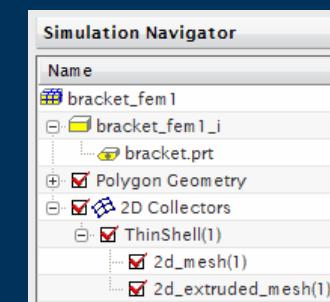


- ▶ Element Creation attached to existing Nodes
- ▶ Mesh Collector selection or Creation on-the-fly
 - ▶ New Mesh
 - ▶ Add to Existing Mesh

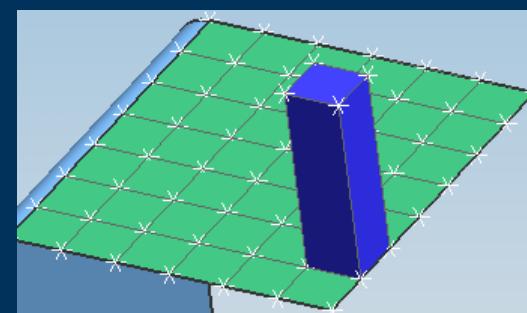
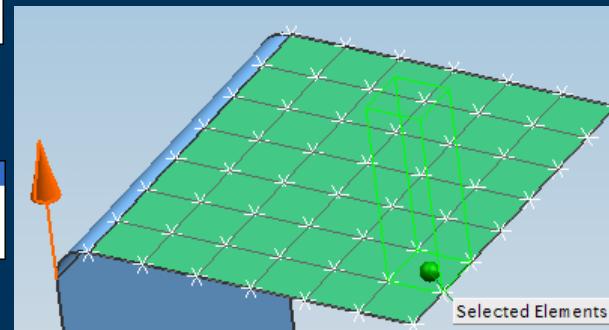
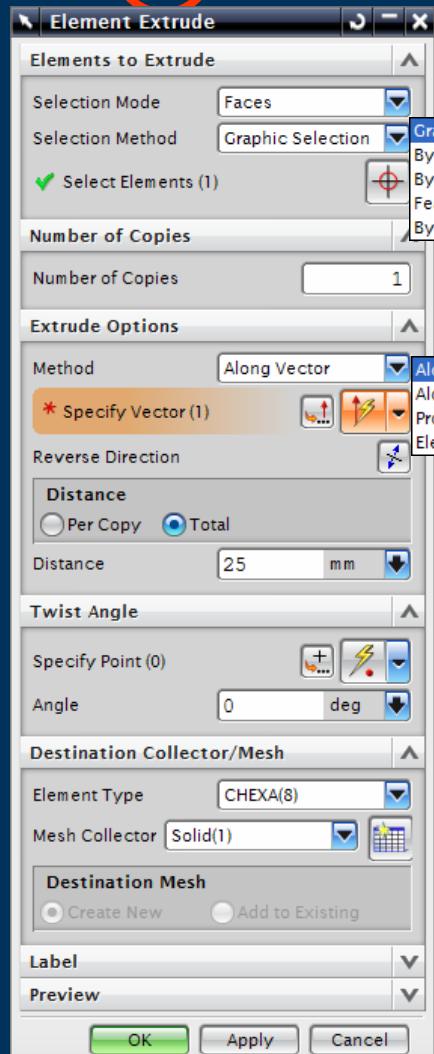
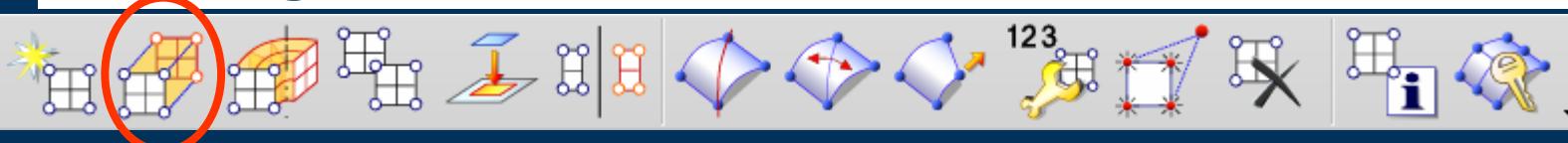
Meshering – Element Extrude



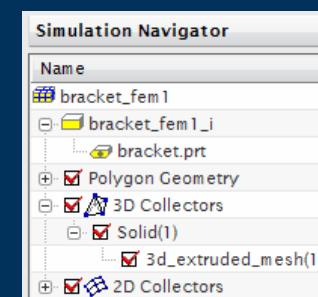
- ▶ Extrude an Existing Element(s) Edge
- ▶ Mesh Collector selection or Creation on-the-fly
- ▶ New Mesh
- ▶ Add to Existing Mesh



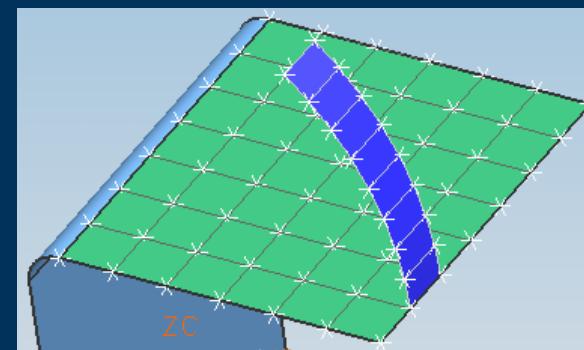
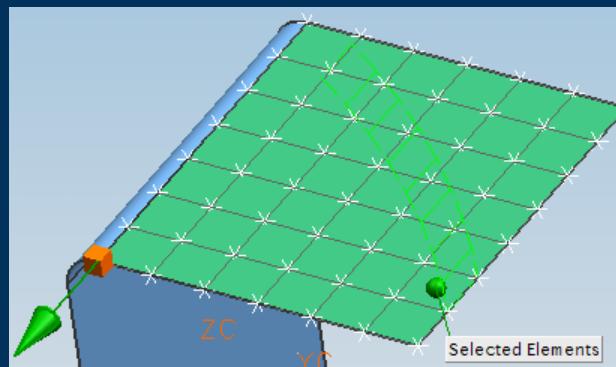
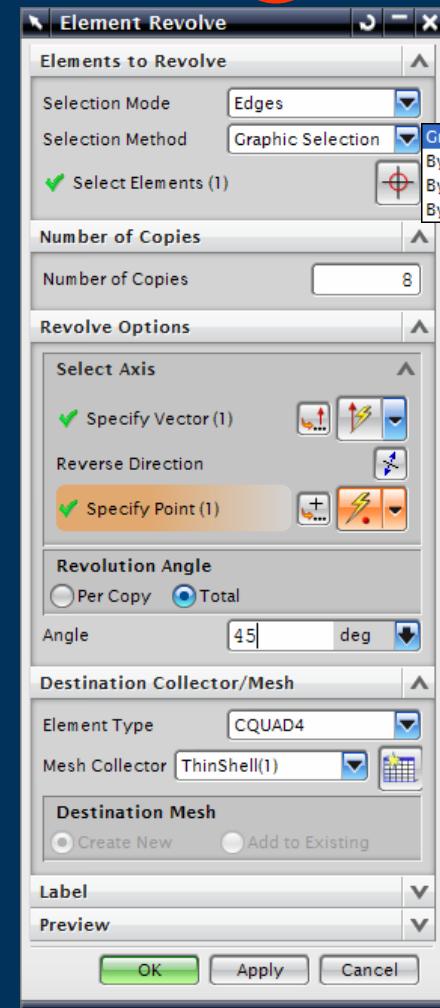
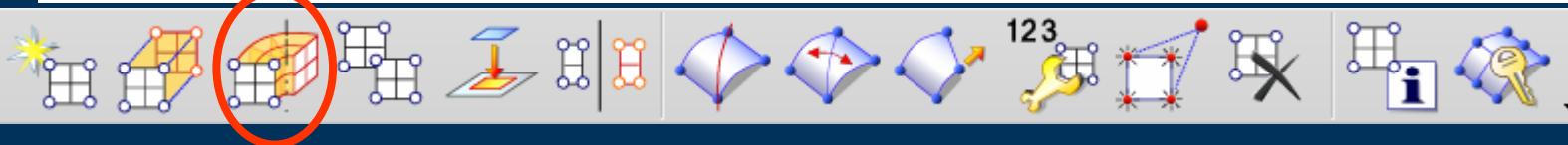
Meshering – Element Extrude



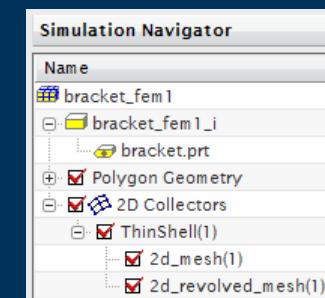
- ▶ Extrude an Existing Element(s) Face
- ▶ Mesh Collector selection or Creation on-the-fly
- ▶ New Mesh
- ▶ Add to Existing Mesh



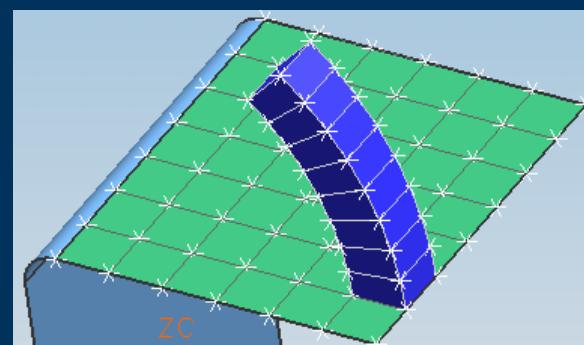
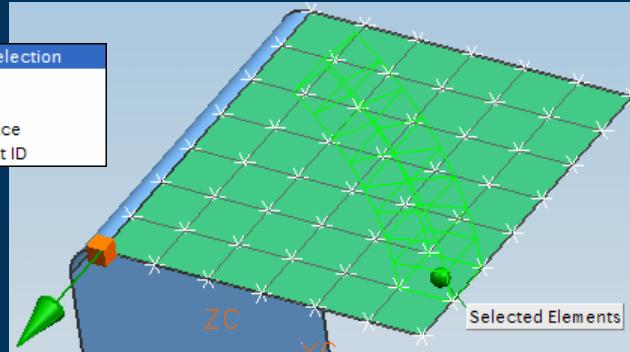
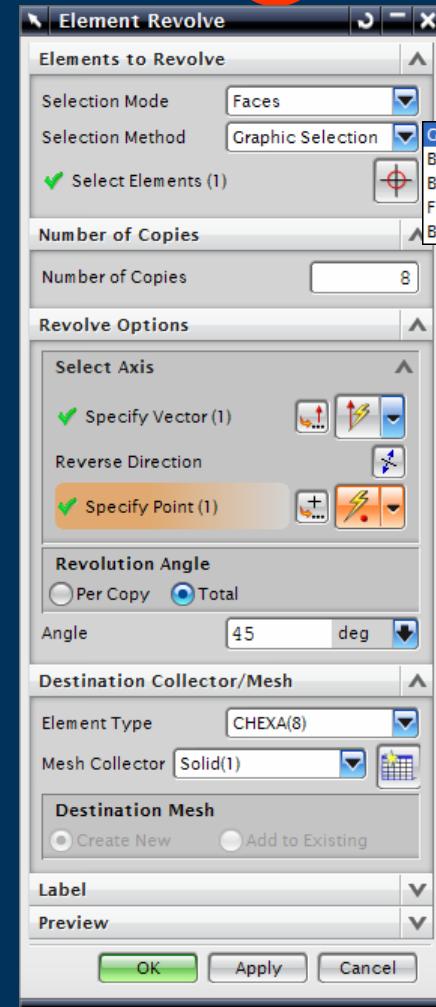
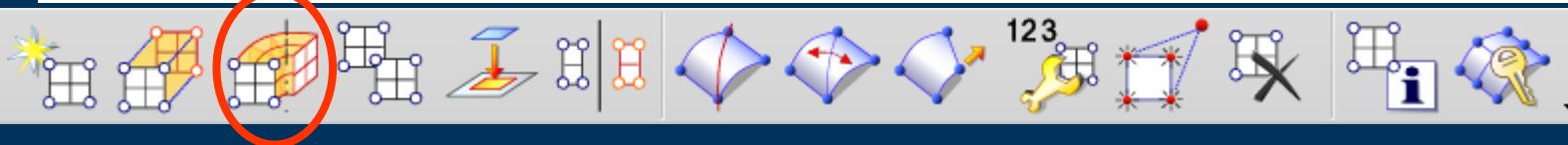
Meshering – Element Revolve



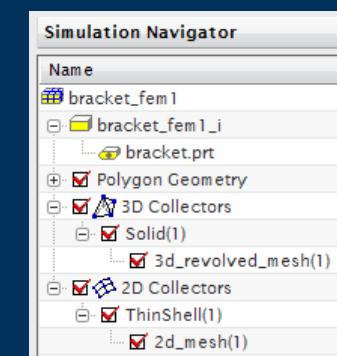
- ▶ Revolves an Existing Element(s) Edge
- ▶ Mesh Collector selection or Creation on-the-fly
 - ▶ New Mesh
 - ▶ Add to Existing Mesh



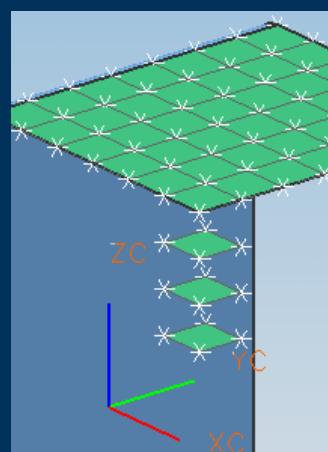
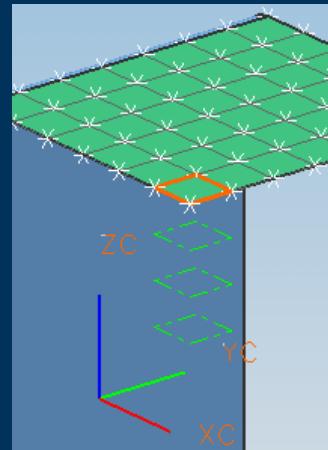
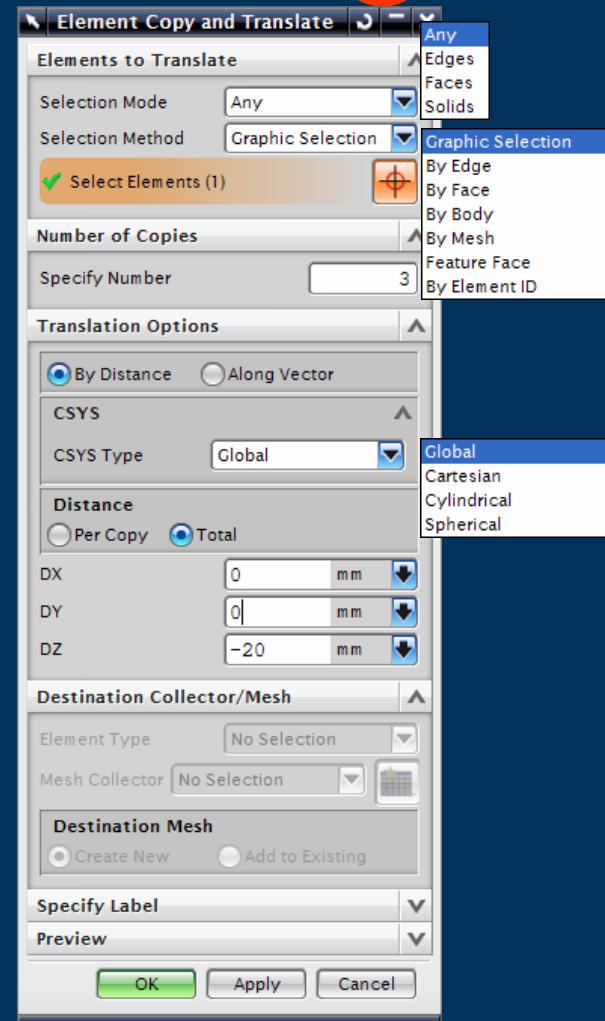
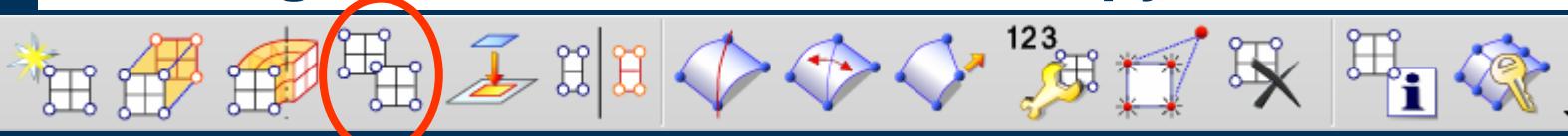
Meshering – Element Revolve



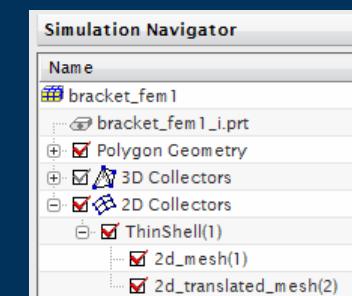
- ▶ Revolve an Existing Element(s) Face
- ▶ Mesh Collector selection or Creation on-the-fly
 - ▶ New Mesh
 - ▶ Add to Existing Mesh



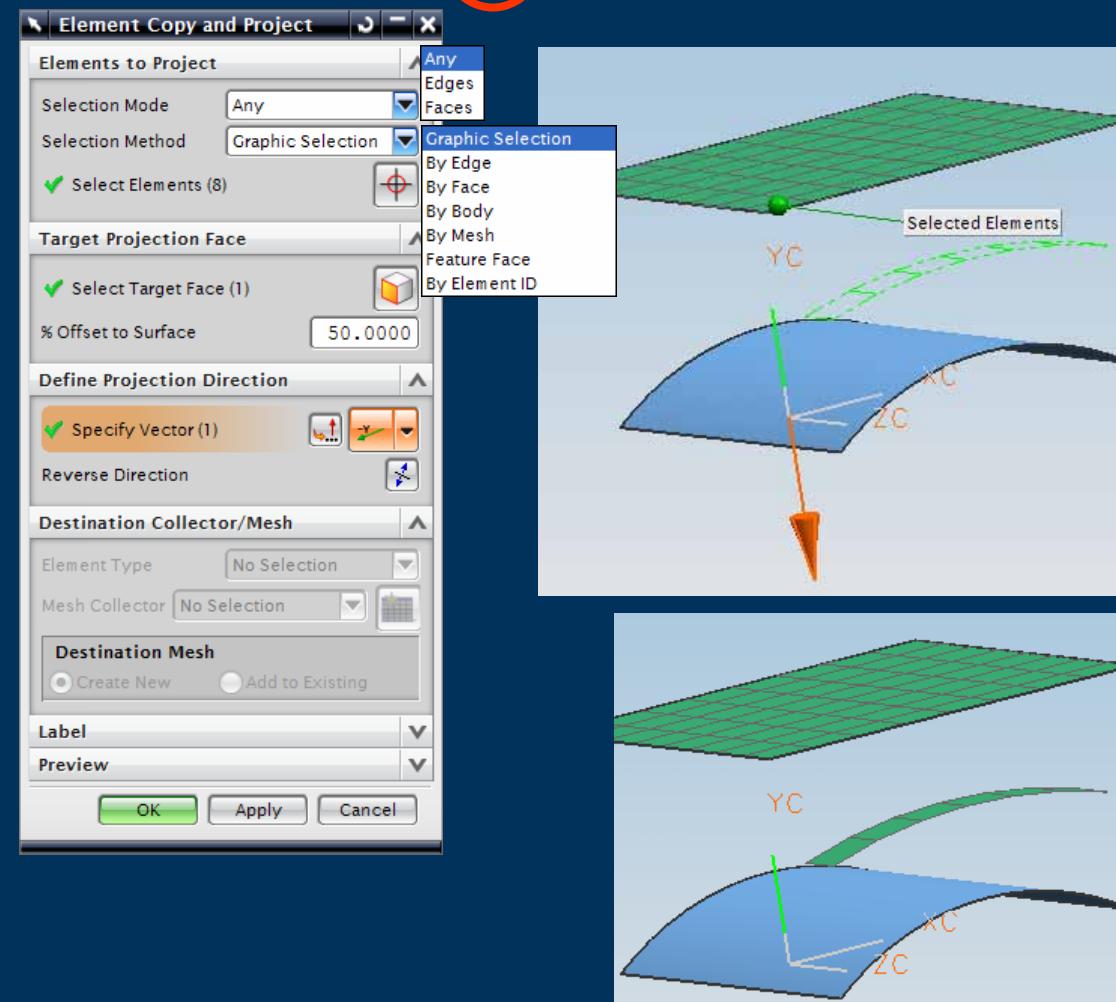
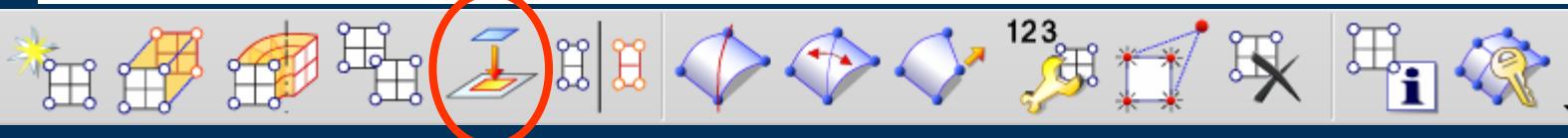
Meshering – Element Translate & Copy



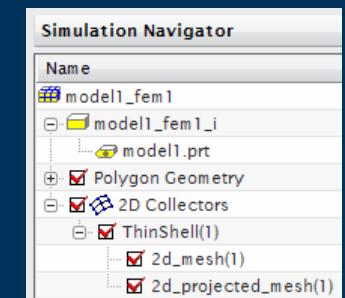
- ▶ Translate & Copy Element(s) relative to CSYS or a Vector
- ▶ Mesh Collector selection or Creation on-the-fly
 - ▶ New Mesh
 - ▶ Add to Existing Mesh



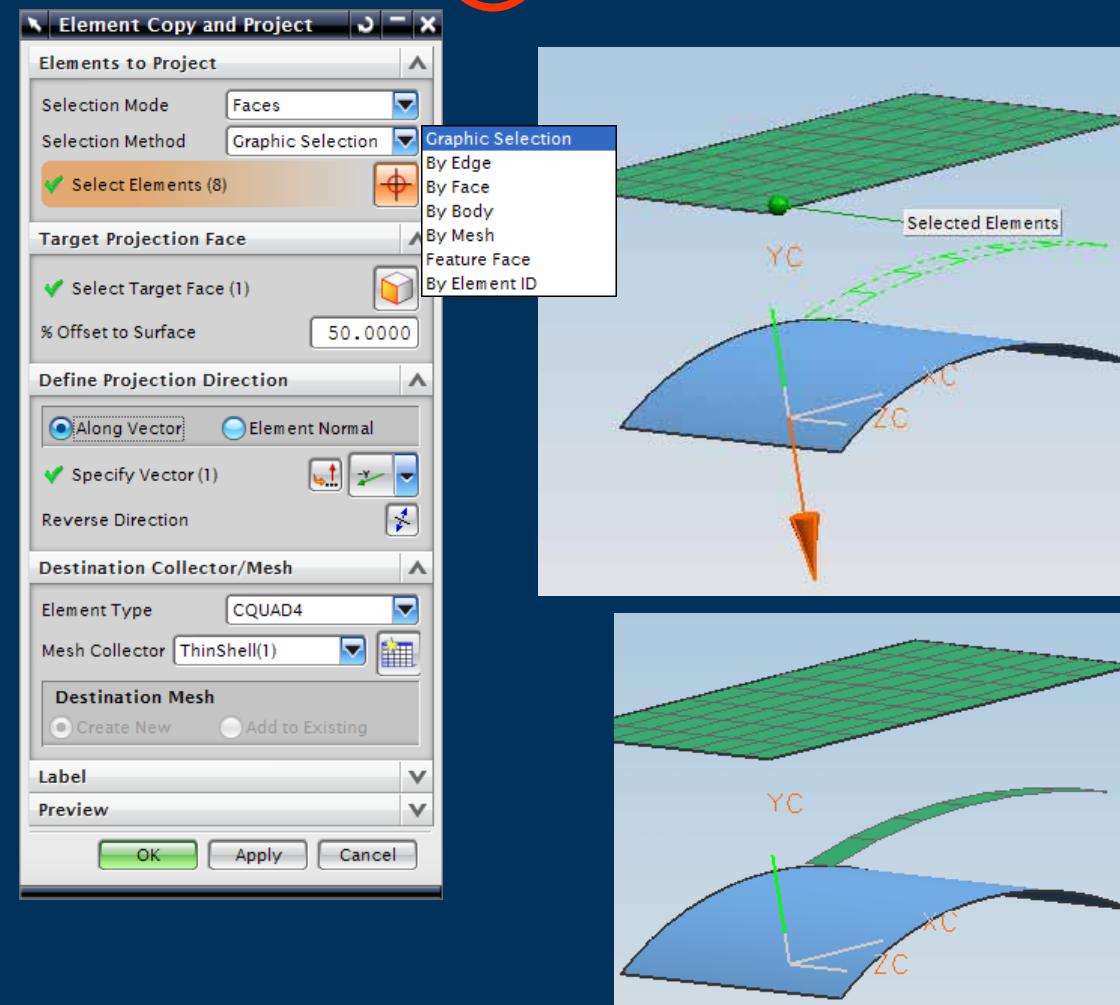
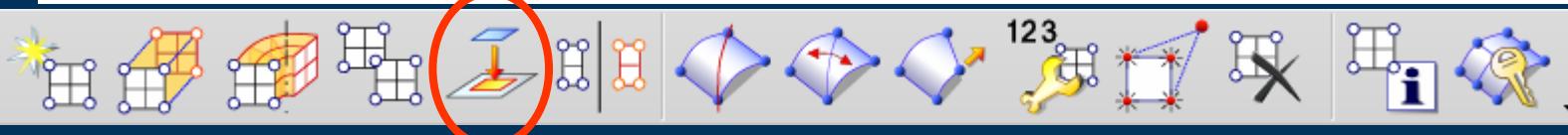
Meshering – Element Copy & Project



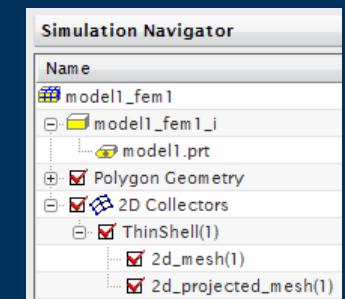
- ▶ Project & Copy Element(s) onto a Target Surface(s)
- ▶ Mesh Collector selection or Creation on-the-fly
 - ▶ New Mesh
 - ▶ Add to Existing Mesh



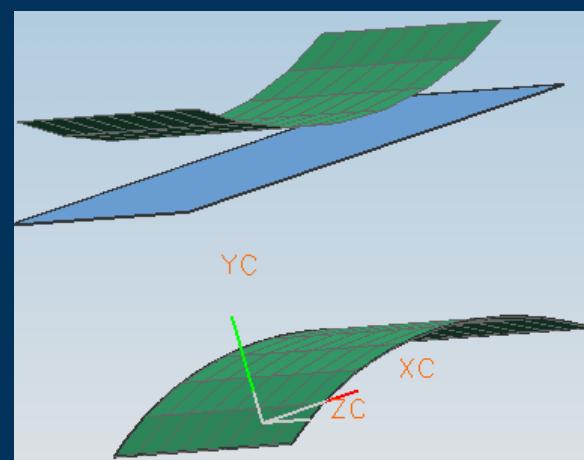
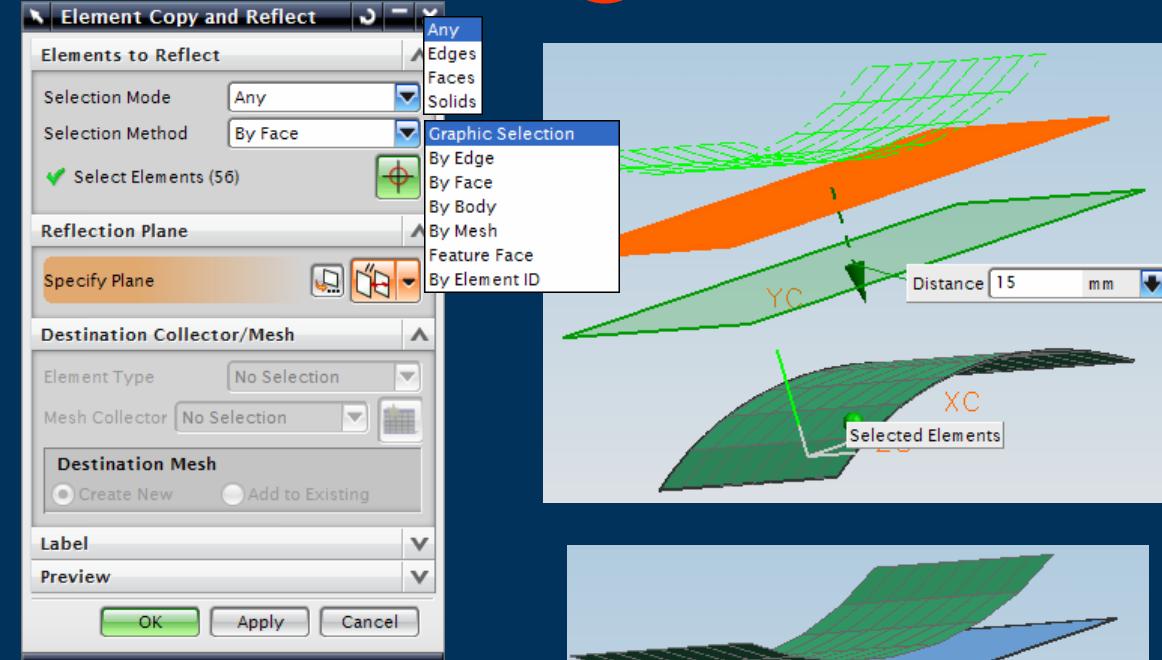
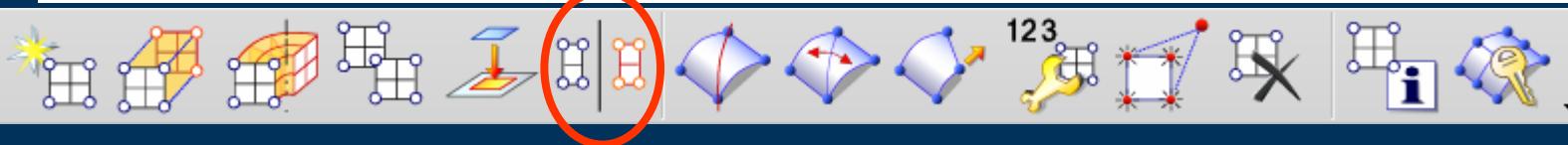
Meshering – Element Copy & Project



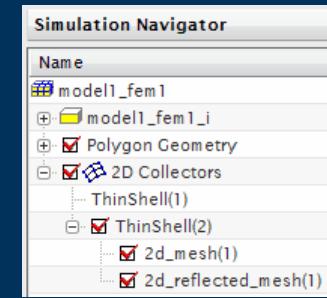
- ▶ Project & Copy Element(s) onto a Target Surface(s)
- ▶ Mesh Collector selection or Creation on-the-fly
 - ▶ New Mesh
 - ▶ Add to Existing Mesh



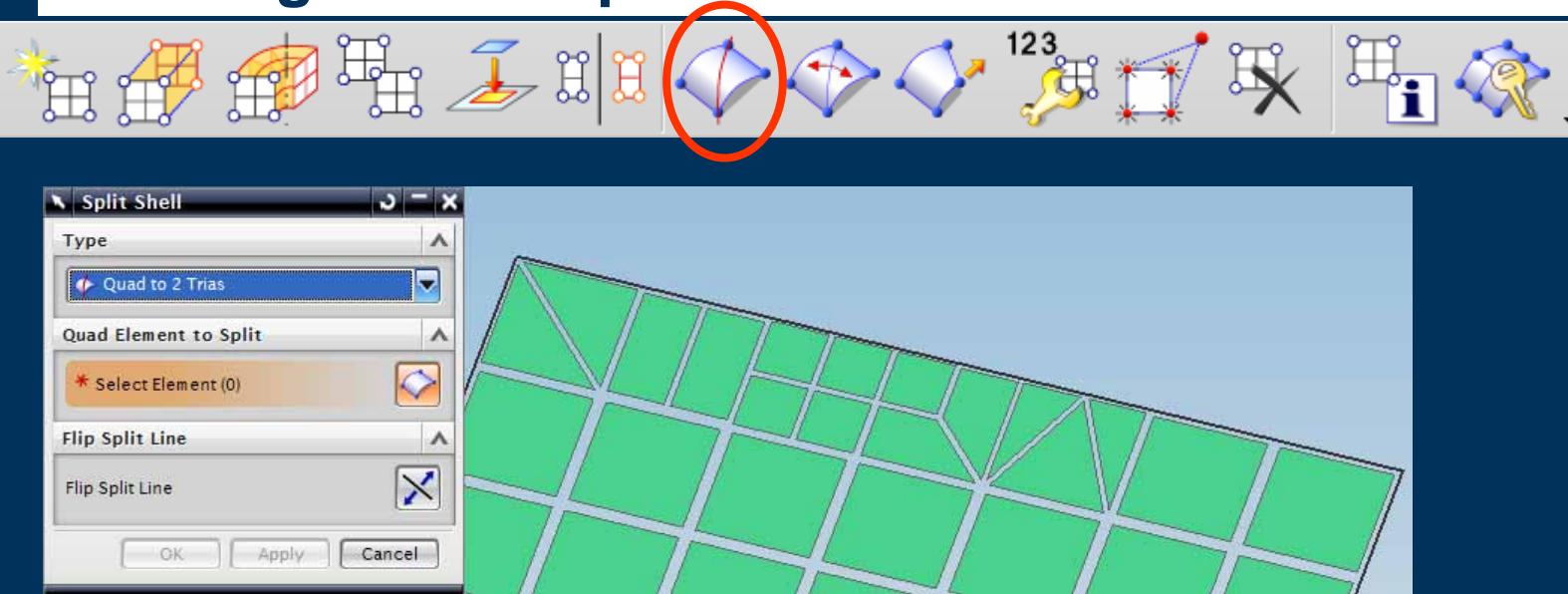
Meshering – Element Copy & Reflect



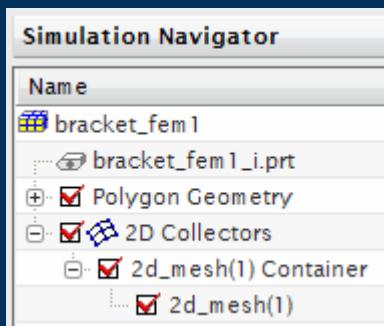
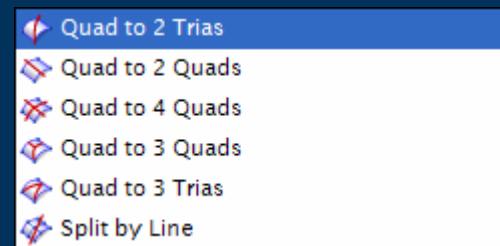
- ▶ Reflect & Copy Element(s) about a Plane
- ▶ Mesh Collector selection or Creation on-the-fly
 - ▶ New Mesh
 - ▶ Add to Existing Mesh



Mesher – Shell Split

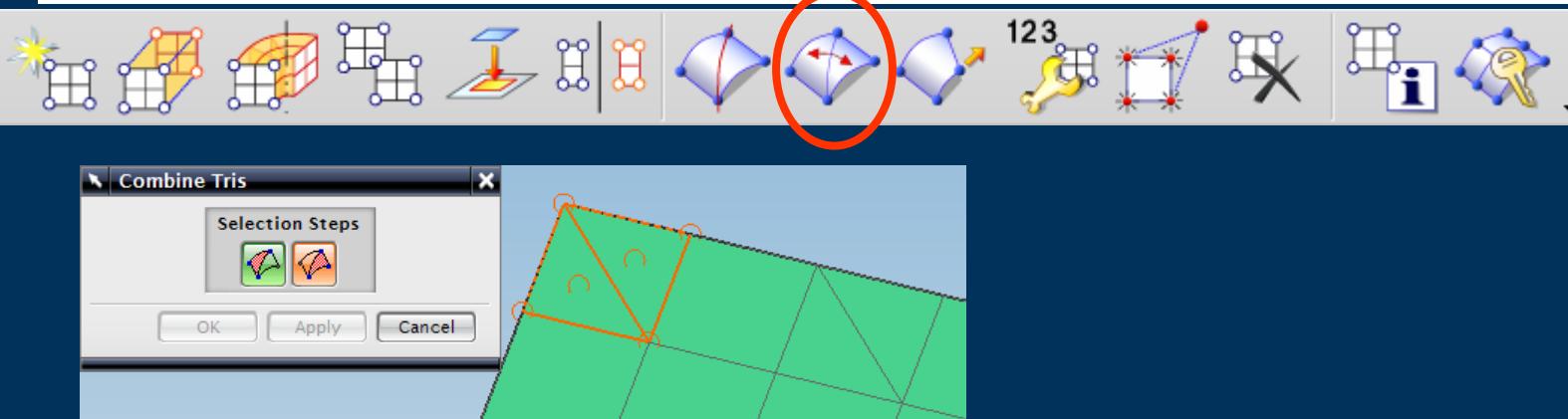


- Splits Quadrilateral Multiple Elements

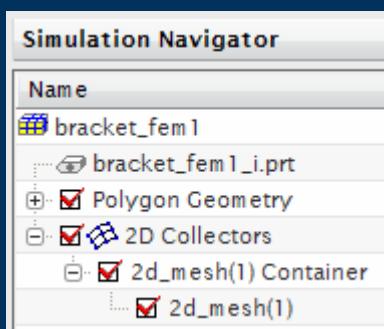


- Mesh Update will remove Manual changes
- New Elements remain in Mesh Collector

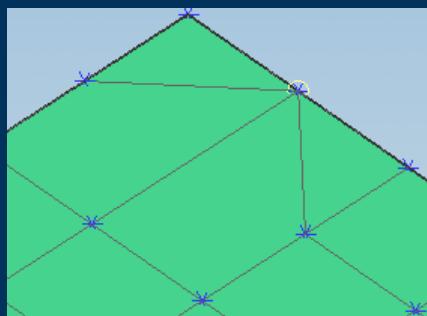
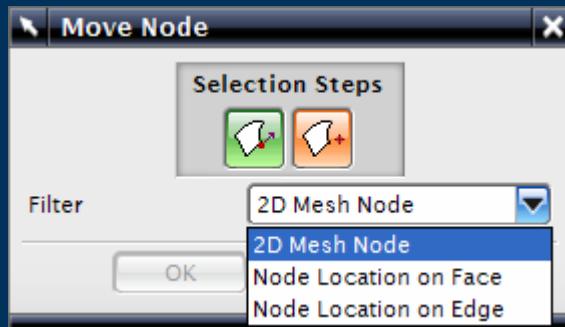
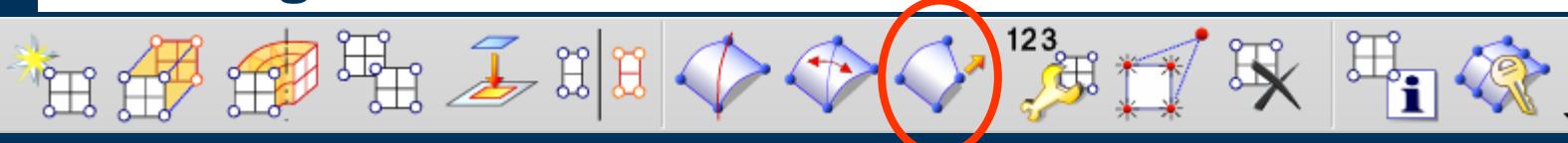
Meshering – Combine Tris



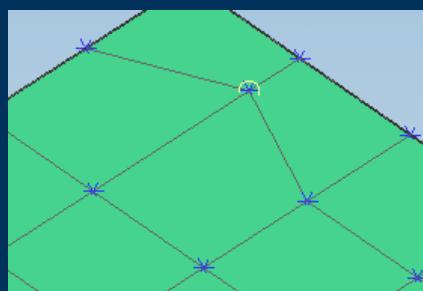
- ▶ Combine Triangular elements into Quadrilaterals
 - ▶ Linear to Linear
 - ▶ Parabolic to Parabolic
- ▶ Mesh Update will remove Manual changes
- ▶ New Element remains in Mesh Collector



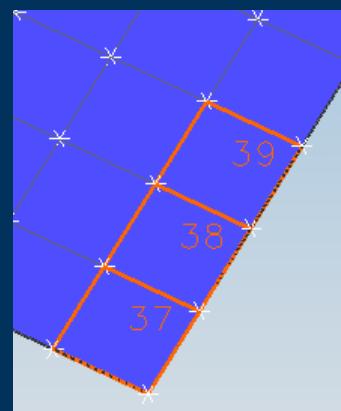
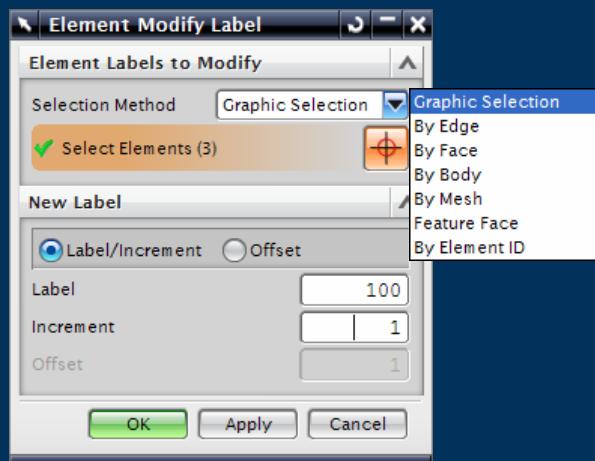
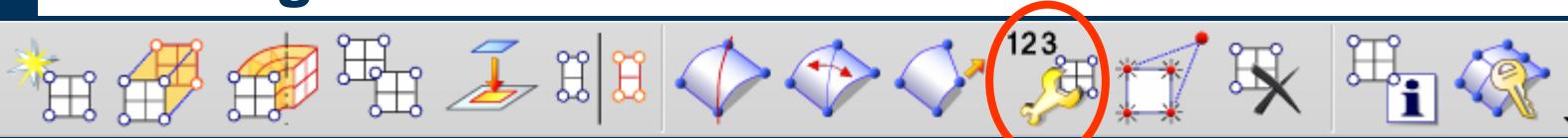
Mesher – Move Node



- ▶ Move a Node (and its connected elements)
- ▶ Converts Quads to Tris if required & removes duplicate nodes
- ▶ Mesh Update will remove Manual changes



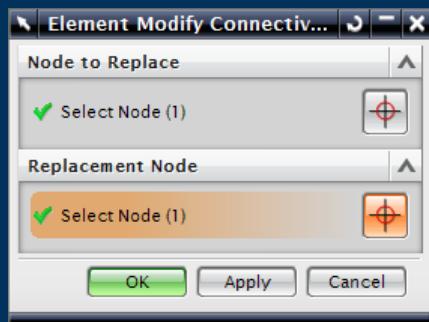
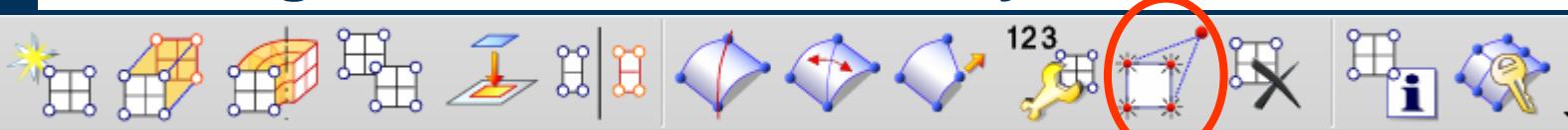
Meshering – Element Re-Label



► Modify Element Numbering/Label



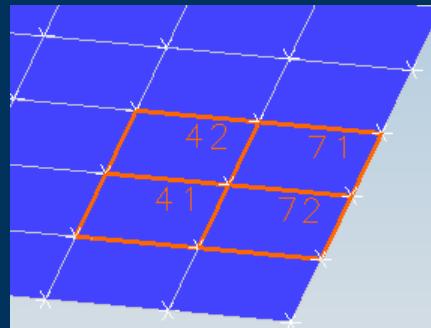
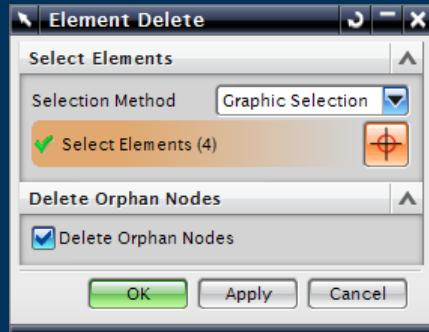
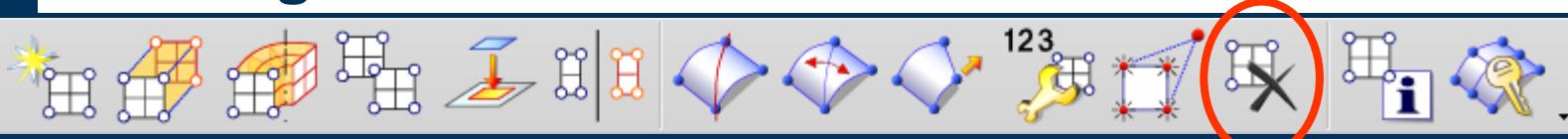
Mesher – Element Connectivity



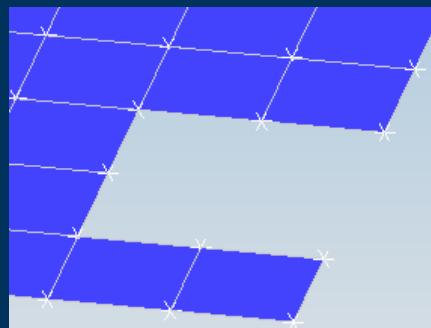
- ▶ Replace One Node with another Node
- ▶ Specific Mesh Connections



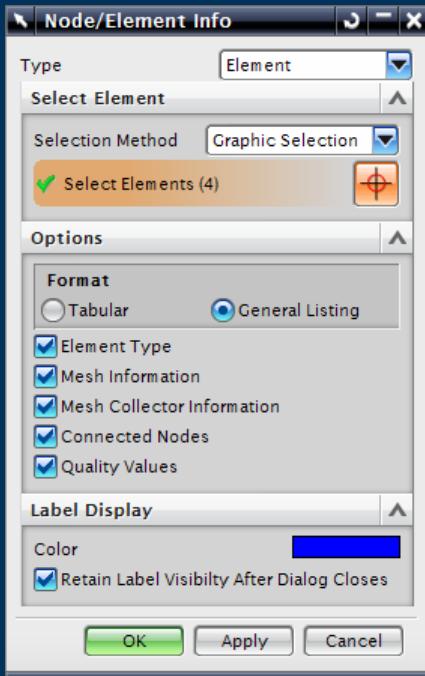
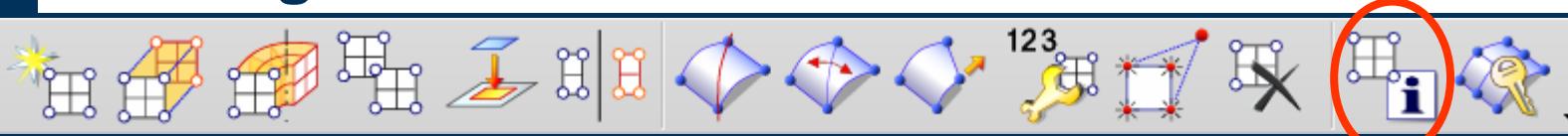
Mesher – Element Deletion



- ▶ Delete Elements
- ▶ Optionally delete Orphaned Nodes



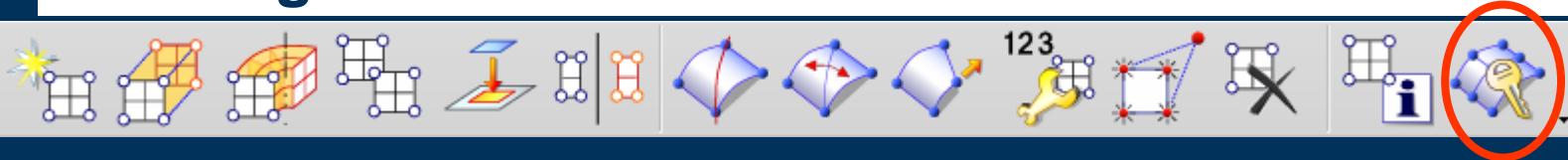
Meshting – Node & Element Information



Information	
ELEMENT INFORMATION	
Label	: 53
Element Type	: CQUAD4
Connected Nodes	: 96 78 55 95
Aspect Ratio	: 1.081081
Warp	: 0.000000
Skew	: 90.000000
Taper	: 0.000000
Jacobian Ratio	: 1.000000
Jacobian Zero	: 23.125000
Minimum Angle	: 90.000000
Maximum Angle	: 90.000000
MESH INFORMATION	
Name	: 2d_mesh(2)
Type of mesh	: 2D
Number of elements in the mesh	: 28
Number of nodes in the mesh	: 43
Quad, Thin Shell elements	: 28
Shell Offset	: Not defined
Enable MCID	: false
MCID Definition	: User Defined
MCID	: Global
Ignore Midsurface Thickness	: false
Layer	: 1
MESH COLLECTOR INFORMATION	
Name	: ThinShell(1)
Type	: ThinShell
Shell Property	: PSHELL1
Name	: PSHELL1
Type	: PSHELL
Label	: 1
Plane Strain	: false
Material 1	: Inherited from geometry.
Material 2	: Inherited from geometry.
Material 3	: Inherited from geometry.
Material 4	: (none)
Default Thickness	: Not defined
Bending Coefficient of Inertia Ratio:	: 1
Transverse Shear Thickness Ratio	: 0.833333
Nonstructural Mass	: 0 kg/mm^2
Fiber Distance, Z1	: Not defined
Fiber Distance, Z2	: Not defined

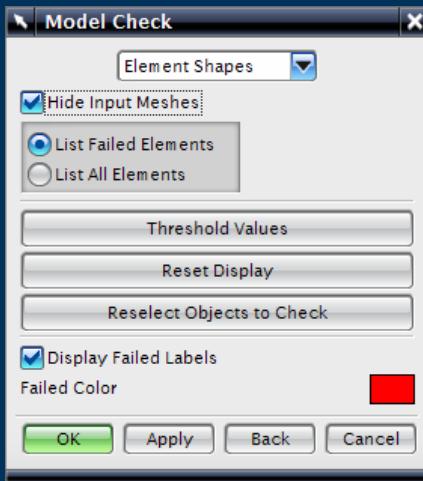
- ▶ Element Information
- ▶ Type
- ▶ Mesh
- ▶ Collector
- ▶ Nodes
- ▶ Quality

Mesher – Mesh Unlock



- ▶ Unlock a Mesh for Manual Operations to be carried out

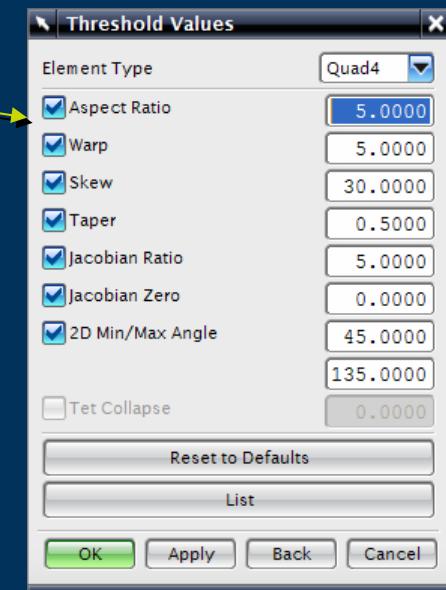
Model Checking – Element Shape



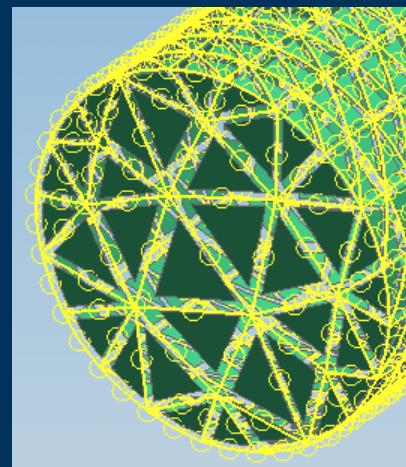
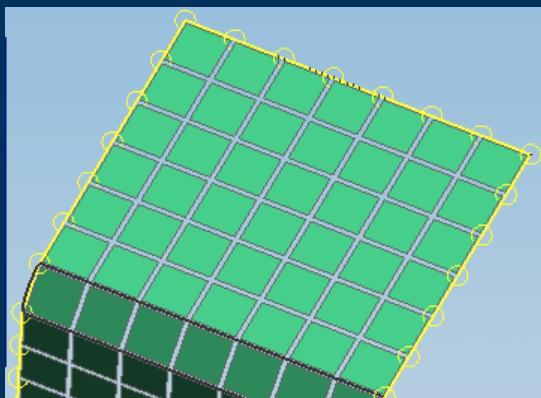
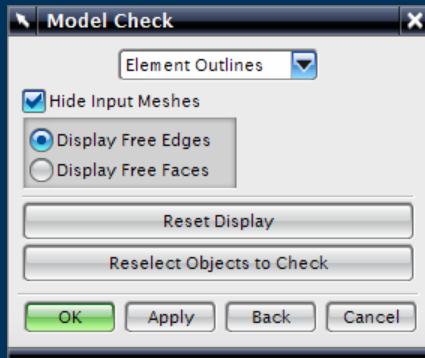
Results of Element Shape Check									
Overview									
Elements	Number failed	Number checked							
Check									
Aspect Ratio	0	5.702181							
Warp	0	-N/A-							
Skew	0	-N/A-							
Taper	0	-N/A-							
Twist	0	-N/A-							
Jacobian Ratio	0	7.206479							
Jacobian Zero	0	0.437397							
Minimum Angle	0	-N/A-							
Maximum Angle	0	-N/A-							
Tet Collapse	0	43.554548							
Threshold values									
Shape	Aspect Ratio	Warp	Skew	Taper	Jacobian Ratio	Jacobian Zero	Minimum Angle	Maximum Angle	Tet Collapse
Tri3	5.000000	-N/A-	60.000000	-N/A-	5.000000	0.000000	20.000000	120.000000	-N/A-
Tri6	5.000000	-N/A-	60.000000	-N/A-	5.000000	0.000000	20.000000	120.000000	-N/A-
Quad4	5.000000	5.000000	30.000000	0.500000	5.000000	0.000000	45.000000	135.000000	-N/A-
Quad8	5.000000	5.000000	30.000000	0.500000	5.000000	0.000000	45.000000	135.000000	-N/A-
Tetra4	20.000000	-N/A-	-N/A-	-N/A-	10.000000	0.000000	-N/A-	120.000000	100.000000
Tetra10	20.000000	-N/A-	-N/A-	-N/A-	10.000000	0.000000	-N/A-	120.000000	100.000000
Hex8	20.000000	5.000000	100.000000	0.500000	30.000000	0.000000	45.000000	155.000000	-N/A-
Hex20	20.000000	5.000000	100.000000	0.500000	30.000000	0.000000	45.000000	155.000000	-N/A-
Wedge6	20.000000	5.000000	100.000000	0.500000	30.000000	0.000000	45.000000	155.000000	-N/A-
Wedge15	20.000000	5.000000	100.000000	0.500000	30.000000	0.000000	45.000000	155.000000	-N/A-

- ▶ Element Shape tests the elements against a series of Threshold Values for different element types
- ▶ User can set these values in the Preference dialog

Threshold
Values set in
Customer
Defaults

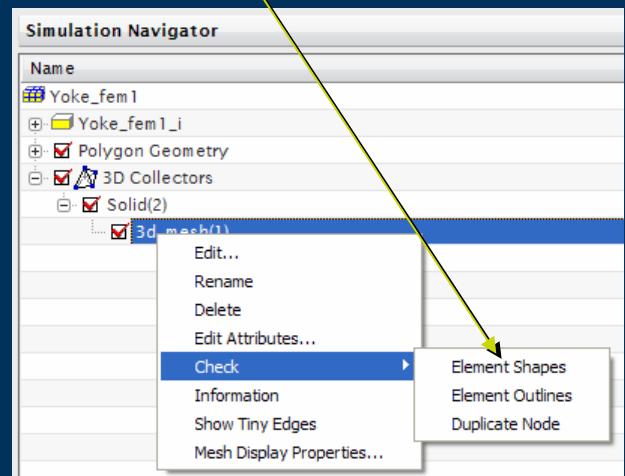


Model Checking – Element Outlines

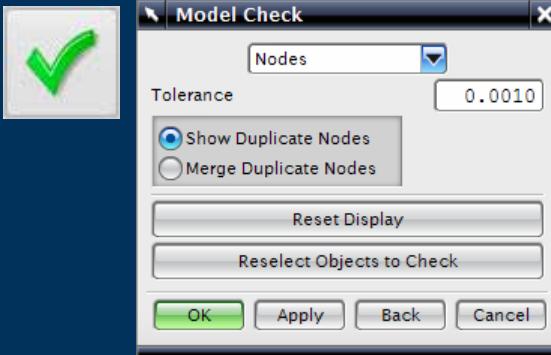


- ▶ Element Outlines show the Free Element Faces or Edges

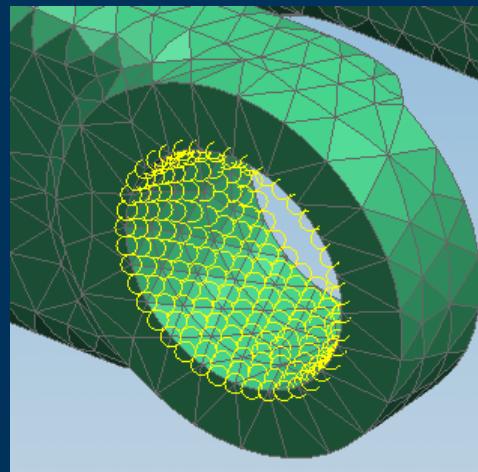
All Checks also available from the Navigator



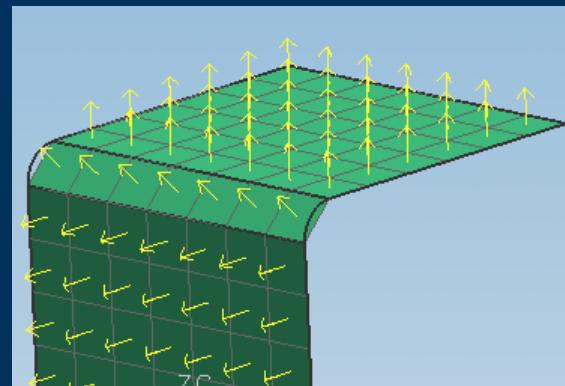
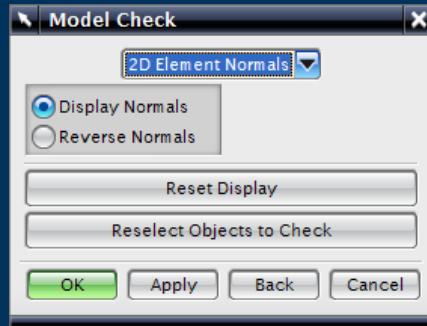
Model Checking – Duplicate Nodes



- ▶ Duplicate Nodes
 - ▶ Locate to check model
 - ▶ Merge to correct model



Model Checking – Element Normals

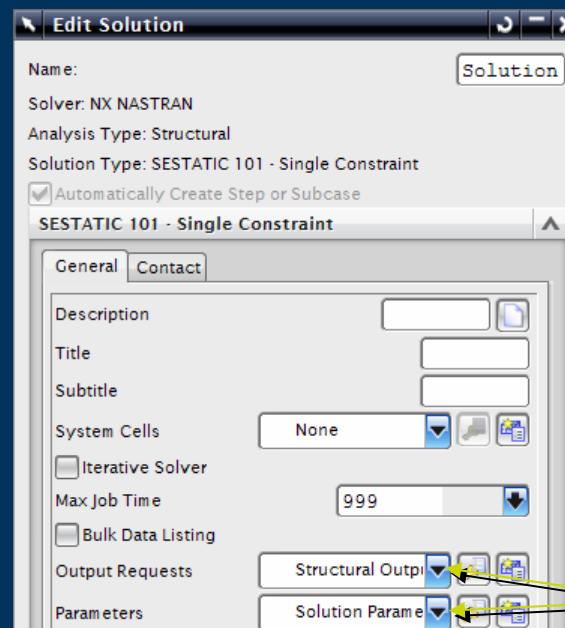
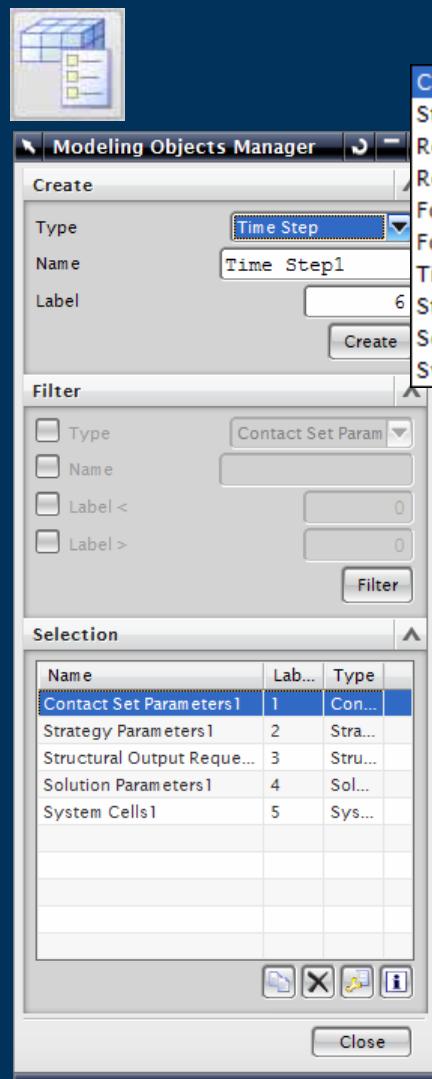


- ▶ Displays the Element Normals

SIEMENS

SIM Part – Pre-Processing

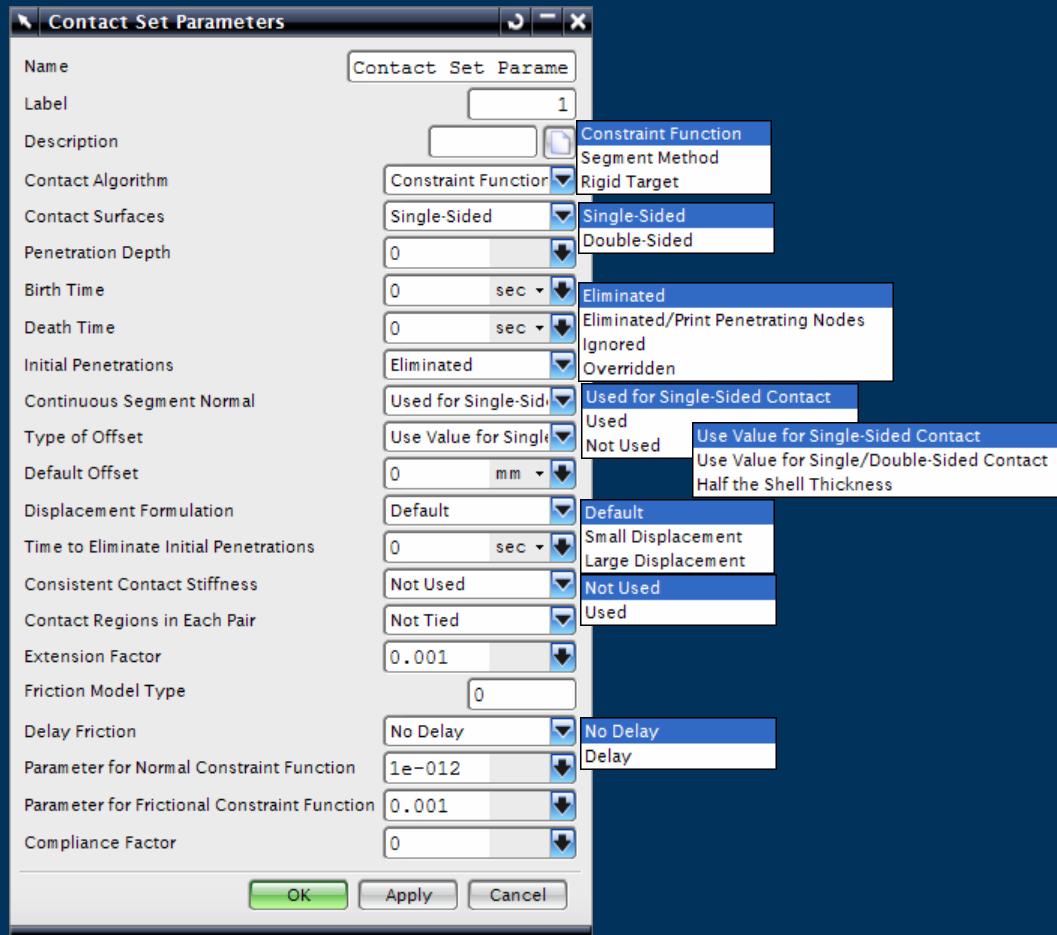
Modeling Objects – Manager



- ▶ Modeling Objects
- ▶ For re-use by multiple solves
- ▶ Solver and Solution Type dependant

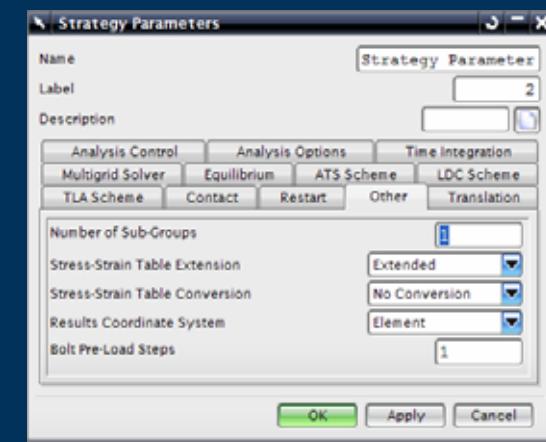
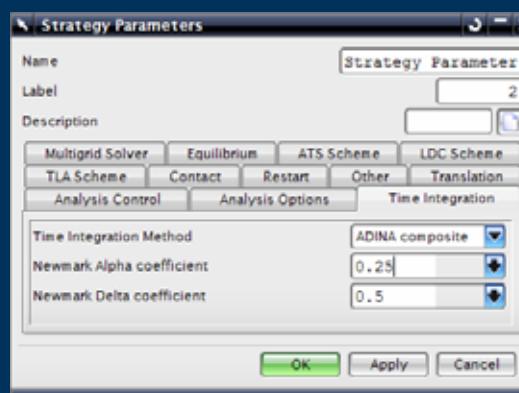
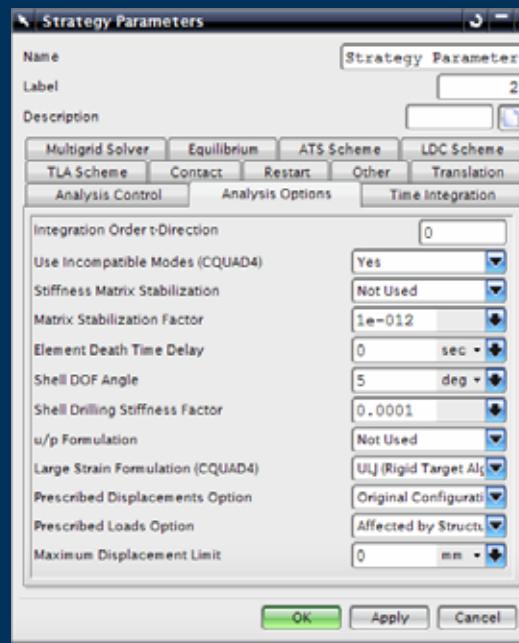
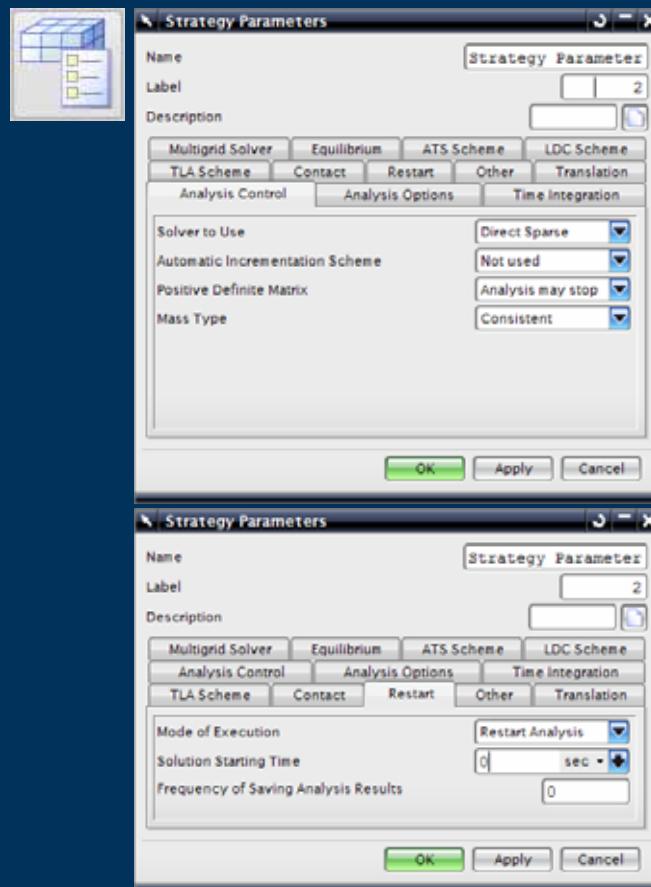
Referenced Modeling Objects

Modeling Objects – Contact Set Parameters



- ▶ Parameters to define the Contact conditions
- ▶ Solver and Solution Type dependant
- ▶ Options shown for NX Nastran

Modeling Objects – Strategy Parameters

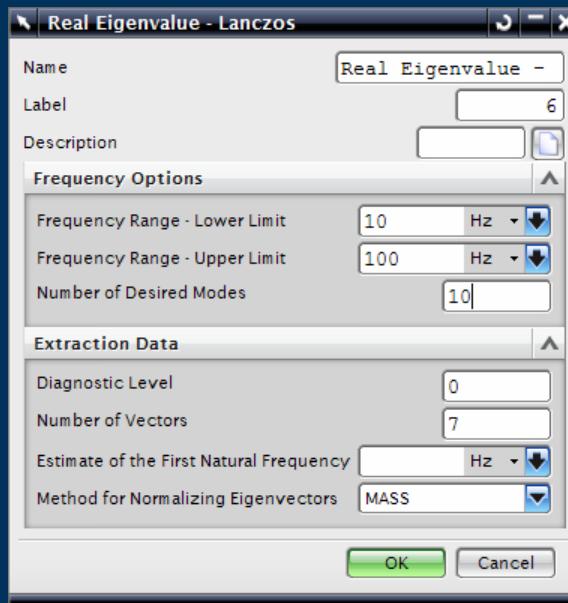


- ▶ Parameters to define the Non-Linear Strategy
- ▶ Solver and Solution Type dependant
- ▶ Options shown for NX Nastran

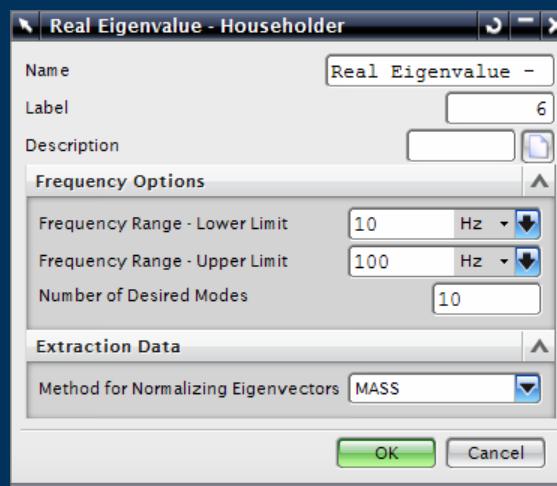
Modeling Objects

– Real Eigenvalue – Lanczos & Householder

SIEMENS



- ▶ Parameters for a Lanczos run
- ▶ Solver and Solution Type dependant
- ▶ Options shown for NX Nastran

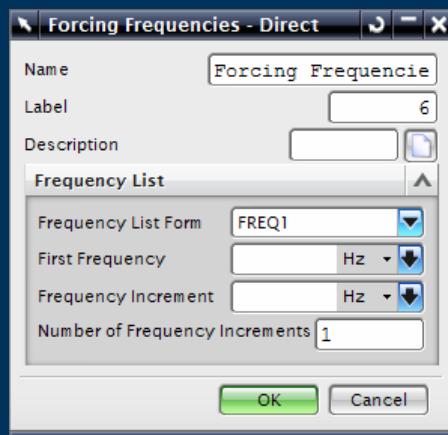


- ▶ Parameters for a Householder run
- ▶ Solver and Solution Type dependant
- ▶ Options shown for NX Nastran

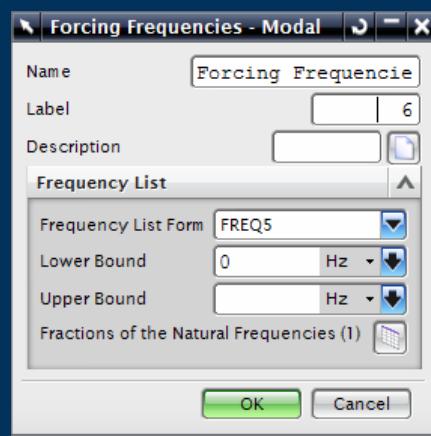
Modeling Objects

– Forcing Frequencies – Direct & Modal

SIEMENS

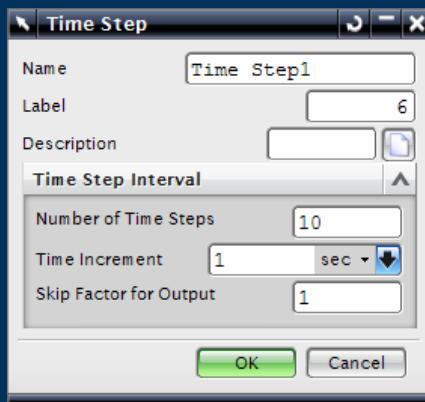


- ▶ Parameters for a Direct Forced Frequency run
- ▶ Solver and Solution Type dependant
- ▶ Options shown for NX Nastran



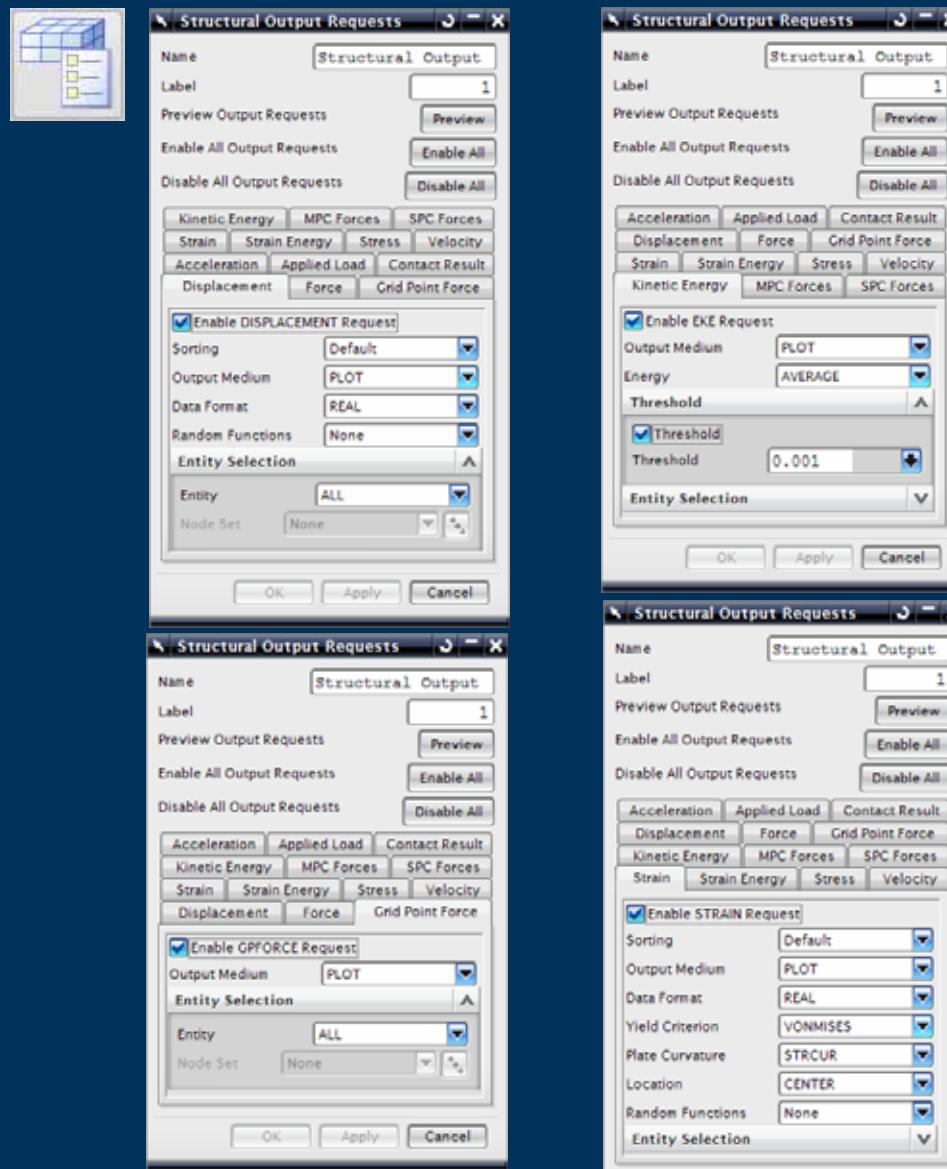
- ▶ Parameters for a Modal Forced Frequency run
- ▶ Solver and Solution Type dependant
- ▶ Options shown for NX Nastran

Modeling Objects – Time Step



- ▶ Parameters to define a Time Step

Modeling Objects – Structural Output Requests



- ▶ Parameters to define Structural Output Requests
- ▶ Grouped according to function
- ▶ Preview to see what will be written to the solver

i Information

File Edit

```
=====
Information listing created by : gwills
Date : 26/04/2007 14
Current work part : C:\GuyWills\DESIGN
Node name : gbhitwills
=====

DISPLACEMENT (PLOT,REAL) = ALL
SPCFORCES (PLOT,REAL) = ALL
STRESS (PLOT,REAL,VONMISES,CENTER) = ALL
```

Modeling Objects – Solution Parameters



Solution Parameters

Name	Solution Parameter
Label	6
A-B	▼
C-D	▼
E-F	▼
G-H	▼
I-J	▼
K-L	▼
M-N	▼
O-P	▼
Q-R	▲
Q	0
RANREAL	0
RESLOPT	8
RESVSLT	NO
RESVEC	NO
RESVNER	NO
RESVPGF	1e-006
RESVSE	NO
RESVSLI	YES
RESVSO	YES
RMSINT	LINEAR
RMXTRAN	NO
ROTCFS	
ROTGPF	
RPOSTS1	0
RSPECTRA	-1
RSPRINT	0
S-T	▼
U-V	▼
W-Z	▼

I-J

IFP	
IFTM	0
INP4FMT	32
INREL	0
IRES	-1
ITAPE	-1
IUNIT	11

Add **Remove**

- ▶ Solution Parameters
- ▶ Solver and Solution Type dependant
- ▶ Options shown for NX Nastran
- ▶ See Quick Reference Guide for details

NX Nastran Quick Reference Guide - Microsoft Internet Explorer

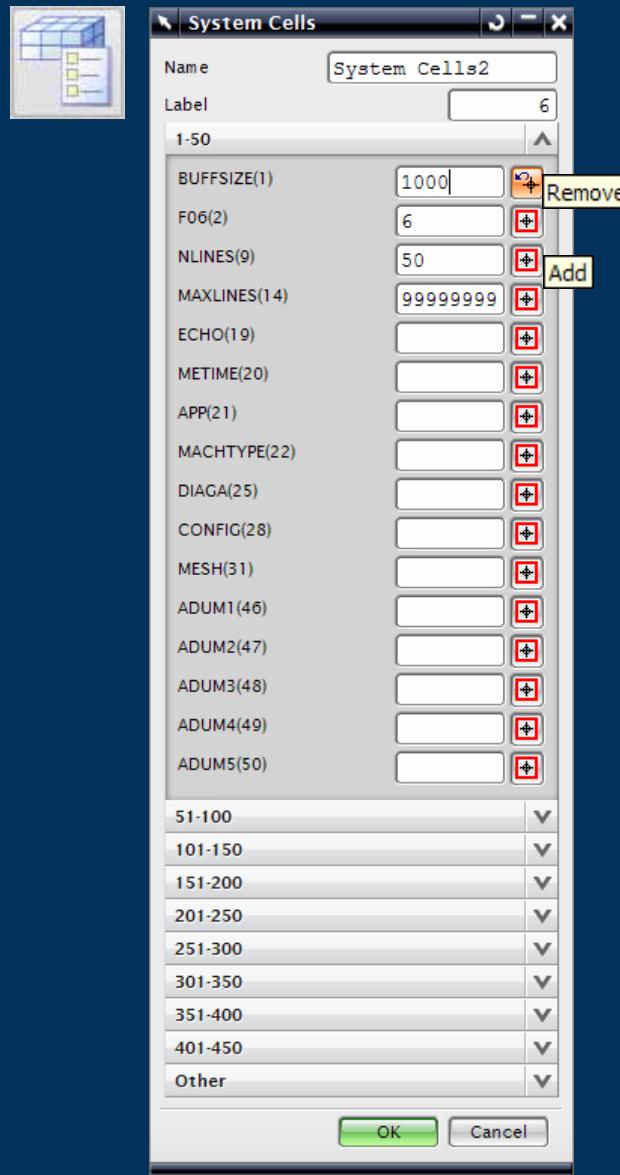
NX Nastran Quick Reference Guide

Parameter Descriptions

Parameters are used extensively in the solution sequences for input of scalar values and for requesting special features. Parameters values are specified on PARAM Bulk Data entries or PARAM Case Control commands. For more information on the PARAM Bulk Data entry, see [PARAM](#). For more information on the PARAM Case Control command, see [PARAM](#). A complete alphabetical list of PARAMeter names and their functions is given in this section. [Table 7-2](#) and [Table 7-3](#) at the end of this section summarize parameter applicability in the structured and unstructured solution sequences, respectively.

ACOUT	Default = PEAK
ACOUT specifies the type of output to be used with the FORCE Case Control command in coupled fluid-structural analysis (see Performing a Coupled Fluid-Structural Analysis in the NX Nastran User's Guide). ACOUT=RMS requests root-mean-square output.	
To obtain sound pressure level in units of dB and dBA given by the FORCE command, a peak reference pressure must be specified with PARAM, PREFDB. The dB level is defined as:	
$dB = 20 \cdot \log\left(\frac{P}{PREFDB}\right)$	
ACSYM	Default = YES
By default, the dynamic equations for coupled fluid-structure analysis in frequency response are symmetrized for efficiency. PARAM,ACSYM,NO requests the pre-MSC.Nastran Version 69 formulation which involves no symmetrization and will require more CPU time. See the 'Formulation of Dynamic Equations in SubMAP-GMA' in the NX Nastran User's Guide.	
If the iterative solver is selected (see the ITER=YES keyword on the NASTRAN statement) then the external work diagnostic will be different between ACSYM=YES and ACSYM=NO.	
ADPCON	Default = 1.0
Initial penalty values used in contact analysis are calculated automatically by	

Modeling Objects – System Cells



- ▶ Solution Parameters
- ▶ Solver and Solution Type dependant
- ▶ Options shown for NX Nastran
- ▶ See Quick Reference Guide for details

NX Nastran Quick Reference Guide - Microsoft Internet Explorer

NASTRAN

Executive System Parameter Modification

Specifies values for certain Executive System operational parameters called system cells.

FORMAT:

```
NASTRAN cellname1=expression1, ..., cellnamen=expressionn
or
NASTRAN SYSTEM(i)=expression1, ..., SYSTEM(n)=expressionn
```

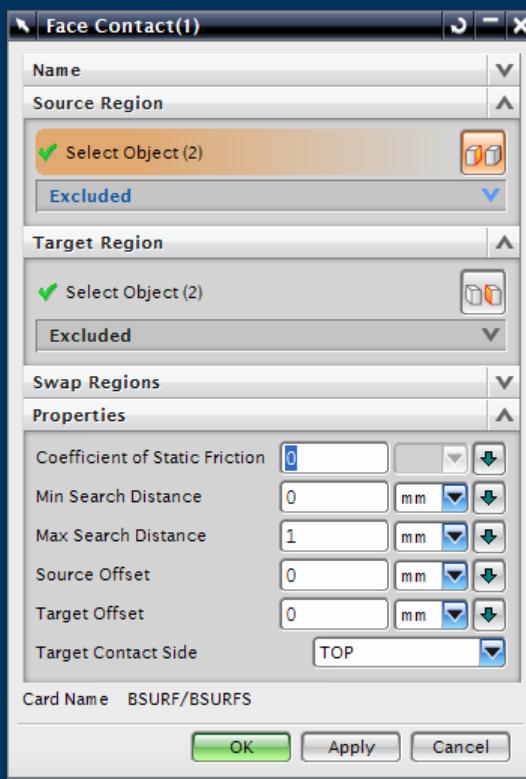
DESCRIPTORS

Descriptor	Meaning
cellnamei	System cell names from Table 1-1
SYSTEM	Specifies the system cell number.
expression	See DEFINE statement for description.
i	System cell number from Table 1-1

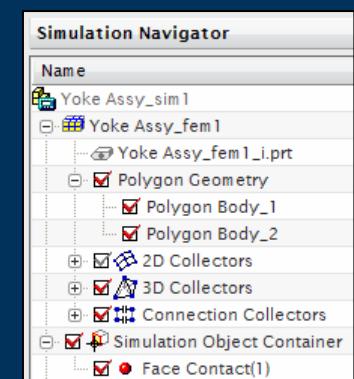
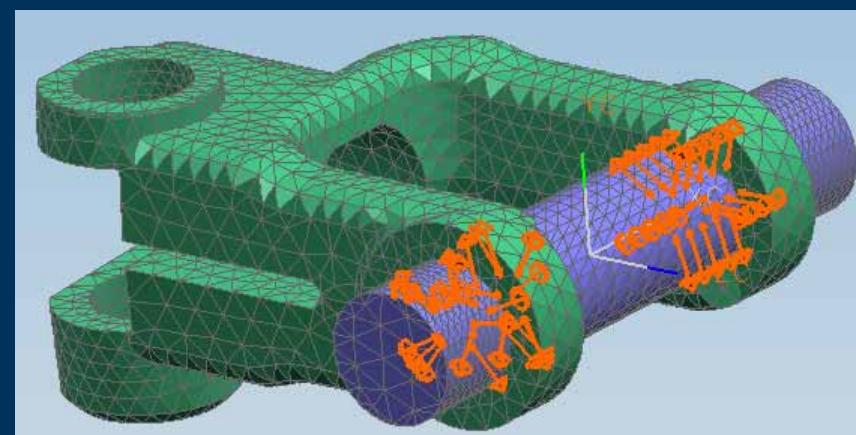
REMARKS:

1. The NASTRAN statements may appear anywhere in the File Management Section. The NASTRAN statement may also be specified in Runtime Configuration (RC) files. See "Customizing the Runtime Configuration Files" in the [NX Nastran Installation and Operations Guide](#).
2. System cell values and their associated cell names may also be set with the **DEFINE** statement. They may also be set or values returned with the DMAP PUTSYS and GETSYS functions and the PARAM module. See "[PUTSYS, GETSYS](#)" of the [NX Nastran DMAP Programmer's Guide](#).

Surface to Surface – Contact



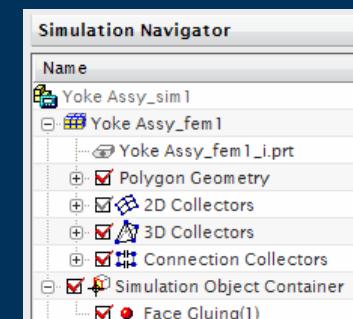
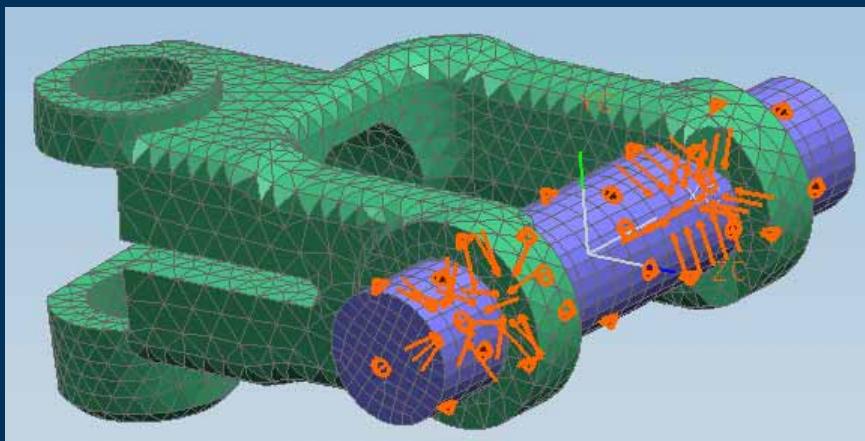
- ▶ Surface to Surface Contact options
 - ▶ Automatic Detection or Manual Selection
 - ▶ Coefficient of Friction
 - ▶ Search distances
 - ▶ Offsets



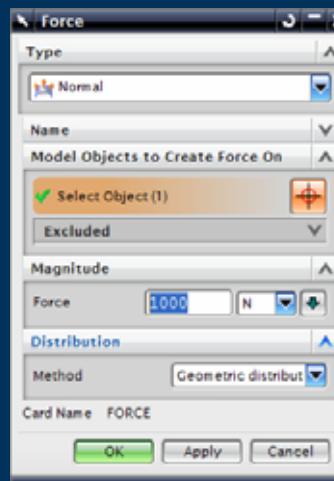
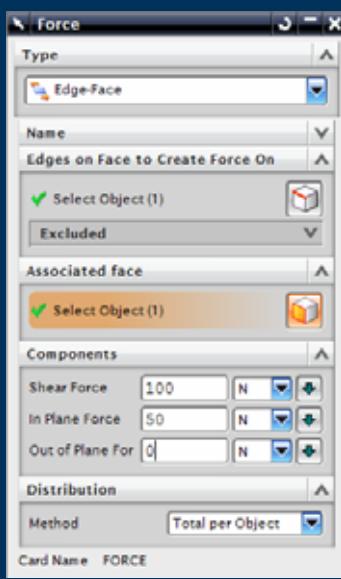
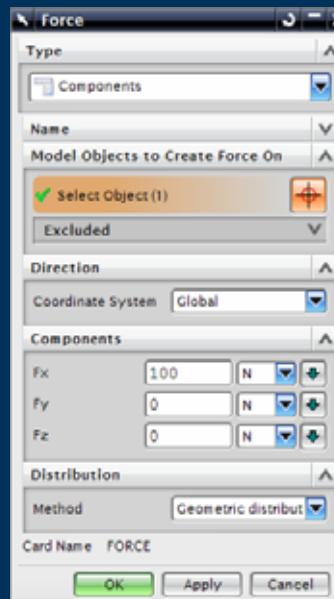
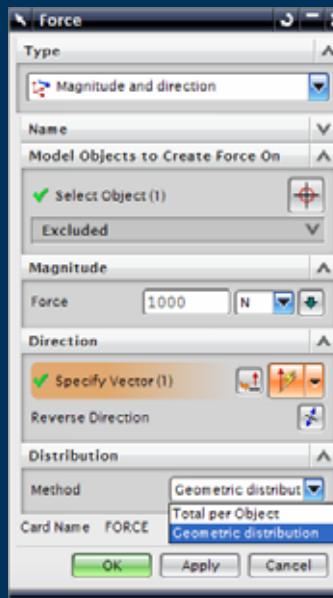
Surface to Surface – Glue



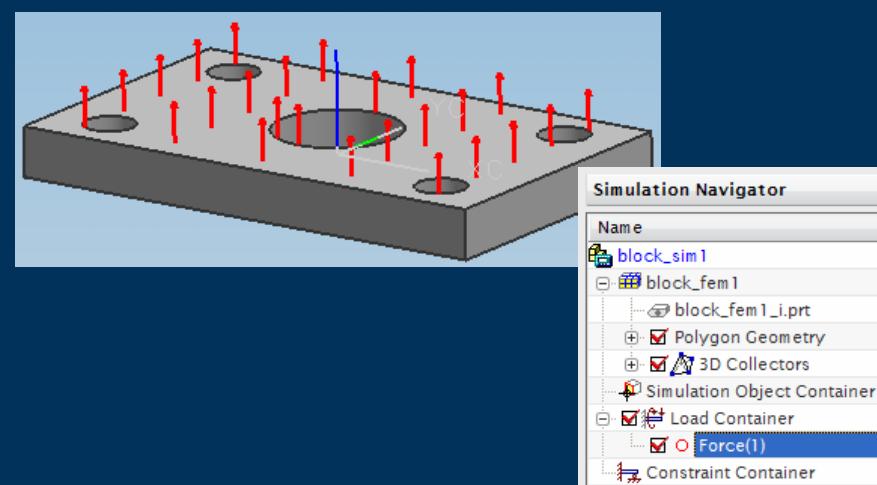
- ▶ Surface to Surface Glue options
 - ▶ Search distance
 - ▶ Penalty Value
- ▶ Does not require similar meshes
 - ▶ For example Tet to Hex
- ▶ Smooth transition of loads across boundaries



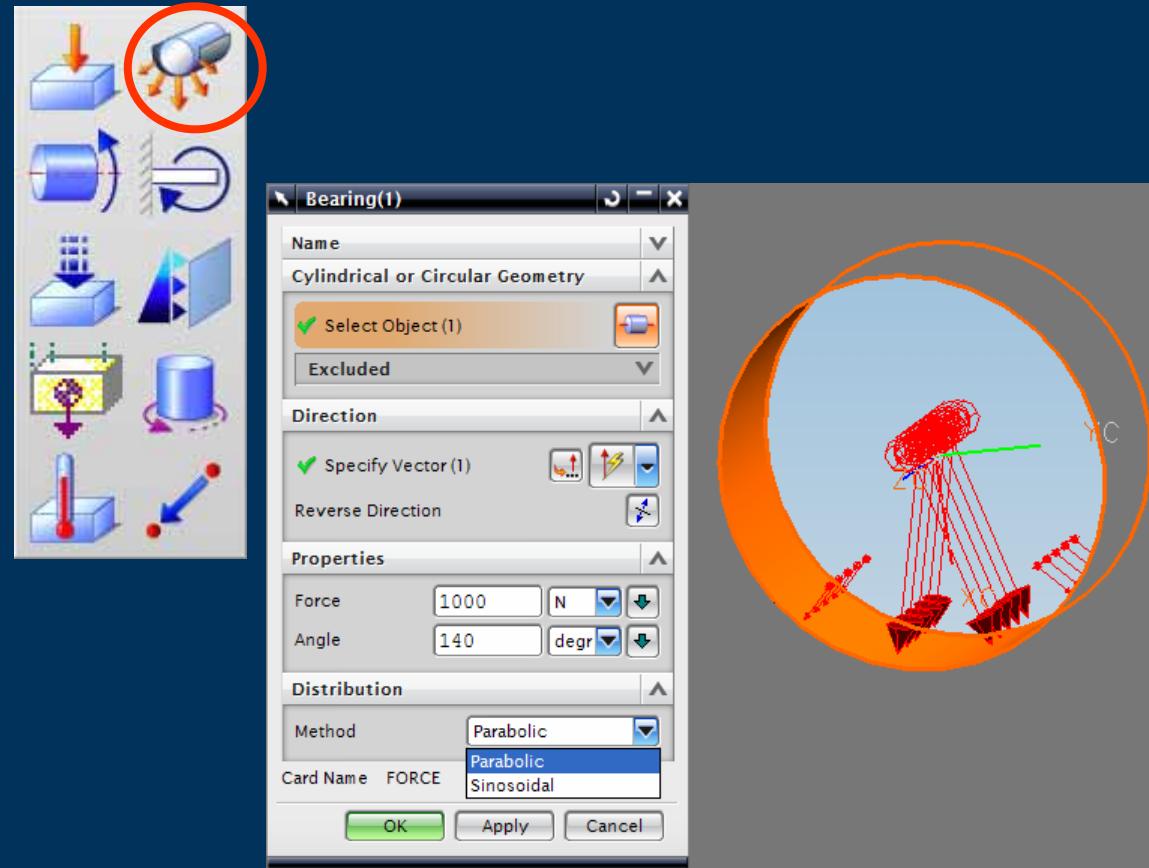
Loads – Force



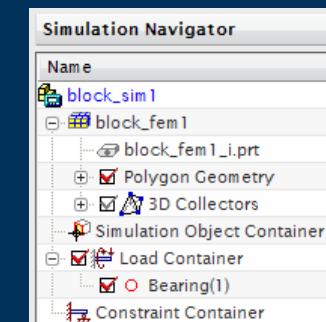
- ▶ Force Load Options
 - ▶ Magnitude and direction
 - ▶ Normal to selected faces
 - ▶ Fx, Fy, Fz Components relative to selected coordinate system
 - ▶ Shear, In/Out plane force
 - ▶ Managed in the Load Container



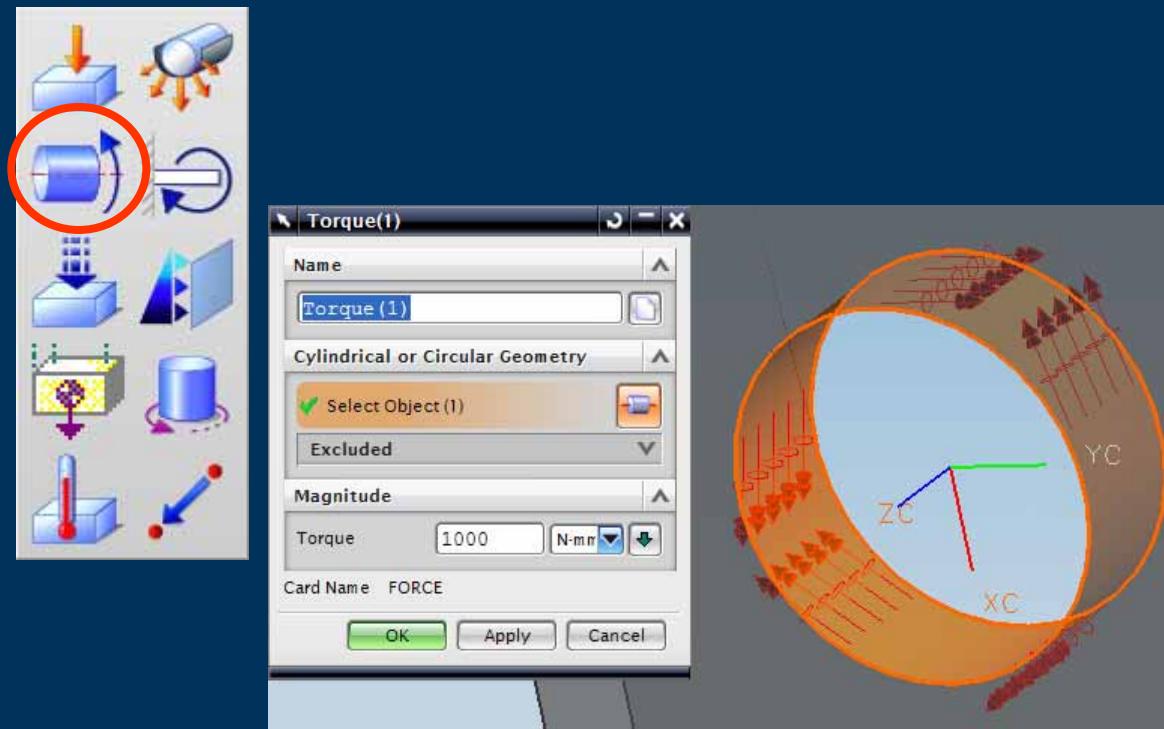
Loads – Bearing



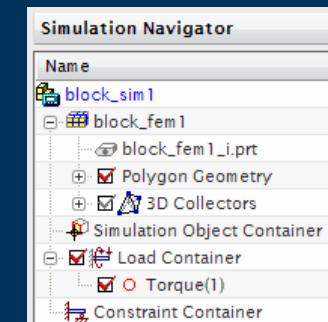
- ▶ Bearing Load
- ▶ Distributed load across cylindrical curves or faces
- ▶ Parabolic or Sinosoidal distribution
- ▶ Managed in the Load Container



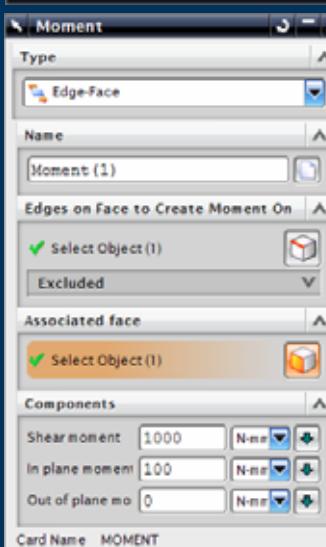
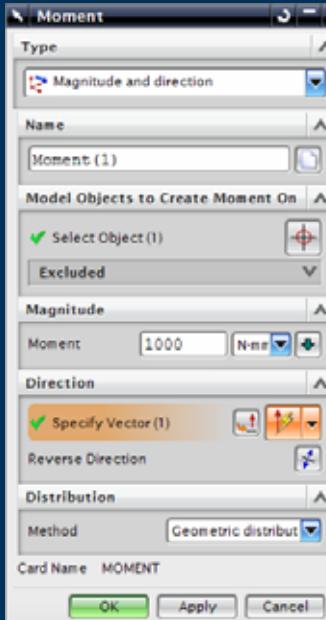
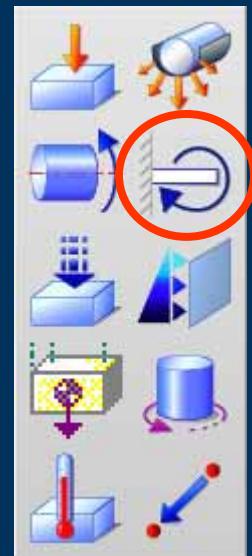
Loads – Torque



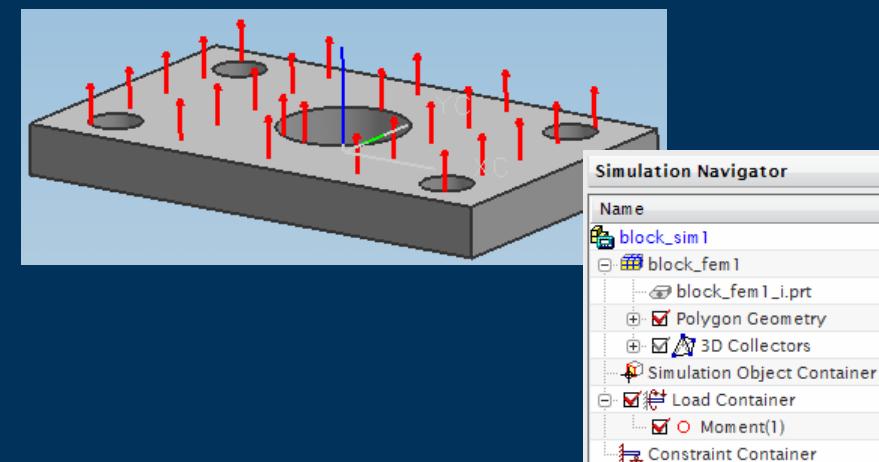
- ▶ Torque Load
- ▶ Distributed load across cylindrical curves or faces
- ▶ Managed in the Load Container



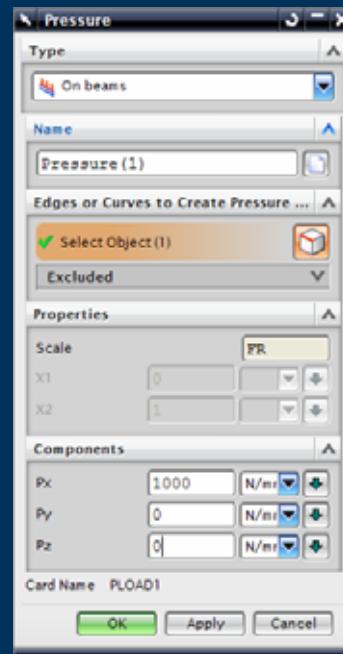
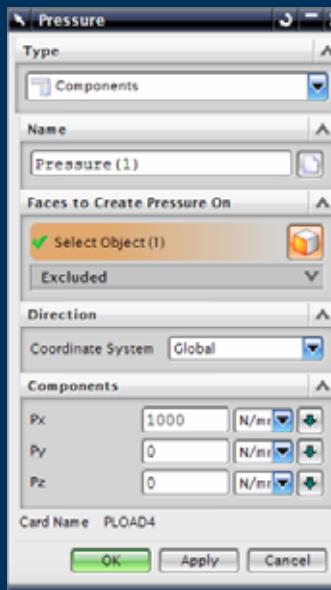
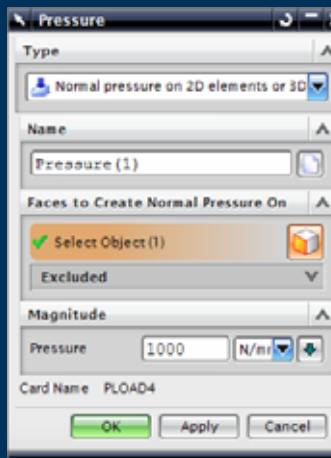
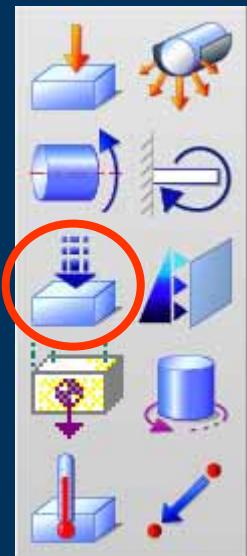
Loads – Moment



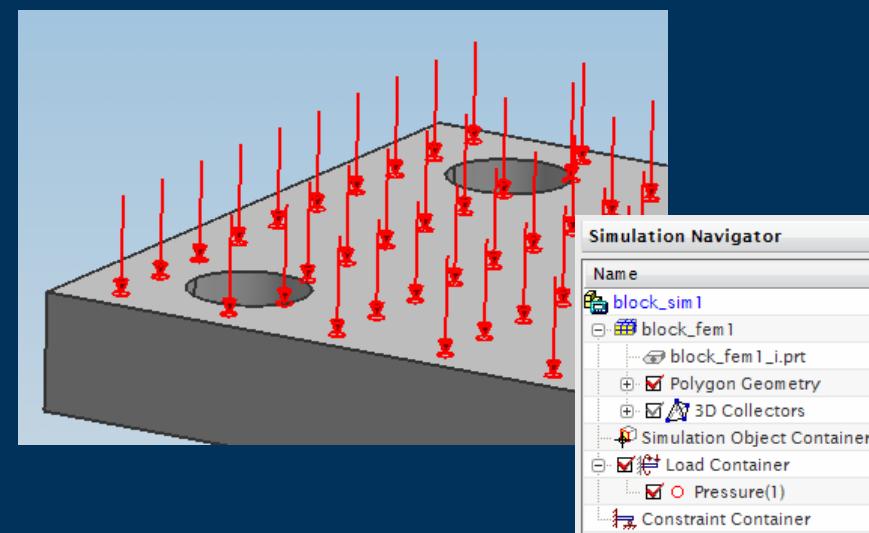
- ▶ Moment Load Options
 - ▶ Magnitude and direction
 - ▶ Normal to selected faces
 - ▶ M_x, M_y, M_z Components relative to selected coordinate system
 - ▶ Shear, In/Out plane moment
- ▶ Managed in the Load Container



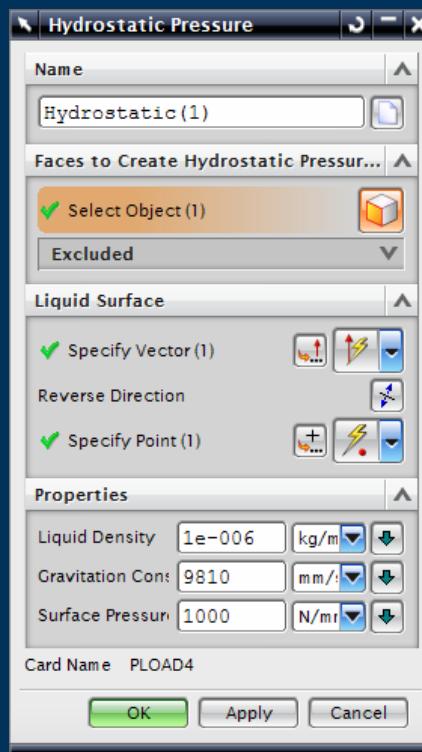
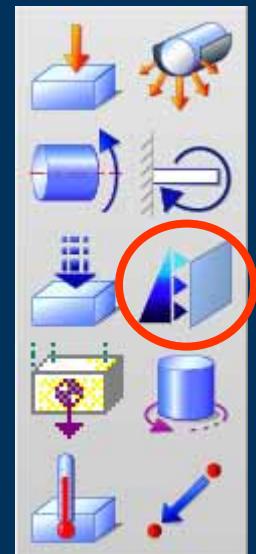
Loads – Pressure



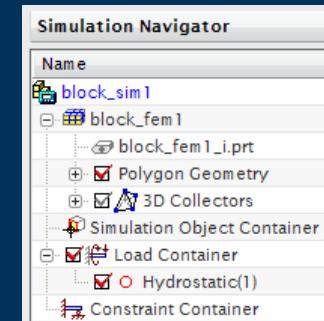
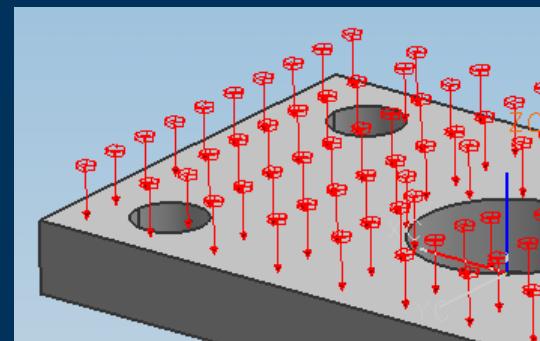
- ▶ Pressure Load Options
 - ▶ Normal to 3D faces
 - ▶ Normal to 2D faces only
 - ▶ Px, Py, Pz Component Pressure
 - ▶ Px, Py, Pz Component Pressure on Beams
- ▶ Managed in the Load Container



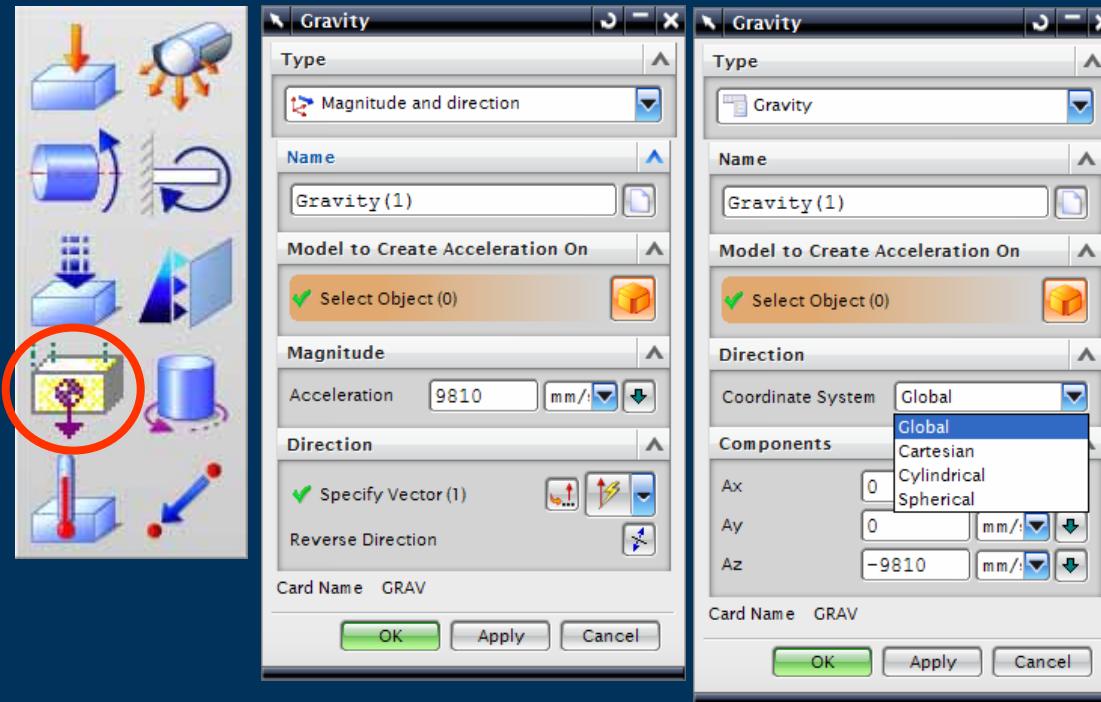
Loads – Hydrostatic Pressure



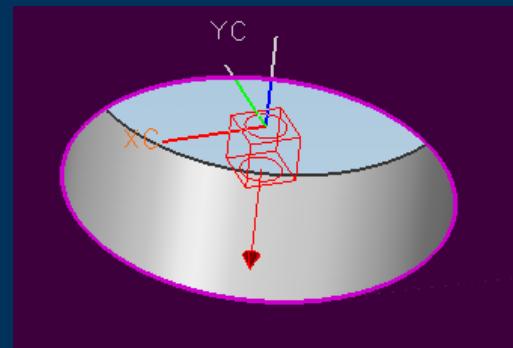
- ▶ Hydrostatic Pressure
- ▶ Distributed pressure across selected faces
- ▶ Managed in the Load Container



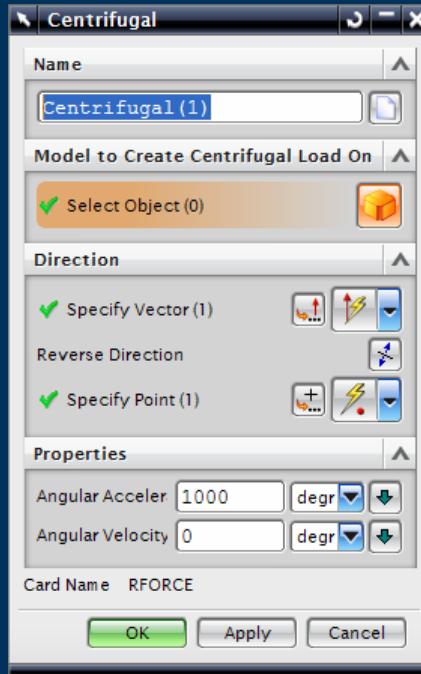
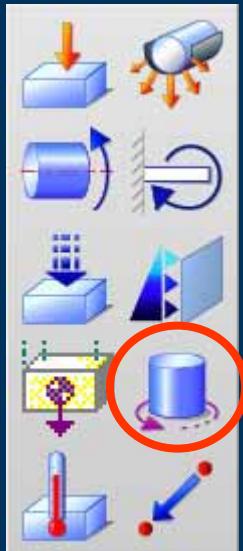
Loads – Gravity



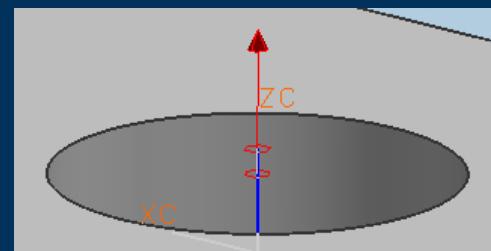
- ▶ Gravity Load
 - ▶ Applied to complete model
 - ▶ Magnitude and Direction
 - ▶ Ax, Ay, Az Component Gravity relative to selected coordinate system
- ▶ Managed in the Load Container



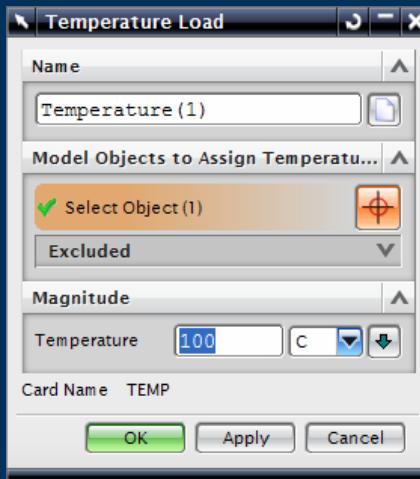
Loads – Centrifugal



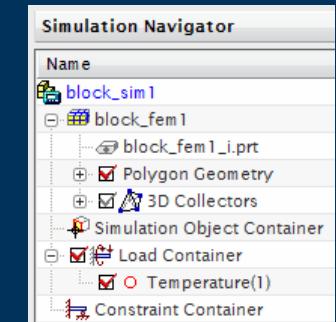
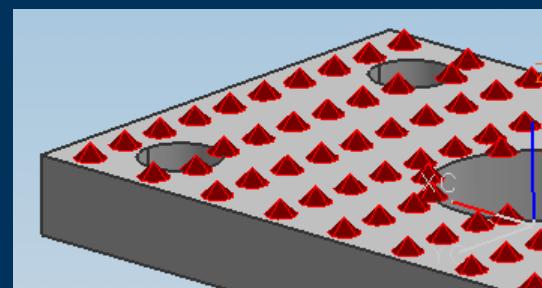
- ▶ Centrifugal Load
 - ▶ Applied to complete model
 - ▶ Direction & centre of rotation
 - ▶ Angular Acceleration
 - ▶ Angular Velocity
- ▶ Managed in the Load Container



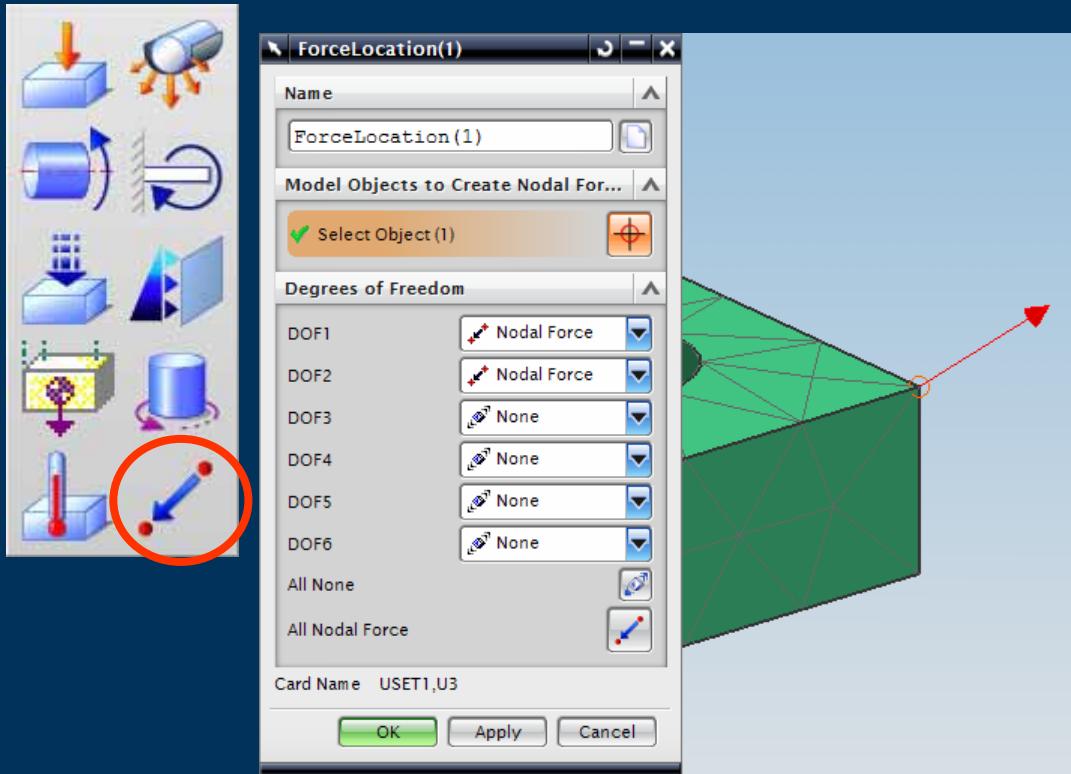
Loads – Constant Temperature



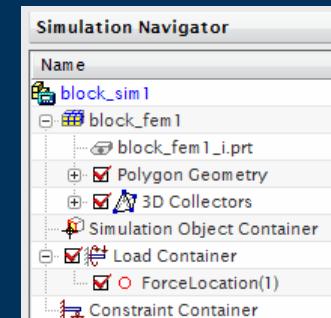
- ▶ Constant Temperature Load
 - ▶ Applied to curves, edges or faces
- ▶ Managed in the Load Container



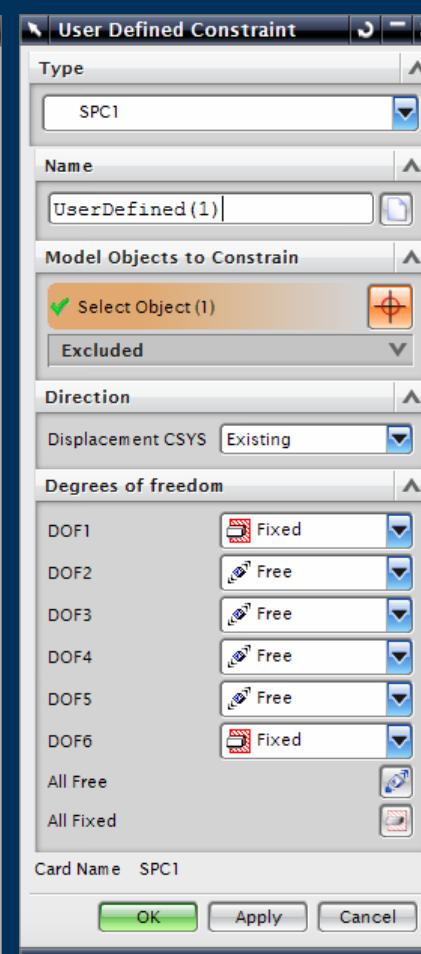
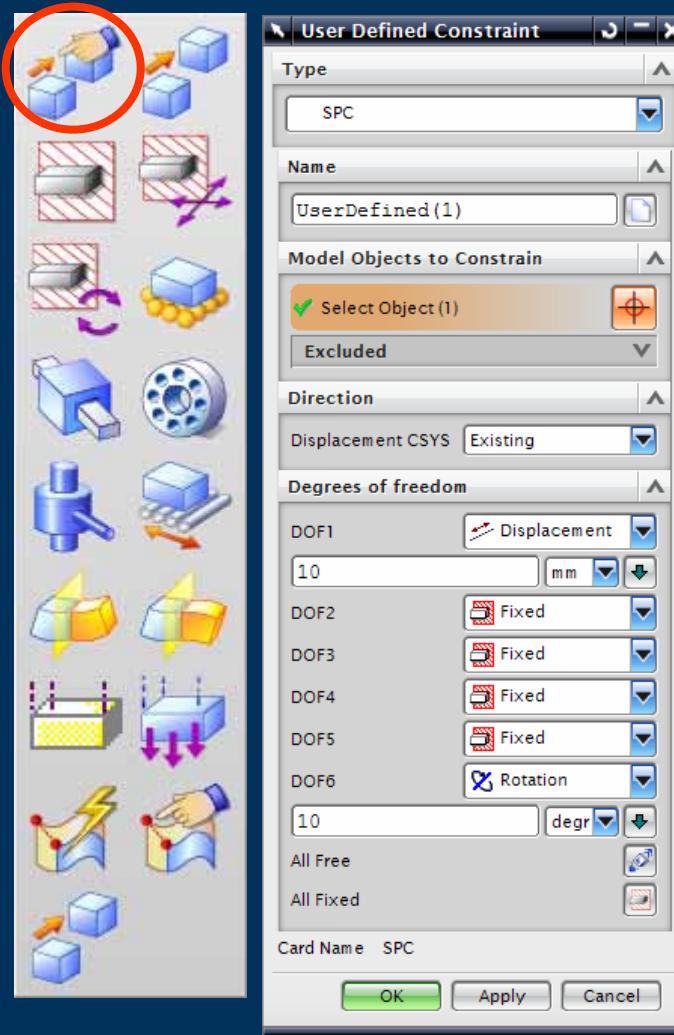
Nodal Force Location



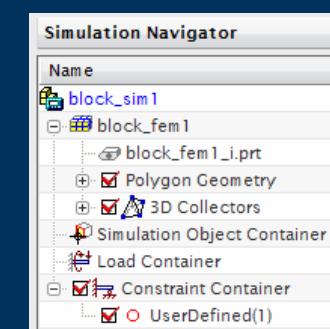
- ▶ Location for a Nodal Force Excitation for the NX Response Simulation application
- ▶ Requires a matching Dynamic Load
- ▶ Managed in the Load Container



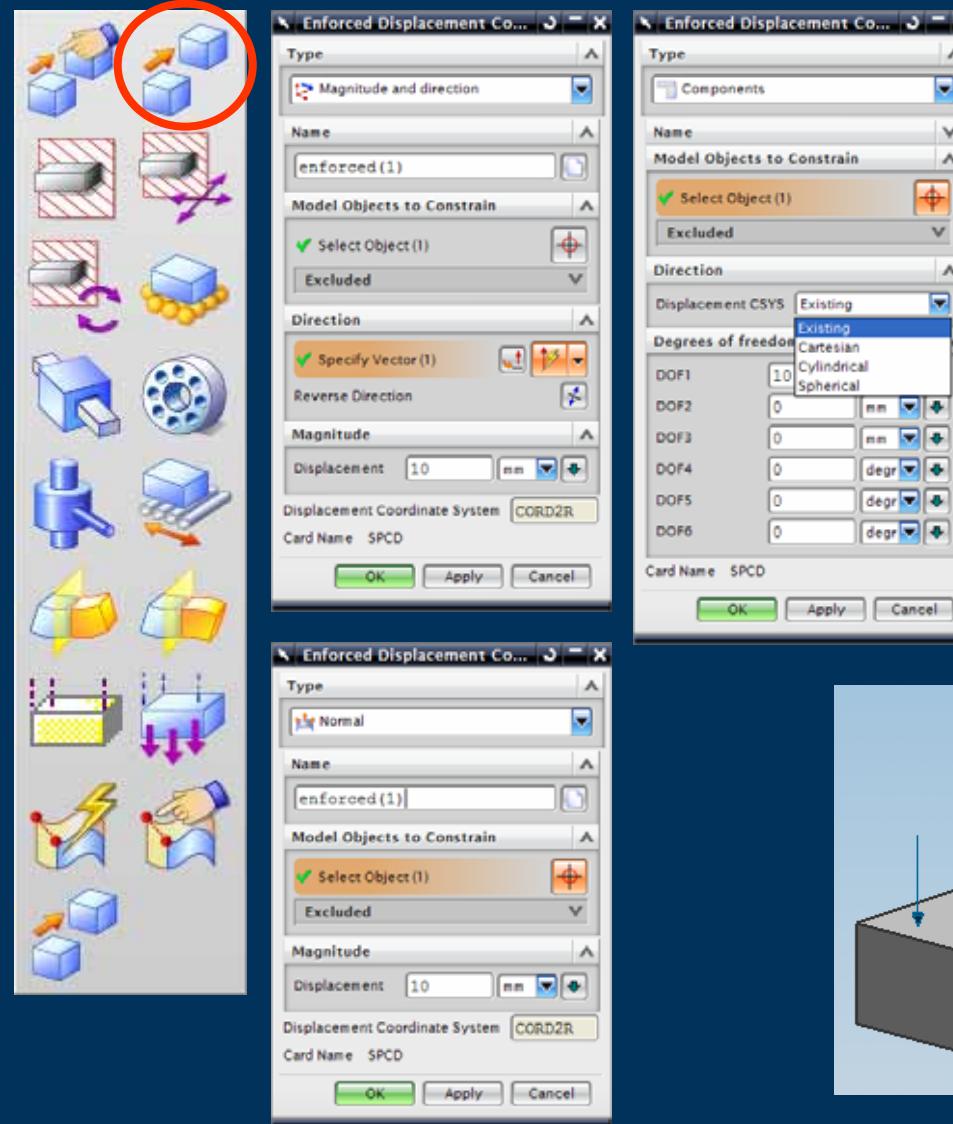
Constraints – User Defined



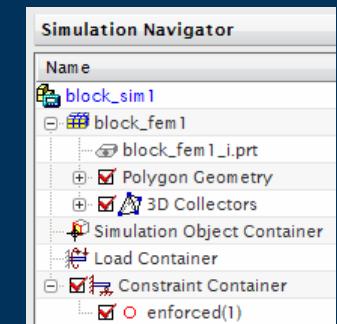
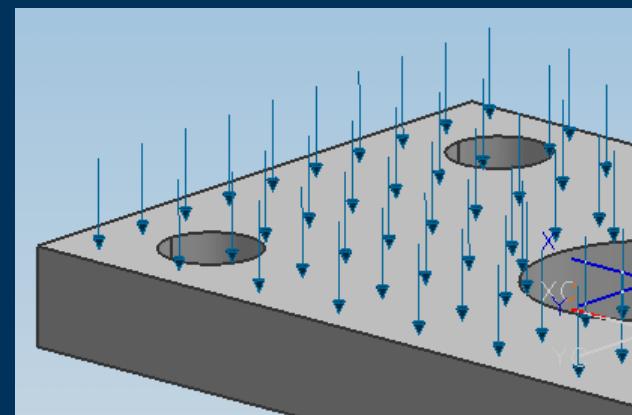
- ▶ User Defined Constraints
 - ▶ Free, Fixed or Displacement
 - ▶ Cartesian, Cylindrical or Spherical coordinate system
- ▶ Managed in Constraint Container



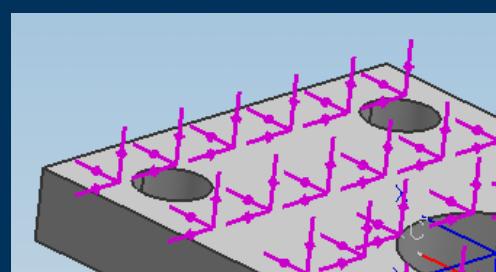
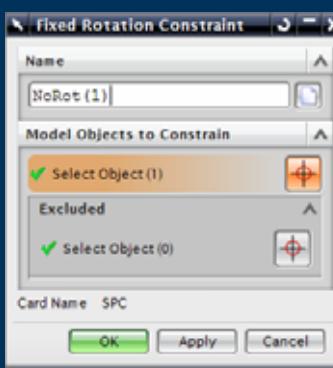
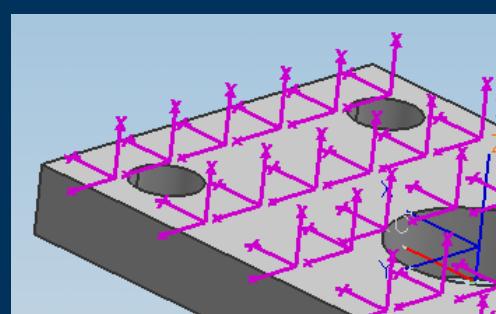
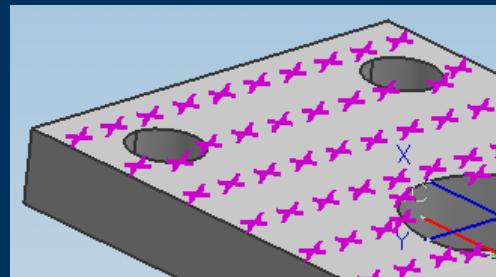
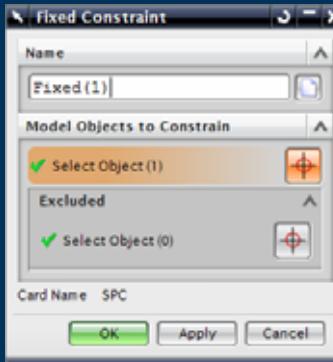
Constraints – Enforced Displacement



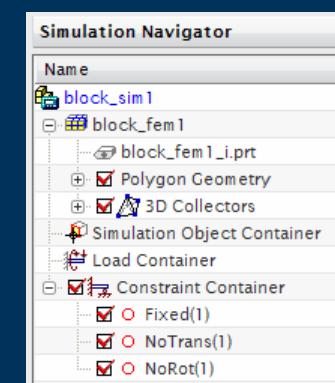
- ▶ Enforced Displacement Options
 - ▶ Magnitude and direction
 - ▶ Normal to selected faces
 - ▶ Component Displacement relative to selected coordinate system
- ▶ Managed in the Constraint Container



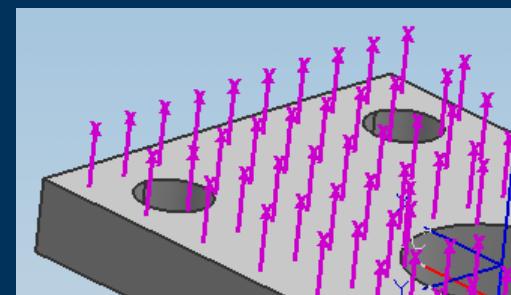
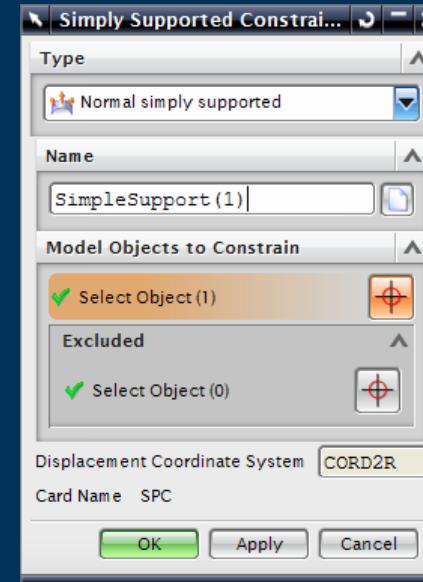
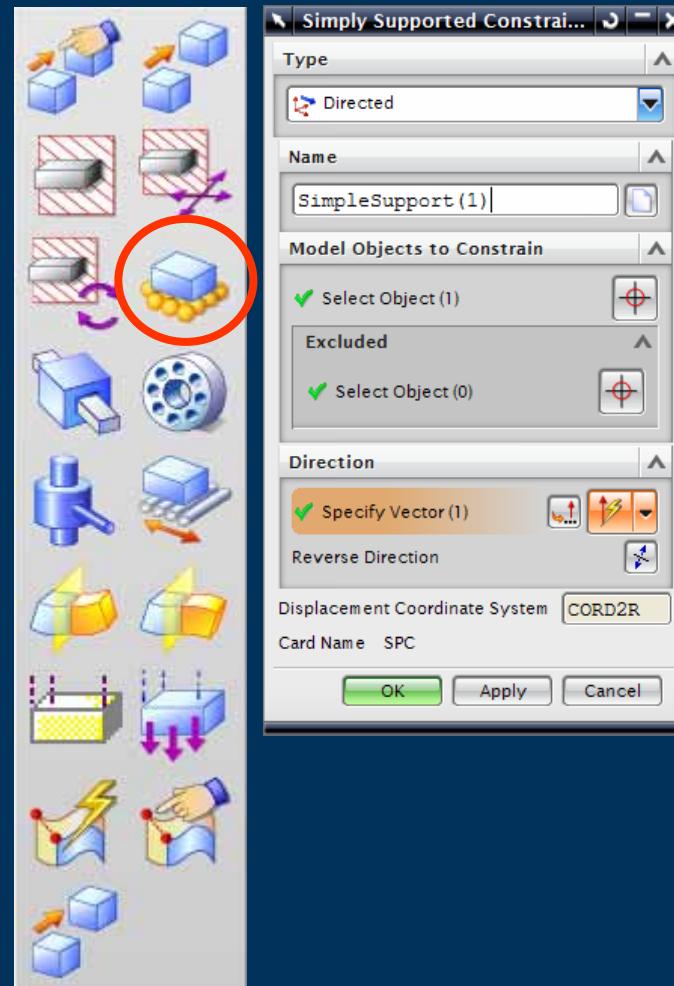
Constraints – Fixed, Translation & Rotation



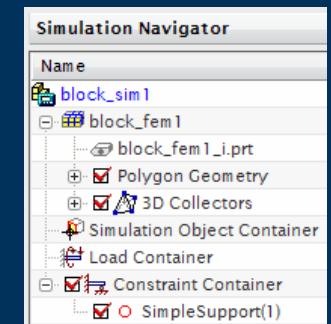
- ▶ Fixed Constraints (Restraints)
 - ▶ All DOF
 - ▶ No Translation
 - ▶ No Rotation
- ▶ Managed in the Constraints Container



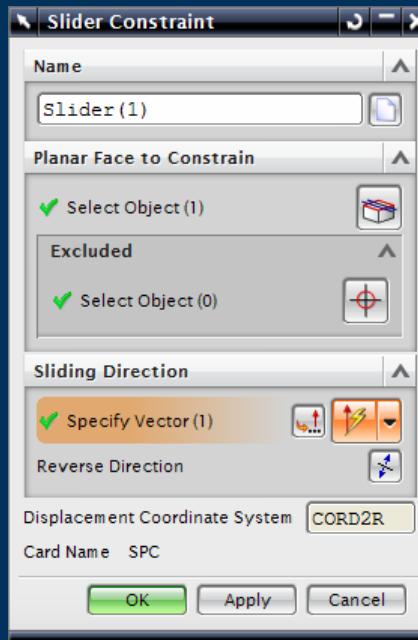
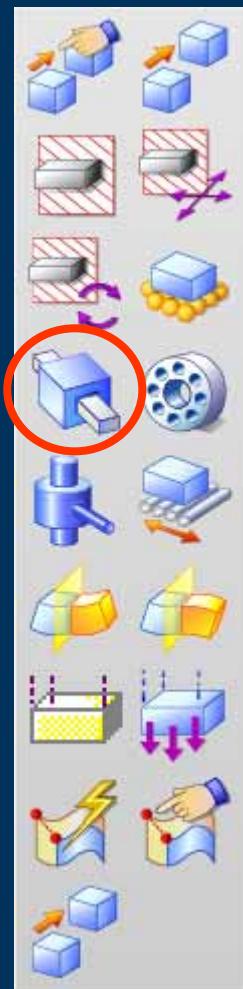
Constraints – Simply Supported



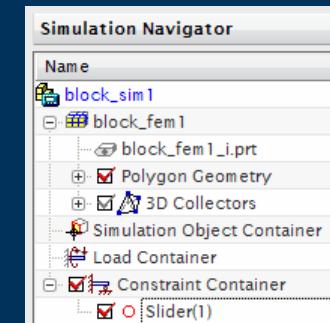
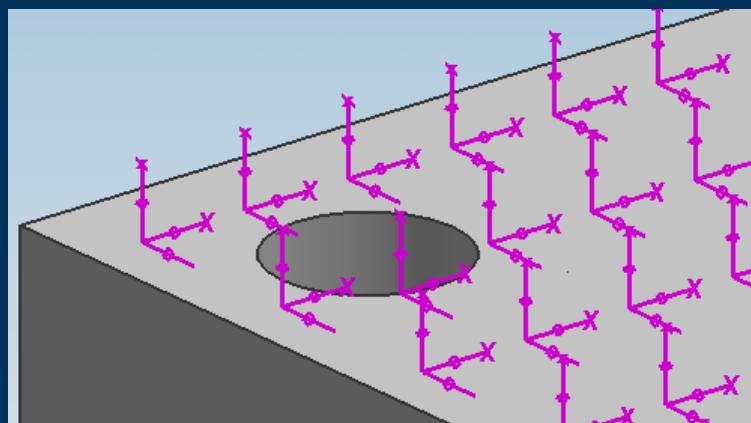
- ▶ Simply Supported Constraint
- ▶ Magnitude and Direction of Support
- ▶ Normal to selected surfaces
- ▶ Managed in the Constraint Container



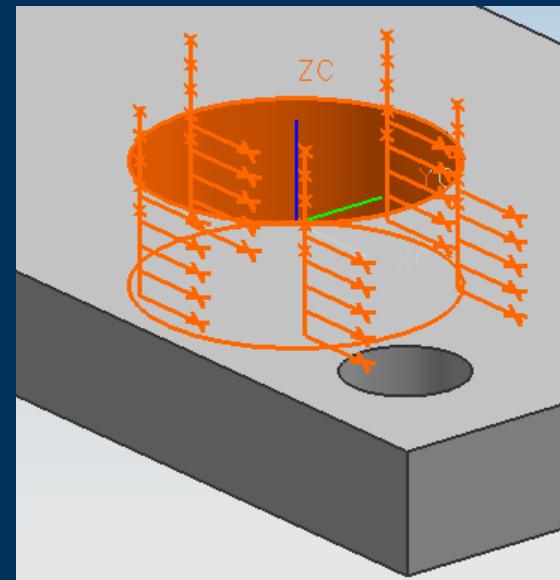
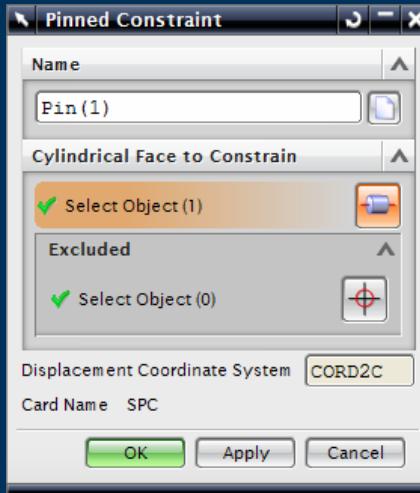
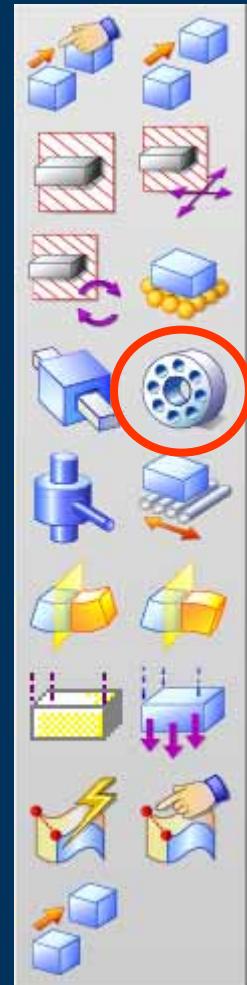
Constraints – Slider



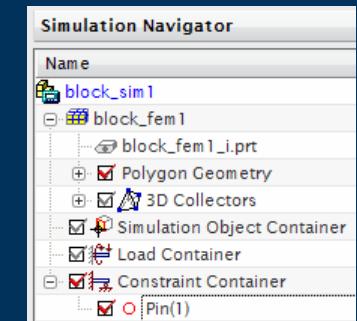
- ▶ Slider constraint
 - ▶ Planar sliding face
 - ▶ Sliding direction
- ▶ Managed in the Constraint Container



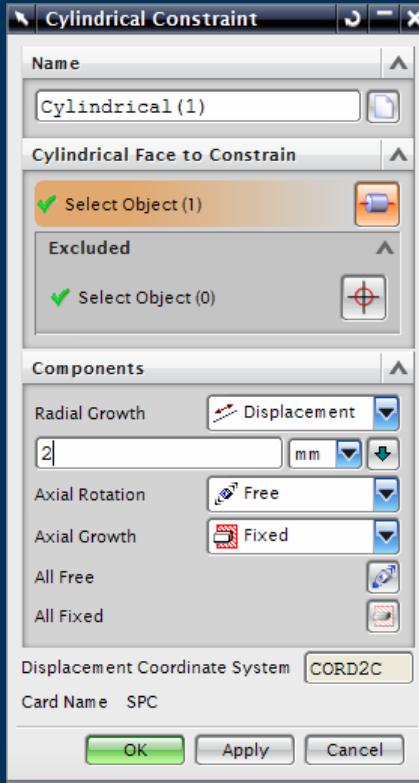
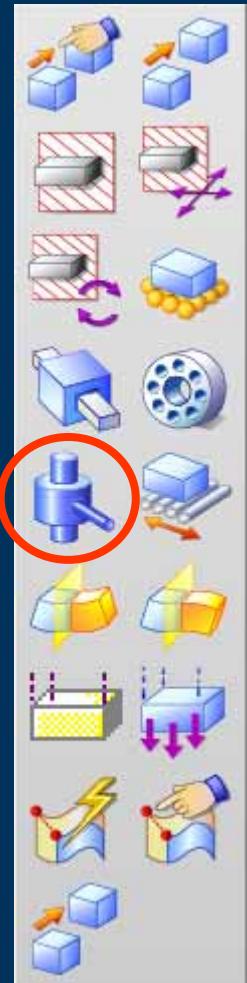
Constraints – Pinned



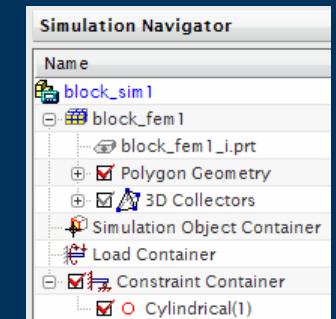
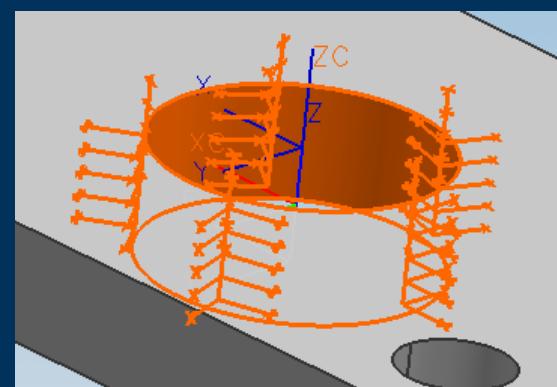
- ▶ Pinned Constraint for Cylindrical Surfaces
- ▶ Managed in the Constraint Container



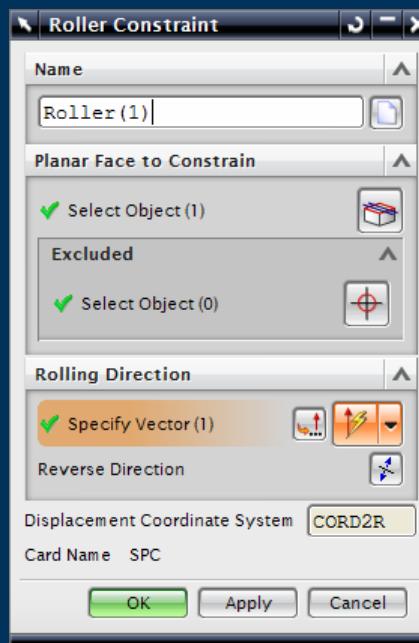
Constraints – Cylindrical



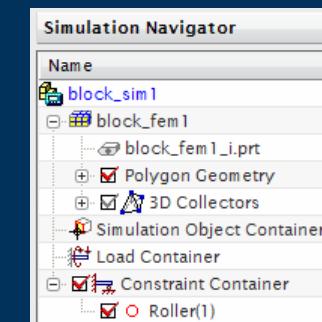
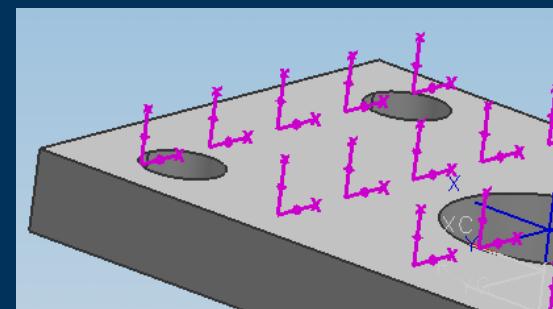
- ▶ Cylindrical Constraint
 - ▶ Radial Growth
 - ▶ Axial Rotation
 - ▶ Axial Growth
 - ▶ Relative to selected cylindrical surface
- ▶ Managed in the Constraint Container



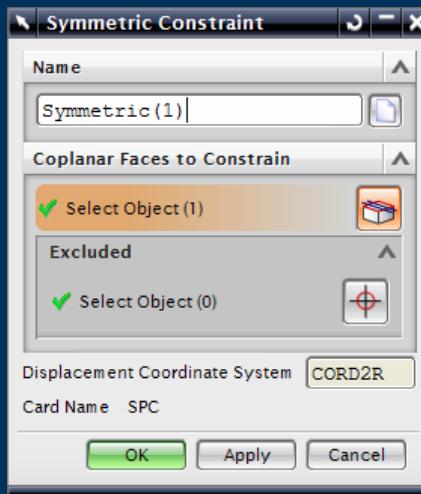
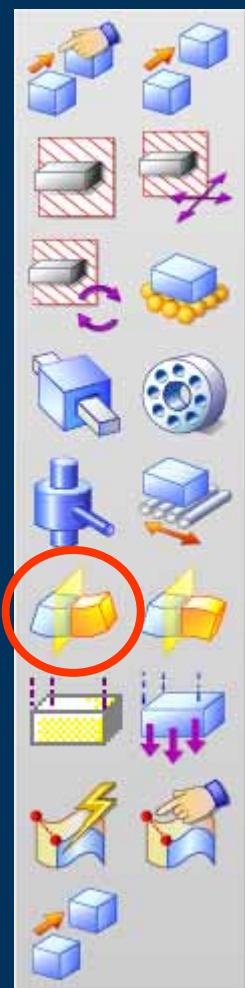
Constraints – Roller



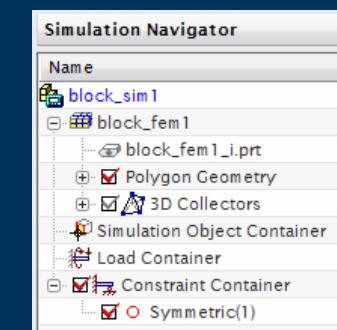
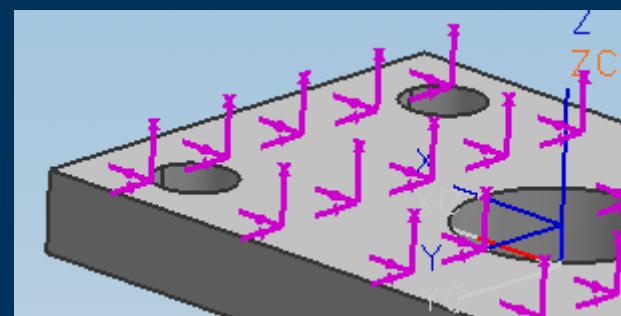
- ▶ Roller Constraint
- ▶ Managed in the Constraint Container



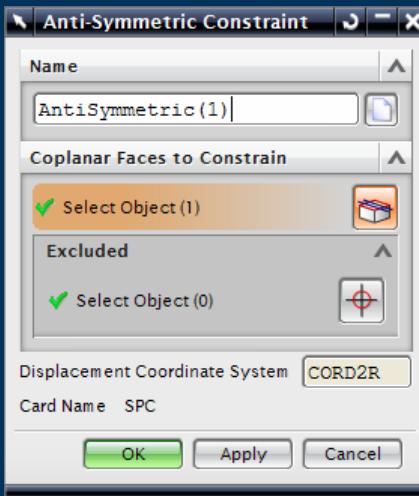
Constraints – Symmetric



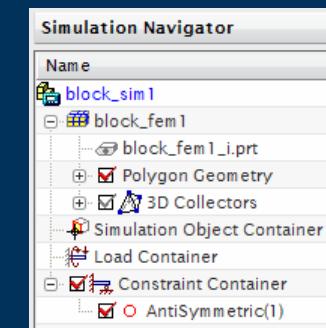
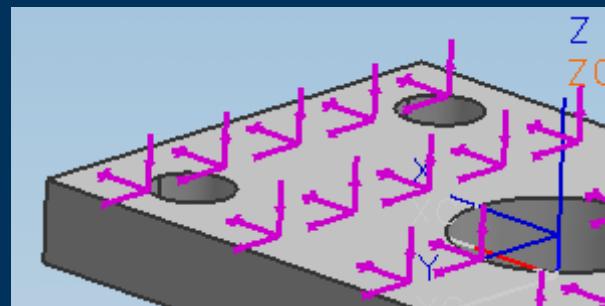
- ▶ Symmetric Constraint
- ▶ Managed in the Constraint Container



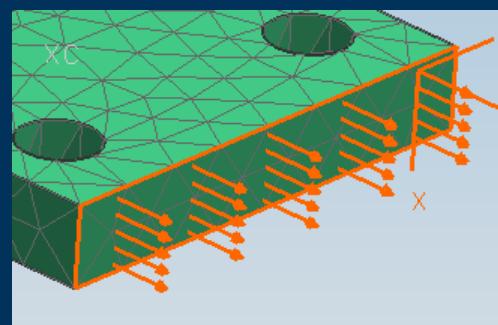
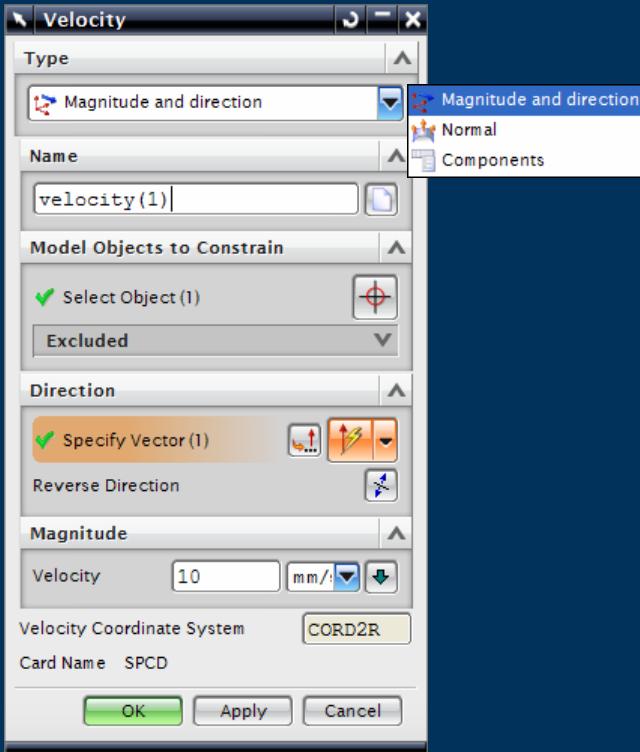
Constraints – Anti-Symmetric



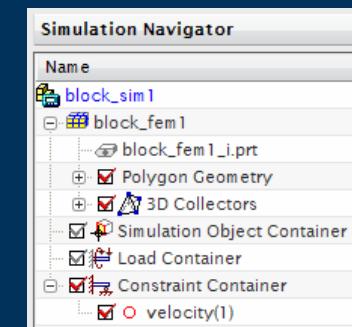
- ▶ Anti-Symmetric Constraint
- ▶ Managed in the Constraint Container



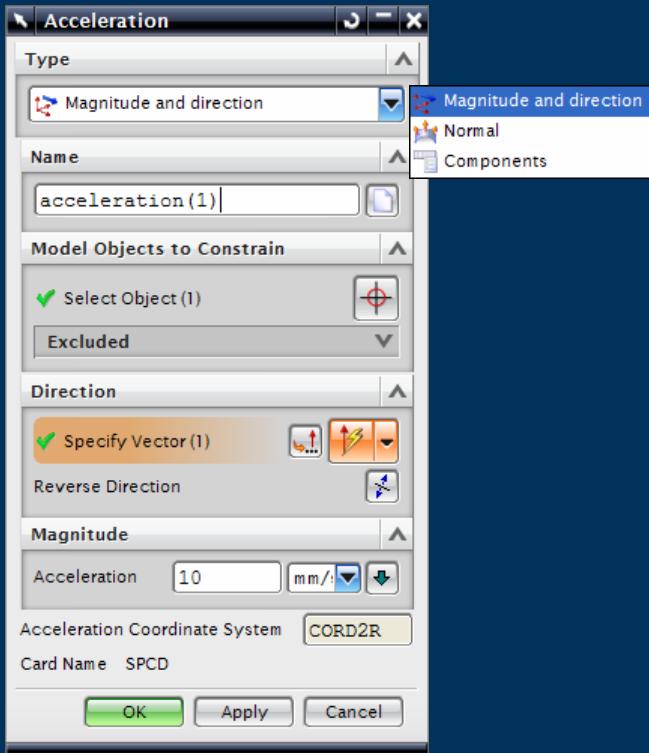
Constraints – Velocity



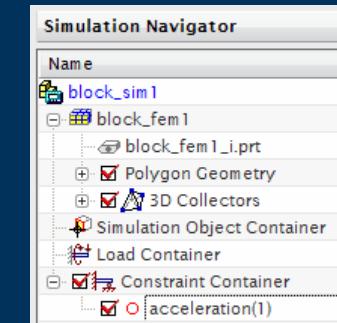
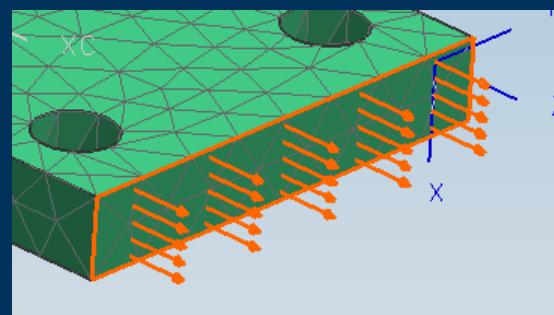
- ▶ Velocity Constraint
- ▶ Specific to these NX Nastran Solutions
 - ▶ SEDFREQ 108 — Direct Frequency Response
 - ▶ SEDTRAN 109 — Direct Transient Response
 - ▶ SEMFREQ 111 — Modal Frequency Response
 - ▶ SEMTRAN 112 — Modal Transient Response
- ▶ Managed in the Constraint Container



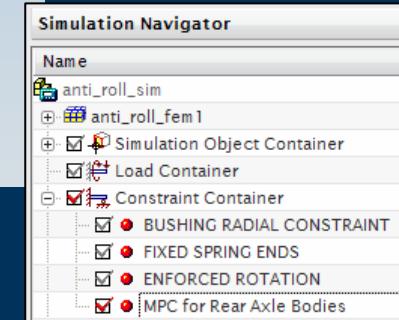
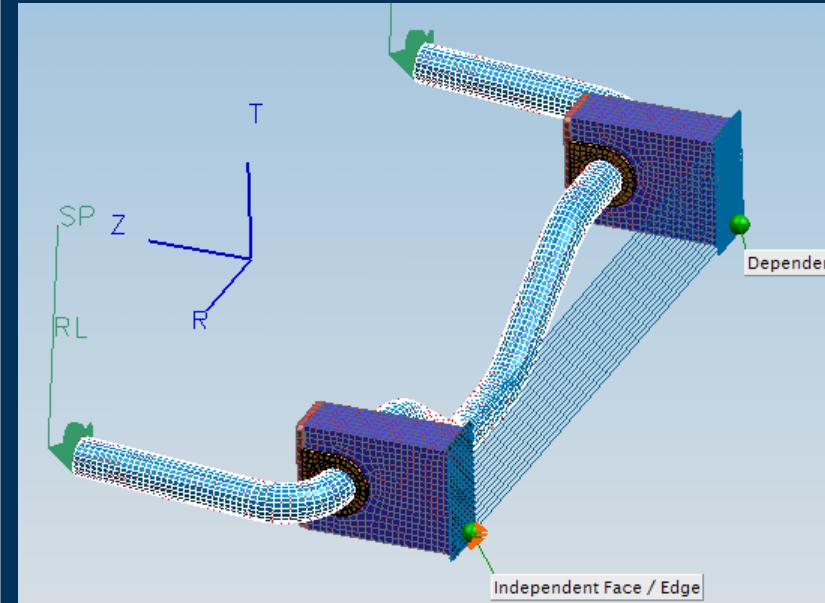
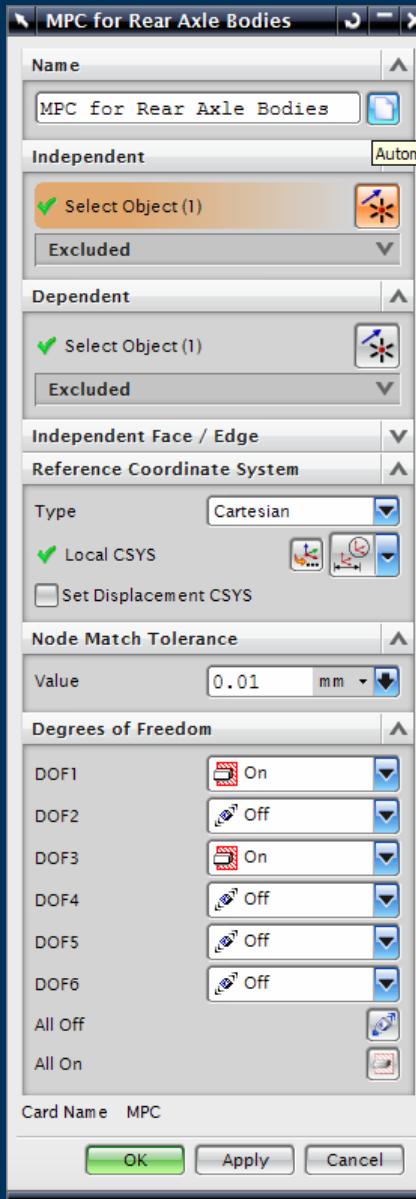
Constraints – Acceleration



- ▶ Velocity Constraint
- ▶ Specific to these NX Nastran Solutions
 - ▶ SEDFREQ 108 — Direct Frequency Response
 - ▶ SEDTRAN 109 — Direct Transient Response
 - ▶ SEMFREQ 111 — Modal Frequency Response
 - ▶ SEMTRAN 112 — Modal Transient Response
- ▶ Managed in the Constraint Container

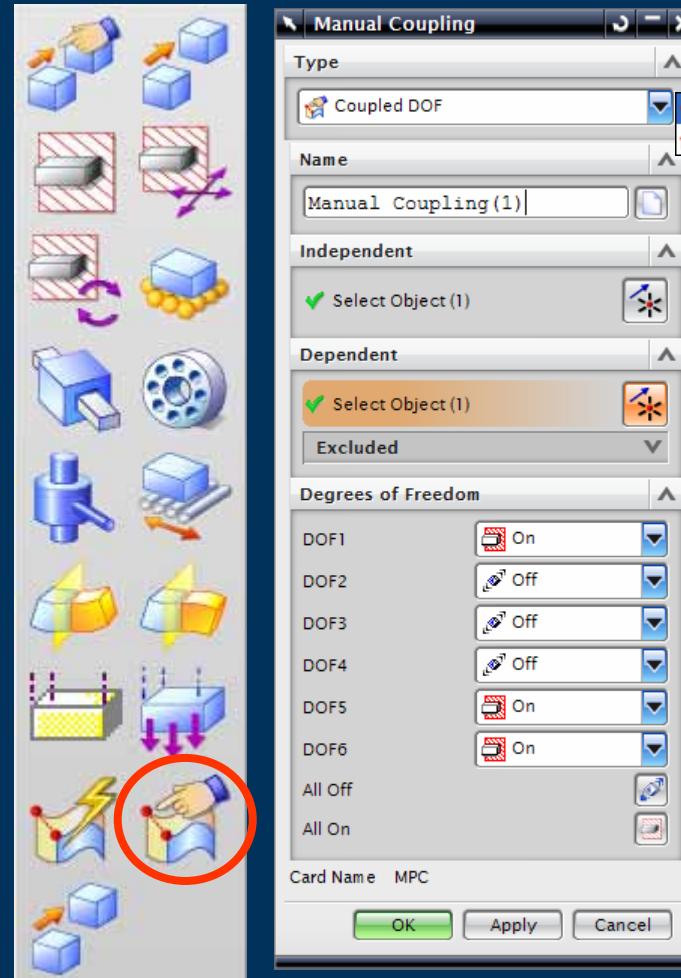


Constraints – Automatic Coupling

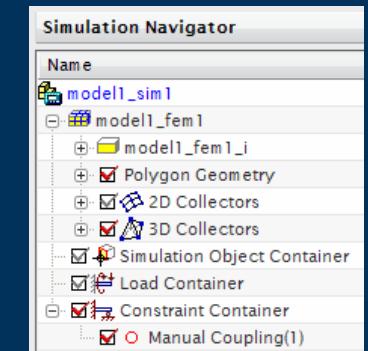


- ▶ Coupled degrees of freedom between offset or symmetric meshes
- ▶ Managed in the Constraint Container

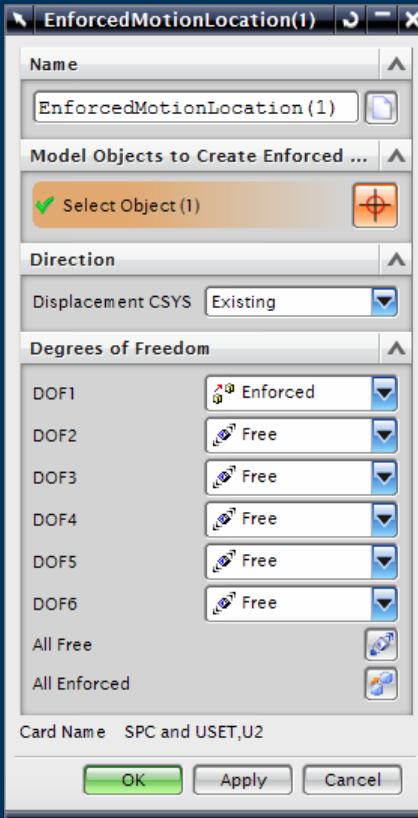
Constraints – Manual Coupling



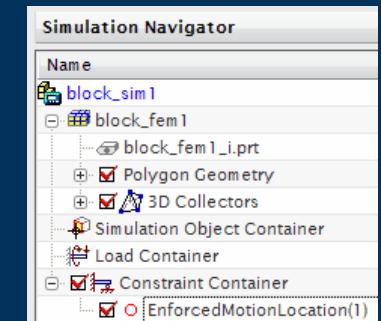
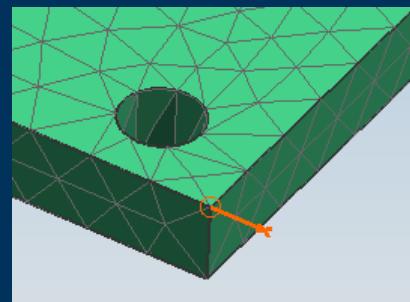
- ▶ Create either Coupled DOF or Constraint Equations between selected nodes
- ▶ Managed in the Constraint Container



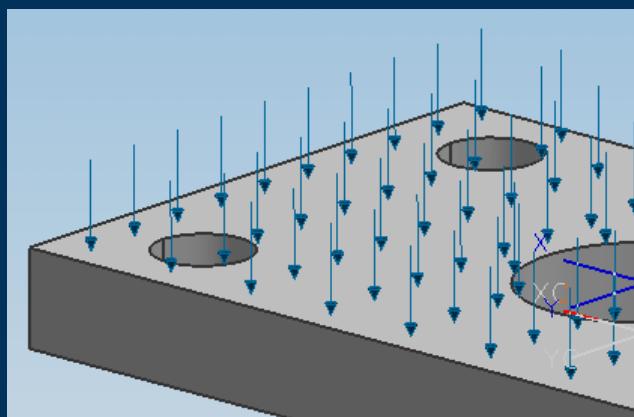
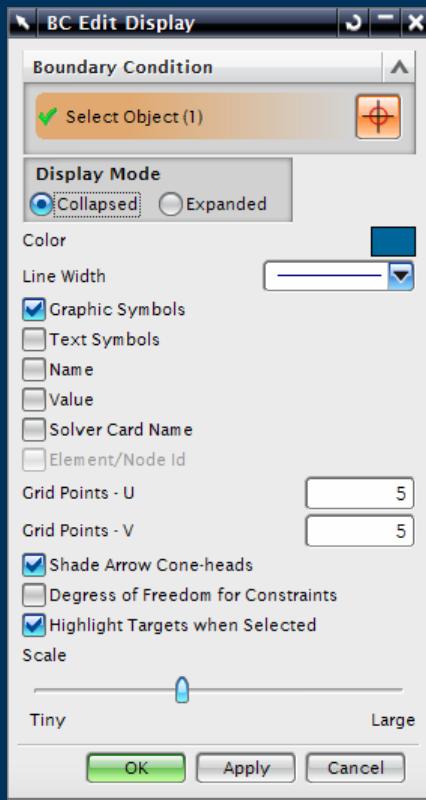
Constraints – Enforced Motion Location



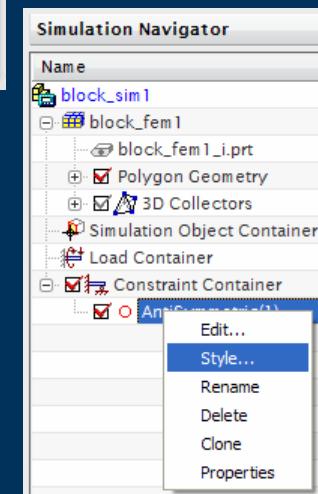
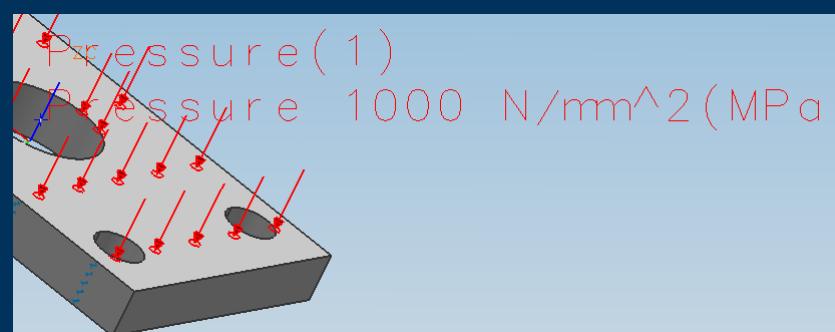
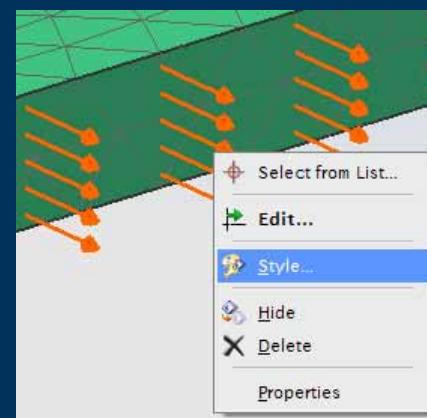
- ▶ Enforced Motion Location Constraint
- ▶ Specific to these NX Nastran Solutions
 - ▶ SEDFREQ 108 — Direct Frequency Response
 - ▶ SEDTRAN 109 — Direct Transient Response
 - ▶ SEMFREQ 111 — Modal Frequency Response
 - ▶ SEMTRAN 112 — Modal Transient Response
- ▶ Managed in the Constraint Container



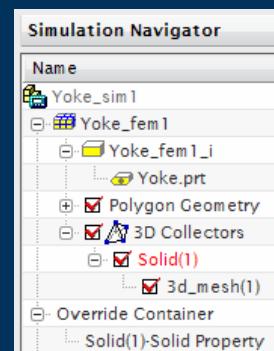
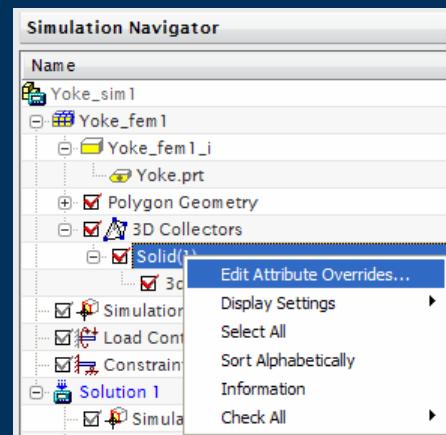
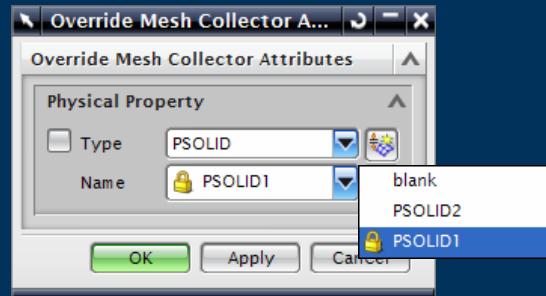
Boundary Condition Symbol Display Controls



- ▶ All Boundary Conditions have a Symbol associated and the Style can be changed



Physical Property Overrides



- ▶ Allows the SIM file to override the Physical properties defined in the FEM file
- ▶ Mesh with Overridden property shown in Red
- ▶ “What-if” studies

Custom Units & Units Converter

Units Manager

Measure: Length

Unit Name: Millimeter

Unit Display Name: mm

Description: millimeters

Conversion Parameters:

Conversion Equation: Unit = (a) * (mm) + (b)

Multiplication Factor (a): 1.0000

Addition Factor (b): 0.0000

Default Unit

New Unit

Delete Unit

Update Unit

Coefficient per Unit Length

Moment of Inertia (Area)

Viscous Damping

Energy

Power

Momentum

Temperature Gradient

Energy per Unit Mass

Dissipation Rate of Energy per Unit Mass

Mass Flux

Mass per Unit Length

Mass per Unit Area

Units Converter

Quantity: Force Per Unit Length

From: 1.0000 N/mm

To: 68.5217 lbf/ft

Units Converter

Quantity: Fatigue Strength Coefficient

From: 1.0000 N/mm²(MPa)

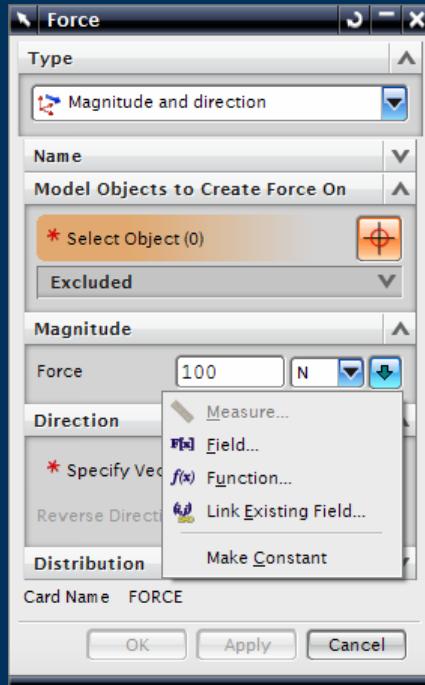
To: 145.0376 lb/in²(psi)

Close

- ▶ Units Manager create Custom Units for various Measures
- ▶ Units Converter

Measure	Unit Name	Display Name	Description
Length	Millimeter	mm	millimeters
Area	SquareMillimeter	mm ²	millimeters squared
Volume	CubicMillimeter	mm ³	millimeters cubed
Mass	Kilogram	kg	kilograms
Mass Density	KilogramPerCubicMillimeter	kg/mm ³	kilograms per millimeter cubed
Fatigue Strength Coefficient	HertzPerSquareMillimeter	Hz/mm ² (MPa)	Hertz per square millimeter squared
Time	Second	sec	seconds
Angle	Degrees	degrees	degrees
Velocity	MillimeterPerSecond	mm/sec	millimeters per second
Acceleration	MillimeterPerSquareSecond	mm/sec ²	millimeters per second squared
Force	Newton	N	Newtons
Pressure	NewtonPerSquareMillimeter	N/mm ² (MPa)	Newtons per square millimeter
Moment	NewtonMillimeter	N-mm	Newtons-millimeters
Stress	NewtonPerSquareMillimeter	N/mm ² (MPa)	Newtons per square millimeter
Strain	Strain_Metric1	mm/mm	millimeters per millimeter
Strain Energy	StrainEnergy_Metric1	N-mm	Newtons-millimeters
Strain Energy Density	StrainEnergyDensity_Metric1	N-mm/mm ³	Newtons-millimeters per millimeter cubed
Temperature	Celsius	°C	Celsius
Heat	Watt	W	Watts
Convection Coefficient	WattPerMillimeterSquared	W/m ²	Watts per millimeter squared
Thermal Conductivity	WattPerMillimeterPerDegreeCelsius	W/m°C	Watts per millimeter per degree Celsius
Thermal Expansion Coefficient	ThermalExpansion_Metric1	1/C	Expansion coefficient per degree Celsius
Specific Heat	SpecificHeat_Metric1	J/kg·K	Joules per Kilogram per degree Kelvin
Angular Velocity	DegreesPerSecond	degrees/sec	degrees per second
Angular Acceleration	DegreesPerSecondSquared	degrees/sec ²	degrees per second squared
Fatigue Life	DutyCycles	Duty Cycles	Duty Cycles
Heat Flow Rate	HeatFlow_Metric1	W	Watt
Thermal Energy	ThermalEnergy_Metric1	J	Joule
Mass Moment of Inertia	KilogramMillimeterSquared	kg-mm ²	Kilogram - millimeter squared
Dynamic Viscosity	DynamicViscosity_Metric1	kg/m·sec	Kilograms per millimeter per second
Heat Generation	HeatGeneration_Metric1	W/mm ³	Watts per millimeter cube
Thermal Conductance	ThermalConductance_Metric1	W/C	Watts per millimeter
Conductance per Unit Length	ThermalConductivity_Metric1	W/mm·C	Watts per millimeter per degree Celsius
Thermal Resistance	ThermalResistance_Metric1	C/W	Watts per millimeter per degree Celsius
Mass Flow Rate	KilogramPerSecond	kg/sec	kilograms per second
Volume Flow Rate	CubicMillimeterPerSecond	mm ³ /sec	millimeters cubed per second
Temperature Difference	CelsiusDifference	°C	Celsius
Frequency	Hertz	Hz	Hertz
Moment of Inertia (Area)	CoefficientsPerMillimeter	1/mm	coefficients per millimeter
Viscous Damping	MillimeterFourth	mm ⁴	millimeters fourth
Energy	KilogramPerSecond	kg/sec	Kilograms per second
Power	Joule	J	Joule
Momentum	Mass	kg	Kilogram
Temperature Gradient	KilogramMeterPerSecond	kg-m/sec	Kilogram-meter per second
Energy per Unit Mass	CelsiusPerKilogram	C/mm	Celsius per millimeter
Dissipation Rate of Energy per Unit	EnergyPerMass_Metric1	mm ² /sec ²	millimeters squared per second squared
Mass Flux	DissipationRate_Metric1	mm ² /sec ³	millimeters squared per second cubed
Mass per Unit Length	MassFlux_Metric1	kg/sec-mm ²	Kilograms per second per millimeter squared
Mass per Unit Area	KilogramPerMillimeter	kg/mm ²	Kilograms per millimeter
	KilogramPerMillimeterSquared	kg/mm ²	Kilograms per millimeter squared

Unit Selection



- ▶ Numeric entry for a value can be entered in different units
- ▶ Measure
 - ▶ “on the fly” measurement from existing geometry
- ▶ Field
 - ▶ Define the magnitude as a constant or variable (eg time dependant)
- ▶ Function
 - ▶ Define the magnitude as a function that calculates a single value
- ▶ Link Existing Field
 - ▶ Link to an existing Field Variable
- ▶ Make Constant
 - ▶ Converts an expression to a constant value

Examples

m	radians	m N	m N/m m^2(kPa)
mm	degrees	N	N/m m^2(MPa)
in		Ibf	Pa(N/m^2)
ft	m N-mm	Ibf	Ibf/in^2(psi)
cm	N-mm	C	Ibf/ft^2
km	N-m	F	bars
mi	Ibf-in	K	atmospheres
micron	Ibf-ft	R	
nm	rev/sec^2		
angstrom	rev/min^2		
	degrees/sec^2		
	radians/sec^2		

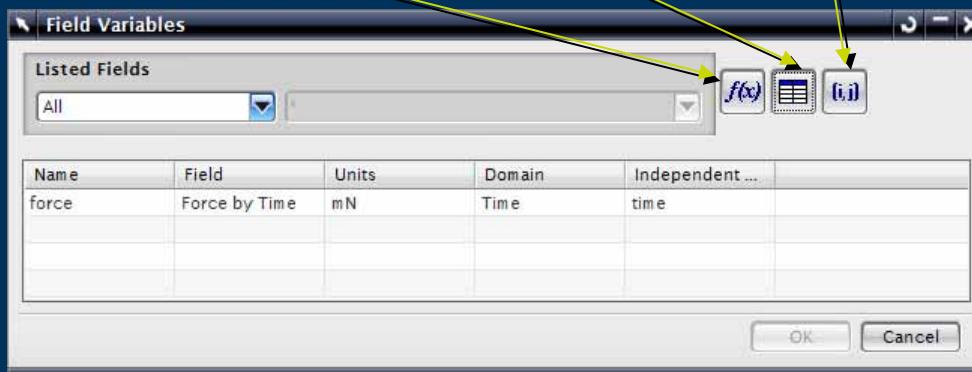
Create Table Field		
Table Field		
Name	Row ID	time (sec)
	1	10
	2	25
	3	35
Values		

Boundary Condition Magnitude – Table Field

Maths Expression Field

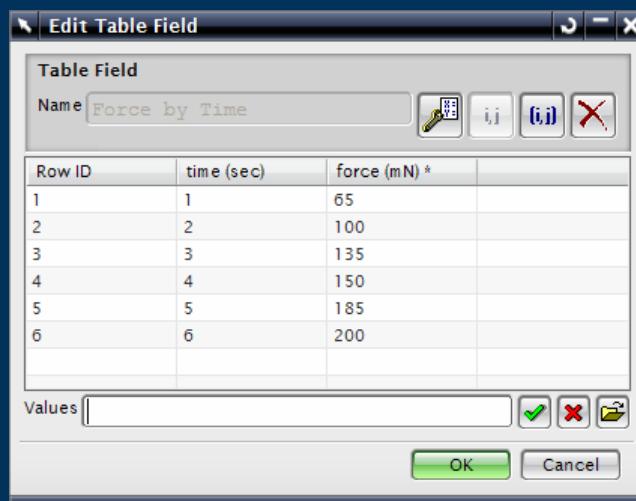
Table Based Field

Existing Named Variables



► Tables Field

- User selected Dependant and Independent columns



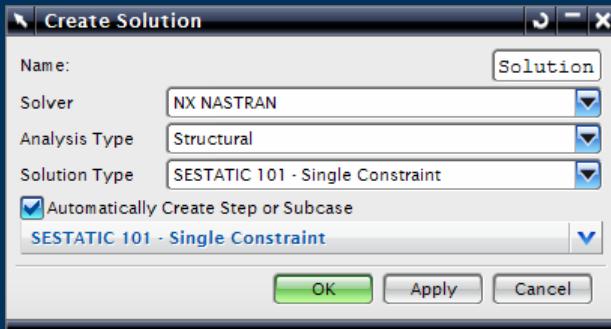
Boundary Condition Magnitude – Function Field

The figure consists of three screenshots of the UG NX software interface:

- Create Math Expression Field:** A dialog box where a user has defined a variable named "sys_field201" with a unit type of "Force". The expression entered is "ug_fieldVar("Force by Time","force")ug_var("time")".
- Insert Function (beams category):** A dialog box showing a list of functions under the "beams" category. One function, "ug_centerLoadBendingStressMaximum", is selected. A tooltip provides information: "Calculates the maximum bending stress under a center load. The return dimensionality is Stress." It also lists requirements: "Number: Length of Beam", "Number: Load on Beam", "Number: Distance from Neutral Axis to Extreme Fibers", and "Number: Moment of Inertia".
- Insert Function (math category):** A dialog box showing a list of mathematical functions under the "math" category. Functions listed include abs, arccos, arcsin, arctan, arctan2, ceiling, cos, floor, hypcos, hypsin, hyptan, log, log10, max, minimum, mod, pi, round, sin, sqrt, and tan.

- ▶ Pre-defined functions that calculate a value
- ▶ Categories
 - ▶ Beams
 - ▶ Fluids
 - ▶ Gears
 - ▶ Geometry
 - ▶ Materials
 - ▶ Maths
 - ▶ Mechanics
 - ▶ Misc
 - ▶ O Rings
 - ▶ Plate
 - ▶ Spreadsheet
 - ▶ Spring
 - ▶ String
 - ▶ Units
 - ▶ Vibration

Solution



Solver	Analysis Type	Solution Type
NX Nastran	Structural	SESTATIC 101 - Single Constraint SESTATIC 101 - Multiple Constraint SEMODES 103 SEMODES 103 Response - Simulation SEBUCKL 105 NLSTATIC 106 SEDFREQ 108 SEDTRAN 109 SEMFRQ 111 SEMTRAN 112 ADVNL 601, 106 ADVNL 601, 129
	Thermal	NLSCSH 153
	Axisymmetric Structural	SESTATIC 101 - Single Constraint SESTATIC 101 - Multiple Constraint NLSTATIC 106
	Axisymmetric Thermal	NLSCSH 153

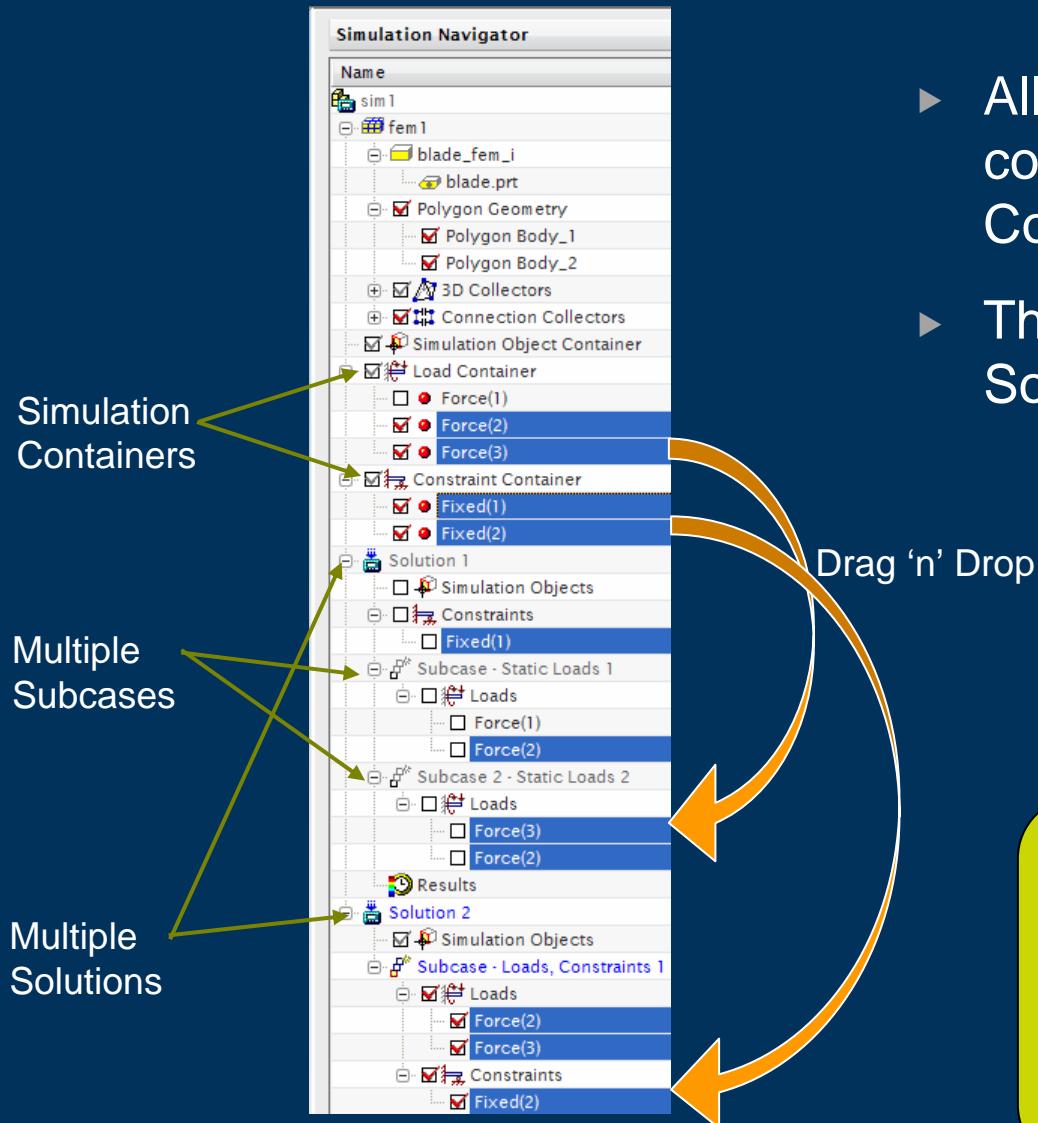
Solver	Analysis Type	Solution Type
ABAQUS	Structural	General Analysis
	Thermal	Heat Transfer
	Axisymmetric Structural	General Analysis
	Axisymmetric Thermal	Heat Transfer

Solver	Analysis Type	Solution Type
ANSYS	Structural	Linear Statics Modal Buckling Nonlinear Statics
	Thermal	Thermal
	Axisymmetric Structural	Linear Statics Nonlinear Statics
	Axisymmetric Thermal	Thermal

- ▶ Solution is Solver dependant
- ▶ Solution gathers everything together to perform a solve
- ▶ SIM File can contain many Solutions to study different aspects of the design
- ▶ Only one is active

Name	Environment	Description
block_sim1	Active: NX NASTRAN - T...	
block_fem1	Default: NX NASTRAN - ...	
Load Container		
Constraint Container		
Linear Statics 1	NX NASTRAN - Structural	SESTATIC 101 - Single Constraint
Linear Statics 2	NX NASTRAN - Structural	SESTATIC 101 - Single Constraint
Normal Modes 1 to 25	NX NASTRAN - Structural	SEMODES 103
Normal Modes 26 to 100	NX NASTRAN - Structural	SEMODES 103
Buckling Prediction	NX NASTRAN - Structural	SESTATIC 101 - Multi Constraint
Thermal Constant 75C	NX NASTRAN - Thermal	NLSCSH 153

Solution – Containers and Re-using Data



- ▶ All Boundary Conditions, constraints etc are stored in Containers
- ▶ They are then referenced by the Solutions and Subcases

Benefits

- ▶ Re-use of data
- ▶ Quickly and easily explore effects of different loading conditions
- ▶ Efficient analysis in complex environments

Solution – Subcase Management

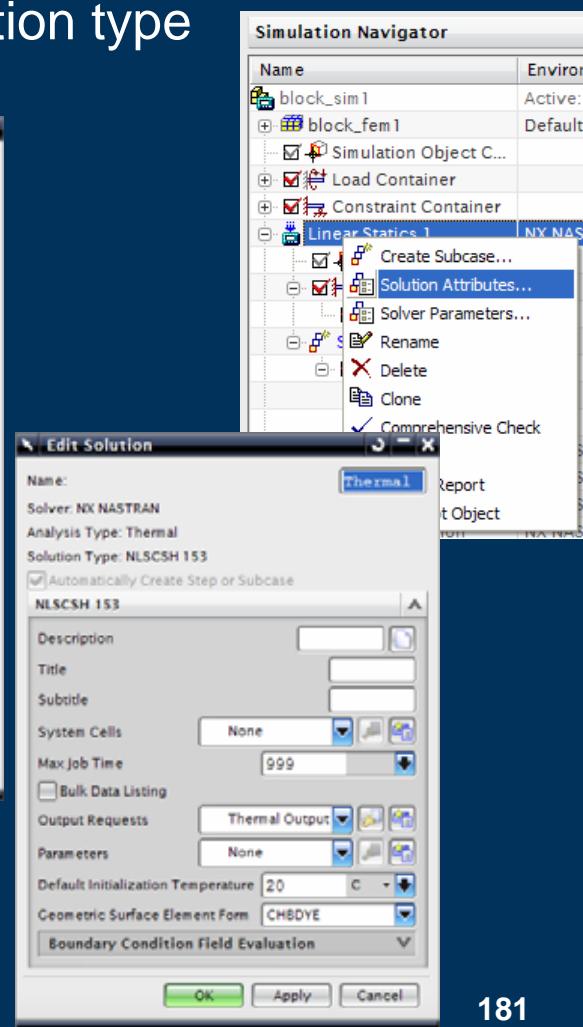
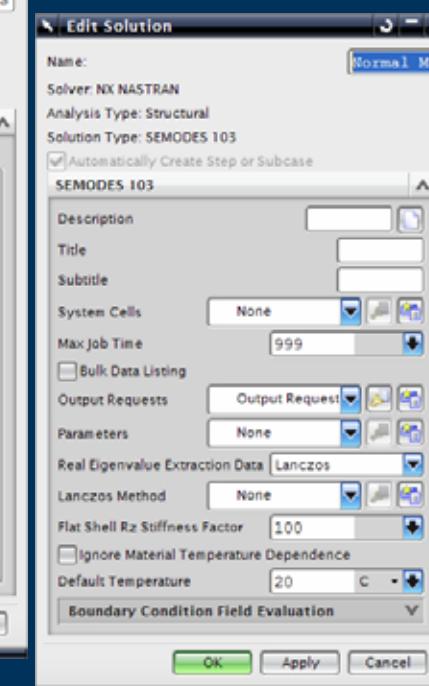
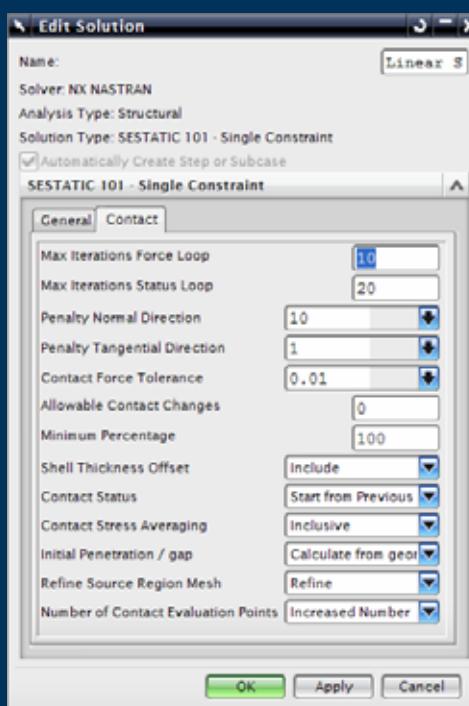
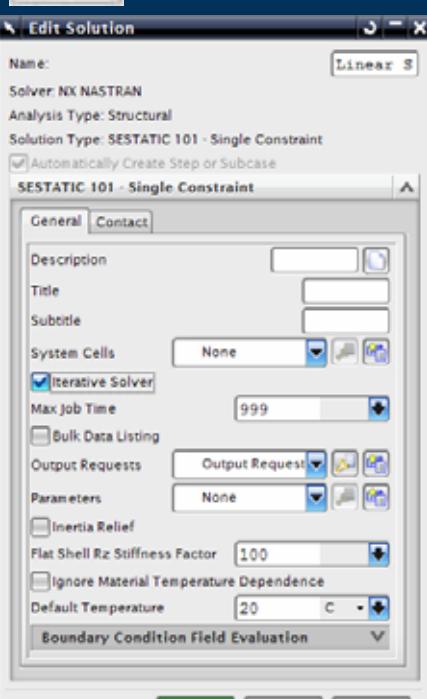
The image shows three windows from the NX Nastran software:

- Create Solution Step or Subcase (Top Left):** This dialog is for creating a Subcase. It includes fields for Name, Solver Type (set to NX NASTRAN), Analysis Type (Structural), and Solution (SESTATIC 101 - Single Constraint). The Step is set to Subcase - Static Loads. Under Subcase - Static Loads, there is a section for Output Requests labeled "Structural Output". A yellow arrow points from the text "Output Request Object" to this dropdown menu, which is open to show options like "None", "NASTRAN Temperatures", "NX THERMAL Temperatures", "ABAQUS Temperatures", and "ANSYS Temperatures".
- Create Solution Step or Subcase (Bottom Left):** This dialog is for creating a Subcase. It includes fields for Name, Solver Type (set to NX NASTRAN), Analysis Type (Thermal), and Solution (NLCSH 153). The Step is set to Subcase - Loads, Constraints. Under Subcase - Loads, Constraints, there is a section for Output Requests labeled "Thermal Output".
- Simulation Navigator (Right):** This window lists simulation objects and provides context-sensitive commands. It shows "block_sim1" as the active environment. Under "block_fem1", there are "Simulation Object C...", "Load Container", and "Constraint Container". A context menu is open over "Create Subcase...", with options including "Solution Attributes...", "Solver Parameters...", "Rename", "Delete", "Clone", "Comprehensive Check", "Solve...", "Create Report", "KF Adopt Object", and "Buckling Prediction".

List of Features and Benefits:

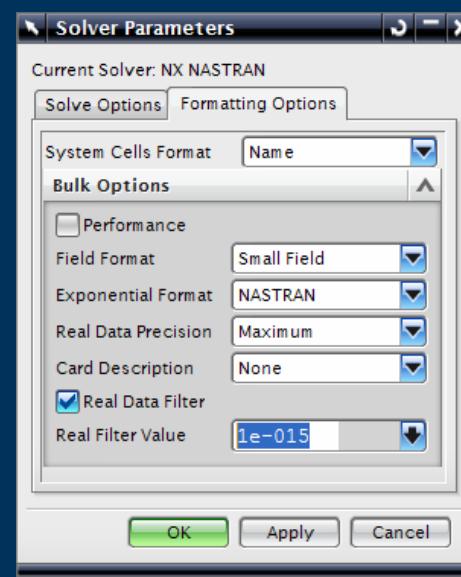
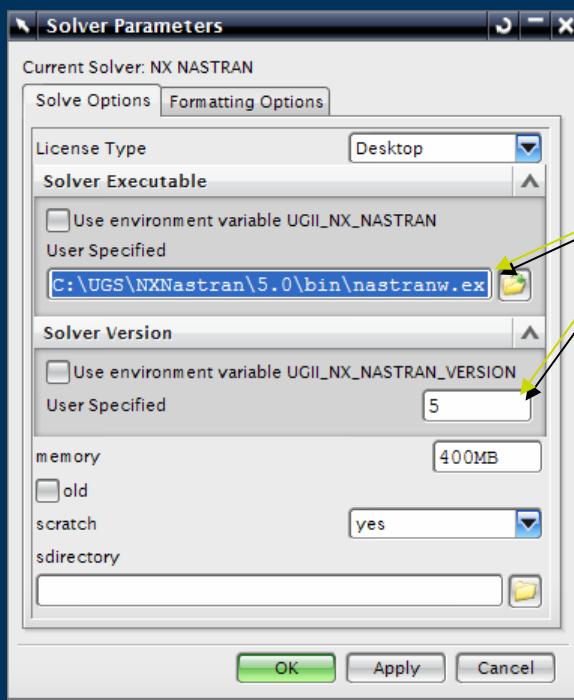
- Subcase availability and options will vary according to the active Solver and Solution type
- Each Solution can have multiple Subcases
- Loads can be used in any combination of Subcases
- Subcases can include Pre-Loads like Thermal results from a previous solve

Solution – Attributes

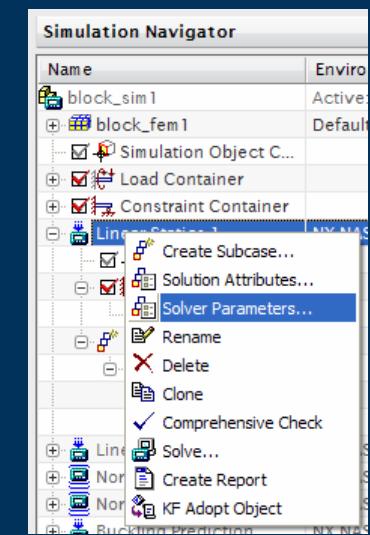


- ▶ Solution Attributes availability and options will vary according to the active Solver and Solution type

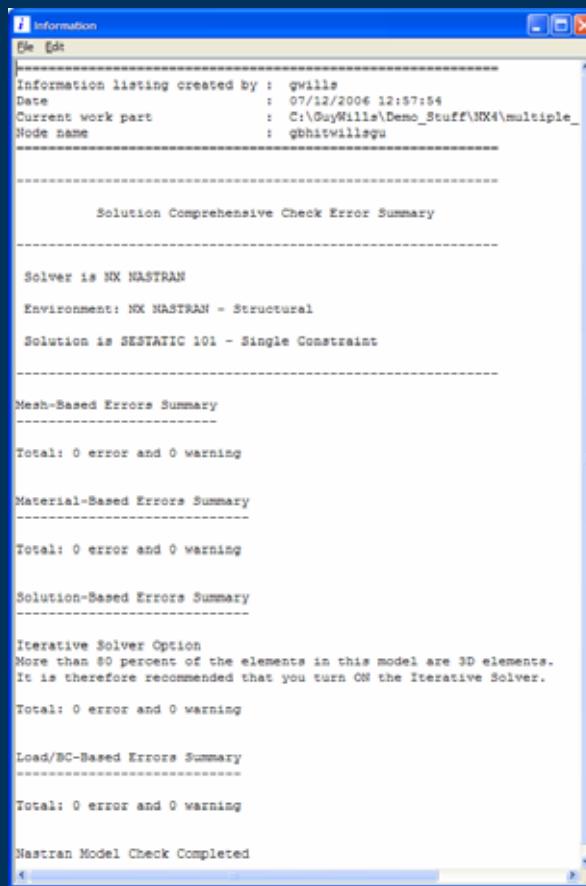
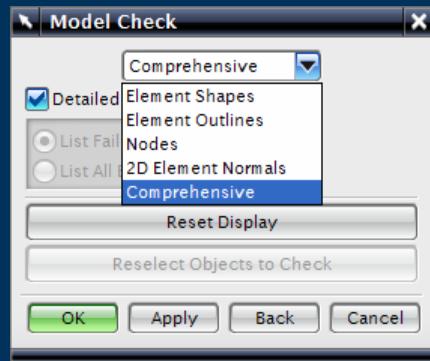
Solution – Parameters



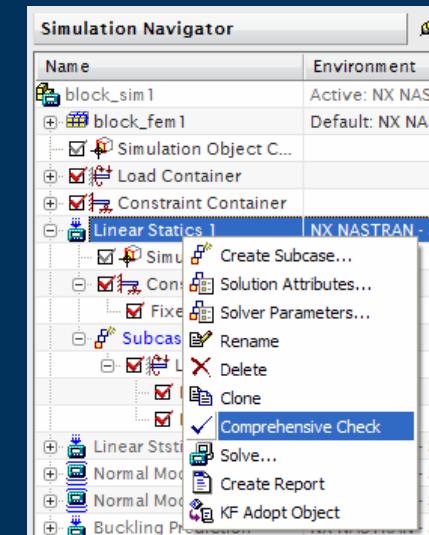
- ▶ Solution Attributes availability and options will vary according to the active Solver and Solution type



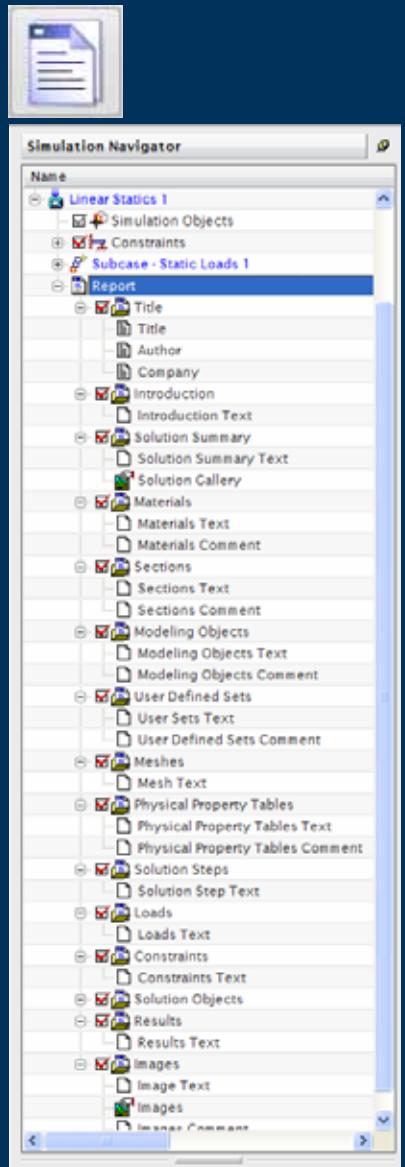
Solution – Comprehensive Check



- ▶ Solution Comprehensive Check
- ▶ Warnings & Errors
- ▶ Mesh
- ▶ Materials
- ▶ Boundary Conditions
- ▶ Solution



Solution – Report Before Solve



Simulation Report

Author: grols
Company: UGS
Date: 07/12/2006
Software Used: NX 4.0.1.3

Introduction

Solution Summary

Environment

Solution:	Solution 1
Solver:	NX NASTRAN
Analysis Type:	Structural
Solution Type:	MSTATIC 101 - Single Constraint
Literacy:	Linear

Simulation Navigator:

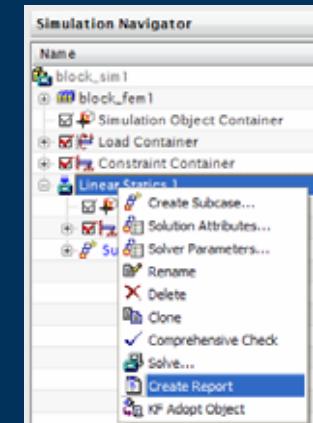
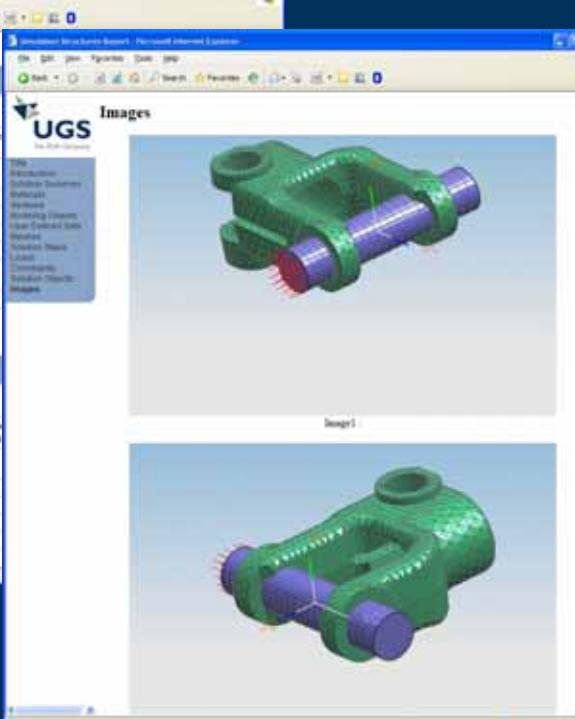
- Name
 - Yoke Assy. inst.
 - Yoke Assy. frcld
 - Override Container
 - Subcase Container
 - Load Container
 - Constraint Container
 - Solution 1
 - Subcase - Static Loads
 - Load
 - Force(1)
 - Report
 - Title
 - Author
 - Company

Loads

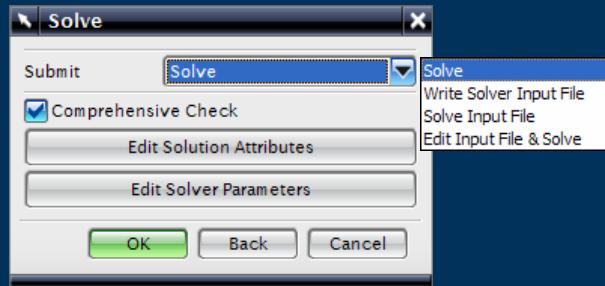
Step Name	Number of referenced loads
Subcase - Static Loads 1	1

Images

- ▶ Solution Report – Before Solve
- ▶ User entered text description/documentation
- ▶ Snapshot screen images
- ▶ HTML Interactive report export



Solution – Solve the Active Solution



TextPad - [C:\GuyVillis\Demo_Stuff\NX4\multiple_parts\yoke_assy_sim1\solution_1.dat]

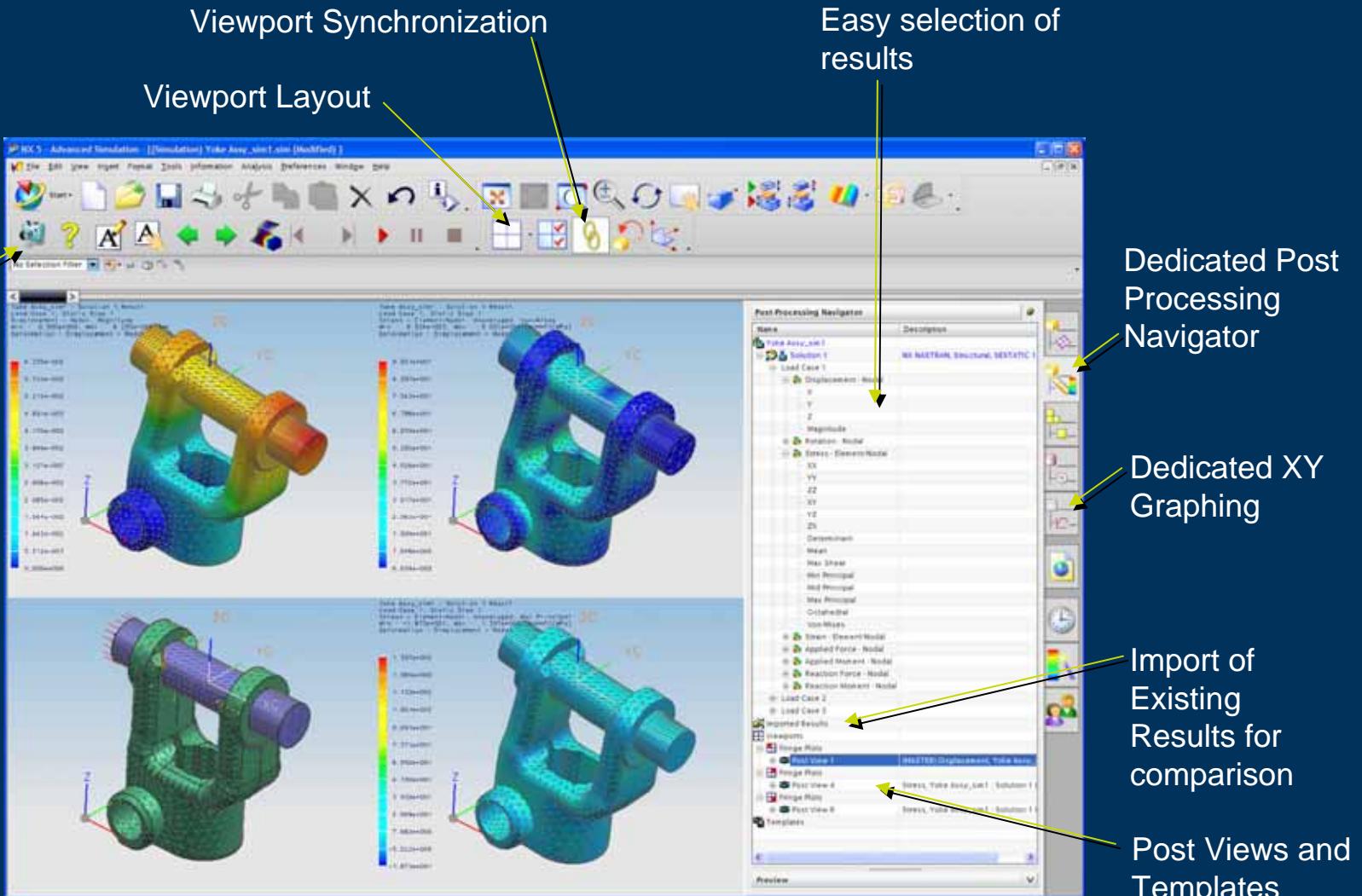
```

1  NX 4.0 NASTRAN TRANSLATOR
2  FOR NX NASTRAN VERSION 4
3
4  INPUT FILE: yoke_assy_sim1-solution_1.dat
5  EXPORTED: AT 13:30:10 ON 7-Dec-2006
6  FEM FILE: C:\GuyVillis\Demo_Stuff\NX4\multiple_parts\Yoke Assy_fem.fem
7  SIM FILE: C:\GuyVillis\Demo_Stuff\NX4\multiple_parts\Yoke Assy_sim1.sim
8
9  UNITS: MM-mm (milli-newton)
10    ... LENGTH : mm
11    ... TIME : sec
12    ... MASS : kilogram (kg)
13    ... FORCE : milli-newton
14    ... TEMPERATURE : deg Celsius
15
16
17
18
19
20
21
22  # NASTRAN
23
24
25
26  NASTRAN ELEMITER=YES
27  NASTRAN ITER=1000
28
29
30
31
32  # FILE MANAGEMENT
33
34
35  ASSIGN OUTPUT2='yoke_assy_sim1-solution_1.op2'.UNIT=12
36
37
38
39  # EXECUTIVE CONTROL
40
41
42
43  ID NASTRAN.yoke_assy_sim1-solution_1
44  SOL 101
45  TIME 999
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
669
670
671
672
673
674
675
676
677
678
679
679
680
681
682
683
684
685
686
687
688
689
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
709
710
711
712
713
714
715
716
717
718
719
719
720
721
722
723
724
725
726
727
728
729
729
730
731
732
733
734
735
736
737
738
739
739
740
741
742
743
744
745
746
747
748
749
749
750
751
752
753
754
755
756
757
758
759
759
760
761
762
763
764
765
766
767
768
769
769
770
771
772
773
774
775
776
777
778
779
779
780
781
782
783
784
785
786
787
787
788
789
789
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
809
810
811
812
813
814
815
816
817
818
819
819
820
821
822
823
824
825
826
827
828
829
829
830
831
832
833
834
835
836
837
838
839
839
840
841
842
843
844
845
846
847
848
849
849
850
851
852
853
854
855
856
857
858
859
859
860
861
862
863
864
865
866
867
868
869
869
870
871
872
873
874
875
876
877
878
879
879
880
881
882
883
884
885
886
887
888
889
889
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
909
910
911
912
913
914
915
916
917
918
919
919
920
921
922
923
924
925
926
927
928
929
929
930
931
932
933
934
935
936
937
938
939
939
940
941
942
943
944
945
946
947
948
949
949
950
951
952
953
954
955
956
957
958
959
959
960
961
962
963
964
965
966
967
968
969
969
970
971
972
973
974
975
976
977
978
979
979
980
981
982
983
984
985
986
987
988
989
989
989
990
991
992
993
994
995
996
997
998
999
1000
1001
1002
1003
1004
1005
1006
1007
1008
1009
1009
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1019
1020
1021
1022
1023
1024
1025
1026
1027
1028
1029
1029
1030
1031
1032
1033
1034
1035
1036
1037
1038
1039
1039
1040
1041
1042
1043
1044
1045
1046
1047
1048
1049
1049
1050
1051
1052
1053
1054
1055
1056
1057
1058
1059
1059
1060
1061
1062
1063
1064
1065
1066
1067
1068
1069
1069
1070
1071
1072
1073
1074
1075
1076
1077
1078
1079
1079
1080
1081
1082
1083
1084
1085
1086
1087
1088
1089
1089
1090
1091
1092
1093
1094
1095
1096
1097
1098
1099
1099
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1109
1110
1111
1112
1113
1114
1115
1116
1117
1118
1119
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128
1129
1129
1130
1131
1132
1133
1134
1135
1136
1137
1138
1139
1139
1140
1141
1142
1143
1144
1145
1146
1147
1148
1149
1149
1150
1151
1152
1153
1154
1155
1156
1157
1158
1159
1159
1160
1161
1162
1163
1164
1165
1166
1167
1168
1169
1169
1170
1171
1172
1173
1174
1175
1176
1177
1178
1179
1179
1180
1181
1182
1183
1184
1185
1186
1187
1188
1189
1189
1190
1191
1192
1193
1194
1195
1196
1197
1198
1199
1199
1200
1201
1202
1203
1204
1205
1206
1207
1208
1209
1209
1210
1211
1212
1213
1214
1215
1216
1217
1218
1218
1219
1220
1221
1222
1223
1224
1225
1226
1227
1228
1229
1229
1230
1231
1232
1233
1234
1235
1236
1237
1238
1239
1239
1240
1241
1242
1243
1244
1245
1246
1247
1248
1249
1249
1250
1251
1252
1253
1254
1255
1256
1257
1258
1259
1259
1260
1261
1262
1263
1264
1265
1266
1267
1268
1269
1269
1270
1271
1272
1273
1274
1275
1276
1277
1278
1279
1279
1280
1281
1282
1283
1284
1285
1286
1287
1288
1289
1289
1290
1291
1292
1293
1294
1295
1296
1297
1298
1299
1299
1300
1301
1302
1303
1304
1305
1306
1307
1308
1309
1309
1310
1311
1312
1313
1314
1315
1316
1317
1318
1318
1319
1320
1321
1322
1323
1324
1325
1326
1327
1328
1329
1329
1330
1331
1332
1333
1334
1335
1336
1337
1338
1339
1339
1340
1341
1342
1343
1344
1345
1346
1347
1348
1349
1349
1350
1351
1352
1353
1354
1355
1356
1357
1358
1359
1359
1360
1361
1362
1363
1364
1365
1366
1367
1368
1369
1369
1370
1371
1372
1373
1374
1375
1376
1377
1378
1379
1379
1380
1381
1382
1383
1384
1385
1386
1387
1388
1389
1389
1390
1391
1392
1393
1394
1395
1396
1397
1398
1399
1399
1400
1401
1402
1403
1404
1405
1406
1407
1408
1409
1409
1410
1411
1412
1413
1414
1415
1416
1417
1418
1418
1419
1420
1421
1422
1423
1424
1425
1426
1427
1428
1429
1429
1430
1431
1432
1433
1434
1435
1436
1437
1438
1439
1439
1440
1441
1442
1443
1444
1445
1446
1447
1448
1449
1449
1450
1451
1452
1453
1454
1455
1456
1457
1458
1459
1459
1460
1461
1462
1463
1464
1465
1466
1467
1468
1469
1469
1470
1471
1472
1473
1474
1475
1476
1477
1478
1479
1479
1480
1481
1482
1483
1484
1485
1486
1487
1488
1489
1489
1490
1491
1492
1493
1494
1495
1496
1497
1498
1498
1499
1500
1501
1502
1503
1504
1505
1506
1507
1508
1509
1509
1510
1511
1512
1513
1514
1515
1516
1517
1518
1518
1519
1520
1521
1522
1523
1524
1525
1526
1527
1528
1529
1529
1530
1531
1532
1533
1534
1535
1536
1537
1538
1539
1539
1540
1541
1542
1543
1544
1545
1546
1547
1548
1548
1549
1550
1551
1552
1553
1554
1555
1556
1557
1558
1559
1559
1560
1561
1562
1563
1564
1565
1566
1567
1568
1569
1569
1570
1571
1572
1573
1574
1575
1576
1577
1578
1579
1579
1580
1581
1582
1583
1584
1585
1586
1587
1588
1589
1589
1590
1591
1592
1593
1594
1595
1596
1597
1598
1598
1599
1600
1601
1602
1603
1604
1605
1606
1607
1608
1609
1609
1610
1611
1612
1613
1614
1615
1616
1617
1618
1618
1619
1620
1621
1622
1623
1624
1625
1626
1627
1628
1629
1629
1630
1631
1632
1633
1634
1635
1636
1637
1638
1639
1639
1640
1641
1642
1643
1644
1645
1646
1647
1648
1649
1649
1650
1651
1652
1653
1654
1655
1656
1657
1658
1659
1659
1660
1661
1662
1663
1664
1665
1666
1667
1668
1669
1669
1670
1671
1672
1673
1674
1675
1676
1677
1678
1679
1679
1680
1681
1682
1683
1684
1685
1686
1687
1688
1689
1689
1690
1691
1692
1693
1694
1695
1696
1697
1698
1698
1699
1700
1701
1702
1703
1704
1705
1706
1707
1708
1709
1709
1710
1711
1712
1713
1714
1715
1716
1717
1718
1718
1719
1720
1721
1722
1723
1724
1725
1726
1727
1728
1729
1729
1730
1731
1732
1733
1734
1735
1736
1737
1738
1739
1739
1740
1741
1742
1743
1744
1745
1746
1747
1748
1748
1749
1750
1751
1752
1753
1754
1755
1756
1757
1758
1759
1759
1760
1761
1762
1763
1764
1765
1766
1767
1768
1769
1769
1770
1771
1772
1773
1774
1775
1776
1777
1778
1779
1779
1780
1781
1782
1783
1784
1785
1786
1787
1788
1789
1789
1790
1791
1792
1793
1794
1795
1796
1797
1797
1798
1799
1800
1801
1802
1803
1804
1805
1806
1807
1808
1809
1809
1810
1811
1812
1813
1814
1815
1816
1817
1818
1818
1819
1820
1821
1822
1823
1824
1825
1826
1827
1828
1829
1829
1830
1831
1832
1833
1834
1835
1836
1837
1838
1839
1839
1840
1841
1842
1843
1844
1845
1846
1847
1848
1848
1849
1850
1851
1852
1853
1854
1855
1856
1857
1858
1859
1859
1860
1861
1862
1863
1864
1865
1866
1867
1868
1869
1869
1870
1871
1872
1873
1874
1875
1876
1877
1878
1879
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888
1889
1889
1890
1891
1892
1893
1894
1895
1896
1897
1898
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2049
2050
2051
2052
2053
2054
2055
2056
2057
2058
2059
2059
2060
2061
2062
2063
2064
2065
2066
2067
2068
2069
2069
2070
2071
2072
2073
2074
2075
2076
2077
2078
2079
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2088
2089
2090
2091
2092
2093
2094
2095
2096
2097
2097
2098
2099
2099
2100
2101
2102
2103
2104
2105
2106
2107
2108
2109
2109
2110
2111
2112
2113
2114
2115
2116
2117
2118
2118
2119
2120
2121
2122
2123
2124
2125
2126
2127
2128
2129
2129
2130
2131
2132
2133
2134
2135
2136
2137
2138
2139
2139
2140
2141
2142
2143
2144
2145
2146
2147
2148
2148
2149
2150
2151
2152
2153
2154
2155
2156
2157
2158
2159
2159
2160
2161
2162
2163
2164
2165
2166
2167
2168
2169
2169
2170
2171
2172
2173
2174
2175
2176
2177
2178
2179
2179
2180
2181
2182
2183
2184
2185
2186
2187
2188
2189
2189
2190
2191
2192
2193
2194
2195
2196
2197
2198
2198
2199
2200
2201
2202
2203
2204
2205
2206
2207
2208
2209
2209
2210
2211
2212
2213
2214
2215
2216
2217
2218
2218
2219
2220
2221
2222
2223
2224
2225
2226
2227
2228
2229
2229
2230
2231
2232
2233
2234
2235
2236
2237
2238
2239
2239
2240
2241
2242
2243
2244
2245
2246
2247
2248
2248
2249
2250
2251
2252
2253
2254
2255
2256
2257
2258
2259
2259
2260
2261
2262
2263
2264
2265
2266
2267
2268
2269
2269
2270
2271
2272
2273
2274
2275
2276
2277
2278
2279
2279
2280
2281
2282
2283
2284
2285
2286
2287
2288
2289
2289
2290
2291
2292
2293
2294
2295
2296
2297
2297
2298
2299
2299
2300
2301
2302
2303
2304
2305
2306
2307
2308
2309
2309
2310
2311
2312
2313
2314
2315
2316
2317
2318
2318
2319
2320
2321
2322
2323
2324
2325
2326
2327
2328
2329
2329
2330
2331
2332
2333
2334
2335
2336
2337
2338
2339
2339
2340
2341
2342
2343
2344
2345
2346
2347
2348
2348
2349
2350
2351
2352
2353
2354
2355
2356
2357
2358
2359
2359
2360
2361
2362
2363
2364
2365
2366
2367
2368
2369
2369
2370
2371
2372
2373
2374
2375
2376
2377
2378
2379
2379
2380
2381
2382
2383
2384
2385
2386
2387
2388
2389
2389
2390
2391
2392
2393
2394
2395
2396
2397
2397
2398
23
```

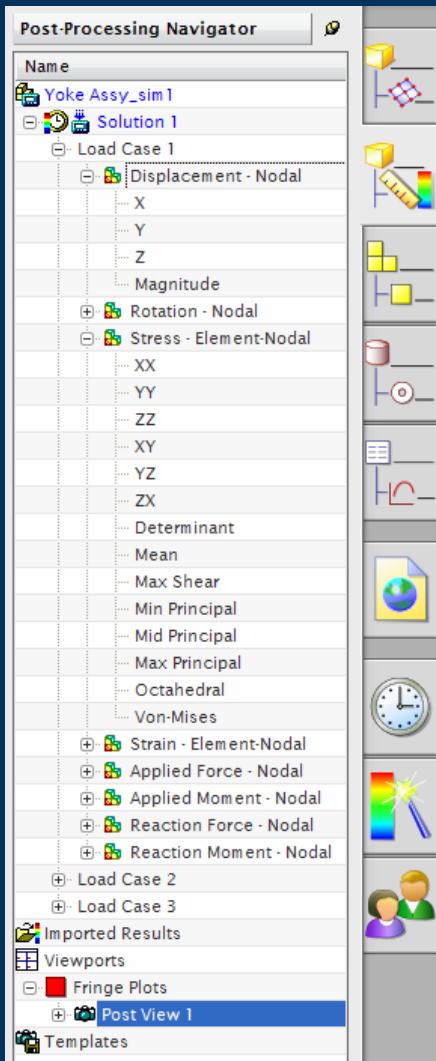
SIEMENS

SIM Part – Post-Processing

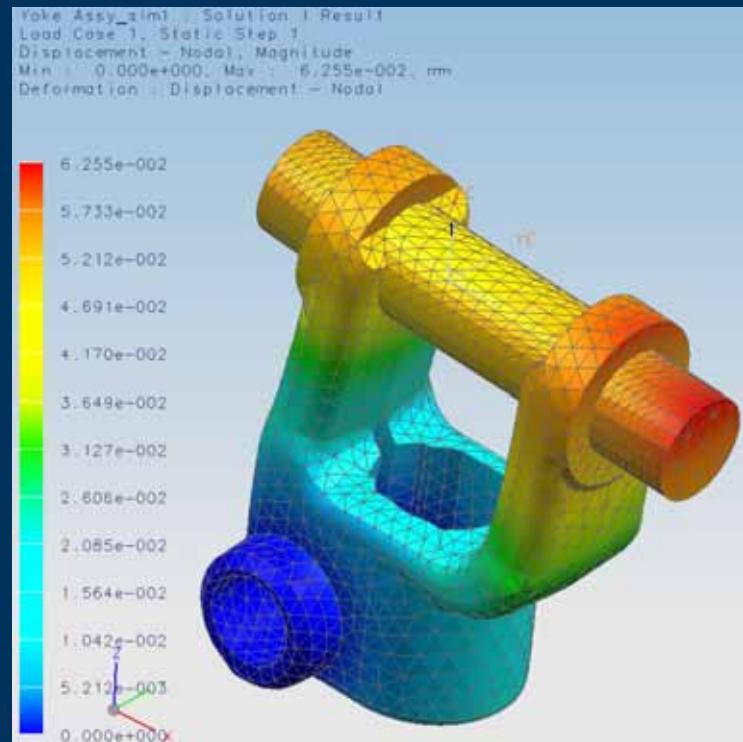
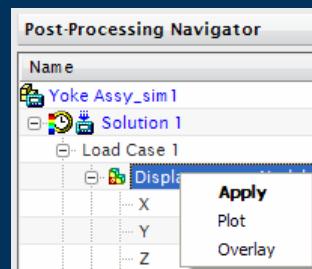
NX – Integrated Post Processing



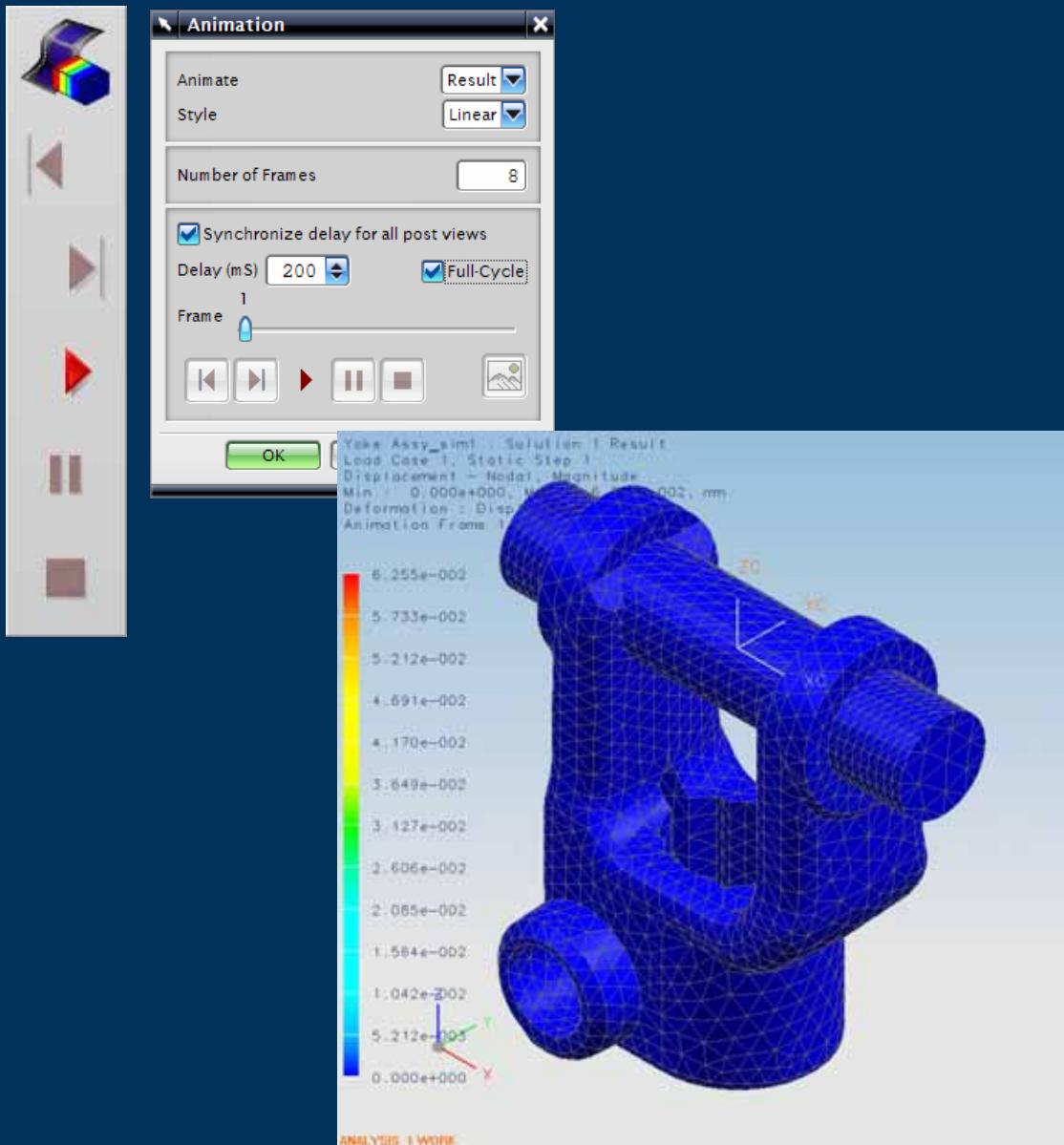
Results – Selection



- ▶ Results Selection from the Post Processing Navigator
- ▶ Ease of navigation through available Results
- ▶ Double mouse click to change the Results display
- ▶ Plot to a Existing Viewport, to a New Viewport or Overlay (combine) Existing display

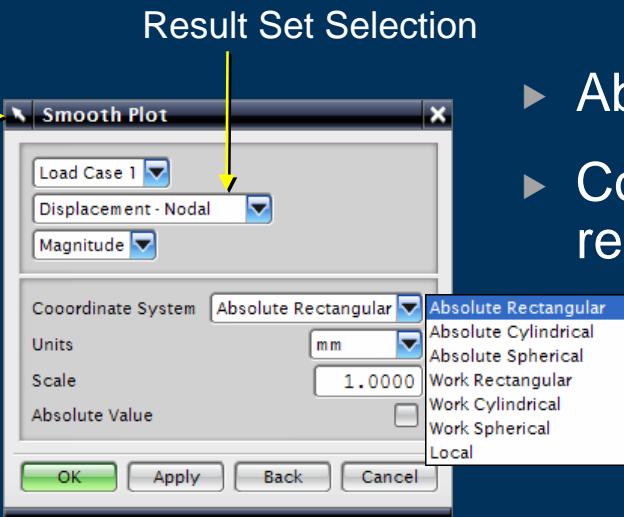
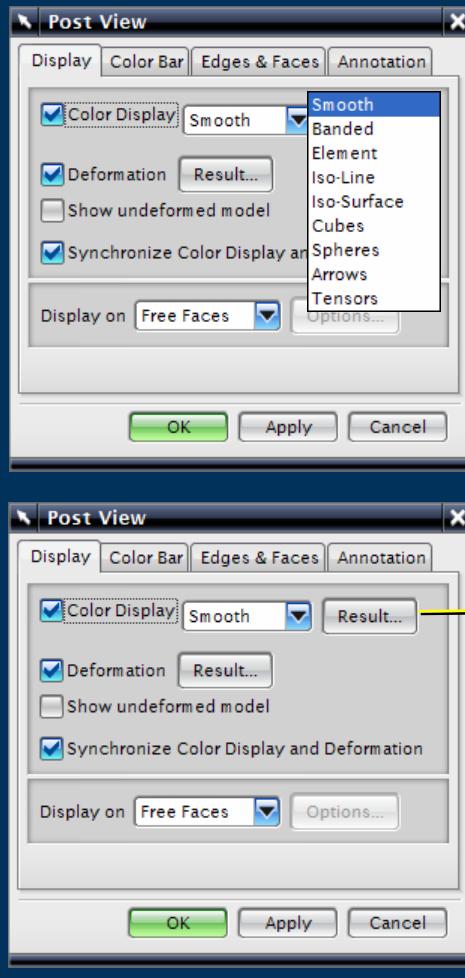
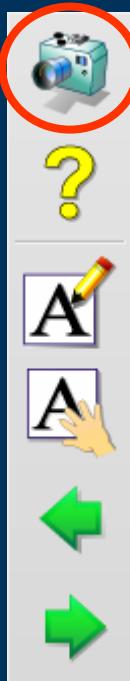


Results – Animation



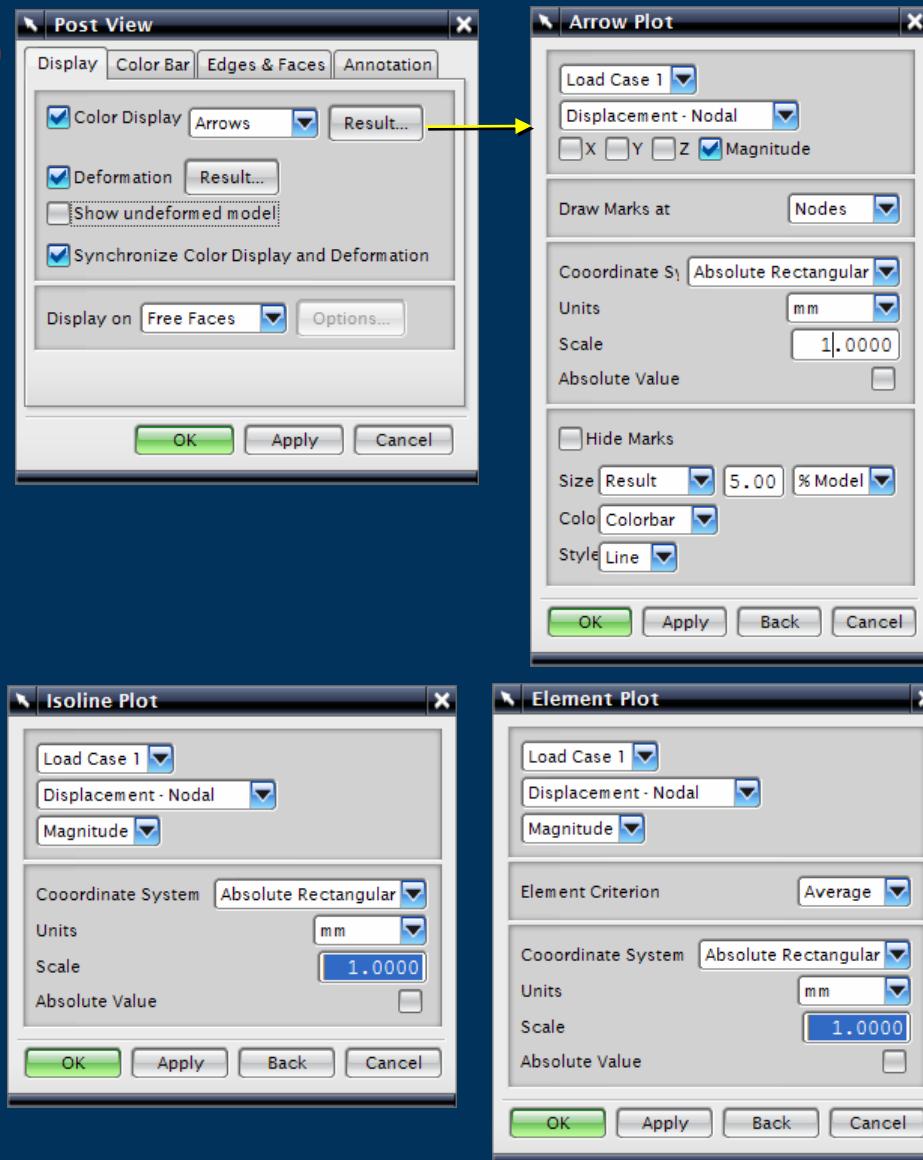
- ▶ Results Animation options
 - ▶ Number of Frames
 - ▶ Delay between frames
 - ▶ Full cycle ("forwards then backwards")
 - ▶ Play, Pause, Stop
 - ▶ Single frame forwards or backwards
- ▶ During Animation
 - ▶ Change the Results
 - ▶ Screen rotate/pan/zoom
 - ▶ Toggle on/off Meshes
 - ▶ Save to Animated GIF

Results – Post View Display

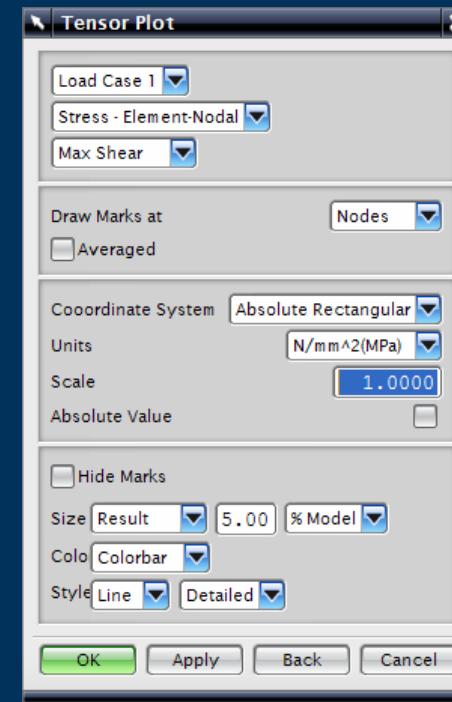


- ▶ Post View Display Options
 - ▶ Styles
 - ▶ Contours
 - ▶ Elements
 - ▶ Isolines, Isosurfaces
 - ▶ Mark – Arrow, Cube, Sphere, Tensor
- ▶ Absolute or scaled values
- ▶ Coordinate System for results calculation

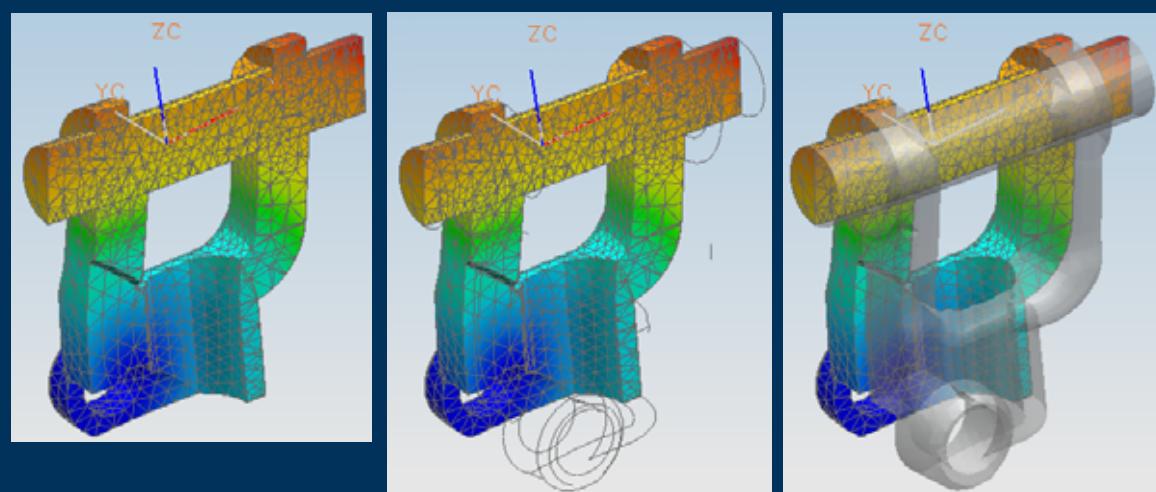
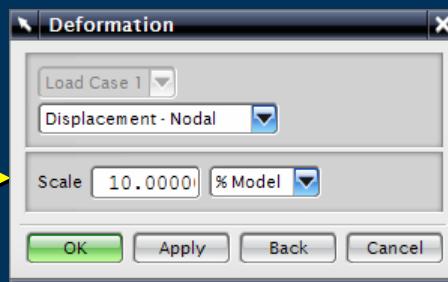
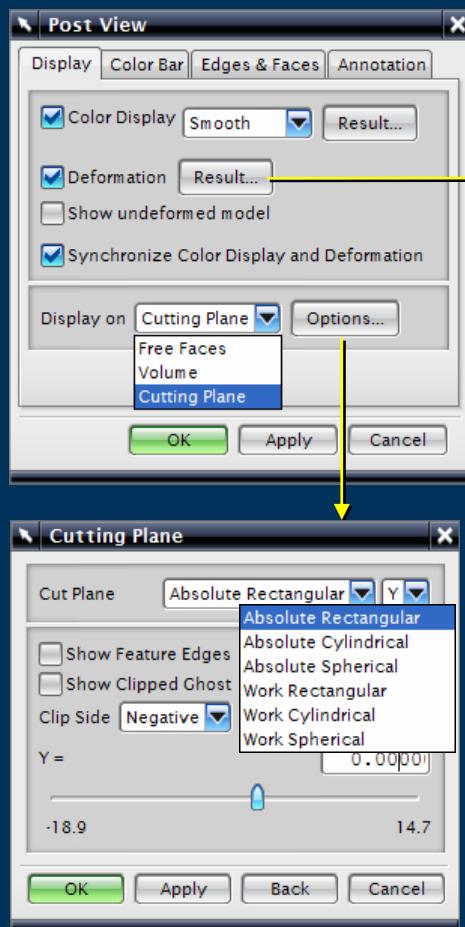
Results – Post View Display



- ▶ Post View Display Options
- ▶ Results Plot options vary according to the Display type

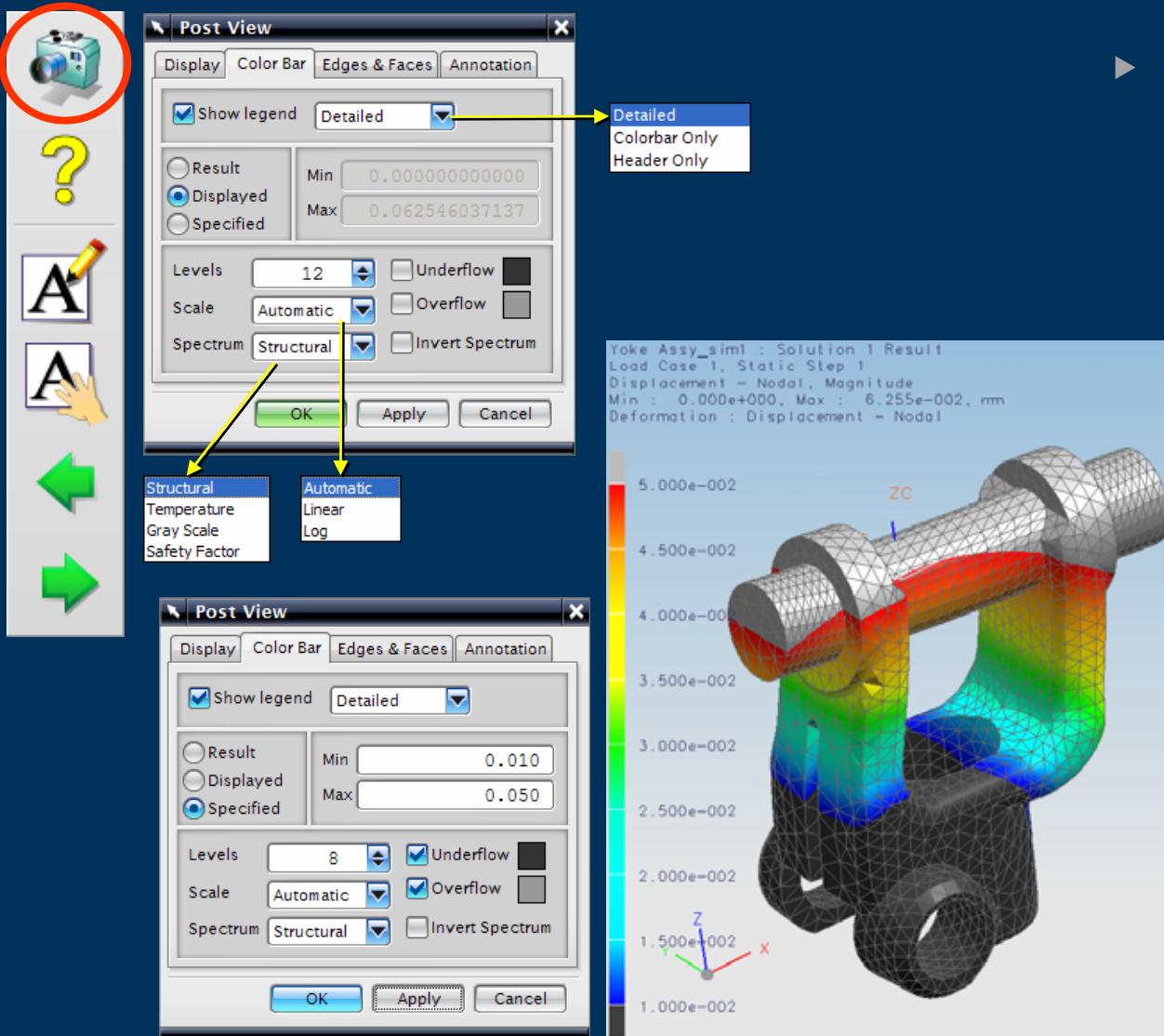


Results – Post View Display



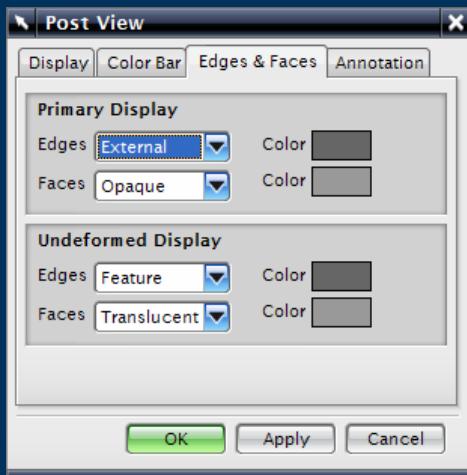
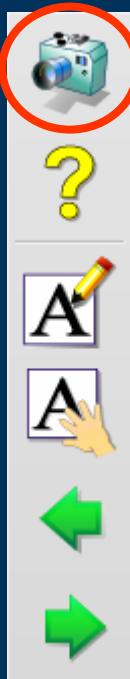
- ▶ Deformed model display
- ▶ Results domain
 - ▶ Free Face
 - ▶ Volume
 - ▶ Cutting Plane

Results – Post View Color Bar

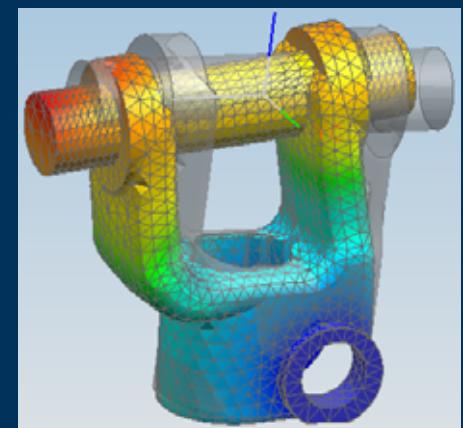
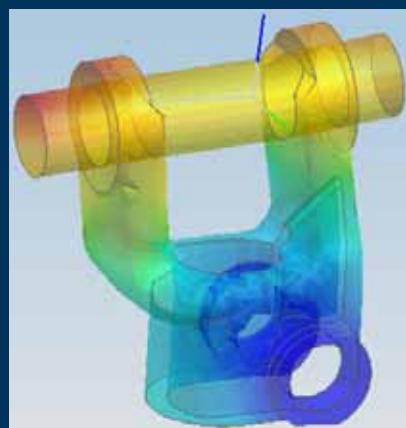
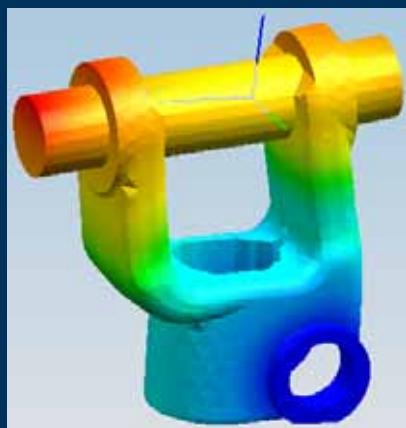
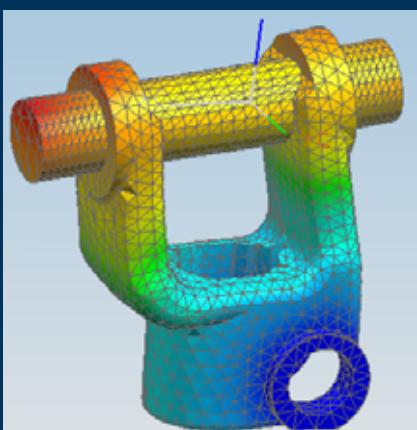


- ▶ Post View Color Bar
 - ▶ Max & Min values
 - ▶ Number of colors
 - ▶ Color scheme
 - ▶ Scale
 - ▶ Legend level of detail

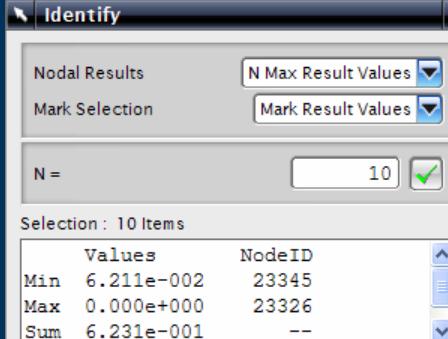
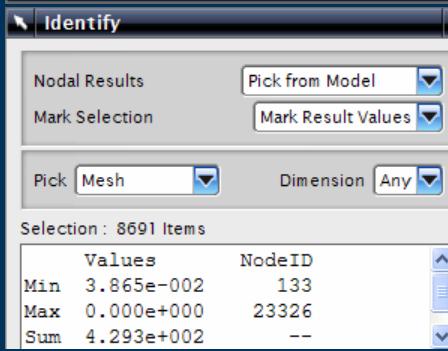
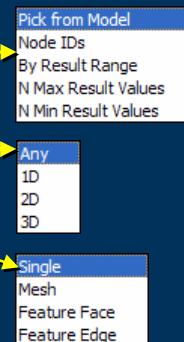
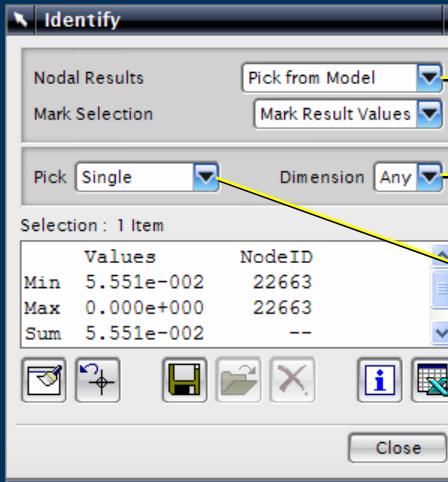
Results – Post View Edges & Faces



- ▶ Post View Edges & Faces display & color options
 - ▶ Primary Display for Element Edge & Faces
 - ▶ Undeformed Display



Results – Identify

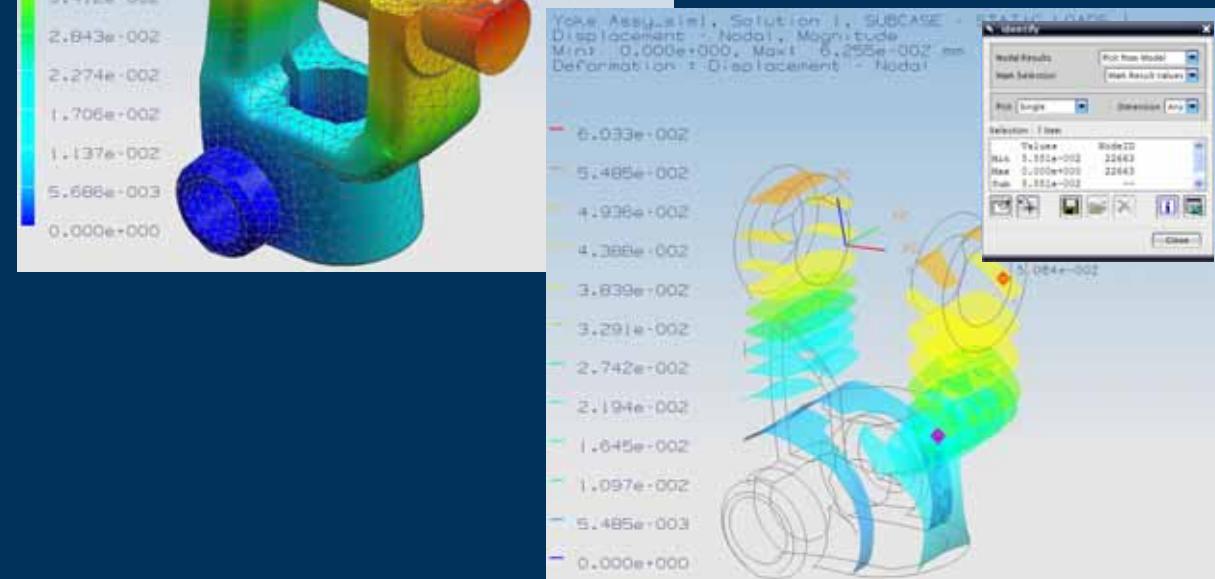
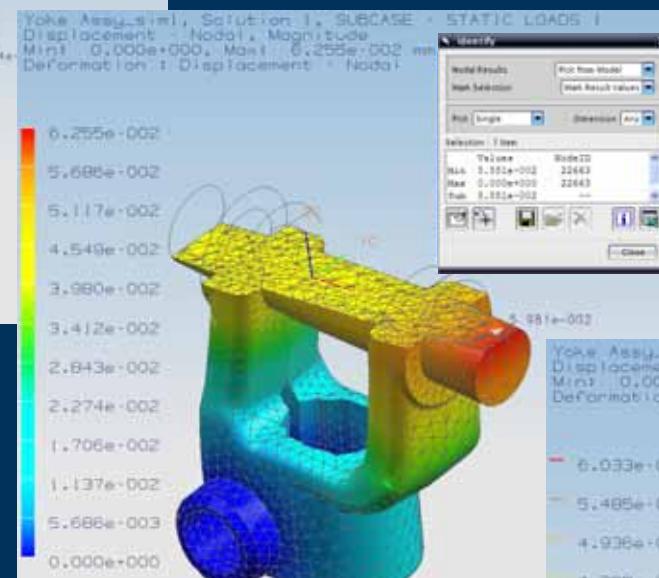
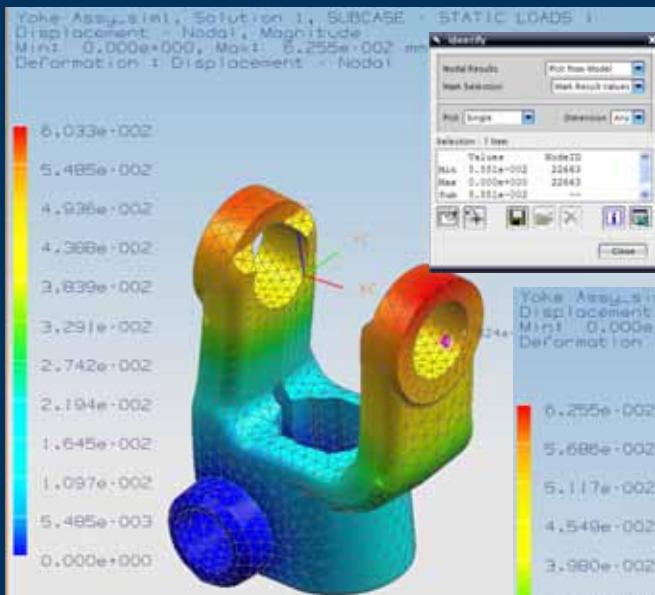
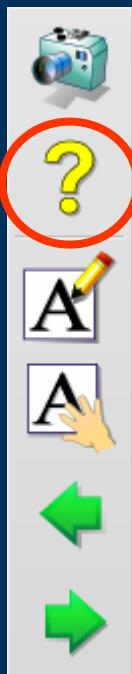


- ▶ **Identify** to probe and display nodal and elemental information
- ▶ Results
 - ▶ n Max, or n Min Result values
 - ▶ Result Range
- ▶ Selected data saved to Excel for further study

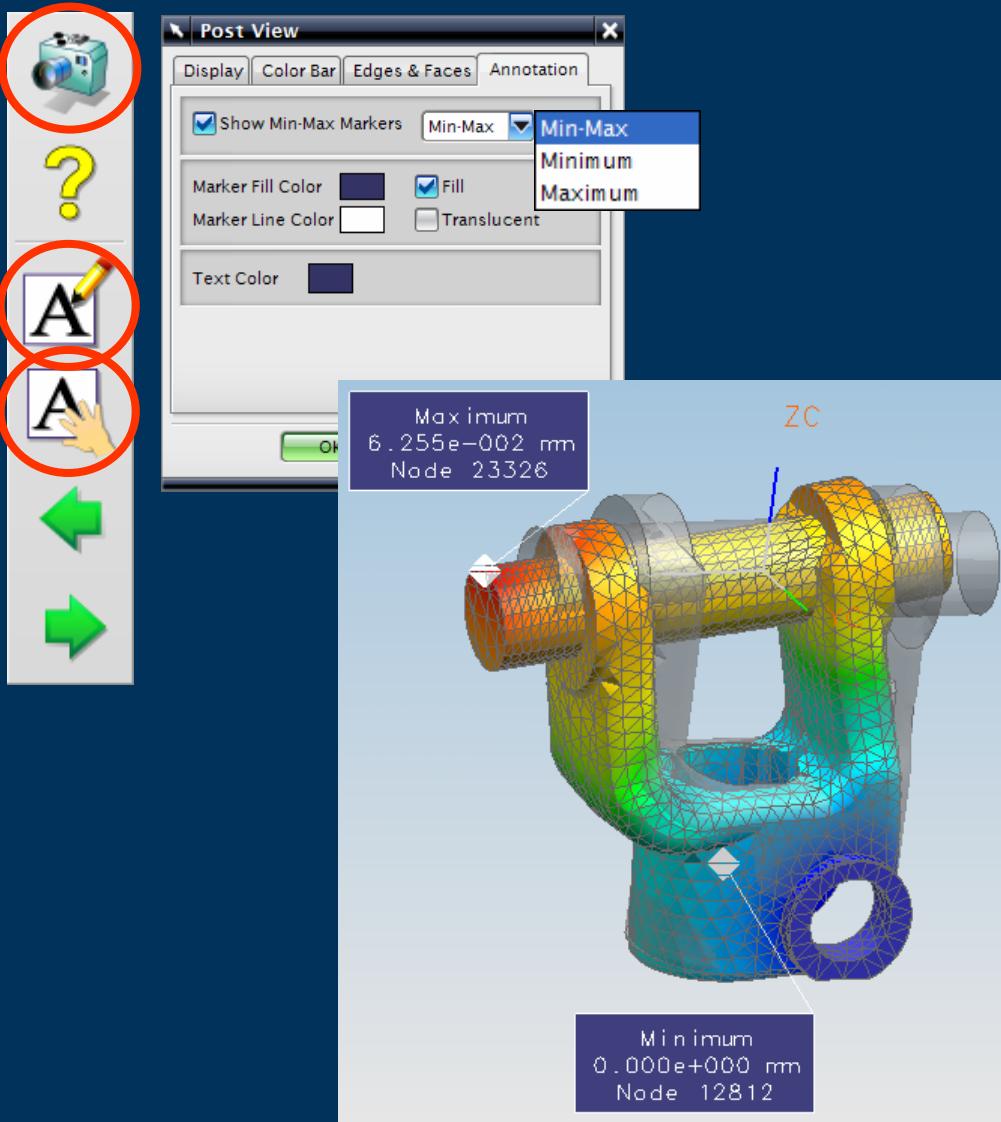
Microsoft Excel - Worksheet in IG PostProcessor Results - Yoke Assy_sim1.xls

	A1	B	C	D	E	F	G	H	I	J	K
2	Result File : C:\GuyWills\Demo_Stuff\NX4\multiple_parts\yoke_assy_sim1-solution_1.op2										
3											
4	Load Case : SUBCASE - STATIC LOADS 1										
5	Iteration/Mo:	SUBCASE - STATIC LOADS 1									
6	Result :	Displacement - Nodal									
7	Units :	mm									
8											
9	Node ID	X Coord	N	Y Coord	Nodal	Z Coord	Nodal	X	Y	Z	Magnitude
10											
11	15107	21.688E+0	-1.529E+0	10.733E+0	54.182E-3	-2.673E-6	-26.374E-3	60.260E-3			
12	15108	21.688E+0	-1.502E+0	10.738E+0	54.189E-3	-31.219E-6	-26.376E-3	60.267E-3			
13	15118	21.688E+0	-3.026E+0	10.431E+0	53.944E-3	-10.559E-6	-26.369E-3	60.044E-3			
14	15125	21.688E+0	-14.089E-3	10.835E+0	54.264E-3	-16.833E-6	-26.377E-3	60.335E-3			
15	15126	21.688E+0	2.998E+0	10.441E+0	53.957E-3	-44.811E-6	-26.373E-3	60.057E-3			
16	17149	32.667E+0	-3.281E+0	4.655E+0	49.333E-3	-28.664E-6	-35.337E-3	60.688E-3			
17	17150	32.667E+0	-4.027E+0	3.990E+0	48.795E-3	-28.881E-6	-35.337E-3	60.247E-3			
18	17176	32.021E+0	-3.310E+0	4.629E+0	49.315E-3	-27.952E-6	-34.813E-3	60.365E-3			
19	18124	30.839E+0	-1.631E+0	5.415E+0	49.954E-3	-26.691E-6	-33.854E-3	60.345E-3			
20	18125	30.193E+0	-1.671E+0	5.401E+0	49.943E-3	-26.019E-6	-33.329E-3	60.040E-3			
21	18126	30.839E+0	-643.315E-3	5.568E+0	50.079E-3	-26.929E-6	-33.854E-3	60.449E-3			
22	18132	30.193E+0	312.674E-3	5.444E+0	49.979E-3	-26.818E-6	-33.330E-3	60.074E-3			
23	18133	32.021E+0	1.624E+0	5.617E+0	50.121E-3	-28.246E-6	-34.816E-3	61.026E-3			
24	18134	30.193E+0	-681.138E-3	5.566E+0	50.078E-3	-26.342E-6	-33.330E-3	60.165E-3			
25	19507	32.667E+0	-2.377E+0	5.091E+0	49.682E-3	-28.555E-6	-35.338E-3	60.968E-3			

Results – Identify

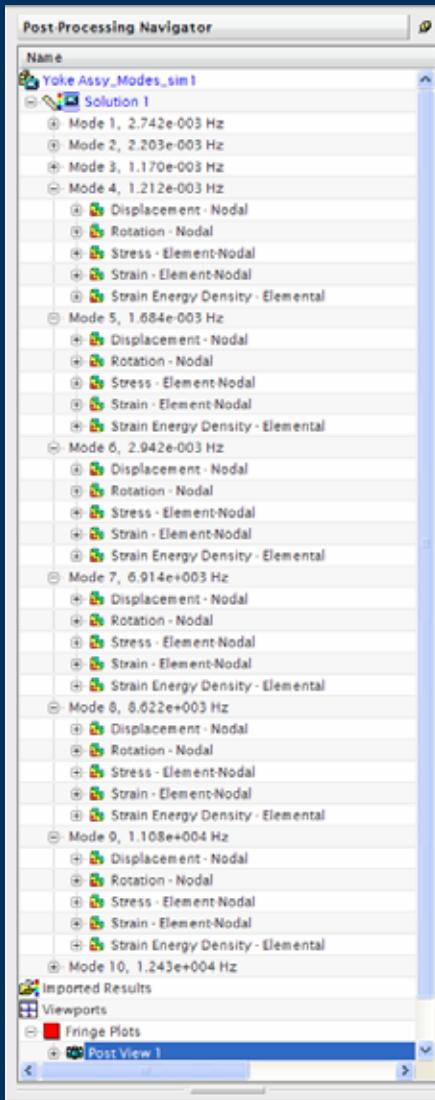
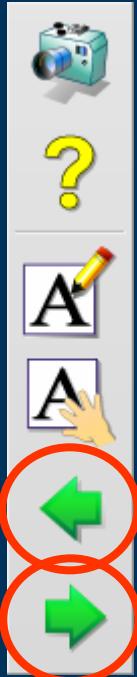


Results – Annotation Markers

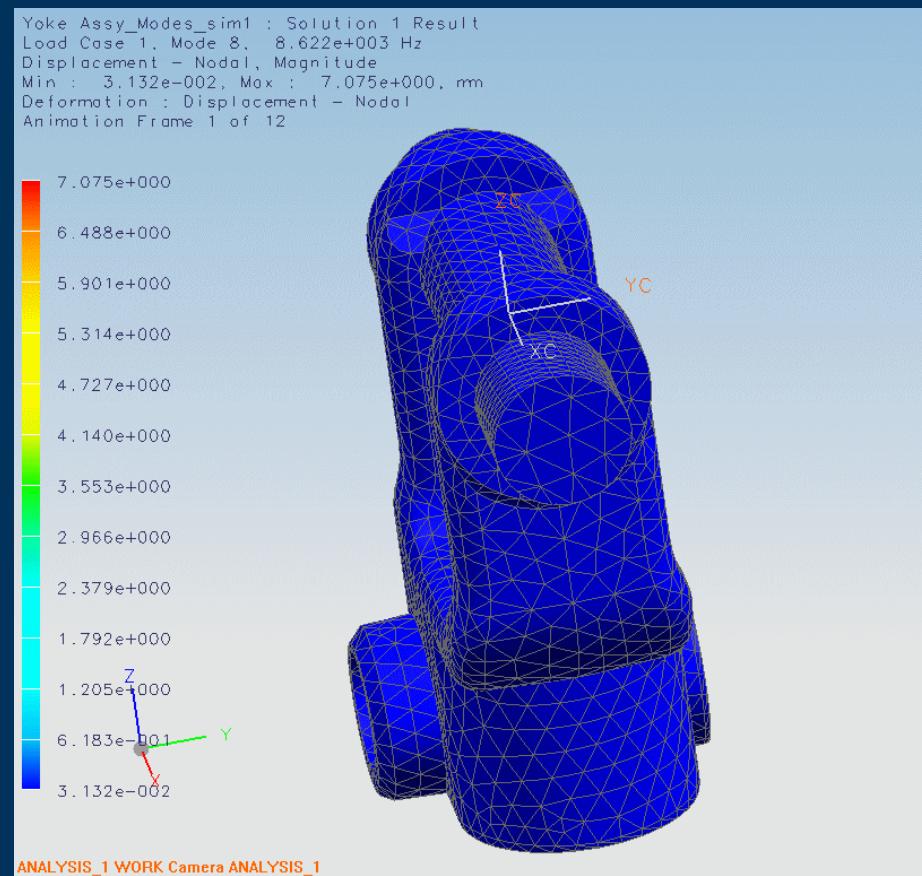


- ▶ Results Marker shows max/min of the current active Result Set
 - ▶ Max & Min
 - ▶ Max only
 - ▶ Min only
- ▶ Drag Marker to reposition

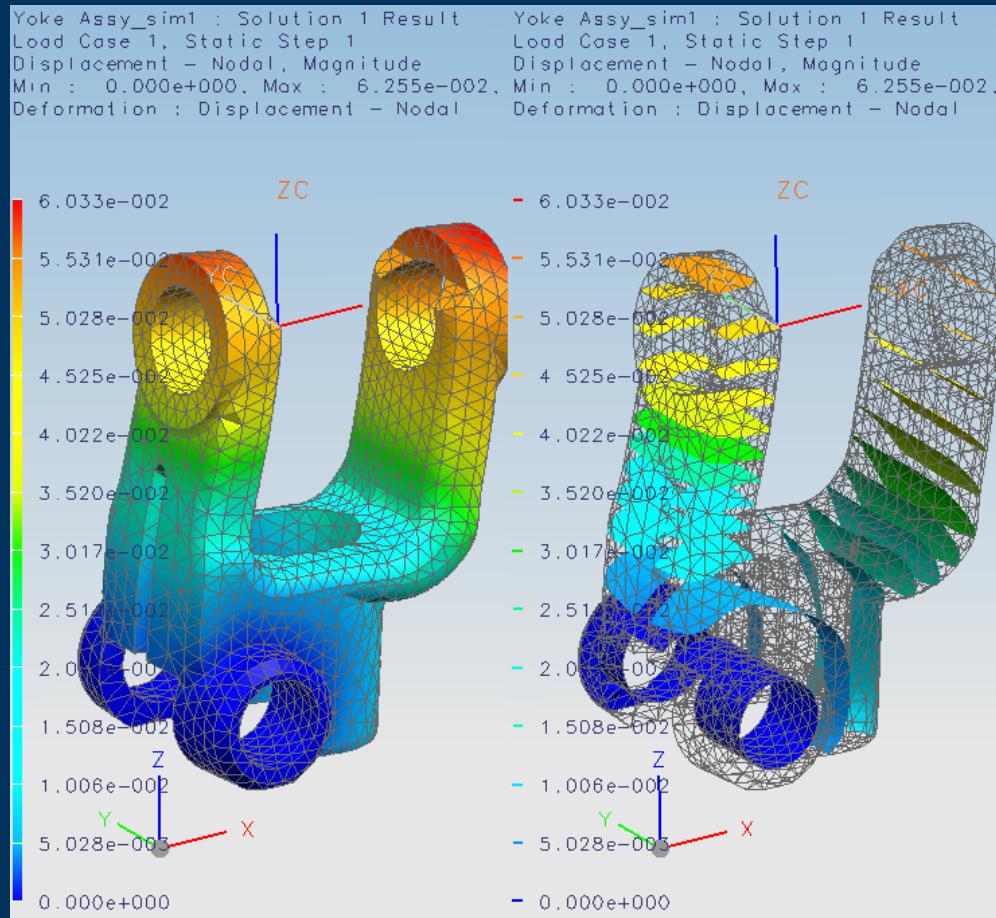
Results – Previous / Next Mode or Iteration



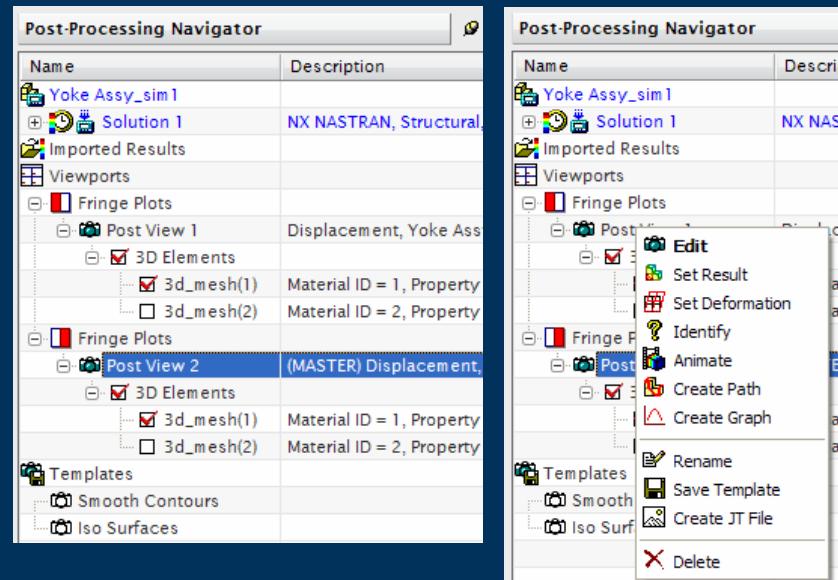
- ▶ Quick change to the next Mode or Iteration



Results – Post Views & Templates



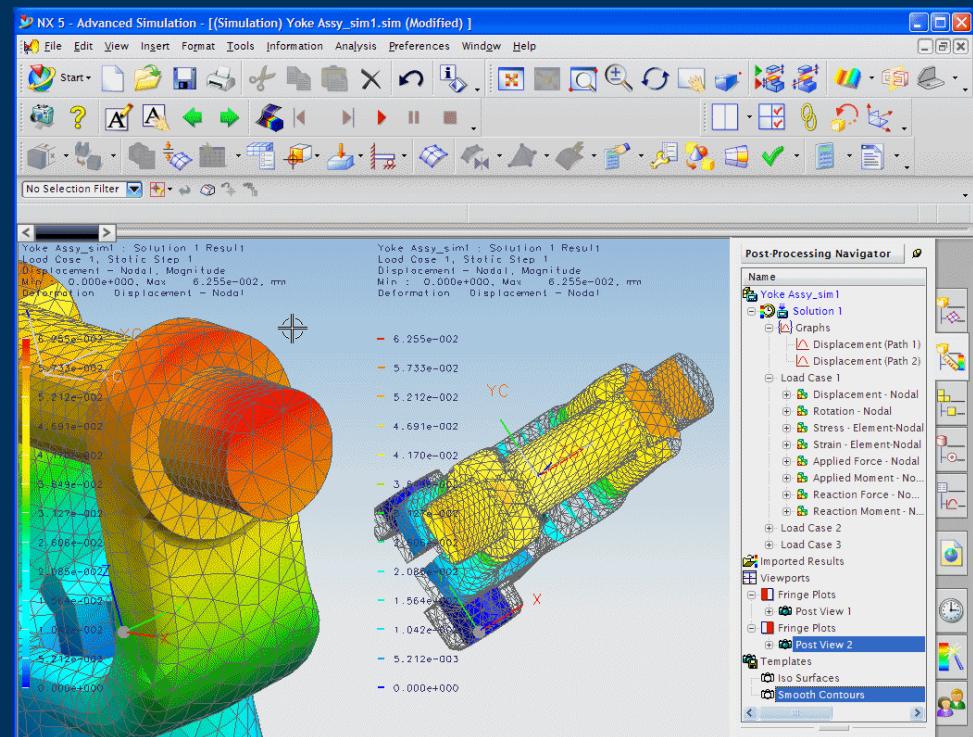
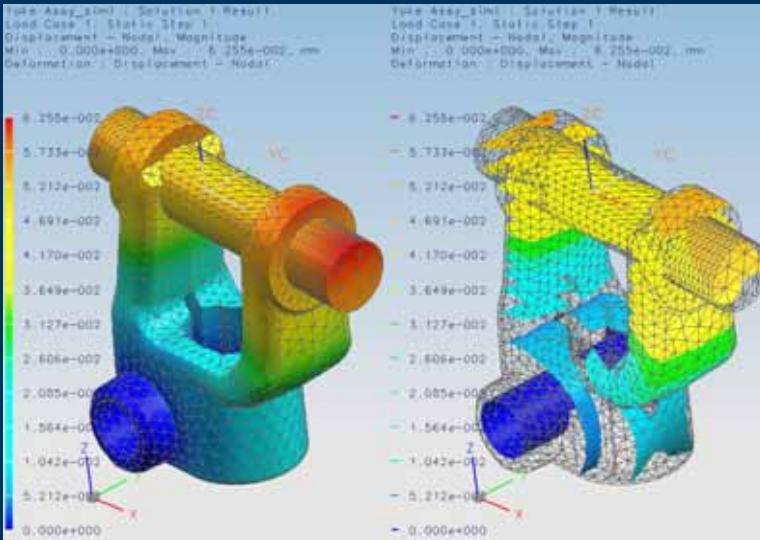
- ▶ Post Views store the Post View setup
- ▶ Provides quick and efficient method of controlling displays in different Views
- ▶ Post Views can be saved and are available for re-use



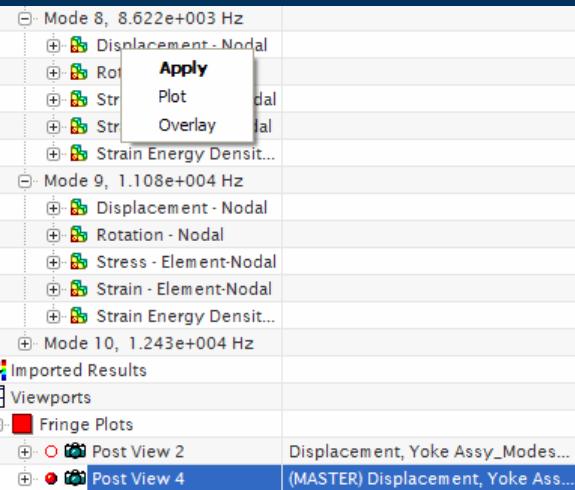
Results – Multiple Viewports



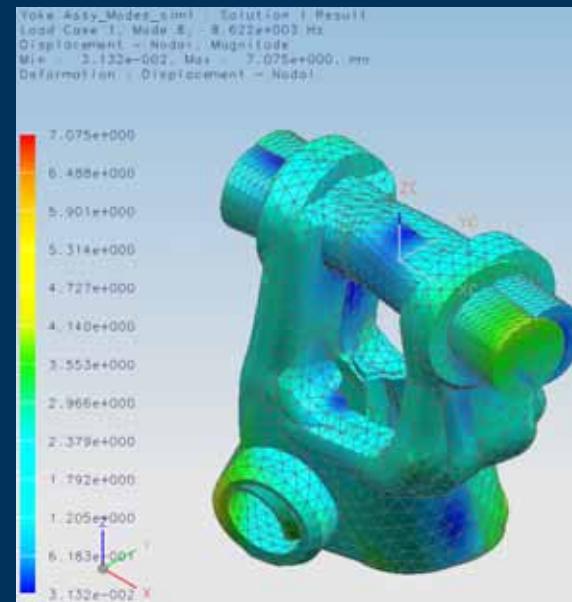
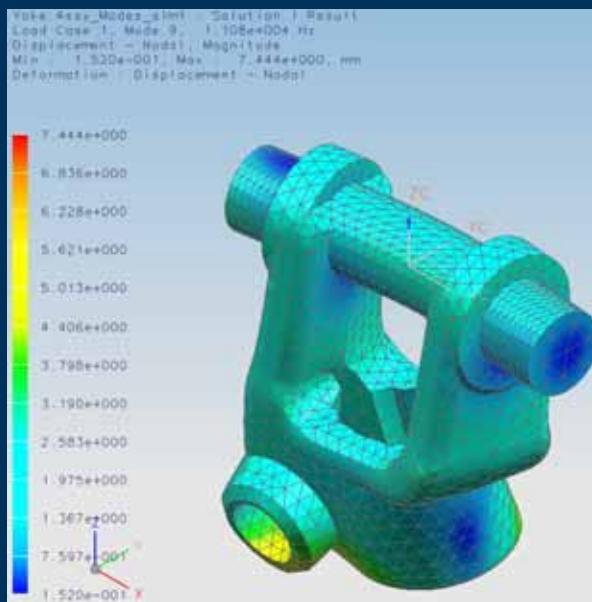
- ▶ Multiple Viewports
- ▶ Different Post Views per Viewport
- ▶ Select all views ports for Synchronised screen rotate/pan/zoon
- ▶ Return the view to Model display



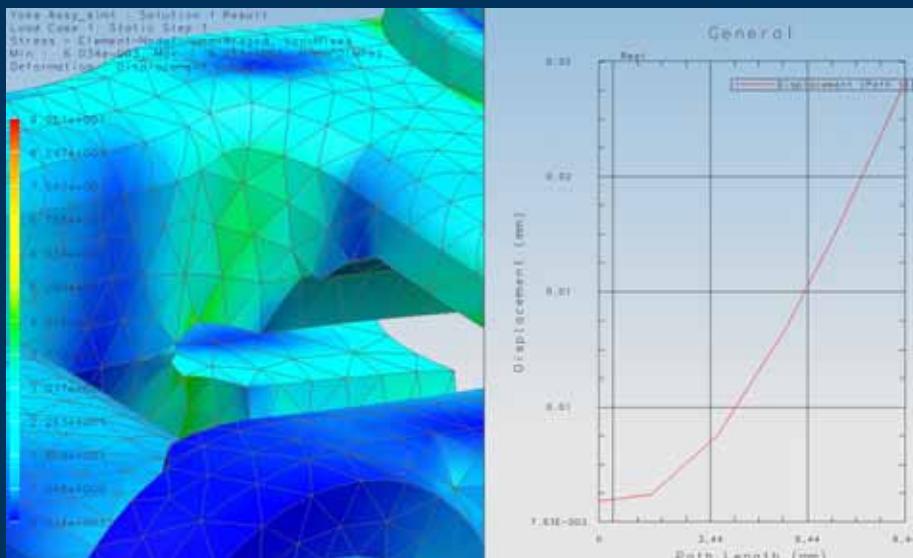
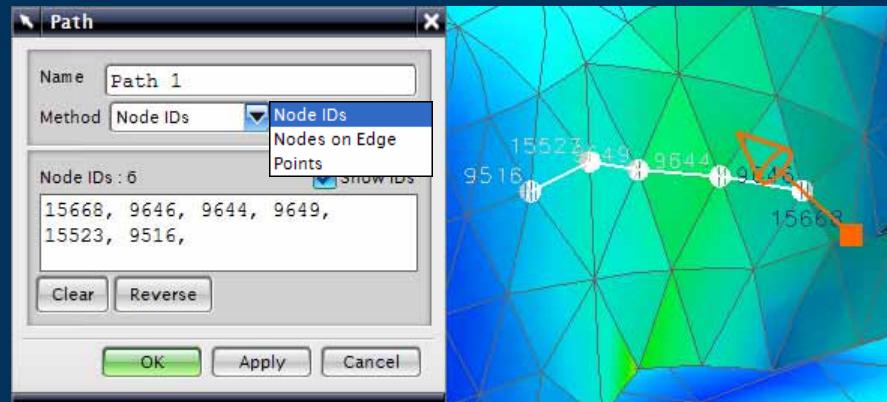
Results – Post View Overlay



- ▶ Post View Overlay
- ▶ Post View changes can be saved to all or selected Post Views



Plotting Paths

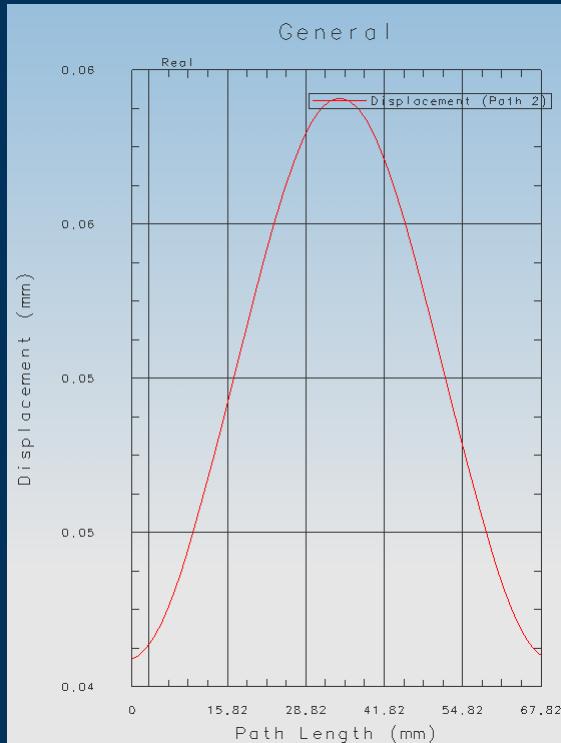


- ▶ Paths defined by
 - ▶ Node labels
 - ▶ Screen selection
 - ▶ Edge selection

The screenshot displays the Siemens Post-Processing interface with the following components:

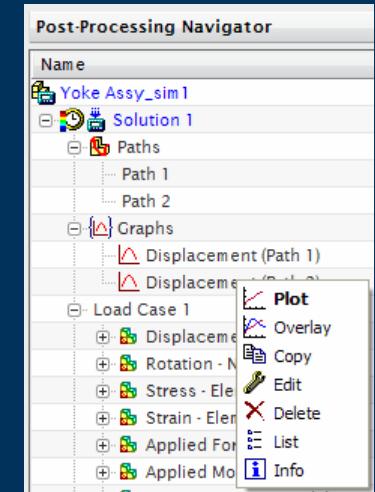
- Post-Processing Navigator:** Shows a tree structure with 'Yoke Assy_sim1' selected, followed by 'Solution 1', 'Paths' (selected), 'Path 1', 'Graphs', and 'Displacement (Path 1)'.
- Graph Dialog Box:**
 - Graph Type:** On Path
 - Name:** Displacement (Path 2)
 - Path:** Path 2 (selected)
 - Display Path:** Checked
 - Abscissa:** Path Length (selected)
 - NoData:** Ignore (selected)
 - Value Sharing:** Average (selected)
 - Plot graph on creation:** Checked
 - Path Length IDs:** Average (selected)

Plotting Paths

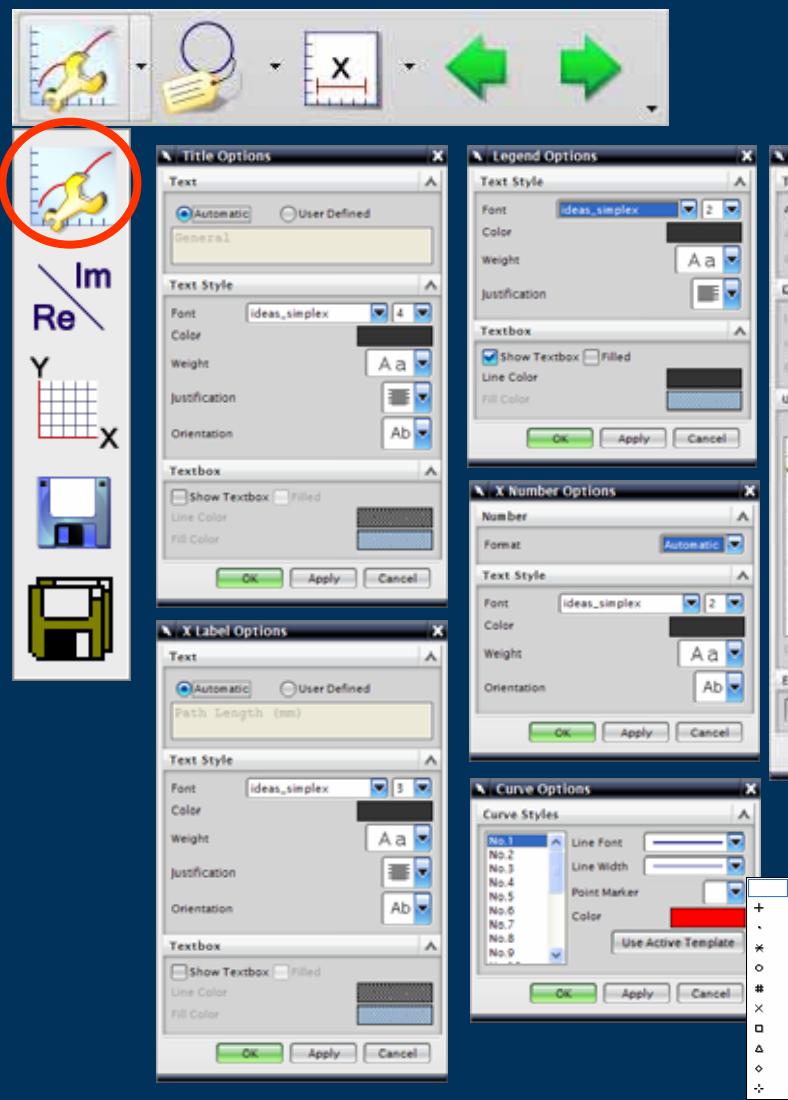


Name	Type
yoke_assy_sim1-solution_1.dat	DAT File
yoke_assy_sim1-solution_1.diag	DIAG File
yoke_assy_sim1-solution_1.f04	F04 File
yoke_assy_sim1-solution_1.f06	F06 File
yoke_assy_sim1-solution_1.log	Text Document
yoke_assy_sim1-solution_1.op2	OP2 File
yoke_assy_sim1-solution_1_PostGraphs.afu	AFU File

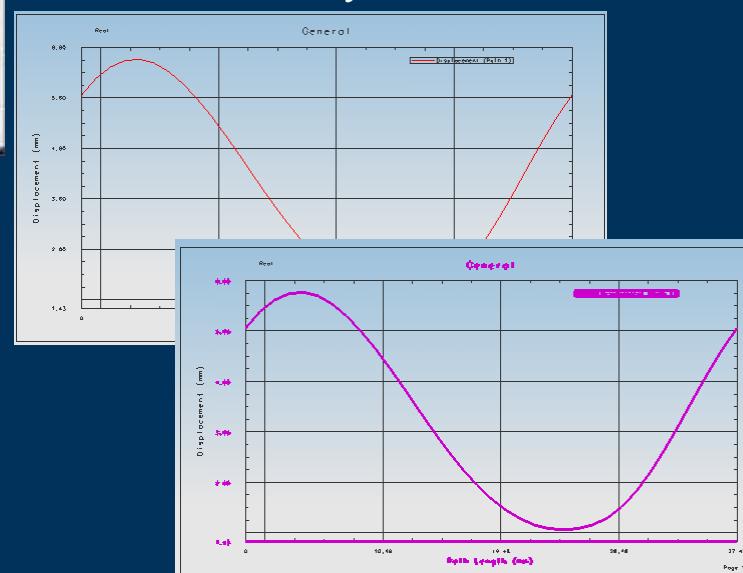
- ▶ Graphs can be Overlaid to compare data using same Axis
- ▶ Path and Graph data stored in external file (*.afu)



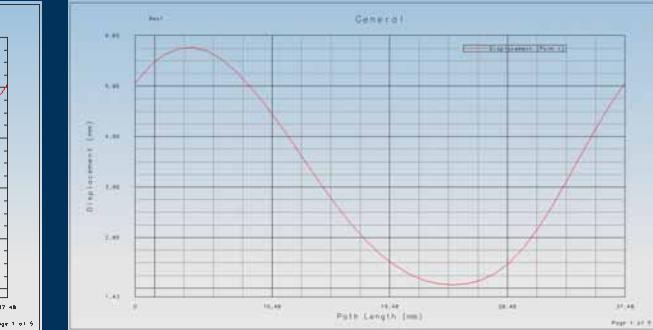
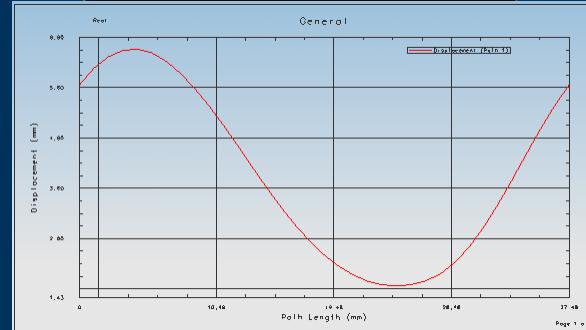
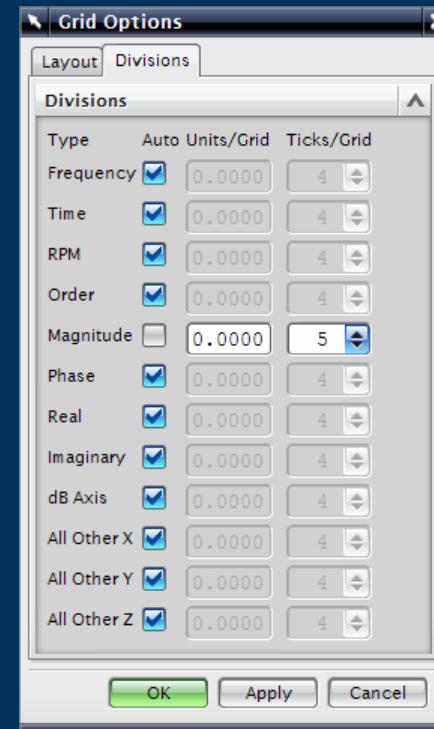
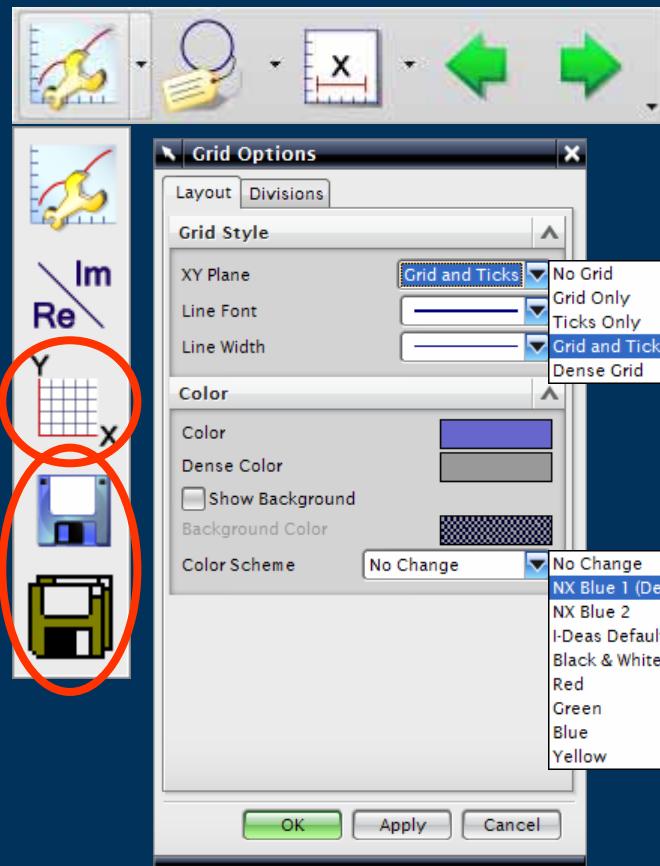
Graph Style



- ▶ Edit Graph Style
 - ▶ Dynamic Selection of Graph element
 - ▶ Graph Title
 - ▶ Graph Legend
 - ▶ Axis style
 - ▶ Axis Labels
 - ▶ Axis Numbers
 - ▶ Axis Type, Values & Units
 - ▶ Curve style

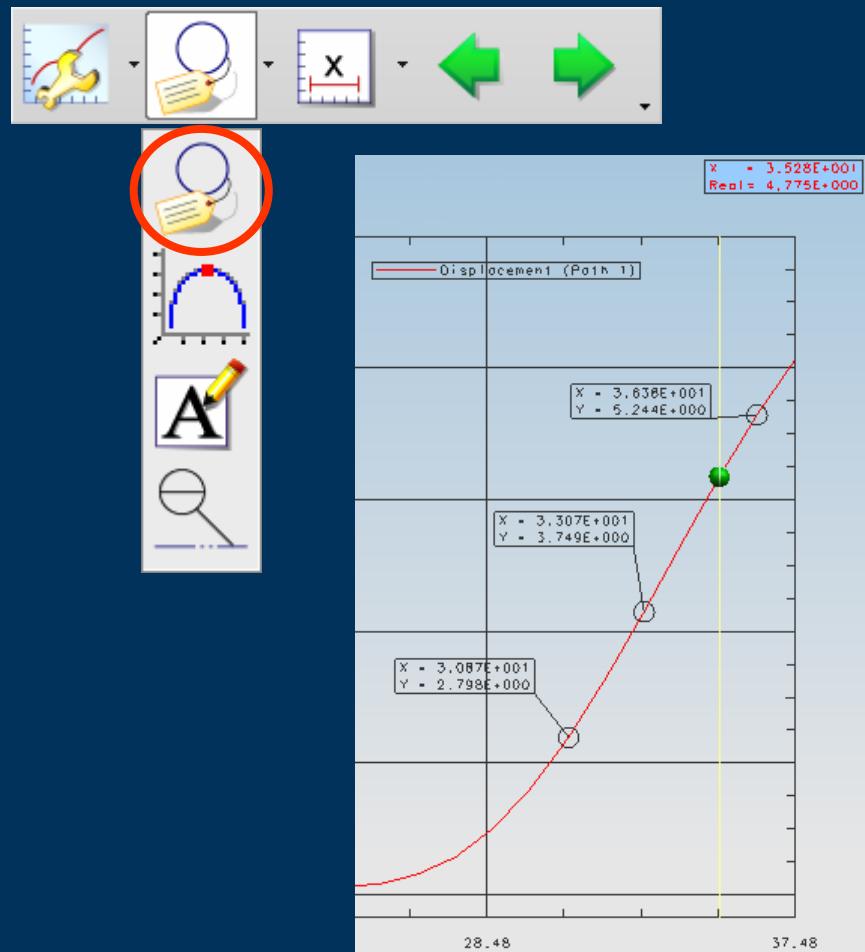


Graph Style

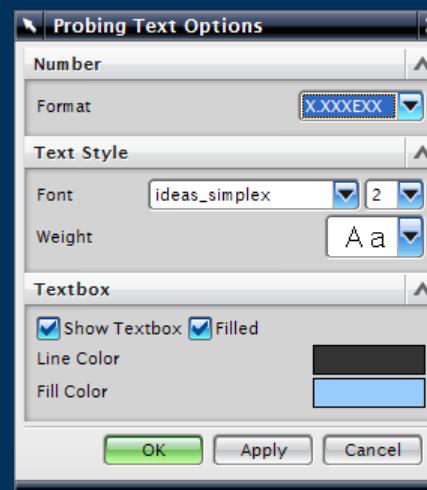


- ▶ Graph Grid Style
 - ▶ Grid Layout
 - ▶ Divisions
- ▶ Save the current Graph Settings to the current Template File
- ▶ Save the current Graph Setting to a new Template File

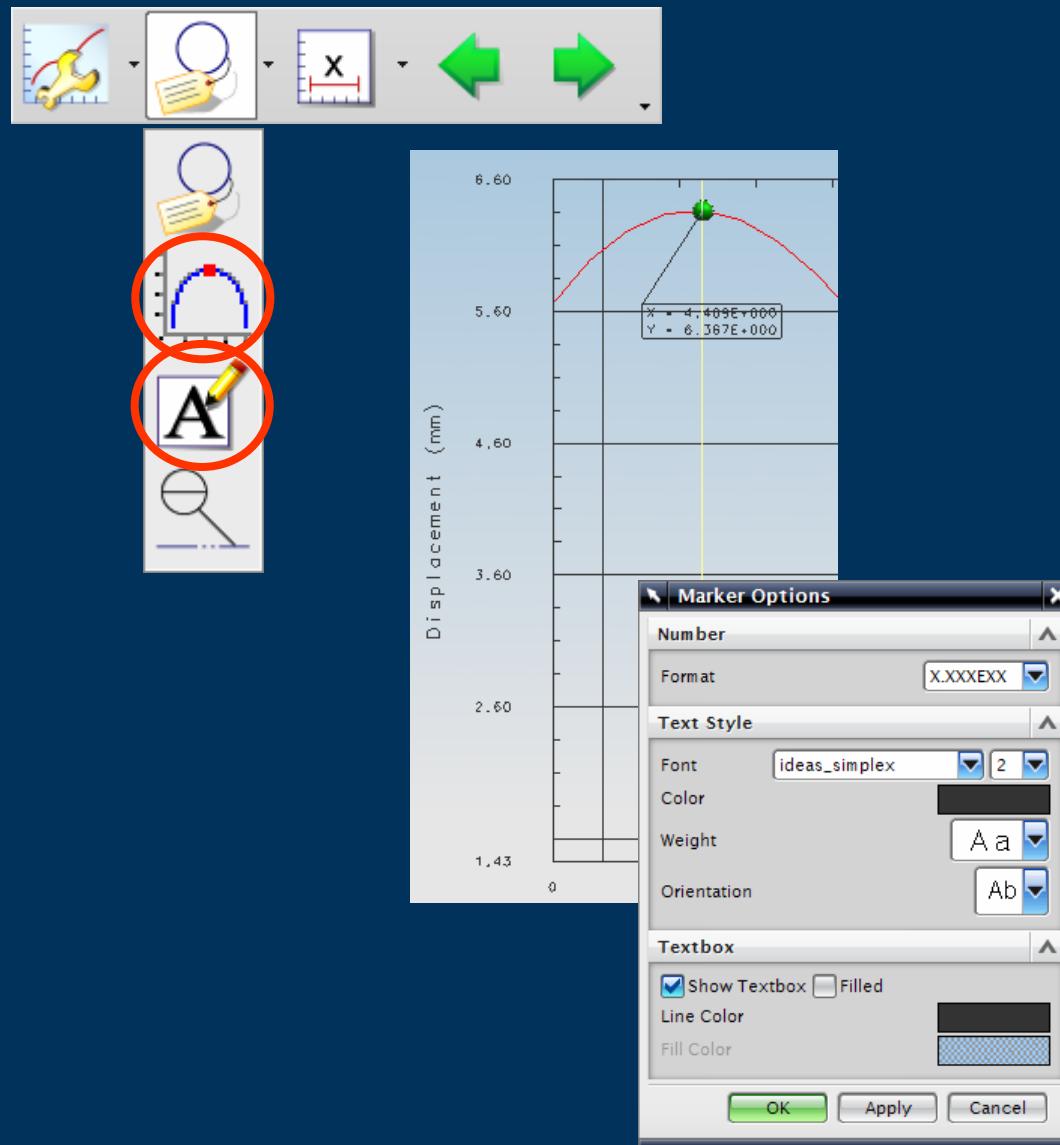
Graph Probing



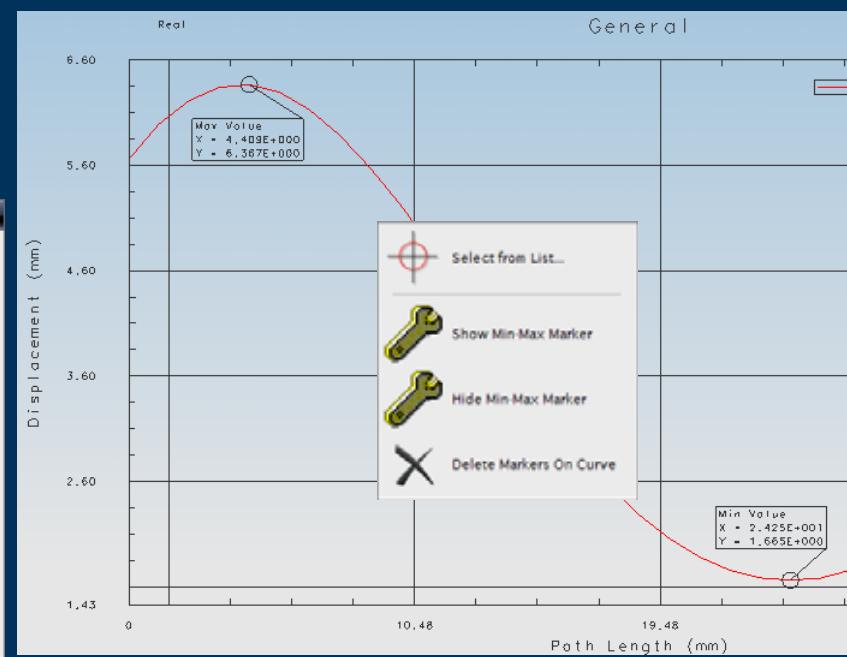
- ▶ Data Point Probing and Marking
- ▶ Dynamic Display of curve data points & values
- ▶ Specific curve location values
- ▶ Probe Text Styles



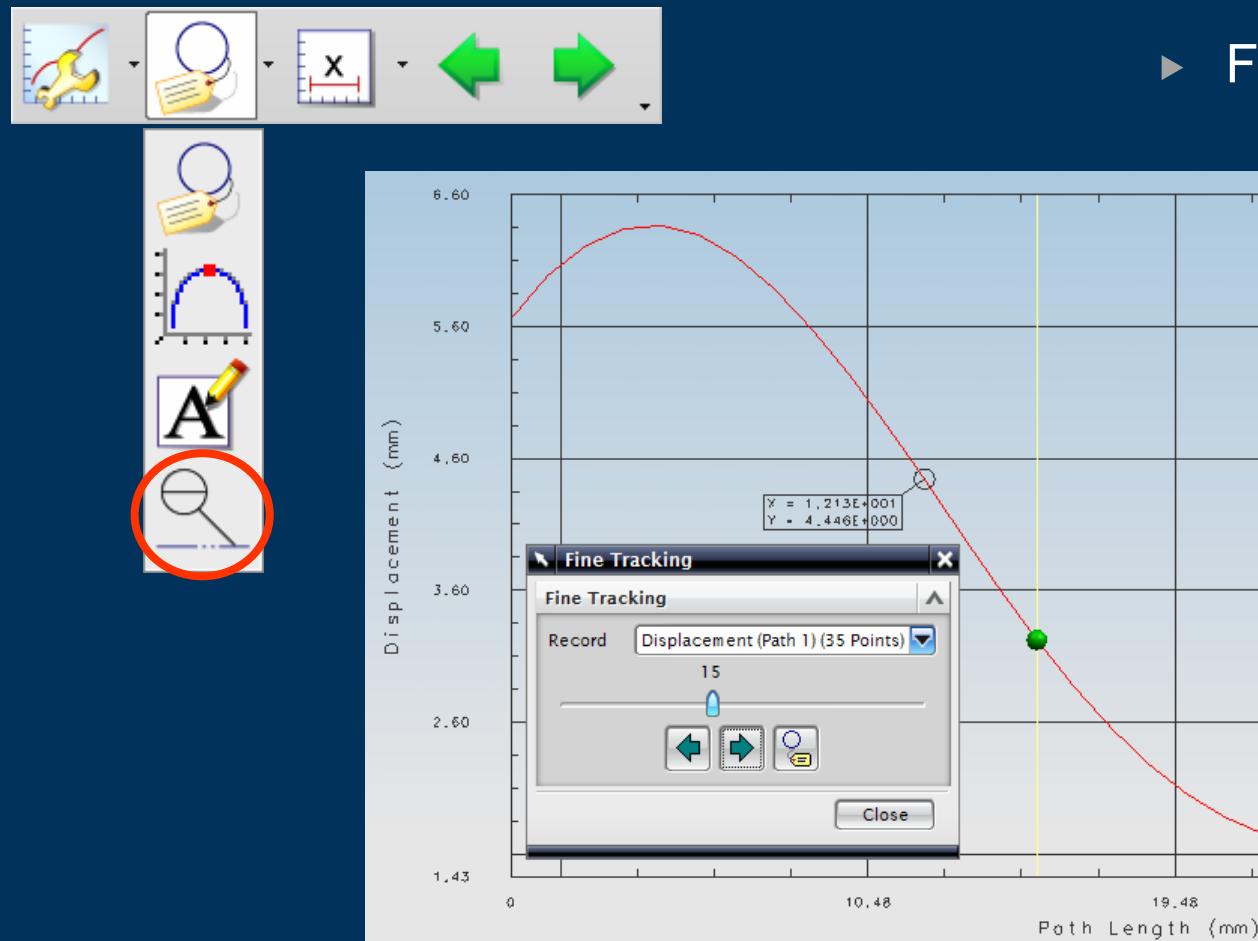
Graph Probing



- ▶ Peak and Valley locating and Marking

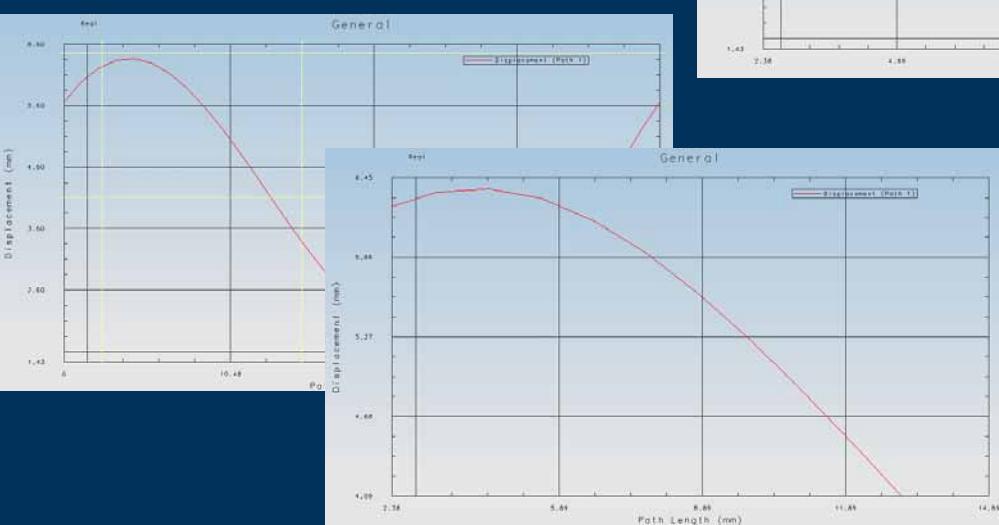
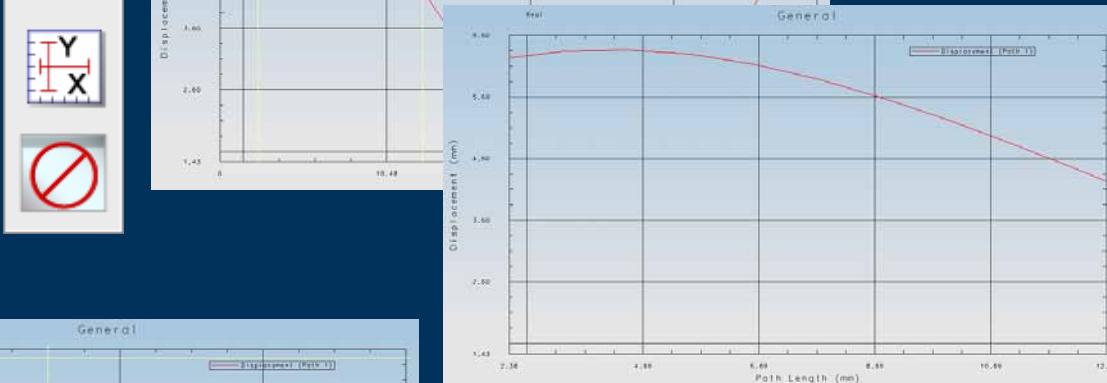
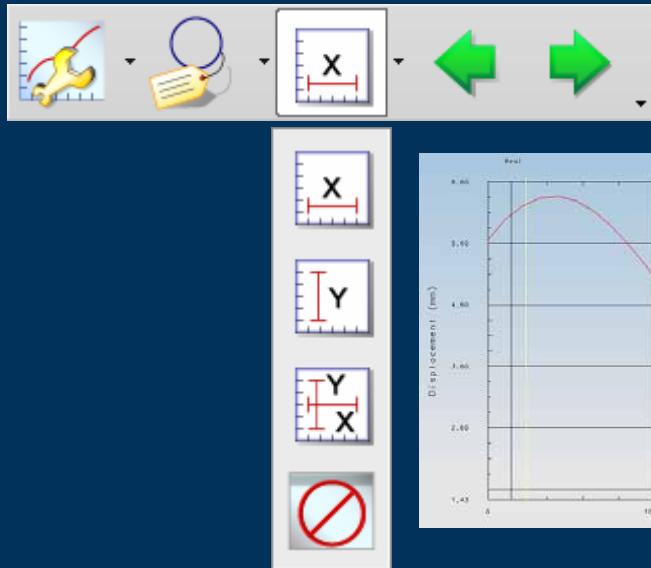


Graph Probing



► Fine Tracking and Marking

Graph Windowing



- ▶ Window into the Graph
 - ▶ X Window
 - ▶ Y Window
 - ▶ X-Y Window
 - ▶ No Window to return to full graph

Solution Report – After Solve



Simulation Navigator

- Name
 - Yoke Assy_Modes_sim1
 - Yoke Assy_fem1
 - Override Container
 - Simulation Object Container
 - Load Container
 - Constraint Container
 - Solution 1
 - Simulation Objects
 - Constraints
 - Results
 - Report
 - Title
 - Title
 - Author
 - Company
 - Introduction
 - Introduction Text
 - Solution Summary
 - Solution Summary Text
 - Solution Gallery
 - Materials
 - Materials Text
 - Materials Comment
 - Sections
 - Sections Text
 - Sections Comment
 - Meshes
 - Mesh Text
 - Solution Steps
 - Solution Step Text
 - Constraints
 - Constraints Text
 - Results
 - Results Text
 - Response Simulation Text
 - Images
 - Image Text
 - Images
 - Images Comment

Simulation Report

Author: johnd Date: 07/12/2006 Company: UGS Software Used: NX 10.0.1.1

Introduction

Solution Summary

Environment

Solver:	Solution 1
Solver:	NX NASTRAN
Analysis Type:	Structural
Solution Type:	MISTATIC 101 - Single Constraint
Limits:	Linear

Simulation Navigator:

- Name
 - Yoke Assy_m1
 - Yoke Assy_fem1
 - Override Container
 - Simulation Object Container
 - Load Container
 - Constraint Container
 - Solution 1
 - Simulation Objects
 - Constraints
 - Results
 - Report
 - Title
 - Title
 - Author
 - Company
 - Introduction
 - Introduction Text
 - Solution Summary
 - Solution Summary Text
 - Solution Gallery
 - Materials
 - Materials Text
 - Materials Comment
 - Sections
 - Sections Text
 - Sections Comment
 - Meshes
 - Mesh Text
 - Solution Steps
 - Solution Step Text
 - Constraints
 - Constraints Text
 - Results
 - Results Text
 - Response Simulation Text
 - Images
 - Image Text
 - Images
 - Images Comment

Loads

Step Name	Number of referenced loads	Loads
Solver : Static Loads 1	1	Force (1) Solver Card Name: Layer: 1 Applied to: 1 Polygon Face Force: -1000-N Distribution Type: Geometric distribution

Constraints

Step Name	Number of referenced constraints	Constraints
Solver : Static Loads 1	1	Fixed (1) Solver Card Name: Layer: 1 Applied to: 2 Polygon Face Description: Fixed - Fixed constraint

Images

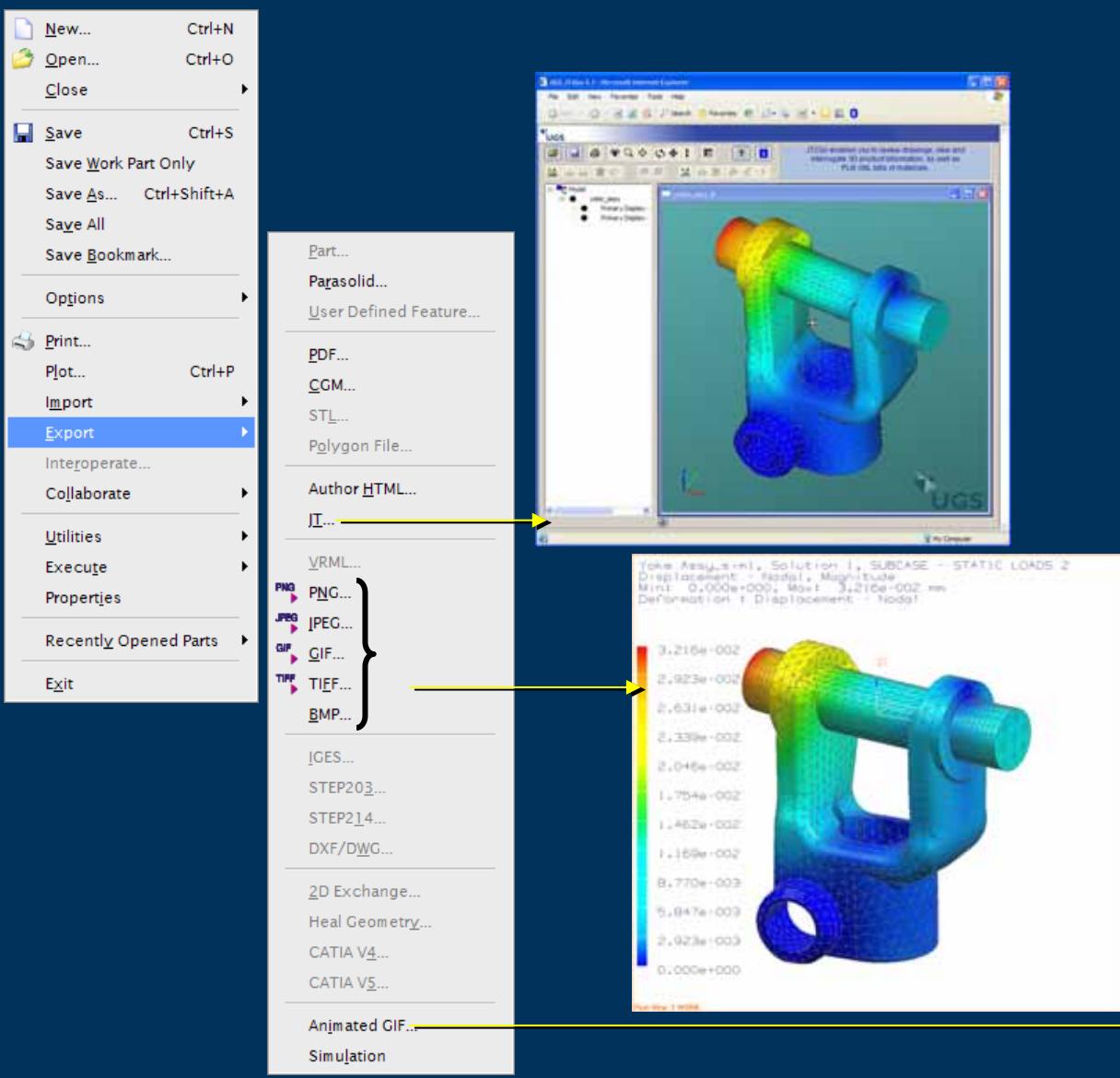
Image 1

Images

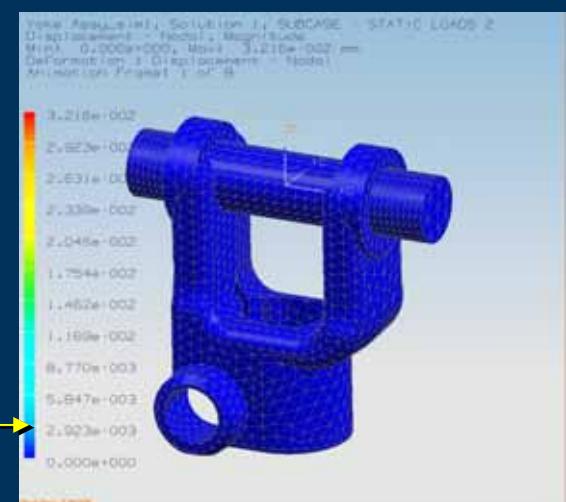
Image 2

- Solution Report – After Solve
- User entered text description/documentation
- Snapshot screen images
- HTML Interactive report export

Export Visualisation Files



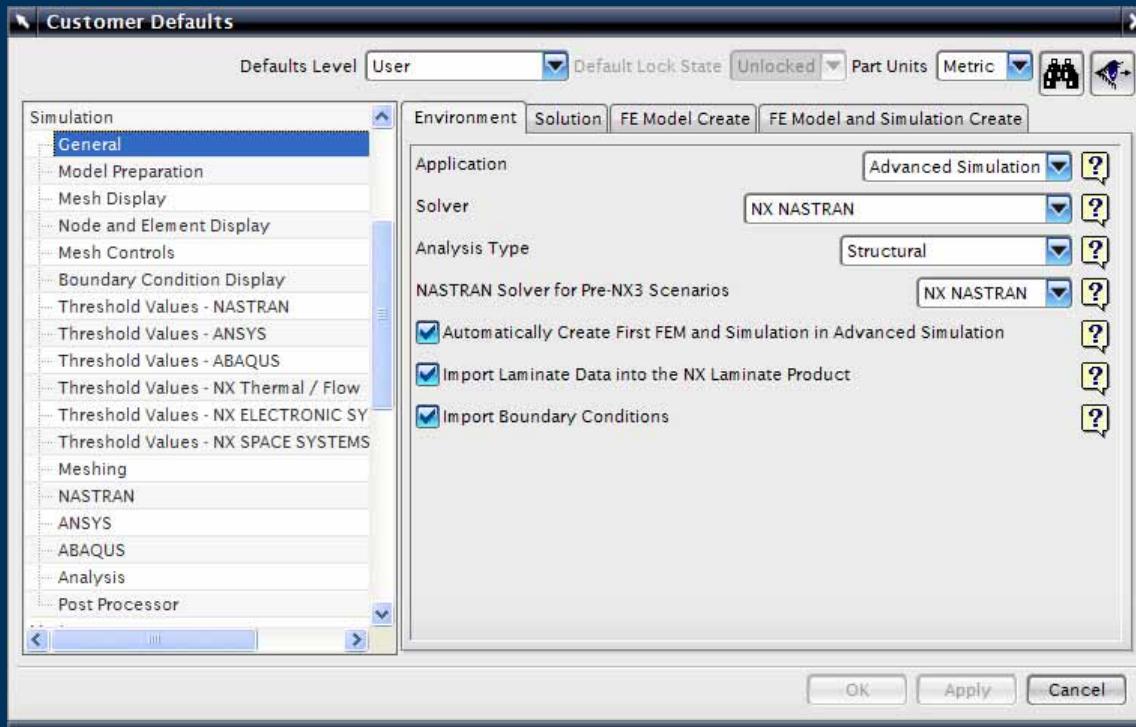
- ▶ Direct export of JT visualisation model
- ▶ Direct export of screen images
 - ▶ PNG
 - ▶ JPEG
 - ▶ GIF
 - ▶ TIFF
 - ▶ BMP
- ▶ Direct export of Animation
 - ▶ Animated GIF





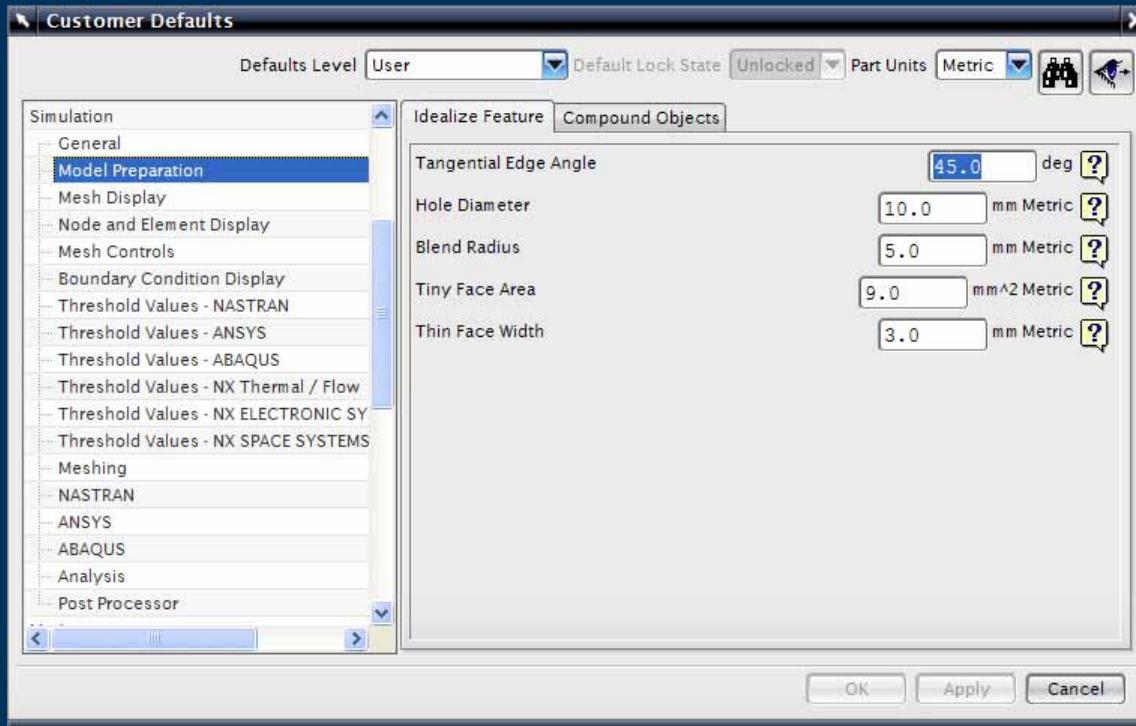
Customer Defaults for Simulation

Customer Defaults – General



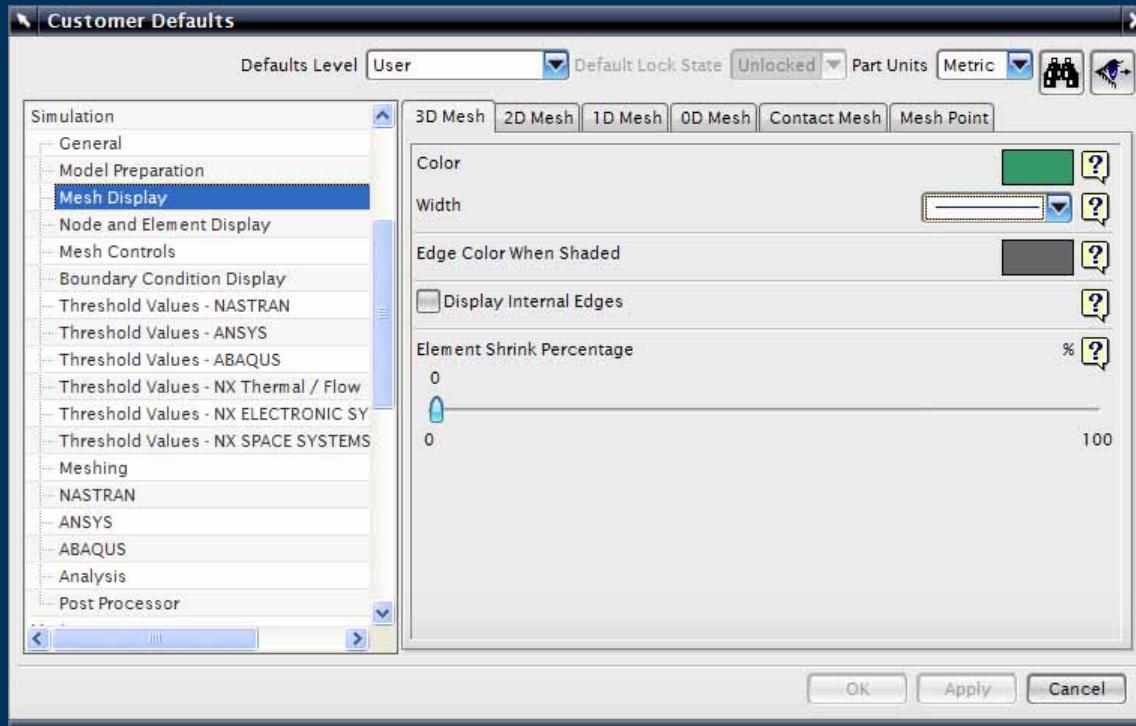
- ▶ General
- ▶ Default Solver Language
- ▶ Creation of the four simulation files

Customer Defaults – Model Preparation



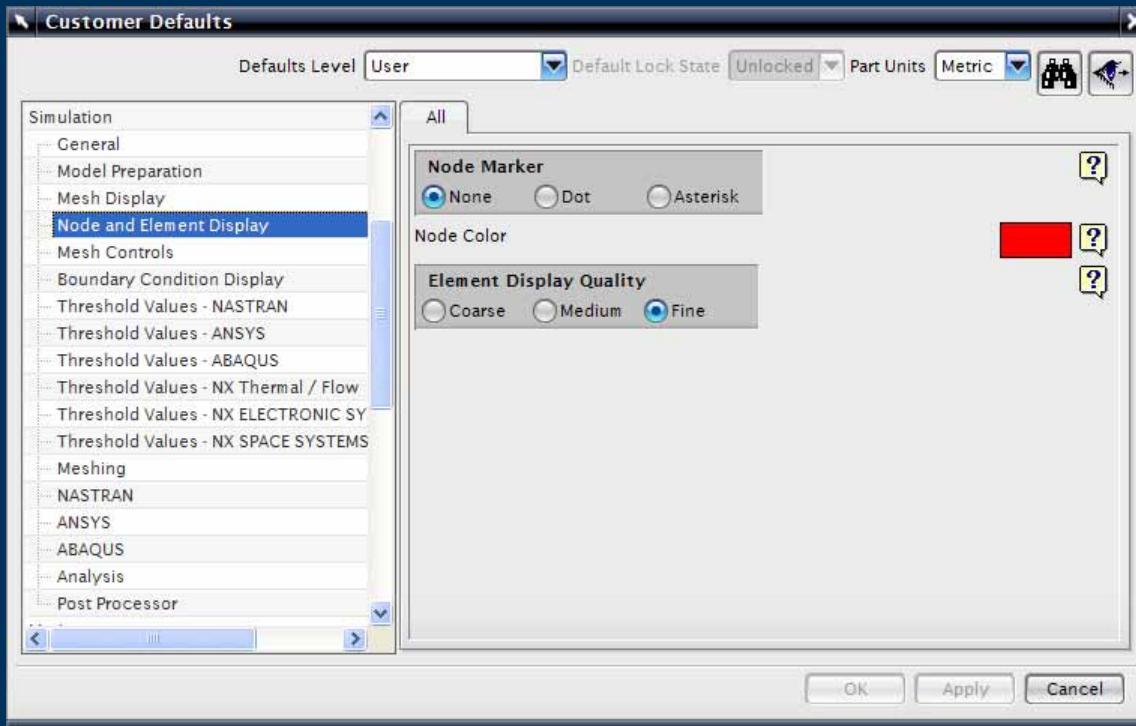
- ▶ Model Preparation
- ▶ Default values for CAE Topology creation

Customer Defaults – Mesh Display



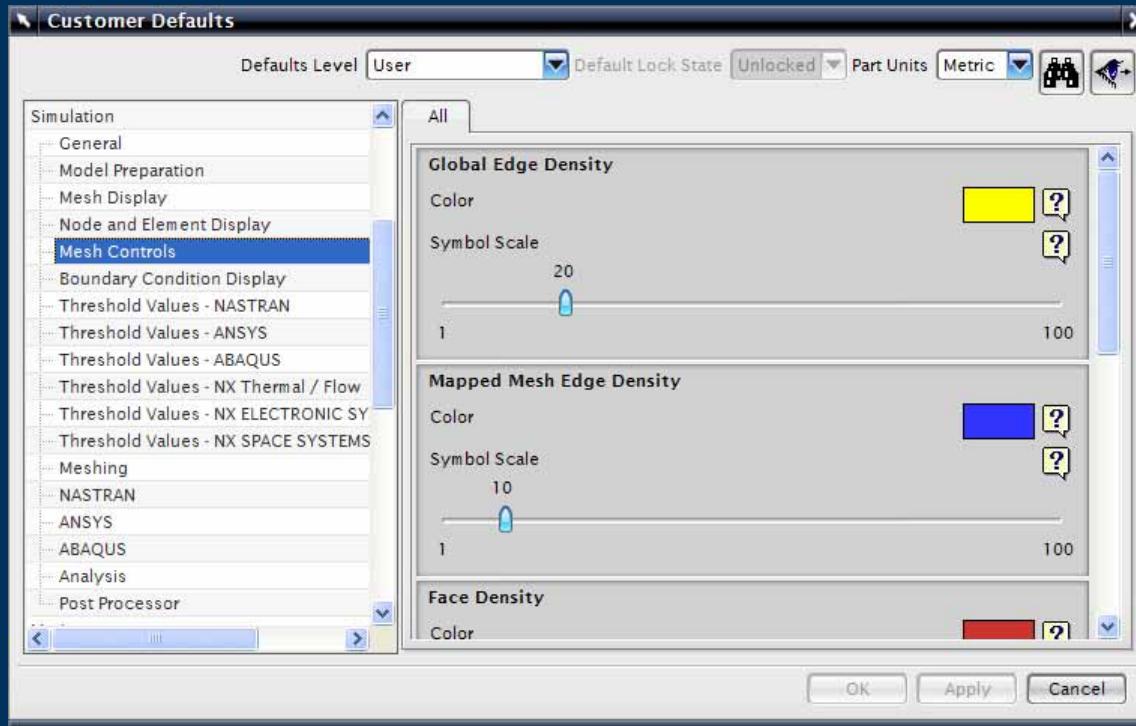
- ▶ Mesh Display
 - ▶ Default Mesh displays for different mesh types
 - ▶ Color, Line width, Shrink etc

Customer Defaults – Node & Element Display



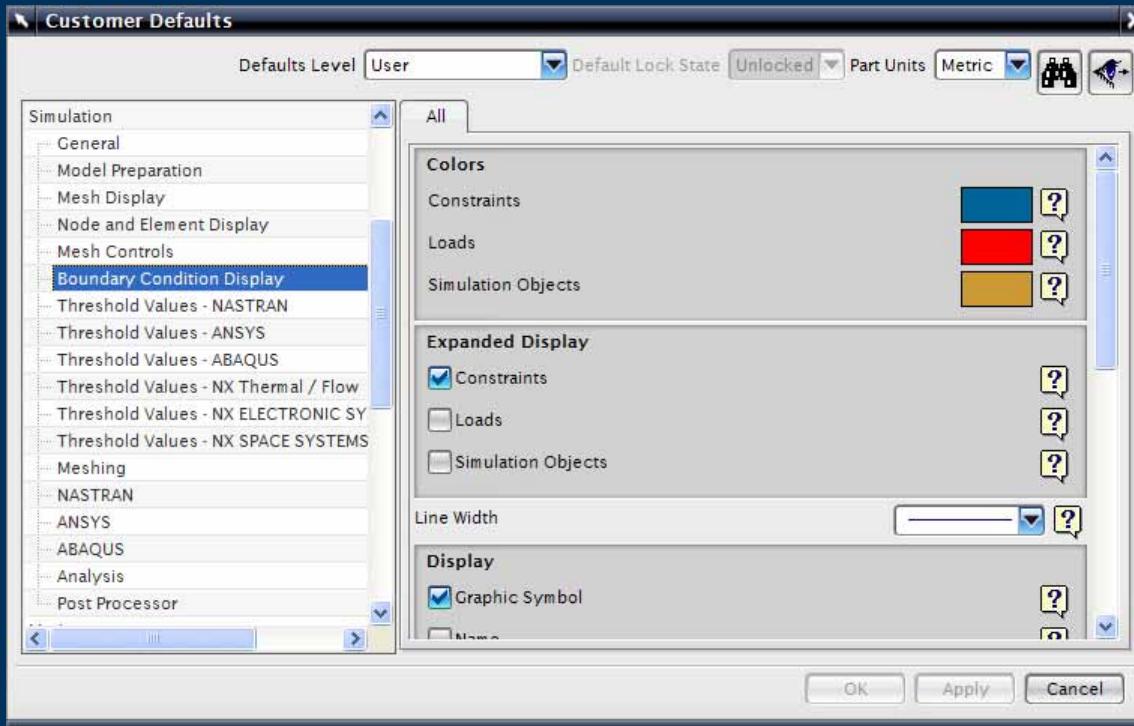
- ▶ Node & Element Display
 - ▶ Node style
 - ▶ Element display quality

Customer Defaults – Mesh Controls



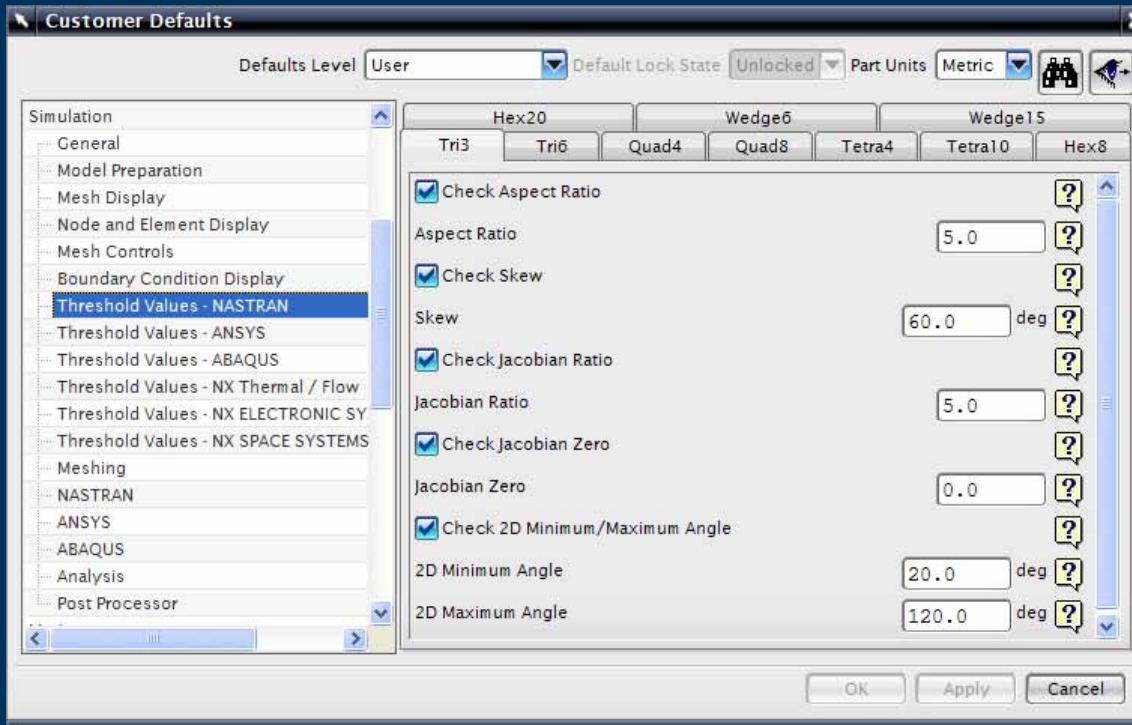
Mesh Control
defaults

Customer Defaults – Boundary Condition Display



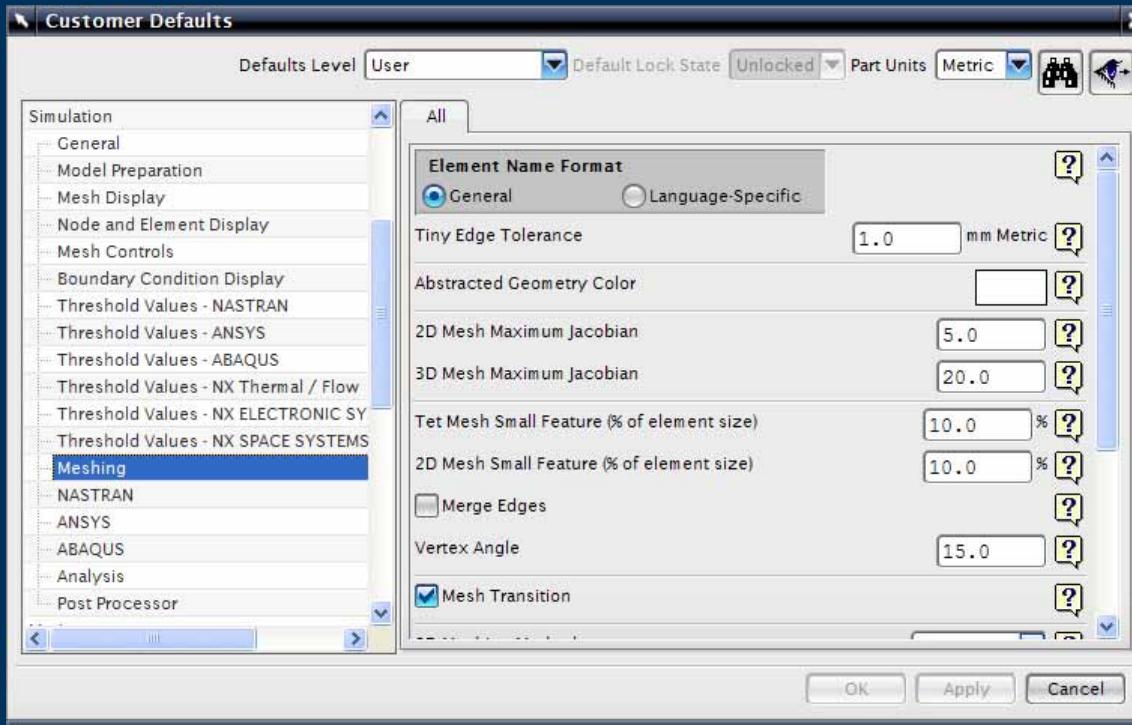
- ▶ Boundary Condition Display
 - ▶ Defaults for color, line width and style

Customer Defaults – Threshold Values Nastran



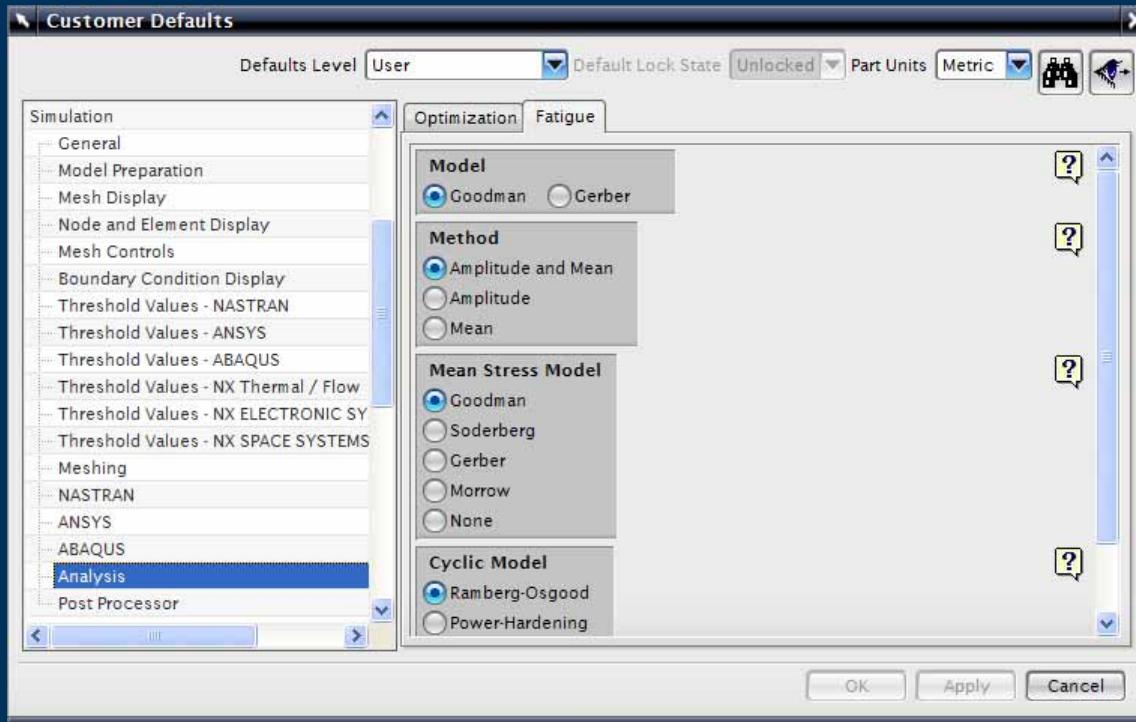
- ▶ Threshold Values – Nastran
- ▶ Element quality check threshold values for Tri, Quad, Tet, Hex and Wedge element types

Customer Defaults – Meshing



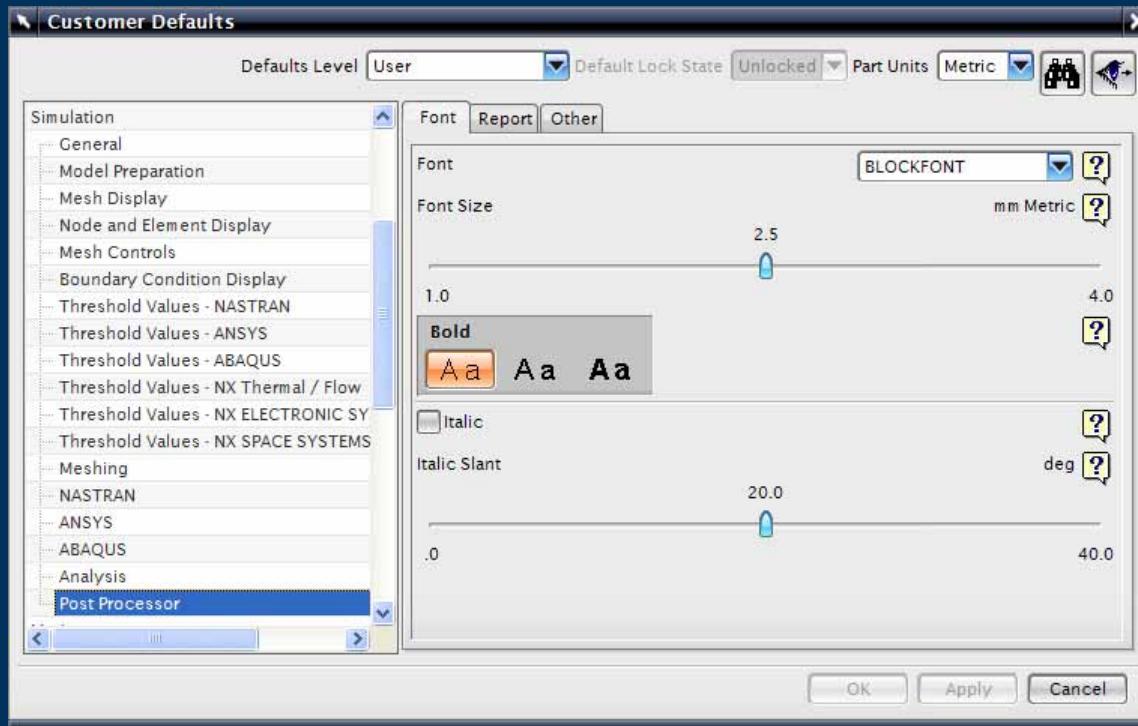
- ▶ Meshing
- ▶ General defaults for the meshing task

Customer Defaults – Analysis



- ▶ Analysis
 - ▶ General and specific for Optimization and Fatigue (Durability)

Customer Defaults – Post Processor



- ▶ Post Processor
 - ▶ Defaults for text display
 - ▶ Report file names

SIEMENS

Thank You