

NX Advanced FEM (Version NX 5)

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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)

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

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

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

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



NX Advanced FEM File Organisation

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Basic file structure

Simulation part



ø -@ Environment Active: NX NASTRAN - Structura Default: NX NASTRAN - Structure 6 NX NASTRAN - Structural ٩ T > Λ. $\mathbf{\Omega}$

Benefits

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

New FEM and Simulation	×
Simulation Name:	model1_sim1.sim
FEM Name:	model1_fem1.fem
Idealized Part Name:	model1_fem1_i.prt
Associate to part	
Create Idealized Part	
model1	▼ 💕
Bodies to use	0
Use all bodies OSelect bo	dies 🔘 No bodies
Geometry Option	ıs
Default Language:	
Solver: NX NASTRAN	
Analysis Type: Structu	ral 🔽
Description:	

Note - Write Access to Master Part is not required

Multiple Idealize and Multiple FEM's



Multiple SIM's – Physical Property Override

SIM1 – Generic Steel (Inherited from Master Part)



SIM2 – AISI_STEEL_1008+HR







Idealize Part



Master Part



Benefits

Quickly and easily explore effects of different materials "What if" and sensitivity studies

Simulation Navigator	Ø
Name	Environment
🚰 sim 1	Active: NX NASTRAN - Structura
	Default: NX NASTRAN - Structuri
⊖ 🗇 blade_fem_i	
🚽 🐨 blade.prt 🚺 Override	e Mesh Collector A 🥥 👘 🗙
🕀 🗹 Polygon Geometr 🛛 Override N	lesh Collector Attributes
🕀 🗹 🦄 3D Collectors	
⊕ ₩ 11 Connection C	Property A
- 🗹 🗣 Simulation Object 📃 Type	PSOLID 🔽 👯
🖻 🖬 🎘 Load Container	
🖻 🖬 🖶 Constraint Contai	
₩ • Fixed(1)	
🖻 📇 Solution 1	
Simulation Objects	
Sonstraints	
Fixed(1)	
□ # [®] Subcase - Static Loads 1	
⊖ ⊠ ∰ Loads	
✓ Pressure(1)	
Results	
<	 >
Simulation File View	
Session	
⊢ ⊡ blade_fem_i	
a blade	

Multiple SIM's – Properties & Material Override





Benefits

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



Variations





Model Interaction

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Simulation Navigator – File View



Simulation File View



Simulation File View

Session
🖃 🐨 Yoke Assy
🖻 🗇 Yoke Assy_fem 1_i
🖻 翻 Yoke Assy_fem 1
🔤 🚰 Yoke Assy_sim

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 File View			
Session			
⊡- 🔁 Yoke Assy_sim 1			
⊡-∰ Yoke Assy_fem 1			
⊖ · 🗇 Yoke Assy_fem 1_i			
	🛶 🐨 Yoke Assv		
🚽 🖅 Yoke Bolt	Make Displayed Part		
- @ Yoke	🖬 Save		
🐨 🐨 Yoke Pin	🕮 New FEM		
	🖀 New FEM and Simulation		

Simulation Navigator – Easy Management

Active Solver

Environment

Simulation Centric File View

Mesh Out-of-Date Symbol

Hide/Show of Polygon models and Meshes during selection

Containers to Organise related CAE Data

Simulation Navigator Name Environment Description block_sim 1 Active: NX NASTRAN - Structural block_fem 1 Default: NX NASTRAN - Structural 🖮 🗇 block_fem 1_i 🐨 🕣 block.prt 🗄 🗹 Polygon Geometry M 3D Collectors 🗹 💭 Simulation Object Container 🖌 🎬 Load Container 🗹 🔮 Force(1) 🐴 Bearing(1) 🖃 🖌 🖶 Constraint Container Fixed(1) 👗 Solution 1 NX NASTRAN - Structur SESTATIC 101 - Single Constraint ☑ 🖗 Simulation Objects 🖻 🖌 🧮 Constraints Fixed(1) 😑 🗗 Subcase - Static Loads 1 🖮 🗹 🎬 Loads Force(1) Bearing(1)

Drag 'n' Drop from Containers to Solution

Simulation Navigator – Easy Management

Simulation Navigator			
Name			
🔁 Yoke Assy_sim1			
🖃 🌐 Yoke Assy_fem 🗳	New Solution		
🐨 Yoke Assy	Import Results		
🕀 🗹 Polygon Ge 🔻	New Solution Process		
🕀 🗹 🐼 2D Colle 🕏	Physical Properties		
🕀 🖬 🎢 3D Colle 🛱	Modeling Objects		
🗄 🗹 🎞 Connec 🔓	Solve All Solutions		
🕀 Override Contain 🕰	Simulation Summary		
🚊 🗹 🖗 Simulation (🌶	Edit		
🚽 🗹 😐 Face Glu	Node and Element Display		
🚊 🗹 🍀 Load Contai	Replace FEM		
🛛 🗹 😐 Force(1)			

🖃 🌐 Yoke Assy_fem 1 Yoke Assv fem1 i.prt 🗄 🗹 Polygon Geometry 🖻 🗹 🐼 2D Collectors 2d_mesh(1) Edit Attribute Overrides... 🗄 🖌 🕅 🕅 3D Colle Display Settings - MIL Connect Select All 🗄 - 🗹 🐔 ММС Sort Alphabetically • Override Containe Information 🗄 🖌 🖗 Simulation (🗹 🔮 Face Glu Check All Element Shapes 🖯 🖌 🗮 Load Container Element Normals Force(1) Element Outlines 🗄 🖌 🔚 Constraint Container Duplicate Node



RMB Operations Directly from Navigator



Simulation Navigator – Resource Bars

Simulation Navigator	
Name	
Yoke Assy_sim1	
🗩 🌐 Yoke Assy_fem 1	
- @ Yoke Assy_fem1_i.prt	
🖃 🗹 Polygon Geometry	
🗹 Polygon Body_1	
Volygon Body_2	
🖻 🖬 🖗 2D Collectors	
2d_mesh(1) Container	
🖨 🖬 🌆 3D Collectors	
🖻 🖬 3d_mesh(2) Container	
₩ 3d_mesh(2)	
₩ 3d_mesh(1)	
I Connection Collectors	
🖻 🖬 👫 MMC Collection	
Override Container	
3d_mesh(2) Container-Solid Prop	
🖻 🗹 🎝 Simulation Object Container	
Face Gluing(1)	
🖻 🖬 🎘 Load Container	
Force(1)	
Constraint Container	
M ● Fixed(1)	
🖻 📇 Solution 1	
⊖ M + Simulation Objects	
Face Gluing(1)	
⊖ M ∰ Constraints	
Fixed(1)	
Engr Subcase - Static Loads 1	
⊡ M 7 Loads	
Porce(I)	
Results	



Resource Bars for Simulation

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HC-

L

- Simulation
- Post Processing
- XY Functions



Simulation Navigator – Resource Bars

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▶ 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

Show

Hide

- ► 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

No Selection Filter		🛃 🔸 🔊 🏞 🐂	No method 🔽
No Selection Filter	~		No method
Curve			Tangent Faces
Point			Adjacent Faces
Mesh Point			Fillet Faces
CSYS			Cylinder Faces
Plane			Sliver Faces
Mesh			
Polygon Body			
Polygon Face	_		
Face Density			
Edge Density			
Mesh Mating	×		

Simulation Navigator Name 🐴 Yoke Assy_sim1 - 📅 Yoke Assy_fem 1 Yoke Assy_fem1_i.prt 🖻 🗹 Polygon Geometry Polygon Body_1 Polygon Body_2 2D Collectors ė 2d_mesh(1) Container ė M A 3D Collectors 🖮 🗹 3d_mesh(2) Container 🖌 3d_mesh(2) ✓ 3d_mesh(1) - MIL Connection Collectors 🖻 🗹 🐔 MMC Collection M auto_mmc_1 ₩ auto_mmc_2



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 and Element Disp	lay 🗙
Node Marker	Asterisk 🔽
Node Color	
Element Display Quality	Coarse 🔽 🔶 🖌 🖌
OK Apply	Cancel

- 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 D	Display	_ ວ = X		
Global Edge Densit	y	^		
Symbol Size	20 1	100		
Mapped Mesh Edge	e Density	~		
Symbol Size	5 1	100		
Face Density		~		
Symbol Size	20 1	100		
Mesh Mating		^		
Symbol Size	20 	100		
Show Through Display				
Generic Properties		^		
Shade Symbols Simple Value Text Display				
OK Apply Cancel				







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





Solver Language Environment

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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
g.		Therma:
		Linear Buckling
	Thermal	Thermal
Solver	Thermal	Thermal
Solver NX Thermal-Flow	Thermal Analysis Type Thermal	Thermal Solution Type Thermal
Solver NX Thermal-Flow	Thermal Analysis Type Thermal	Thermal Solution Type Thermal
Solver NX Thermal-Flow	Thermal Analysis Type Thermal Flow	Thermal Solution Type Thermal Advanced Thermal Flow
Solver NX Thermal-Flow	Thermal Analysis Type Thermal Flow	Thermal Solution Type Thermal Advanced Thermal Flow Advanced Flow
Solver NX Thermal-Flow	Thermal Analysis Type Thermal Flow Coupled Thermal-Flow	Thermal Solution Type Thermal Advanced Thermal Flow Advanced Flow Thermal-Flow
Solver NX Thermal-Flow	Thermal Analysis Type Thermal Flow Coupled Thermal-Flow	Thermal Solution Type Thermal Advanced Thermal Flow Advanced Flow Thermal-Flow Advanced Thermal-Flow
Solver NX Thermal-Flow	Thermal Analysis Type Thermal Flow Coupled Thermal-Flow	Thermal Solution Type Thermal Advanced Thermal Flow Advanced Flow Thermal-Flow Advanced Thermal-Flow Complete
Solver NX Thermal-Flow	Thermal Analysis Type Thermal Flow Coupled Thermal-Flow Axisymmetric Thermal	Thermal Solution Type Thermal Advanced Thermal Flow Advanced Flow Thermal-Flow Advanced Thermal-Flow Complete Axisymmetric Thermal
Solver NX Thermal-Flow	Thermal Analysis Type Thermal Flow Coupled Thermal-Flow Axisymmetric Thermal	Thermal Solution Type Thermal Advanced Thermal Flow Advanced Flow Thermal-Flow Complete Axisymmetric Thermal Advanced Axisymmetric Thermal
Solver NX Thermal-Flow	Thermal Analysis Type Thermal Flow Coupled Thermal-Flow Axisymmetric Thermal Mapping	Thermal Solution Type Thermal Advanced Thermal Flow Advanced Flow Thermal-Flow Complete Axisymmetric Thermal Advanced Axisymmetric Thermal Thermal-Flow
Solver NX Thermal-Flow	Thermal Analysis Type Thermal Flow Coupled Thermal-Flow Axisymmetric Thermal Mapping Axisymmetric Mapping	Thermal Solution Type Thermal Advanced Thermal Flow Advanced Flow Thermal-Flow Complete Axisymmetric Thermal Advanced Axisymmetric Thermal Thermal-Flow
Solver NX Thermal-Flow	Thermal Analysis Type Thermal Flow Coupled Thermal-Flow Axisymmetric Thermal Mapping Axisymmetric Mapping Axisymmetric Mapping Axisymmetric Mapping	Thermal Solution Type Thermal Advanced Thermal Flow Advanced Flow Thermal-Flow Complete Axisymmetric Thermal Advanced Axisymmetric Thermal Thermal-Flow Thermal Solution Type
Solver NX Thermal-Flow Solver	Thermal Analysis Type Thermal Flow Coupled Thermal-Flow Axisymmetric Thermal Mapping Axisymmetric Mapping Axisymmetric Mapping Thermal	Thermal Solution Type Thermal Advanced Thermal Flow Advanced Flow Thermal-Flow Complete Axisymmetric Thermal Advanced Axisymmetric Thermal Thermal-Flow Solution Type Space, Systems Thermal
Solver NX Thermal-Flow Solver NX Space Systems Thermal	Thermal Analysis Type Thermal Flow Coupled Thermal-Flow Axisymmetric Thermal Mapping Axisymmetric Mapping Analysis Type Thermal Mapping	Thermal Thermal Solution Type Thermal Advanced Thermal Flow Advanced Flow Thermal-Flow Complete Axisymmetric Thermal Advanced Axisymmetric Thermal Thermal-Flow Thermal Solution Type Space Systems Thermal Thermal
Solver NX Thermal-Flow Solver NX Space Systems Thermal	Thermal Analysis Type Thermal Flow Coupled Thermal-Flow Axisymmetric Thermal Mapping Axisymmetric Mapping Analysis Type Thermal Mapping	Thermal Solution Type Thermal Advanced Thermal Flow Advanced Flow Thermal-Flow Advanced Thermal-Flow Complete Axisymmetric Thermal Advanced Axisymmetric Thermal Thermal-Flow Solution Type Space Systems Thermal Thermal
Solver NX Thermal-Flow Solver NX Space Systems Thermal Solver	Thermal Analysis Type Thermal Flow Coupled Thermal-Flow Axisymmetric Thermal Mapping Axisymmetric Mapping Analysis Type Thermal Mapping Analysis Type Analysis Type	Thermal Thermal Solution Type Thermal Advanced Thermal Flow Advanced Flow Thermal-Flow Complete Axisymmetric Thermal Advanced Axisymmetric Thermal Thermal Solution Type Space Systems Thermal Thermal Solution Type Space Spa
Solver NX Thermal-Flow Solver NX Space Systems Thermal Solver NX Electronic Systems Cooling	Thermal Analysis Type Thermal Flow Coupled Thermal-Flow Axisymmetric Thermal Mapping Axisymmetric Mapping Axisymmetric Mapping Analysis Type Thermal Mapping Analysis Type Coupled Thermal-Flow	Thermal Solution Type Thermal Advanced Thermal Flow Advanced Flow Thermal-Flow Advanced Thermal-Flow Complete Axisymmetric Thermal Advanced Axisymmetric Thermal Thermal-Flow Thermal Solution Type Space Systems Thermal Thermal Solution Type Electronic Systems Cooling
Solver NX Thermal-Flow Solver NX Space Systems Thermal Solver NX Electronic Systems Cooling	Thermal Analysis Type Thermal Flow Coupled Thermal-Flow Axisymmetric Thermal Mapping Axisymmetric Mapping Analysis Type Thermal Mapping Analysis Type Coupled Thermal-Flow	Thermal Solution Type Thermal Advanced Thermal Flow Advanced Flow Thermal-Flow Advanced Thermal-Flow Complete Axisymmetric Thermal Advanced Axisymmetric Thermal Thermal-Flow Thermal Solution Type Space Systems Thermal Thermal Solution Type Electronic Systems Cooling Advanced Electronic Systems Cooling

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
		SEMFREQ 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

 Import of I-deas Universal file with CAE data only

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

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"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

Nerester Solution Nu Name: Solution Nu Solver NX NASTRAN Production	Structural Output ame
N Create Solution Solu Name: Solu Solver NX NASTRAN Pro-	ame (
Name: Solu Solver NX NASTRAN Pr Analysis Type Structural	ane (
Solver NX NASTRAN Pr	A . A
Analysis Type Structural	ibel
	eview Output Request
Solution Turne SESTATIC 101 - Single Constraint	nable All Output Reque
Automatically (SESTATIC 101 - Single Constraint Di	isable All Output Requ
SESTATIC 101 - SESTATIC 101 - Multi Constraint	
SEMODES 103	Displacement Fo
SEBUCKL 105	Strain Strain Energy
NLSTATIC 105	Acceleration Applie
SEDFREQ 108	
SEDTRAN 109 SEMFRED 111	Enable ACCELERATI
SEMTRAN 112	Sorting
	Output Medium
N Physical Property Tables M J 🗖 🗙	Data Format
Greate	Random Functions
	Entity Selection
Type PSOUD	
Name PSOLID	
Label PSHELL	
Laminate	
PCOMP	
Filter PROD	
Selection PBAR E) Mesh
Name PBARL PBEAM	
PBEAML	
PBUSH 💌 Meshi	ing Method
N 3D Mesh	Equivalent E
	tianting Collector
Type A CTETRA(II)	uter tic Mode
Fourier Floor	Automatic Mode
Mes	h Collector
Overall Element Size 15.20 CTETRADU	
N 3D Swept Mesh X	N ID Mesh
Selection Steps	
	Туре
	Equiva
den anno 🗖	
Mesn Type	Destination Collec
Destination Collector	Automatic Mode
Automatic Mode	Mesh Collector
Mesh Collector (3d mesh(1) Container VI	
	Default Element



Requests

C Forces

ON Request

Default

PLOT

REAL

None

Stress

Structural Output

<u>ວ = x</u>

Preview

Enable All

Disable All

SPC Forces

Velocity d Load Contact Result

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v

OK Cancel

CQUAD4 COUADS

CTRIA6

∧ CTRIA3 CTRIAR

CQUADR

ent Elem

CO CBEAM

CBAR Q CROO

Y RBE2 20 CBUSH CELAS2

Grid Point Force



Force J	- ,
Туре	^
Nagnitude and direction	-
Name	Y
Model Objects to Create Force On	^
* Select Object (0)	Þ
Excluded	V
Magnitude	۸
Force	•
Direction	^
* Specify Vector (0)	-
Reverse Direction	4
Dist il sta	V
Card Name FORCE	
OK Apply Cance	1

"ANSYS 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

A Create Se	olution	× = د	Create Sol	ution		x = x	N Force	ວ = x
Name:		Solution	Name:		Solu	tion	Туре	^
Solver 7	ANSYS		Solver	ANSYS		-	Magnitude and directio	n 💌
Analysis Ty	Structural		Analysis Type	Structural		-		
Solution Ty	linear Statics		Solution Type	Modal		-	Name	Y
Automatica	Illy Create Step or Subcase		Automatical	y Create Step or Sub	case		Model Objects to Define	Force On A
Linear Stati	cs	^	Modal			^	💙 Select Object (1)	
Description			Description				Excluded	v
Format Co	omponents		Run Job in I	Foreground			Magnitude	
Scratch Dire	ctory		Format Con	ponents			Farma	
			Scratch Direct	ory			Force [100	
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SIEMENS

"ABAQUS 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

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Master Part

UGS PLM Software

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Master Part



Material Property – Library

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38 Copper_C10100 39 iron_Cast_G2S 40 Magnésium_Cast 41 AlSI_Steel_1008-HR 42 AlSI_STeel_1008-HR 43 Titanium-Annealed 44 Aluminum_A356 45 inconel_718-Aged 46 AlSI_Steel_1005 47 AlSI_Steel_1005 47 AlSI_Steel_Maraging 49 iron_Cast_G00 50 iron_Cast_G00 51 Titanium_1H-GAI-4V	37	Aluminum_5086	Lib Ref.	Name
39 iron_Cast_G2S 102 Air 40 Magnesium_Cast 102 Air 41 AlSL_SteeL_1008-HR 42 AISL_SS_304-Annealed 43 Titanium-Annealed 44 Aluminum_A356 45 InconeL_718-Aged 46 AISL_SteeL_1005 47 AISL_SteeL_1005 47 AISL_SteeL_Maraging 49 iron_Cast_G00 50 iron_Cast_G00 51 Titanium_1H6AI-4V 51 Titanium_1H6AI-4V	38	Copper_C10100	101	Water
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47 AISI_Steel_4340 48 AISI_Steel_Maraging 49 iron_Cast_G40 50 iron_Cast_G60 51 Titanium_TH6AI-4V	46	AISI_Steel_1005		
48 AISI_Steel_Maraging 49 iron_Cast_G40 50 iron_Cast_G60 51 Titanium_Ti-6AI-4V	47	AISI_Steel_4340		
49 iron_Cast_C40 50 iron_Cast_C60 51 Titanium_Ti-6Al-4V	48	AISI_Steel_Maraging		
S0 Iron_Cast_C60 S1 Titanium_Ti-6AI-4V	49	Iron_Cast_G40		
S1 Titanium_Ti-6AI-4V	50	Iron_Cast_G60		
	51	Titanium_Ti-6Al-4V		

e-Sof e-Hard

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

Material Properties

sotropic Orthotropic Anisotropic Fluid	Isotropic Orthotropic Anisotropic Fluid
Basic Structural	
Mass Density 7.92701e B kg/mmA3 Reference Temperature C Young's Modulus TABLE B mN/mmA2(kPa) Poisson's Ratio TABLE B Shear Modulus B N/mmA2(MPa) Stress/Strain B Thermal Expansion Coefficient TABLE D TABLE V Electrical V Durability V	Strength XASLE Yield Strength TASLE Ultimate Tensile Strength TABLE Max Allowable Stress in Tension N/mm^2(MPa) Max Allowable Stress in Compression N/mm^2(MPa) Max Allowable Strain in Tension N/mm^2(MPa) Max Allowable Strain in Compression N/mm^4/N42 Table microl/kg/K Thermal Mass De Thermal Conductivity TABLE Thermal Mass De
Isotropic Orthotropic Anisotropic Fluid Max in plane Shear Stress N/mm^2(MPa) Max in plane Shear Strain Tsal-Wu Interaction Coefficient (F12) X Y Z Unit Young's Modulus W W W W W N/mm Poisson's Ratio HB B B W/mm Thermal Expansion Coefficient B B W/mm Max Stress in Tension N/mm Max Stress in Compression N/mm Max Strain in Compression	Young's Poisson Shear M Shear M She

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

^

ss Density	7.92781e 🖲 kg/mm^3 🔽
erence Temperature	kg/m^3
erence remperature	kg/mm^3
ung`s Modulus	TABLE Blbf-sec^2/in^4
	Slugs/ft^3
sson`s Ratio	TABLE bm/in^3
aar Madulua	(m^3
ear Modulus	t/mm^3




Idealize Part

UGS PLM Software

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Idealize Part







Master 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



Idealize Part – Defeature Geometry



Idealize

Part

Idealize Part – Partition



Idealize Part – Midsurface



Idealize Part – Subdivide Faces



- Subdividing Faces
 - Intersection of Datum Planes
 - Intersection of Faces
 - Projected Curves and Edges
 - Projected Line between
 2 points

Idealize

Part

- Load/Restraint Application
- Local mesh control

Idealize

Part

Idealize Part – Additional Modelling



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

Sketch S Datum/Point June Curve from Curves June Curve from Curves Arc/Circle Cyrve from Bodies Unes and Arcs Dgsign Feature Basic Curves Associative Copy Chagfer Combine Bodies Bectangle Jrim O Polygon Qffset/Scale D glipse Detail Feature Eneral Conic Sugface Hyperbola Mesh Surface General Conic Sygeep Helig Flange Surface Curve Arc Taggent Tangent Arc Taggent Tangent Spline Spline Sheet Metal Feature Tix Spline Strid Spline Circle Tangent Tangent Strid Spline Circle Tangent Tangent	Ingert Format Tools As	semblies information Analy	/sis <u>P</u> references Wind <u>o</u> w <u>H</u> elp
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Idealize Part – Direct Modelling



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

Little End Moved







Bolt Holes moved

Idealize Part – Material Properties

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Naterials	×	3
Category	*	
Material 🔺	Category	
STEEL-ROLLED	METAL	
Materials Inherited		
STEEL	C:\Guywiiis\Demo_Stuff\NX5_CAE\NX5	
Name	STEEL-BOLLED	
Category	METAL	
Library Reference	14	
Isotropic Orthotropic	Anisotropic Fluid	
Pasio Structural		
Mass Density	7.85e-00 (m) kg/mm^3	
Reference Temperature		
Young`s Modulus	2.06e+00 (mN/mm^2(kPa))	
Poisson`s Ratio	0.3	
Shear Modulus	■ N/mm^2(MPa) ▼	
Stress/Strain	TABLE	
Thermal Expansion Coef	ficient 1.728e-0	
Filter	Any 🔽	
	OK Apply Back Cancel	
		-

Override Material

Master Part Material

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





UGS PLM Software

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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

A Mesh options
Model Tolerances
Small Feature (% of Element Size)
10.0
0
.0 20.0
Process Fillets
Fillet Pre-Processing
Fillet Type Inside Radius
Minimum Radius 0.0000
Maximum Radius 3.0000
Number of Elements per Quarter Round
3
1 20
Preview Fillets
OK Apply Cancel

NX CAE Topology – Geometric Abstraction and Meshing





















NX CAE Topology – Auto Heal

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🔪 Auto Heal Geometry 📃 🗙
Selection
Select Object (1)
Model Tolerances
Small Feature 1 mm
Process Fillets
Fillet Pre-Processing
Min Fillet Radius 0 mm 💽
Max Fillet Radius 3 mm 💽
Preview Fillets
OK Apply Cancel

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



Before Heal



After Heal

NX CAE Topology – Split Edge



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elect location on	Edge
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x 🔊 😵	
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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

Selection		^		_
🗸 Select ea	dge to match (1)		1	
* Select ed	dge to match with (0)			
Parameters		^		
	Project Switch			
Constant Tallana	1 1	mm 📮		



- 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 for one with the CAD surfaces
- Recover data for including in Mesh

NX CAE Topology – Mesh Updates





Simulation Navigator
Name
Stacket_fem 3
🕀 🗐 bracket_fem 3_i
🗄 🗹 Polygon Geometry
🖹 🖬 🐼 2D Collectors
🖮 🗹 ThinShell(1)

- 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 Tables M Image: Create Type PSOLID PSOLID Name PSOLID2 PSOLID Label 4 Create PCOMP Filter PBAR PBARL PBARL PBARL PBARL PBARL	 Physical Property is Solve Element dependant Family of Elements Material Reference 	Prand Physical Property Tables M > - X Create Type Name Label Filter Filter
Nam e Nam e PBEAM PBEAML PBUSH Label < A01 · Distort = Filter Selection	 Commonly referred to as Often used to identify different parts in an Assembly 	Selection
Name Label Type PSOLID1 1 PSOLID PSHELL1 3 PSHELL Image: Im	PBUSH1 Name PSOLID Name Image: Paulit integration Name PSOLID2 Name Label 4 Abel Label Image: Paulit integration N/mire Ping Name Integration N/mire Material Integration Name Integration N/mire Stress Output Location Default Material Integration N/mire OK Cancel Default Name PBEAM Integration Trans Name PBEAM Integration Fiber Name PBEAM Integrating <t< th=""><th>IELL PSHELL2 PSHELL2 in e Strain al 1 Inherited Ca al 2 Use Material 1 Ca al 3 Use Material 1 Ca al 4 None Ca it Thickness mm · • ng Coefficient of Inertia Ratio 1 · • verse Shear Thickness Ratio 0.833333 · ructural Mass 0 kg/r-• Distance, Z1 mm · • Distance, Z2 mm · •</th></t<>	IELL PSHELL2 PSHELL2 in e Strain al 1 Inherited Ca al 2 Use Material 1 Ca al 3 Use Material 1 Ca al 4 None Ca it Thickness mm · • ng Coefficient of Inertia Ratio 1 · • verse Shear Thickness Ratio 0.833333 · ructural Mass 0 kg/r-• Distance, Z1 mm · • Distance, Z2 mm · •

Material

Nonstructural Mass, End A

Nonstructural Mass, End B

OK Cancel

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Inherited

OK

Mesh Collectors

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Mesh Collector	ی – ۲
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Properties	Bar Collector Beam Collector Rigid Link Collector
Physical Property Type PBAR	Two dof Spring Collector PROD PBUSH
Name PE	SARI
ОК	Apply Cancel

Mesn Colle	ctor	
Element Topol	ogy	
Element Family	2D	
Collector Type	ThinShell	
Properties		
Physical Prop	erty	~
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Name	PSHELL1	
Name	ThinShell(1))
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Mesh Collecter Topol Element Family Collector Type Properties Physical Prop Type Name Name	Ctor ogy 3D Solid Perty PSOLID PSOLID1 Solid (1)	

- 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



JD Mest	,	
ype		CTETRA(10)
	Equivalent	Elements
Destinatio	on Collector	
Automat	tic Mode	

Mesh Collectors



Simulation Navigator	ß
Name	
🗃 anti_roll_fem 1	
🗄 🗹 Polygon Geometry	
🚊 🖬 🌮 Mesh Controls	
🗹 Edge Density	
🖻 🗹 🔪 1D Collectors	
🕀 🗹 Rigid Link Collector(1)	
₩ 1d_mesh(1)	
₩ 1d_mesh(2)	
Id_reflected_mesh(1)	
SPRING-SHOCK	
😑 🖬 🖗 2D Collectors	
⊡ 🗹 ThinShell(1)	
- ∑ 2d_mapped_mesh(1)	
2d_mesh(2)	
M M 3D Collectors	
⊖ M BAR	
→ 3d_extruded_mesh(1)	
✓ 3d_extruded_mesh(2)	
M 3d_extruded_mesh(3)	
M 3d_extruded_mesh(4)	
M 3d_extruded_mesh(5)	
M 3d_extruded_mesh(6)	
M 3d_extruded_mesh(7)	
→ 3d_reflected_mesh(1)	
M 3d_reflected_mesh(3)	
M 3d_mesh(2)	
→ M 3d_reflected_mesh(2)	
m M ∋a_mesh(I)	
🛨 M BUSHING	

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



3613		
Туре		
Node set		
Element set		
Name 🔺	Label	
🌐 Elm Set_1	1	
🗰 Elm Set_2	2	
🗰 Elm Set_3	3	

		1
ОК	Apply	Cancel

N Sets	ఎ – ×
Type Node set Element set	
Name 🔺	Label
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🗰 NodeSet_2	2
🗰 NodeSet_3	3
	Cancel

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Strain Stra	in Energy	Stre	ess	Velocity	
Displacement	Force		Grid F	Point Force	
Enable DISPL	ACEMENT Re	quest			
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Output Medium		PLOT			
Data Format REAL					
Random Function	ns	None			
Entity Selection	on				
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		_			
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- 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

<u>ა – x</u>

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Cancel

2 🔷 📃 Offset

Apply

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	Append Fem
100	Source Fem
1114	Loaded Fem bracket_fem 1
	String to prepend fem object names
	bracket_fem1
	ID Specification
	Node 1037 🗢 Offset
	Element 444 S Offset

Physical (PID)

OK

Simulation Navigator
Name
🕮 block_fem 1
man block_fem1_i.prt
🗄 🗹 Polygon Geometry
🚊 🗹 🐼 2D Collectors
🖻 🗹 bracket_fem 1_2d_mesh(1) Container
✓ bracket_fem1_2d_mesh(1)
🖻 🖬 🌆 3D Collectors
🖮 🗹 3d_mesh(1) Container

- 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

		lbf-ft			
Select solver NX THERMAL / FLOW NX THERMAL / FLOW NX SPACE SYSTEMS THERMAL NX ELECTRONIC SYSTEMS COOLING NX NASTRAN DESIGN MSC NASTRAN ANSYS ABAQUS IDEAS UNV	NASTRAN Solver Input File Units mN-mm File Type ASCII	IDI-IC kg-m poundal-ft mN-mm CN-cm Ibf-in kg-mm N-mm ation_1.dat Browse nced Options Ict Browse	e	 Import of from an E Units s incomi 	i E n
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File Type ASCII binary Input File ANSYS Version 9.0 New FEM File B New SIM File	wse Import Sim ABAQUS Solver Input File Units File Type o ASCII	ulation mN-mm	×		
<u>ок</u>	Cancel Input File	<	Browse Browse Browse	Import Simulation I-DEAS UNV Solver Input File [0_Stuff\air_geot.un	1

New

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

×

Browse.

Browse ...

Cancel

Mesh Connections – Mesh Mating



Name

Mesh Mating Conditions	×
Creation Method	^
Auto Create	
Selection	^
Select faces/bodies (0)	
Parameters	^
Mesh Mating Type	
Face Search Option All Pairs	
Distance Tolerance 0.0254	mm 💽
Reverse Direction	*
Preview	V
OK Apply	Cancel

- 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

Simulation Navigator		
Name		
🕮 e2f_mating_fem1		
⊖ 🗖 e2f_mating_fem1_i		
e2f_mating.prt		
🗄 🗹 Polygon Geometry		
🗄 🗹 🎞 Connection Collectors		
🖮 🗹 🌏 EF Connection Collector(1)		
🦳 🗹 cn_mesh(2) - Side to Body		

Glue Meshes



Match Meshes



Mesh Connections – Edge Contact Mesh



Simulation Navigator

e2e_contact_fem 1
 e2e_contact_fem 1_i
 e2e_contact_fem 1_i
 e2e_contact.prt
 G Polygon Geometry

Polygon Body_1
 Polygon Body_2
 Polygon Body_2
 Polygon Collectors
 Polygon Collector(1)
 Polygon Body_2

Name



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

Element Attributes		<u> </u>		
Element Attributes		A		
Element Mesh				
* Specify Vector (0)				
Reverse Direction		4		
Cap	Value			
Initial Gap Opening	0	nn - 💽		
PreLoad	0	mN - 💽		
Axial Stiffness for Closed Gap	0	mN/1* 💽		
Axial Stiffness for Open Gap		N/m- 💽		
Transverse Stiffness When Gap Closed		N/m.		
Coefficient of Friction in Y	0	Flement Attributes		
Coefficient of Friction in Z			~	1
Maximum Allowable Penetration	0	Element Mesh		
Maximum Allowable Adjustment Ratio	100	Gap Tolerance No		
Minimum Allowable Penetration	0.001	Gap Tolerance Value		P
Set to default		Number of Elements	_	
[Ignore Midside Nodes Yes		
OK	Apply	Align Target Edge Nodes Yes		
		Target Edge Node Alignment Method Minimum Distance		~
		OK Apply	Cancel	

Mesh Connections – Surface Contact Mesh



🔪 Element Attributes 🍡 🕹) 💳 🗙 🔪 Element Attributes	<u>ວ</u> - ×
Element Attributes	Element Attributes	~
Element Mesh * Specify Vector (0) Reverse Direction Contact Type Standard Pre Load mN *	Element Mesh Gap Tolerance No Gap Tolerance Value 0.0 Number of Elements Ignore Midside Nodes	001 mm • • 2
Closed Contact Stiffness 2.06844 mN/i Open Contact Stiffness 2.06844e mN/i Coefficient of Friction in Y 0 Coefficient of Friction in Z Maximum Penetration 0 mm •	Align Target Edge Nodes No Target Edge Node Alignment Minin Target Edge Node Alignment Minin	mum Distance 🔽
Set to default	Set to default	
OK Apply Canc	сеі ОК Ар	pply Cancel

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

Simulation Navigator
Name
🕮 Yoke Assy_fem 2
⊝ 🖅 Yoke Assy_fem2_i
🐨 🐨 Yoke Assy.prt
🗄 🗹 Polygon Geometry
🗄 🖬 🖬 Connection Collectors
🖮 🗹 🞣 Surface Contact Collector(1)
₩ cn_mesh(1)
… 🗹 cn_mesh(2)
└── 🗹 cn_mesh(3)

Meshing – Mesh Points





- Used to create specific location for a node, for example on an Edge or Face
- Point can Associative or Non-Associative 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

Mesh Point

Datum Coordinate Systems



No Selection Filter 🔽 🖶 - 🍬 🗇 🛸 🐂 😥 🖊 🔪 🕂 💽 🗘 🕂 🏈 Select objects to infer CSYS 🔪 CSYS 🥥 🗖 🗙 > Туре • Z ▼ 🐔 Inferred і́к к к **Object to Define CSYS** • .<u></u>+ * Select Object (0) Settings ~ Output CSYS Cartesian $\overline{}$ Associative Cartesian Cylindrical Spherical OK

- Datum Coordinate Systems
 - Cartesian

- Cylindrical
- Spherical

Mesh Size Selection

🔪 3D Mesh 🛛 🗙	N 2D Mesh X
Type	Type
Equivalent Elements	Meshing Method Subdivision 🔽
Destination Collector	Equivalent Elements
Automatic Mode	Destination Collector
Mesh Collector None 💌	Automatic Mode
	Mesh Collector
Overall Element Size 3.7700	
Draviaw	Filter Arry
Midnodes Mixed	Overall Element Size 2.5400
Maximum Jacobian 10,0000	Create Mesh Points
Mesh Options	Preview
Surface Mesh Size Variation	
	Mesh Options
Minimum Maximum	Edge Match 0.5080
Volume Mesh Size Variation	Midnades Mixed
50	Split Ouad
Minimum Maximum	Maximum Warp 5.0000
Mesh Transition	Maximum Jacobian 5.0000
	Mesh Size Variation
OK Apply Back Cancel	0
	0
	Min Max
	Attempt Mapping Fxport Mesh to Solver
	Mesh Transition
	Apply Back Cancel

- 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

N 3D Mesh	×
Туре	CTETRA(10)
Equiva	lent Elements
Destination Collec	tor
Automatic Mode	
Mesh Collector	None
Overall Element Size (3.7700
	Preview
Midnodes	Mixed 🔽
Max	kimum Jacobian 10.0000
Mes	sh Options
Surface Mesh Size Var	iation
	50
	-0
Minimum	Maximum
Volume Mesh Size Vari	iation
	50
	-0
Minimum	Maximum
Mesh Transition 🤇	i
OK Apply	Back Cancel

- 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

Nesh Options	د ا
Model Tolerance	s
Small Feature (% of	Liement Size)
10.0	F
.0	40.0
Merge Edges	
Vertex Angle	15.0000
Process Fillets	
Fillet Pre-Process	ing
Fillet Type	Inside Radius 🔽
Minimum Radius	
in reactors	
Maximum Radius	3.0000
Number of Element	s per Quarter Round
3	
_	
1	20
	dans Eillana
Prev	/lew Fillets
ОК	Apply Cancel

- 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

Nesh Control	×	Mesh Control	<u>ວ</u> =
Density Types		Density Types	/
Number on Edge		Size on Edge	
Selection	^	Selection	/
* Select Targets (0)	+	* Select Targets (0)	+
Number on Edge	^	Size on Edge	/
Number of Elements	15 🖨	Location on Edge Over	all 🔽
Auto Size	1	Element Size S	mm 💽
Preview		Auto Size	1
OK Apply	Cancel	Preview	1
	Cancer	OK Appl	Cancel
N Mesh Control	ఎ = x	()(
Density Types	~	N Mesh Control	- د
Chordal Tolerance on Edge		Density Types	
Selection	^	💺 Biasing on Edge	
* Select Targets (0)	-	Selection	
Chordal Tolerance on Edge	^	* Select Targets (0)	+
Tolerance 0.01	nn 🔸	Blasing on Edge	
Auto Size	1	Bias Origin Start	of Edge 🖉
Preview		Number of Elements	15
	Cancel	Bias Ratio	5
C OK CANNA (Cancer	Edge Fraction	
Nesh Control	ఎ = x	Auto Size	1
Density Types	~	Preview	
🔅 Size on Face		OK Appl	Cancel
Selection	^		
* Select Targets (0)	-		
Size on Face	^		
Element Size 5	mm 🔹		
Auto Size	1		
Preview	v		
	Cancel		

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



Simulation Navigator		
Name		
🗰 Yoke Assy_fem 1		
💬 🐨 Yoke Assy_fem 1_i.prt		
🕀 🗹 Polygon Geometry		
🖻 🖬 🌮 Mesh Controls		
- 🗹 Edge Density		
🔤 🗹 Face Density		

Mesh Controls



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

Meshing – OD Mesh



OD or Scalar Elements for Lumped or Distributed Mass

Simulation Navigator
Name
🕮 block_fem 6
⊝∘🗖 block_femδ_i
🐨 🖅 block.prt
🗄 🗹 Polygon Geometry
🖮 🗹 📲 0D Collectors
🚊 🗹 Concentrated Mass Collector(1
🗹 0d_mesh(1)
Ĵ

lement Attributes				
Element Mesh				
Mass	kg •	Ŧ		
Center of Gravity, X-Offset	mm	٠		
Center of Gravity, Y-Offset	mn •	•		
Center of Gravity, Z-Offset	mm •	•		
Mass Moment of Inertia, Ixx	kg-m •	•		
Mass Product of Inertia, Iyx	kg m +	•		
Mass Moment of Inertia, Iyy	kg-m •	٠		
Mass Product of Inertia, Izx	kg-m •	٠		
Mass Product of Inertia, Izy	kg m +	•		
Mass Moment of Inertia, Izz	kg-m •	٠		
CSYS Options	Basic CSYS	-		
Set to default				

Element Attributes vary according to the Solver Environment & Element Type

Meshing – 1D Element Cross Sections

Standard Cross Sections	User Defined Properties
Section Name SECTION 000	Section Name SECTION_000
Thin I Beam	Area Area Area Area Area Area Area Area
b - Breadth	Moment of Inertia, Iyz Torsional Constant, K Warping Constant, Cw
t - Thickness tw - Thickness b and h measured to center of thickness	Y-Eccentricity, Yecc

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

User Defined Sketch		
Section X		
Section Name SECTION_000		
User Defined Thin Wall		
Selection Steps		
Filter Curve 💌		
OK Apply Cancel		

×	User Defined Solid Face		
	Section Name SECTION_000		
	User Defined Solid		
	Selection Steps		
9	Filter Face V		
	OK Apply Cancel		

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

x	N Element Attributes J = X	N Element Attributes 🛛 🗖 🗙	🔪 Element Attributes 🛛 🗸 🗮 🗙
	Element Attributes A	Element Attributes A	Element Attributes A
Values V	Element Mesh DOF1 Fixed V DOF2 Fixed V DOF3 Fixed V DOF4 Fixed V DOF5 Fixed V	Element Mesh Element Orientation	Element Mesh Spring Type Translation V Stiffness N/mir Component End A X V Component End B X V
	DOF6 Fixed Set to default OK Apply	Setto default.	Set to default

Specifie

Set to default.

nn 🗭

Element Attributes vary according to the Solver Environment & Element Type

Meshing – 1D Mesh – Element Attributes

	N
Δ	Na
\sim	Lat
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139	No
	No
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AT I	Na
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	No
	No
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PBEAM	ు – x
ne	PBEAM1
oel	2
ction	Constant 🔽
ore Section	SQR_SECTION_001 🔽 📲
terial	STEEL 🔽 🏹
nstructural Mass, Er	nd A 🛛 kg/m 🗕 🖶
nstructural Mass, Er	nd B 🛛 kg/rr 🔸
OK	Apply Cancel
	<u> </u>
ГБЕАМ	
me	PBEAM1
pel	2
ction	Tapered 🔽
ore Section	SQR_SECTION_001
ft Section	SQR_SECTION_002
terial	STEEL 🔽 🏹
nstructural Mass, E	nd A 🛛 kg/rr 🗸
nstructural Mass, E	nd B 0 kg/rr 🗣
ОК	Apply Cancel

1D	Element	Cross
Se	ctions	

Element Attributes		
lement Attributes		^
Element Mesh		
Orientation and Offsets	Specified Values	
Orientation Vector * Spe	cify Vector (0) 💶 📫	1
Reverse	Direction	1
End A Offset		íl
X (along beam)	0 mm 💽	II
Y (along orientation)	0 mm 💽	II
Z (sideways)	0 mm 💽	II
End 8 Offset		il
X (along beam)	0 mm 🔶	II
Y (along orientation)	0 mm 🐳	н
Z (sideways)	0 mm 🔶	ll
Z (sideways)	0 mm 🗣	
Z (sideways) Set to c	0 mm 🗣	
Z (sideways) Set to d	0 mm	
Z (sideways) Set to c OK-	efault Apply Cancel	
Z (sideways) Set to c OK Element Attributes Element Attributes	efault Cancel	
Z (sideways) Set to c OK Element Attributes Element Attributes Element Mesh	Cancel	
Z (sideways) Set to d OK- Element Attributes Element Attributes Element Mesh Element Orientation	Comm	
Z (sideways) Set to d OK Element Attributes Element Attributes Element Mesh Element Orientation	lefault Cancel	
Z (sideways) Set to c OK Element Attributes Element Attributes Element Orientation Uniaxial * Specify Vector (0)	efault Apply Cancel	
Z (sideways) Set to c OK Element Attributes Element Attributes Element Mesh Element Orientation Uniaxial * Specify Vector (0) Breverse Direction	efault Cancel	
Z (sideways) Set to c OK Element Attributes Element Attributes Element JMesh Element Orientation Uniaxial * Specify Vector (0) Reverse Direction Venable CS Override	Cancel	
Z (sideways) Set to d OK- Element Attributes Element Attributes Element Orientation Uniaxial * Specify Vector (0) Reverse Direction @ Enable CS Override * CS Override	efault Apply Cancel	
Z (sideways) Set to d OK Element Attributes Element Attributes Element Orientation Uniaxial * Specify Vector (0) Reverse Direction * Enable CS Override * CS Override	efault Apply Cancel	

Apply Cancel

- 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

Meshing – 2D Dependant Mesh



🔪 2D Dependent Mesh 🛛 🗸 🗮 🗙	
Туре	
Type Symmetric	
Select Master and Target Face	
Select Master Face (1)	
Select Target Face (1)	1
Match Loops	
Y Select Master Edge (1)	
✔ Select Target Edge (1)	
Flip Direction	
List 🔨	
Direction	
✓ Specify CSYS	
Mesh Type	
Mesh Type 🔗 Free Mesh 🔽	
OK Cancel	
	4



- 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



Meshing – 2D Mapped Mesh



Solver Environment & Element Type

Meshing – 2D Mesh

N 2D Mesh	X 2D Mesh X
Туре	Type
Meshing Method Subdivision	Meshing Method Subdivision
Equivalent Element Subdivision	Equivalent Element Subdivision
Paver Paver	Paver Paver
Automatic Mode	Automatic Mode
Mesh Collector	Mesh Collector
Filter Any	Filter Any
Overall Element Size 1.0000	Overall Element Size 1.0000
Create Mesh Points	Create Mesh Points
Preview	Preview
Mesh Options	Mesh Options
Edge Match 0.50	30 Edge Match 0.5080
Midnodes Mixed	Midnodes Mixed 🔽
Split Quad	Split Quad
Maximum Warp 5.00	00 Maximum Warp 5.0000
Maximum Jacobian 5.00	00 Maximum Jacobian 5.0000
Mesh Size Variation	Mesh Size Variation
0	0
0	- 0
Min	Max Min Max
Attempt Mapping	Attempt Mapping
Export Mesh to Solver	Export Mesh to Solver
OK Apply Back Cance	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





	Element Attributes	ა		×
E	lement Attributes		^	^
ſ	Element Mesh			≡
	Shell Offset 2 mm -	¥		
	Ignore Midsurface Thickness			~
	OK Apply Ca	anc	el	

Meshing – 2D Mesh Seeding for 3D Mesh

N 2D Mesh	×
Туре	
Meshing Method	Subdivision
Equivalent Elem	ents
Destination Collector	
Automatic Mode	
Mesh Collector	None 💌
Filter Any	
Overall Element Size 18.20	00 🖌
Create Mesh Po	ints
Preview	
Mesh Option	\$
Edge Match	0.5080
Midnodes	Mixed 🔽
Split Quad	
Maximum	Warp 5.0000
Maximum Jac	obian 5.0000
Mesh Size Variation	
0	
0	
Min	Max
Export Mash to Solver	
Mesh Transition	
OK Attempt Mapping	1
Export Mesh to S	olver
Mesh Transition	
	Back





- 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



Meshing – 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



Meshing – 3D Swept Mesh



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

- Simulation Navigator Name 🛱 block femõ 🕀 🗖 block_fem6_i 🗄 🗹 Polygon Geometry 🗄 🗹 🌮 Mesh Controls 🗄 🗹 🐼 2D Collectors 🗄 材 ThinShell(1) ✓ 2d_mesh(1) ThinShell(2) 2d_mesh(2) 🗄 🗹 爘 3D Collectors 🖮 🗹 Solid(1) ✓ 3d_mesh(1) . ⊢. ✓ Solid(2) ✓ 3d_mesh(2)
- 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
- Swept Mesh starts with these Seed meshes

Meshing – Solid from Shell Mesh



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

Meshing – 3D Tetrahedral Mesh

Туре	CTETRA(10)			
Equivalent El	ements		CF.	
Overall Element Size 3.	8400	al	AT	The
Previe	w	100		AC 12
Midnodes	Mixed 🔽	A CONTRACTOR		X
Maximum	Jacobian 10.0000		CALLER .	TV
Mesh Opt	ions			
Surface Mesh Size Variation		ZC		XLAN
50			XCAL	
Minimum	Maximum			and the
Volume Mesh Size Variation				
50				
Minimum	Maximum			
Mesh Transition	Plazantan			

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

Meshing – 3D Tetrahedral Mesh





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

Meshing – Node Create



▼ + 0 0 * * № / / 1 + 0 0 + / 3

< 🔪 Node Create	ఎ - x >		
Specify Label			
Label		1065	
Location		~	
CSYS		Λ	
CSYS Type	Global		
Y Specify Point (1)	(<u>.</u>	∕	
x	-17.5327 m	n 💽	
Y	-8.21022 m	n 💽	
z	-53.7299 m	n 💽	
Displacement CSYS		~	
CSYS Type	Global		
ОК	Apply C	ancel	

 Location & Displacement by Global or Selected CSYS

Node Create	<u>ວ</u> -
Specify Label	^
Label	1065
Location	•
CSYS	٨
CSYS Type	Cylindrical 🔽
* Specify CSYS	
Specify Point (1)	L.
R	-17.5327 mm 🔻
Theta	0 deg 🗲
z	-53.7299 mm 🔻
Displacement CSYS	•
CSYS Type	Cylindrical 🔽
* Specify CSYS	
ОК	Apply Cancel

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

123 🗤 🛛 XYZ

Meshing – Node on Curve/Edge





123 🗤 XYZ

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

Meshing – Node Translate

Node Translate	ు - ×
Туре	^
Translate	
Nodes to Translate	•
🞸 Select Node (1)	→
Selection Method	Graphic Selection 🔽
Translation Method	d A
By Distance	Along Direction
CSYS	^
CSYS Type	Global
DX	1 mm 🗣
DY	0 mm 💽
DZ	0 mm 💽
ОК	Apply Cancel

Node Translate	
Туре	A
Copy and Translate	
Nodes to Translate	^
🞸 Select Node (1)	+
Selection Method	Graphic Selection
Number of Copies	A
Specify Number	4
Translation Method	A
By Distance	Along Direction
Specify Direction	^
🗸 Specify Vector (1) 💽 🗾 🔽
Reverse Direction	*
Distance Per Copy OTo	tal
Distance	15 mm 💽
Specify Label	~
Label Options	Label/Increment
Label	3
Increment	1
Displacement CSYS	~
CSYS Type	Global
	Anniv Concol

' ×	Node Translate J - X
^	Туре
2	Translate
~	Nodes to Translate
	✔ Select Node (1)
•	Selection Method Graphic Selection Graphic Selection
^	Translation Method By Face
4	By Distance Along Direction By Mesh
^	Specify Direction By Element By Feature Face
	Specify Vector (1)
	Reverse Direction
	Distance 15 mm
]	

** ** ** ** ** ** ** ** *** ***

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

Meshing – Node Rotate

Node Rotate 🕥 🗖 🗙
Туре 🔨
Rotate
Nodes to Rotate
✓ Select Node (1)
Selection Method Graphic Selection 🔽
Axis of Rotation
✓ Specify Vector (1)
Reverse Direction
♥ Specify Point (1)
Rotation Angle
Angle -30 deg 🗣
OK Apply Cancel

: ; ;	* * * * *		° * ↓ *	*	* z ×	123	* x`	yz S
	Node Rotate		.	- x				
	Туре			_				
	Copy and Rotate							
	Nodes to Rotate			^				
	Y Select Node (1)		-	\				
	Selection Method	Graphic	Selection	G	raphic Selecti / Edge	on		
	Number of Copies			AB	/Face			
	Specify Number		5	By	/Body /Mesh			
	Axis of Potation		· · ·	B	Element			
	AXIS OF ROLATION				/ Feature Face / Node ID			
	Y Specify Vector (1))						
	Reverse Direction			1				
	Specify Point (1)		£.					
	Rotation Angle			^				
	Per Copy OTo	otal						
	Angle	-30	deg					
	Specify Label			^				
	Label Options	Label/In	crement					×
	Label			3				
	Increment			1				
	Displacement CSYS			•				
	CSYS Type	Global						
	ОК	Apply	Cance				*	

Node Rotate/Copy

i

- Multiple Selection Methods
- Displacement by Global or Selected CSYS



Meshing – Node Reflect



Meshing – Node Drag

🖎 Node Drag		_ ວ = x
Туре		~
Off Geometry		
Display Element	Quality Indicat	or A
Quality Check	None	
	(Close



 Node Dragging Off Geometry

123 XYZ

 Drags in a plane parallel to screen through start node location



Meshing – Node Drag



Node Drag		_ ఎ = ×
Туре		^
Along Geometry		
Display Element	Quality Indicato	or A
Quality Check	None	
	E	Close





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





Meshing – Node Align



Node Align		ວ =	5
Define Alignment Lir	ne	~	
🞸 Select Nodel (1)			
🞸 Select Node2 (1)		¢	
Select Nodes to Alig	jn	^	
🖋 Select Node (8)			
Selection Method	Graphic Select	tion 🔽	Graphic Selection
ОК	Apply C	ancel I	By Edge By Face By Body By Mesh
		8	By Element
		E	By Feature Face
		E	3y Node ID

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



Meshing – Node Displacement CSYS

*****	*** *** 🛃 ***
 ▲ Assign Nodal Displacemen J = X Assign to specified node or geometry ▲ ✓ Select Object (1) 	 ▲ Assign Nodal Displacemen → Assign to specified node or geometry ✓ Select Object (1)
Coordinate System Type Global Local Specify Coordinate System	Coordinate System Type Global Local Specify Coordinate System
* Specify CSYS	Specify CSYS
Geometry Rules Interior Nodes Only Boundary Nodes Only Interior and Boundary Nodes 	Geometry Rules Interior Nodes Only Boundary Nodes Only Interior and Boundary Nodes
OK Apply Cancel	OK Apply Cancel

Assign Nodal Displacement Coordinate System

i ^Y x

Cartesian

123 XYZ

- Cylindrical
- Spherical
- Pre-Existing or Created on-the-fly
- Select Nodes by
 - Edge
 - Face
 - Body
 - **Individual Selection**

Meshing – Node Re-Numbering

Node Modify La	bel J	- ×
Nodes to Modify		^
🗸 Select Node (6)	-	→
Selection Method	Graphic Selection	Graphic Selection
New Label		By Edge
Label Options	Label/Increment	By Body By Mesh
Label	5	00 By Element
Increment		By Feature Face 1 By Node ID
ок (Apply Cance	1

No.

Modify Node Numbering/Label

i ^v x

123 🕁

XYZ




Meshing – Node Modify Coordinates

*	*****	* ***	***	* ^z 2 ¹²³	🏂 🍾	

🔪 Node Modify Coordinates 🛛 🗸 🗖 🎗				×		
CSYS			~	∧ Global		
CSYS Type Global				Cartesian Cylindrical Spherical		
Nodes to Move			^	Spherical		
Select Node (3) Selection Method Craphic Selection		ଡ଼	Graphic Selection By Edge			
		ection	-	By Face By Body		
New Location			~	By Mesh		
×	50 mm		÷	By Feature Face		
Υ	-25	mm 🚽 By Node ID		By Node ID		
🗹 z	50	mm	•	📏 <u>M</u> easure		
ОК	Apply	Cance		= <u>F</u> ormula f(x) F <u>u</u> nction		
				<u> </u>		
				0		
				Make <u>C</u> onstant		

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

Meshing – Node Deletion

By Face

By Body By Mesh By Element By Feature Face By Node ID

Cancel

OK

Apply



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

i

Meshing – Node & Element Information





Label 158 : GLOBAL Displacement Csys Global coordinates : 50.0000 -3.5714 50.0000 Connected elements : 130 131 Label 500 Displacement Cays : GLOBAL Global coordinates : 50.0000 -25.0000 50.0000 Connected elements + 128 Label 502 Displacement Csys : GLOBAL Global coordinates : 50.0000 -17.8571 50.0000 Connected elements : 128 129 Label 503 Displacement Cays : GLOBAL Global coordinates : 50.0000 -10.7143 50.0000 Connected elements : 129 130

Node Information

123 👃 XYZ

- 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

Meshing – Element Create

🔪 Element Create 🛛 🕹 🗖 🗙	🔪 Element Create 🛛 🗸 🧮 🗙
Destination Collector/Mesh	Destination Collector/Mesh
Element Family OD	Element Family
Element Type	Element Type
Collector Concentrated Mass	Collector Beam Collector(1)
Destination Mesh	Destination Mesh CROD
OCreate New OAdd to Existing	Create New Add to Existing
Select Mesh Od_manual_mesh(1)	Select Mesh 1d_manual_mesh(1)
Nodes to Define Element	Nodes to Define Element
* Select Node (0)	* Select Node (0)
Label 🔨	Label A
Label 2	Label 2
Increment 1	Increment 1
Close	Close

 Element Creation attached to existing Nodes

- Mesh Collector selection or Creation on-the-fly
 - New Mesh
 - Add to Existing Mesh

Element Creation

Mesh Collector

New Mesh

Mesh

Nodes

on-the-fly

attached to existing

selection or Creation

Add to Existing

Meshing – Element Create

Element Create Image: Collector/Mesh Element Family 2D Element Type CQUAD4 Collector ThinShell(1) Image: Collector ThinShell(1) Destination Mesh CTRIA6 Create New Add to Existing Select Mesh 2d_manual_mesh(1) Nodes to Define Element Image: CQUADA * Select Node (0) Image: Close Label 3 Increment 1	Element Create Image: Check and a constraint of the cons

Meshing – Element Extrude

	Å
N Element Extrude J – X	
Elements to Extrude	
Selection Mode Edges	
Selection Method Graphic Selection Graphic Selection	
Select Elements (1)	
Number of Copies	
Number of Copies 1	
Extrude Options	
Method Along Vector	
* Specify Vector (1)	
Reverse Direction	
Distance	
Per Copy Total Selected Elements	
Distance 25 mm	
Twist Angle	
Specify Point (0)	
Angle O deg 🐳	
Destination Collector/Mesh	
Element Type CQUAD4	
Mesh Collector ThinShell(3)	
Destination Mesh	
Create New Add to Existing	
Label	
Preview V	
OK Apply Cancel	

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

Simulation Navigator		
Name		
📅 bracket_fem 1		
🖃 🗐 bracket_fem 1_i		
🐨 🐨 bracket.prt		
🕀 🗹 Polygon Geometry		
🖻 🖬 🐼 2D Collectors		
🚊 🗹 ThinShell(1)		
… ₩ 2d_mesh(1)		
₩ 2d_extruded_mesh(1)		

Meshing – Element Extrude

Apply

Cancel



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

Simulation Navigator		
Name		
🕮 bracket_fem 1		
🐨 🐨 bracket.prt		
🕀 🗹 Polygon Geometry		
🚊 🖬 🕅 3D Collectors		
🖻 🗹 Solid(1)		
🗄 🖬 🧭 2D Collectors		

Meshing – Element Revolve



 Revolves an Existing Element(s) Edge

- Mesh Collector selection or Creation on-the-fly
 - New Mesh
 - Add to Existing Mesh

Simulation Navigator		
Name		
🛱 bracket_fem 1		
🕞 🚍 bracket_fem 1_i		
🐨 🖅 bracket.prt		
🕀 🗹 Polygon Geometry		
🖻 🖬 🐼 2D Collectors		
🖮 🗹 ThinShell(1)		
₩ 2d_mesh(1)		
2d_revolved_mesh(1)		

Meshing – Element Revolve



 Revolve an Existing Element(s) Face

- Mesh Collector selection or Creation on-the-fly
 - New Mesh
 - Add to Existing Mesh



Meshing – 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

Simulation Navigator		
Name		
🕮 bracket_fem 1		
🗄 🗹 Polygon Geometry		
🗄 🗹 🖄 3D Collectors		
🖻 🖬 🧭 2D Collectors		
🖮 🗹 ThinShell(1)		
… ₩ 2d_mesh(1)		
✓ 2d_translated_mesh(2)		

Meshing – 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



Meshing – 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



Meshing – Element Copy & Reflect

123

XC



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

Simulation Navigator		
Name		
🕮 model1_fem1		
⊕ 🗐 model1_fem1_i		
🗄 🗹 Polygon Geometry		
🖻 🖬 🐼 2D Collectors		
ThinShell(1)		
🖹 🗹 ThinShell(2)		
✓ 2d reflected mesh(1)		

Meshing – Shell Split





Simulation Navigator		
Name		
🕮 bracket_fem 1		
💬 🐨 bracket_fem 1_i.prt		
🗄 🗹 Polygon Geometry		
🖻 🖬 🐼 2D Collectors		
🖹 🗹 2d_mesh(1) Container		
📈 🗹 2d_mesh(1)		

Splits Quadrilateral Multiple Elements

💠 Quad to 2 Trias
💸 Quad to 2 Quads
🔆 Quad to 4 Quads
🍄 Quad to 3 Quads
🛷 Quad to 3 Trias
🌾 Split by Line

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

Meshing – Combine Tris



Simulation Navigator
Name
🕮 bracket_fem 1
····· 🐨 bracket_fem 1_i.prt
🕀 🗹 Polygon Geometry
🖻 🖬 🐼 2D Collectors
🖻 🗹 2d_mesh(1) Container
₩ 2d_mesh(1)

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

Meshing – Move Node





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

Meshing – Element Re-Label

🔪 Element Modify Label 🛛 🔊 🗖	×
Element Labels to Modify	
Selection Method Graphic Selection 🔽	Graphic Selectio By Edge By Face
New Label	By Body By Mesh Feature Face
Label 100	By Element ID
Offset	
OK Apply Cancel	



Modify Element Numbering/Label



Meshing – Element Connectivity

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- Replace One Node with another Node
- Specific Mesh
 Connections

Meshing – Element Deletion







- Delete Elements
- Optionally delete
 Orphaned Nodes



Meshing – Node & Element Information





i Information	
Ele Edit	
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 ma	esh : 28
Number of nodes in the mesh	: 43
Quad4 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 Thickne	ess Ratio : 0.833333
Nonstructural Mass	: 0 kg/mm^2
Fiber Distance, Z1	: Not defined
Fiber Distance, Z2	: Not defined

Element Information

- ▶ Туре
- Mesh
- Collector
- Nodes
- Quality



Meshing – Mesh Unlock





 Unlock a Mesh for Manual Operations to be carried out

Model Checking – Element Shape

	Nodel Check X						
	Element Shapes 🔽						
•	Hide Input Meshes						
	List Failed Elements List All Elements						
	Threshold Values						
	Reset Display						
	Reselect Objects to Check						
	Display Failed Labels						
	OK Apply Back Cancel						

Results of Element Shape Check

Number failed

0 Number failed

0

0

0

verview

Elements

Check Aspect Ratio

Warp

Skew

Taper

Twist

Jacobian Ratio Jacobian Zero

Minimum Angle

Maximum Angle

Tet Collapse

 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	×
	Element Type	Quad4 🔽
Threshold —	Aspect Ratio	5.0000
Values set in Customer Defaults	Warp	5.0000
	Skew	30.0000
	Taper	0.5000
	Jacobian Ratio	5.0000
	Jacobian Zero	0.0000
	2D Min/Max Angle	45.0000
	_	135.0000
	Tet Collapse	0.0000
	Reset to Def	aults
	List	
	OK Apply	Back Cancel

		Thresh	old values						
	Aspect				Jacobian	Jacobian	Minimum	Maximum	Tet
Shape	Ratio	Warp	Skew	Taper	Ratio	Zero	Angle	Angle	Collapse
Tri3	5.000000	-N/A-	60.000000	-N/A-	5.000000	0.00000	20.000000	120.00000	-N/A-
Tri6	5.000000	-N/A-	60.000000	-N/A-	5.000000	0.00000	20.000000	120.00000	-N/A-
Quad4	5.000000	5.000000	30.000000	0.500000	5.000000	0.00000	45.000000	135.00000	-N/A-
Quad8	5.000000	5.000000	30.000000	0.500000	5.000000	0.00000	45.000000	135.00000	-N/A-
Tetra4	20.000000	-N/A-	-N/A-	-N/A-	10.000000	0.00000	-N/A-	120.00000	100.00000
Tetra10	20.000000	-N/A-	-N/A-	-N/A-	10.000000	0.000000	-N/A-	120.00000	100.00000
Hex8	20.000000	5.000000	100.00000	0.500000	30.000000	0.000000	45.000000	155.00000	-N/A-
Hex20	20.000000	5.000000	100.00000	0.500000	30.000000	0.000000	45.000000	155.00000	-N/A-
Wedge6	20.000000	5.000000	100.00000	0.500000	30.000000	0.000000	45.000000	155.00000	-N/A-
Wedge15	20.000000	5 000000	100 00000	0 500000	30.000000	0 000000	45 000000	155 00000	-N/7-

Number checked 10727

Worst value

-N/A-

-N/A-

-N/A-

-N/A-

-N/A-

43.554548

0.437397 -N/A-

5.702181

Model Checking – Element Outlines

×

	Nodel Check
8	Element Outlines 🔽
	🛃 Hide Input Meshes
	 Display Free Edges Display Free Faces
	Reset Display
	Reselect Objects to Check
	OK Apply Back Cancel

Element Outlines show the Free Element Faces or Edges





All Checks also available from the Navigator

Simulation Nav	vigator		
Name			
🌐 Yoke_fem 1			
⊕ 🖅 Yoke_fem	1_i		
🗄 🗹 Polygon C	Geometry		
🚊 🗹 🖄 3D Col	lectors	<hr/>	
🗄 🗹 Solid(2	2)		
🗹 3d	mech(1)		
	Edit		\land
	Rename		
	Delete		
	Edit Attributes		
	Check	×	Element Shapes
	Information		Element Outlines
	Show Tiny Edges		Duplicate Node
	Mesh Display Properties	, i	

Model Checking – Duplicate Nodes

100	Nodel Check X						
	Nodes						
× .	Tolerance 0.0010						
	Show Duplicate Nodes Merge Duplicate Nodes						
	Reset Display						
	Reselect Objects to Check						
	OK Apply Back Cancel						

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



Model Checking – Element Normals



Displays the Element Normals





SIM Part – Pre-Processing

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UGS PLM Software

Modeling Objects – Manager



Modeling Objects

<u>ა – x</u>

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Solution

E

Ŧ

None

999

Structural Outp Solution Parame

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

Referenced	Modeling
Objects	

Modeling Objects – Contact Set Parameters



Contact Set Parameters	ల – ు	<u>s</u>	
Name Co	ntact Set Parame		
Label	1		
Description		Constraint Function	
Contact Algorithm	Constraint Function	Rigid Target	
Contact Surfaces	Single-Sided	Single-Sided	
Penetration Depth	0	Double-Sided	
Birth Time	0 sec - 🗣	Eliminated	
Death Time	0 sec - 🗣	Eliminated/Print Penetrat	ting Nodes
Initial Penetrations	Eliminated 🔽	Ignored Overridden	
Continuous Segment Normal	Used for Single-Side	Used for Single-Sided C	ontact
Type of Offset	Use Value for Single	Used Not Used Use Value	for Single-Sided Contact
Default Offset	0 mm - 🗣	Use Value Half the Sh	for Single/Double-Sided Cont tell Thickness
Displacement Formulation	Default 🔽	Default	
Time to Eliminate Initial Penetrations	0 sec - 🗣	Small Displacement	
Consistent Contact Stiffness	Not Used	Not Used	
Contact Regions in Each Pair	Not Tied	Used	
Extension Factor	0.001		
Friction Model Type	0		
Delay Friction	No Delay	No Delay	
Parameter for Normal Constraint Function	1e-012	Delay	
Parameter for Frictional Constraint Function	0.001		
Compliance Factor	0		
ОК	Apply Cancel		

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

act

Modeling Objects – Strategy Parameters

Strategy Parameters	<u>ى</u>	- x		Strategy Param	neters		_		<u>ا</u> د
Name	trategy Parame	ter	,	Name		1	Strate	gy Paras	net
Label		2	1	Label		,		~ <u> </u>	_
Description			C	Description					
Multigrid Solver Equilibrium ATS Sch	ene LDC Sche	ne l		Multigrid Solver	Equilibrium	ATS So	hene	LDC Sch	en
TLA Scheme Contact Restart	Other Translat	on		TLA Scheme	Contact	Restart	Other	Transla	atio
Analysis Control Analysis Options	Time Integratio	n	IJ	Analysis Contro	Analysi	is Options	T	in e Integrat	ion
Solver to Use	Direct Sparse			Integration Order t-	Direction			0	_
Automatic Incrementation Scheme	Not used			Use Incompatible M	todes (CQUAD4)		Yes		
Positive Definite Matrix	Analysis may stop			Stiffness Matrix Sta	bilization		Not Us	ed	5
Mass Type	Consistent			Matrix Stabilization	Factor		1e-01	.2	1
				Element Death Time	e Delay		0	sec	
				Shell DOF Angle			5	deg	- 1
				Shell Drilling Stiffne	ess Factor		0.000)1	
1		_		u/p Formulation			Not Us	ed	
ок	Apply Can	el		Large Strain Formul	ation (CQUAD4)		ULJ (Rig	gid Target A	12
				Prescribed Displace	ements Option		Origina	al Configura	ti 🔹
Strategy Parameters	<u>ں</u>	- x		Prescribed Loads O	ption		Affecte	ed by Struct	n -
Name 3	trategy Parame	ter		Maximum Displacer	nent Limit		0	mm	-
Label		2	l	1			_		_
Description						ОК	Appl	y Car	nce
Multigrid Solver Equilibrium ATS Sch	ene LDC Sche	1e			_		_	_	_
Analysis Control Analysis Options	Time Integratio	n	R	Strategy Param	eters				5 1
TLA Scheme Contact Restart	Other Translat	on	Г	, ottatogy talan					-
Mode of Execution	Restart Analysis	-	1	4am e		I	Strate	gy Paran	aet
Solution Starting Time	o sec •	•	1	abel					_
Frequency of Saving Analysis Results	0	511	1	Description					
	(-			Multigrid Solver	Equilibrium	ATS Sc	hene	LDC Sch	en
				TLA Scheme	Contact F	Restart	Other	Transla	itio
ок	Apply Cano	e		Analysis Contro	Analysi	s Options	T	me integrat	ion
		_		Time Integration Me	thod		ADINA	composite	
				Newmark Alpha coe	fficient		0.25		
									_

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

ame			8	trateg	y Paramete
abel					
escription				(
Analysis Control	Ana	lysis Optic	ons	Tie	e Integration
Multigrid Solver	Equilibriu	m A	TS Sch	епе	LDC Schene
TLA Scheme	Contact	Restart		Other	Translation
Number of Sub-Group	ps				1
Stress-Strain Table E	xtension		(Extende	sd 🔽
Stress-Strain Table C	onversion		(No Con	version 🔽
Results Coordinate S	system		(Element	
Bolt Pre-Load Steps					1

OK Apply Cancel

Modeling Objects **SIEMENS** – Real Eigenvalue – Lanczos & Householder

1	1	9	5	
		1.4	1	
-		121		٦.
		E	-	
		1		
			-	-
			-	-

Pool Eigonvolue

Name	Real Eigenvalue -
Label	6
Description	
Frequency Options	٨
Frequency Range - Lower Limit	10 Hz 🔸
Frequency Range - Upper Limit	100 Hz 🛛 🛃
Number of Desired Modes	10
Extraction Data	^
Diagnostic Level	0
Number of Vectors	7
Estimate of the First Natural Frequer	icy Hz 🔹
Method for Normalizing Eigenvector	rs MASS
	OK Cancel

Real Eigenvalue - Househo	lder	ఎ − ×			
Name	Real Eige	nvalue -			
Label		6			
Description					
Frequency Options		~			
Frequency Range - Lower Limit	10	Hz 👻			
Frequency Range - Upper Limit	100	Hz 👻			
Number of Desired Modes	(10			
Extraction Data					
Method for Normalizing Eigenvectors MASS					
	ОК	Cancel			

- 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

1	1	2	2
	-	122	22
1	_		_
			-
	_	-	-

 Forcing frequent 	cies - Direct			
Name	Forcing Frequencie			
Label	6			
Description				
Frequency List	Λ			
Frequency List Form	FREQ1			
First Frequency	Hz 🔹			
Frequency Increment	nt Hz 🛛 🖶			
Number of Frequency Increments 1				
OK Cancel				

N Forcing Freque	encies - Mod	lal <mark>シニ</mark> ×		
Name	Forcing E	requencie		
Label		6		
Description				
Frequency List		•		
Frequency List Fo	rm FREQ5			
Lower Bound	0	Hz 👻		
Upper Bound		Hz 👻		
Fractions of the Natural Frequencies (1)				
OK Cancel				

- 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

SIEMENS



Modeling Objects – Time Step

17	1	
	6-	
	D	
	_	

N Time Step	J – X
Name	Time Step1
Label	6
Description	
Time Step Interva	A I
Number of Time Ste	eps 10
Time Increment	1 sec 🛛 🕹
Skip Factor for Out	put 1
	OK Cancel

Parameters to define a Time Step

Modeling Objects – Structural Output Requests

10085			
0	Name	Structure	1 Output
5	Label		
	Preview Output Rec	juests	Preview
	Enable All Output R	equests	Enable Al
	Disable All Output R	equests	Disable All
	Kinetic Energy	MPC Forces	SPC Forces
	Strain Strain	Energy Stress	Velocity
	Acceleration A	oplied Load Co	ontact Result
	Displacement	Force Crid	Point Force
	Enable DISPLA	CEMENT Request	
	Sorting	Default	-
	Output Medium	PLOT	-
	Data Format	REAL	-
	Random Function	s None	-
	Entity Selectio	n	^
	Entity	ALL	
	Node Set	None	
	J		
	OK	Annly	Cancel
) [(cancer
	Structural Out	put Requests	_ _ -
	Name	Structura	1 Output
	Label		
	Preview Output Req	uests	Preview
	Enable All Output Re	quests	Enable All
	Disable All Output R	equests	Disable All
	Acceleration	polied Load	untact Result
	Kinetic Energy	MPC Forces	SPC Forces
	Strain Strain I	nergy Stress	Velocity
	Displacement	Force Grid	Point Force
	Finable GPEOPO	F Request	
	Chable Offord	PERCENT OF	

Output Medium

Entity

Entity Selection

Structural Output Requests

<u>ວ = x</u>

Preview Enable All Disable All

 $\overline{}$

A 束

-

Cancel

PLOT

ALL

Apply

None

OK

Name	Structur	al Output
Label		1
Preview Output Reques	ts	Preview
Enable All Output Requi	ests	Enable All
Disable All Output Requ	ests	Disable All
		Usable All
Acceleration Appli	ed Load C	d Point Force
Strain Strain Ener	gy Stress	Velocity
Kinetic Energy M	PC Forces	SPC Forces
Enable EKE Reques	rt.	
Output Medium	PLOT	-
Energy	AVERAGE	-
Threshold		~
Threshold		
Threshold	0.001	-
Entity Selection		v
1		
OK	Apply	Cancel
ОК	Apply	Cancel
OK	Apply	Cancel
OK Structural Outpu	Apply TE Request	Cancel
OK Structural Outpu Name Label	Apply Apply Request Structur	al Output
OK Structural Outpu Name Label Preview Output Reque	Apply It Request Structur	al Output
OK Structural Outpu Name Label Preview Output Requer	Apply 1 Request Structur ats	al Output
OK Structural Outpu Name Label Preview Output Reque Enable All Output Reque	Apply Request Structur ats ests	Cancel s J = al Output Preview Enable All
OK Structural Output Name Label Preview Output Reque Enable All Output Requ Disable All Output Requ	Apply Request Structur ots ests pests	Cancel s 3 al Output Preview Enable All Disable All
OK Structural Output Name Label Preview Output Reque Enable All Output Reque Disable All Output Reque Acceleration Appl	Apply T Request Structur sts ests jests ied Load	Cancel s 3 al Output Preview Enable All Disable All
Structural Output Name Label Preview Output Reque Enable All Output Reque Disable All Output Reque Acceleration Appl Displacement F Visoris F Forame	Apply I ROCUESS Structur sts ests uests ied Load C orce Crit	Cancel al Output Preview Enable All Disable All Contact Result d Point Force SDC Executor
OK Structural Output Name Label Preview Output Reque Enable All Output Reque Disable All Output Reque Acceleration Appl Displacement F Kinetic Energy A Strain Strain Strain	Apply It Request Structur sts ests jests ied Load C Gri IPC Forces Try Strees	Cancel al Output Preview Enable All Disable All Contact Result d Point Force SPC Forces SPC Forces
OK Structural Output Name Label Preview Output Request Enable All Output Request Disable All Output Request Acceleration Appl Displacement F Kinetic Energy A Strain Strain Energy	Apply It Request Structur Sts Jests Jests Jests Jests Info Corce Gri MC Forces Typy Stres Strest	Cancel s J = al Output Preview Enable All Disable All Disable All Contact Result d Point Force S PC Forces s Velocity
OK Structural Output Name Label Preview Output Request Enable All Output Request Disable All Output Request Acceleration Appl Displacement F Kinetic Energy M Strain Strain Red Strain Strain Red Sorting	Apply It Request Structur Structur Sts Jests ied Load C force C IPC Forces rgy Stres suest Default	Cancel S Cancel al Output Preview Enable All Disable All Contact Result d Point Force SPC Forces s Velocity
OK Structural Output Name Label Preview Output Request Enable All Output Request Disable All Output Request Acceleration Appl Displacement F Kinetic Energy M Strain Strain Energy Strain Strain Rec Sorting Output Medium	Apply Apply Apply Structur Structur Structur Sts Sests Sests Sests Sests Default PLOT	Cancel al Output Preview Enable All Disable All Contact Result d Point Force SPC Forces s Velocity T
OK Structural Output Name Label Preview Output Reques Enable All Output Reque Disable All Output Reque Disable All Output Reque Acceleration Acceleration Acceleration Acceleration Comparing Cutput Medium Data Format	Apply Apply Apply Structur Structur Sts ests ests ied Load C force for PC Forces rgy Stres auest Default PLOT stal	Cancel al Output Preview Enable All Disable All Contact Result d Point Force SPC Forces s Velocity Contact Result
OK Structural Output Name Label Preview Output Reques Enable All Output Reque Disable All Output Reque Disable All Output Reque Acceleration Appl Displacement F Kinetic Energy Strain Strain Strain Strain Strain Output Medium Data Format Vield Cottention	Apply Apply Apply Structur Structur Sts ests ests ied Load C force for PC Forces rgy Stres auest Default PLOT REAL VONNIER	Cancel al Output Preview Enable All Disable All Contact Result d Point Force SPC Forces s Velocity Contact Result Contact
OK Structural Output Name Label Preview Output Request Enable All Output Request Disable All Output Request Acceleration Appl Displacement F Kinetic Energy M Strain Strain Energy Enable STRAIN Rec Sorting Output Medium Data Format Yield Criterion Blate Curporting	Apply Apply Apply Structur Structur Structur Apply Structur Structur Defsu PLOT REAL VONNISES STECLE	Cancel al Output Preview Enable All Disable All Contact Result d Point Force SPC Forces s Velocity Contact Result Contact
OK Structural Output Name Label Preview Output Request Enable All Output Request Disable All Output Request Acceleration Appl Displacement F Kinetic Energy M Strain Strain Energy Strain Strain Rec Sorting Output Medium Data Format Yield Criterion Plate Curvature Location	Apply	Cancel al Output Preview Enable All Disable All Contact Result d Point Force SPC Forces s Velocity Contact Result Contact
OK STRUCTURAL OUTPUT Name Label Preview Output Request Enable All Output Request Acceleration Appl Displacement Fixinetic Energy Strain Strain Strain Cotput Medium Data Format Yield Criterion Plate Curvature Location Data EveryInce	Apply	Cancel S Cancel al Output Preview Enable All Disable All Contact Result d Point Force SPC Forces S Velocity

🔪 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				
<u>File E</u> dit				
Information listing created by	:	gwills		
Date	:	26/04/2007 14		
Current work part	:	C:\GuyWills\E		
Node name	:	gbhitwills		
DISPLACEMENT (PLOT, REAL) = ALL				
SPCFORCES(PLOT, REAL) = ALL				
STRESS (PLOT, REAL, VONMISES, CENTE	ER)	= ALL		

Modeling Objects – Solution Parameters

Name Label A-B C-D E-F G-H I-J	Solutio	n Parameter	I-J IFP IFTM INP4FMT INREL IRES ITAPE	0	0 [-1 [-1	move	•	•	Solution Parameter Solver and Solution dependant Options shown for I	rs n Type NX Nastran	
K-L M-N O-P Q-R	6				11		•	•	See Quick Referen for details	ce Guide	
Q RANREAL RESLTOPT	0						B NX Nastran Qu Ble Edit Yew C · O ·	rick Refe Fgyorites	erence Guide - Microsoft Internet Explorer 1 Tools Beb 2 🏠 🔎 🔆 🤣 🖉 🍰 3 🗳 1	Coogle C	tings •
RESVSALT	NO						¥I II Q ≝	•	NX Nast	ran Quick Reference Guid	le
RESVINER	NO						Parameter	Desc	riptions		1
RESVPGF RESVSE	1e-006 NO	↓↓↓					Parameters are u values are specific entry, see <u>PARA</u> PARAMeter name applicability in the	ised exter ed on PA M. For m es and th e structur	ensively in the solution sequences for input of scalar values and for req ARAM Bulk Data entries or PARAM Case Control commands. For mo- more information on the PARAM Case Control command, see <u>PARAM</u> , heir functions is given in this section. <u>Table 7-2</u> and <u>Table 7-3</u> at the en- red and unstructured solution sequences, respectively.	uesting special features. Parameters re information on the PARAM Bulk Data A complete alphabetical list of d of this section summarize parameter	
RESVSLI	YES						ACOUT		Default = PEAK		
RESVSO	YES								ACOUT specifies the type of output to be used with the FORC fluid-structural analysis (see <u>"Performing a Coupled Fluid-Strue</u> Guide) ACOUTERING sequents motion and use output	E Case Control command in coupled ctural Analysis" in the NX Nastran User's	
RMSINT	LINEAR								To obtain sound pressure level in units of dB and dBA given by	y the FORCE command, a peak reference	e
RMXTRAN	NO								pressure must be specified with PARAMI, PREPUB. The dB is	iver is cented as:	
ROTCSV] 🖪							au = 20 · log(PREFD)	5	
ROTGPF							ACSYM		Default = YES		
RPOSTS1 RSPECTRA	0	L •							By default, the dynamic equations for coupled fluid-struc symmetrized for efficiency. PARAM.ACSYM.NO reques formulation which involves no symmetrization and will re "formulation of Dynamic Ecuations in SubDMAP GMA"	cture analysis in frequency response are its the pre-MSC Nastran Version 69 quire more CPU time. See the in the NX Nastran User's Guide.	
RSPRINT	0								If the iterative solver is selected (see the ITER=YES key the external work diagnostic will be different between AC	word on the NASTRAN statement) then SYM=YES and ACSYM=NO.	
S-T		1					ADPCON		Default = 1.0		
U-V		1					c		Initial penalty values used in contact an	nalysis are calculated automatically by	>
W-Z		1					Done			S My Computer	

Modeling Objects – System Cells



Name	System Cells2	
Label		6
1-50		^
BUFFSIZE(1)	1000	Permo
F06(2)	6	Remov
NLINES(9)	50	
MAXLINES(14)	99999999	Add
ECHO(19)		•
METIME(20)		•
APP(21)		•
MACHTYPE(22)		•
DIAGA(25)		
CONFIG(28)		₽
MESH(31)		₽
ADUM1(46)		₽
ADUM2(47)		₽
ADUM3(48)		₩ I I I I I I I I I I I I I
ADUM4(49)		₩ I I I I I I I I I I I I I
ADUM5(50)		
54.400		
51-100		V N
101-150		V
151-200		V
201-250		Y I
201.250		Y I
301-350		Y I
331-400		Y I
401-450		Y I
other		×
	OK Cano	el

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

© · ⊙ ⊌ :≣ Q	· R R 6 P	[*] Coogle C · · · · · · · · · · · · · · · · · ·
¥I≣ Q		NX Nastran Quick Reference Gui
	24 2	
	. 🛥	I •
NASIRA	4	
Executive	System Parameter Mo	dification
Specifies val	ues for certain Executive Syst	tem operational parameters called system cells.
FORMAT:		
NAST	RAN cellname1=expression1,	,, cellnamen=expressionn
or		
NAST	RAN SYSTEM(i)=expression1	1,, SYSTEM(n)=expressionn
DESCRIBER	5	Manalan
Des	riber	meaning
celln	amei	System cell names from Table 1-1.
SYS	TEM	Specifies the system cell number.
expn	Ission	See DEFINE statement for description.
i.		System cell number from Table 1-1
REMARKS:		
	The NASTRAN statements n statement may also be spec	nay appear anywhere in the File Management Section. The NASTRAN ified in Runtime Configuration (RC) files. See "Customizing the Runtime
1.	Configuration Files" in the M	X Nastran Installation and Operations Guide
1.	Configuration Files' in the M System cell values and their may also be set or values re module. See "PUTSYS. GET	X Nastran Installation and Operations Guide. associated cell names may also be set with the DEFINE statement. The turned with the DIMAP PUTSY's and GETSY's functions and the PARAM ISYS' of the NX Nastran DMAP Programmer's Guide.
Surface to Surface – Contact



Face Contact(1)	ు − ×
Name	V
Source Region	^
🖋 Select Object (2)	00
Excluded	V
Target Region	•
🗸 Select Object (2)	
Excluded	V
Swap Regions	V
Properties	•
Coefficient of Static Friction	
Min Search Distance	0 mm 🔽 🗣
Max Search Distance	1 mm 🔽 🗣
Source Offset	0 mm 🔽 🖶
Target Offset	0 mm 🔽 🖶
Target Contact Side	ТОР
ard Name BSURF/BSURFS	
ОК	Apply Cancel

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





Surface to Surface – Glue

Face Gluing(1)	ა -
Name	V
Source Region	
Y Select Object (2)	00
Excluded	V
Target Region	~
Select Object (2)	00
Excluded	V
Swap Regions	V
Properties	^
Search Distance 1 mm	
Penalty Value 100000	
Source Contact Side TOP	
Card Name BGSET	
OK Apply	Cancel

- 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

	N Force	x = x	N Force
	Туре	^	Туре
ALC: N	And the contraction Magnitude and direction		Components
	Name	V	Name
10	Model Objects to Create Force On	^	Model Objects to Create For
	Select Object (1)		🖋 Select Object (1)
	Excluded	V	Excluded
	Magnitude	^	Direction
	Force 1000 N	•	Coordinate System Global
_	Direction	•	Components
	🗸 Specify Vector (1)	2	Fx [100
🔔 ا	Reverse Direction	*	Fy 0
100	Distribution	^	
	Method Geometric distribution	at 💌	Distribution
· •	Card Name FORCE Total per Object Geometric distribution	rtion	Method Geometric
	OK Apply Can	cel	

V Force	<u>ວ = x</u>
Туре	^
🔩 Edge-Face	
Name	V
Edges on Face to Create Force	A no
Y Select Object (1)	8
Excluded	V
Associated face	^
Select Object (1)	
Components	^
Shear Force 100 N	
In Plane Force 50 N	-
Out of Plane For 0	•
Distribution	^
Method Total per Obj	ect 💌
Card Name FORCE	

× Force J = X			
Туре А			
Normal			
Name V			
Model Objects to Create Force On 🛛 🔺			
🗸 Select Object (1)			
Excluded			
Magnitude A			
Force 1000 N 💌 🚸			
Distribution 🔺			
Method Geometric distribut			
Card Name FORCE			
OK Apply Cancel			

ა – x

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- +

• •

distribut 💌

Cancel

ce On

- 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

I	

Moment 3 - >	د Noment 3 -
Туре А	Туре
Nagnitude and direction	Normal
Name A	Name
Moment(1)	Moment(1)
Model Objects to Create Moment On A	Model Objects to Create Moment On
♥ Select Object (1)	Select Object (1)
Excluded V	Excluded
Magnitude A	Magnitude
Moment 1000 N-mm	Moment 1000 N-mr 🗸 🔶
Direction A	Distribution
🗸 Specify Vector (1)	Method Geometric distribut
Reverse Direction	Card Name MOMENT
Distribution A	OK Apply Cancel
Method Geometric distribut	
Card Name MOMENT	Noment 3 -
OK Apply Cancel	Туре
	Components
Moment 3 - >	Name
Туре А	Moment(1)
🔩 Edge-Face	Model Objects to Create Moment On
Name	Select Object (1)
Moment(1)	Excluded
Edges on Face to Create Moment On 🛛 A	Direction
✔ Select Object (1)	Coordinate System Global
Excluded V	Components Cartesian
Associated face	Mx 10 Cylindrical Spherical
🗸 Select Object (1)	My 0 N-mm 🗸 🚸
Components A	Distribution
Shearmoment 1000 N-mm	Marked Comments for the
In plane moment 100 N-mr V	Geometric distribut
Out of plane mo 0 N-mr	Card Name MOMENT
Card Name MOMENT	OK Apply Cancel

ent On A +

- **Moment Load Options**
 - Magnitude and direction
 - Normal to selected faces
 - ► Mx, My, Mz Components relative to selected coordinate system
 - Shear, In/Out plane moment
- Managed in the Load Container



Loads – Pressure

Type Type Nomal pressure on 2D elements or 3D Name Pressure (1) Faces to Create Normal Pressure On Select Object (1) Excluded Pressure OK Apply Card Name Pressure (1) Faces to Create Normal Pressure On Select Object (1) Excluded Pressure OK Apply Card Name PLOAD4 OK Apply Card Name PLOES TO Create Pressure On Select Object (1) Excluded Ype Components Name Select Object (1) Excluded Ype Direction Card Name P/ OK Apply Card Name P/ Components P/ P/ OK Apply Card Name	-	N Pressure J = X	N Pressure J = X
Image: Normal pressure on 2D elements or 3D million Name Presoure (1) Faces to Create Normal Pressure On Image: Select Object (1) Imag		Туре А	Туре А
Name Name Pressure (1) Image: Select Object (1) Faces to Create Normal Pressure On Image: Select Object (1) Image: Select Object (1) Image: Select Object (1) <th>12</th> <th>Normal pressure on 2D elements or 3D</th> <th>Normal pressure on 2D elements</th>	12	Normal pressure on 2D elements or 3D	Normal pressure on 2D elements
Image: Select Object (1) Image: Select Object (1) Image: Select Object (1)		Name	Name V
Faces to Create Normal Pressure On V Select Object (1) Excluded V Magnitude V Pressure 1000 OK Apply Card Name PLOAD4 Name Name Pressure 10 Faces to Create Pressure On Name V Select Object (1) Excluded V Pressure (1) Select Object (1) Excluded V Properties A Cordinate System Clobal V Card Name PLOAD4 OK Apply Card Name PLOAD4 OK Apply <th>9</th> <th>Pressure(1)</th> <th>Faces to Create Normal Pressure On A</th>	9	Pressure(1)	Faces to Create Normal Pressure On A
Select Object(1) Excluded Pressure IOO Nagnitude OK Apply Card Name Pressure Object(1) Edges or Curves to Create Pressure Select Object(1) Excluded V Nume Card Name Rx ON N/nrive Rx ON/nr	N	Faces to Create Normal Pressure On A	🗸 Select Object (1)
Excluded Magnitude Magnitude Magnitude Pressure 1000 Name Name Card Name PLOAD4 OK Apply Card Name PLOAD4 OK Apply Components Name Pressure (1) Faces to Create Pressure On Faces to Create Pressure On Select Object(1) Direction Name Components Name Pr 0 N/m P OK Apply Card Name PLOAD4 OK Apply Card Name PLOAD1		Select Object (1)	Excluded V
Magnitude Pressure 1000 Name Name OK Apply Card Name PLOAD4 OK Apply Card Name PLOAD4 OK Apply Components Name Pressure (1) Type Faces to Create Pressure On Name V Select Object(1) Excluded V Direction Components Rx 1000 N/m Pz OK Apply Card Name PLOAD4 OK Apply Card Name PLOAD1		Excluded	Magnitude A
Magnitude A Pressure 1000 OK Apply OK Apply Card Name PLOAD4 Name Name Pressure		thereitude	Pressure 100 N/mr
Pressure 1000 N/mil • • • • • • • • • • • • • • • • • • •		Magnitude	Card Name PLOAD2
Card Name PLOAD4 OK Apply Cancel	P	Pressure 1000 N/m/ +	
OK Apply Cancel Name Components Pressure (1) Faces to Create Pressure On V Select Object (1) Direction Coordinate System Clobal Components Pr Card Name P.OAD4 OK Apply Cancel Off Apply Cancel		Card Name PLOAD4	OK Apply Cancel
Pressure Image: A pressure Type Image: A pressure Components Image: A pressure Preasure (1) Image: A pressure (1) Faces to Create Pressure On Image: A pressure (1) Excluded Image: A pressure (1) Excluded Image: A pressure (1) Direction Image: A pressure (1) Coordinate System Global Px 1000 N/mi Image: A pressure Px 1000 N/mi Image: A pressure Px 0 N/mi Image: A pressure Px 0 N/mi Image: A pressure Image: A pressure Image: A pressure Image: A pressur		OK Apply Cancel	
Name Pressure Name Pressure (1) Faces to Create Pressure On Select Object (1) Excluded V Select Object (1) Excluded V Select Object (1) Excluded V Oordinate System Global Px 1000 N/m Px 0 N/m Card Name PLOAD4 OK Apply Card Name PLOAD1	1.14		
Type Image: Components Name Image: Components Pressure (1) Image: Components Faces to Create Pressure On Image: Components V Select Object (1) Excluded V Direction Image: Components Px 1000 N/m Image: Components Px 0 Px 0 O N/m Pz 0 OK Apply Card Name PLOAD4 OK Apply Card Name PLOAD4 OK Apply Card Name PLOAD4		N Pressure J = X	N Pressure J = X
Components Name Pressure (1) Faces to Create Pressure On ✓ Select Object (1) Excluded Direction Coordinate System Global Components Px Px O N/m. Pz O OK Apply Card Name PLOAD4 OK Apply Card Name PLOAD4 OK OK Apply Card Name PLOAD4 OK OK Apply Card Name PLOAD4 OK OK </th <th>-</th> <th>Туре А</th> <th>Туре А</th>	-	Туре А	Туре А
Name Pressure (1) Faces to Create Pressure On V Select Object (1) Excluded V Direction Coordinate System Global Components Px 1000 N/m: Pz 0 N/m: Pz OK Apply <th></th> <th>Components</th> <th>No beams</th>		Components	No beams
Pressure (1) Faces to Create Pressure On ✓ Select Object (1) Excluded V Direction Coordinate System Global V 0 N/m Px 1000 N/m Pz 0 N/m Pz 0 N/m Pz 0 N/m Pz 0 0K Apply Card Name PLOAD4 OK Apply Card Name PLOAD1		Name	Name
Faces to Create Pressure On Image: Create Pressure On V Select Object (1) Image: Create Pressure On Excluded V Direction Image: Create Pressure On Coordinate System Global Image: Create Pressure On Components Image: Create Pressure On Px 1000 N/mi Image: Create Pressure On Card Name PLOAD4 OK Apply Card Name PLOAD1		Pressure (1)	Pressure (1)
V Select Object (1) Excluded V Direction A Coordinate System Global C Components A Px 1000 Py 0 N/m: A Pz 0 OK Apply Card Name PLOAD4 OK Apply Card Name PLOAD4 OK Apply Card Name PLOAD1		Faces to Create Pressure On A	Edges or Curves to Create Pressure A
Excluded V Direction A Coordinate System Global Scale Px 1000 Py 0 N/mr A Pz 0 OK Apply Card Name PLOAD4 Pz 0 N/mr Pz OK Apply Card Name PLOAD4 OK Apply Card Name PLOAD1		🗸 Select Object (1)	✔ Select Object (1)
Direction Coordinate System Global Components Px 1000 N/mr Py 0 N/mr Pz 0 N/mr Card Name PLOAD4 OK Apply Cancel Properties A Scale PR Scale PR Scale PR Scale PR Scale PR Scale PR Components Px 1000 N/mr Py 0		Excluded	Excluded
Coordinate System Global Components Px 1000 N/mr Py 0 N/mr Pz 0 N/mr Pz 0 N/mr Py 0 N/mr Pz 0 N/mr Pz 0 N/mr Py 0 N/mr Pz 0 N/mr Py 0 N/mr Pz 0 N/		Direction A	Properties A
Components A Px 1000 N/mr Py 0 N/mr Pz 0 N/mr Card Name PLOAD4 Py OK Apply Cancel		Coordinate System Global	Scale FR
Px 1000 N/m X2 1 V Py 0 N/m A Components A Pz 0 N/m A P 1000 N/m A Card Name PLOAD4 Py 0 N/m A P 2 0 N/m A OK Apply Cancel Card Name PLOAD1 Card Name Carden Card Name Card Name<		Components A	X1 0
Py 0 N/m P2 0 N/m P2 0 N/m P2 0 N/m P2 0 N/m P4 Cancel Card Name PLOAD1		Px 1000 N/mr -	X2 1 🖉 🗣
Pz 0 N/m P Card Name PLOAD4 OK Apply Cancel Card Name PLOAD1 Card Name PLOAD1 Card Name PLOAD1		Py 0 N/m 4	Components A
Card Name PLOAD4 Py 0 N/mr Pz 0 N/mr Card Name PLOAD1 Card Name PLOAD1 Card Name PLOAD1		Pz 0 N/m 💌 🔶	Px 1000 N/m -
OK Apply Cancel		Card Marco, D. O. D.	Py 0 N/m 🔍 🕸
OK Apply Cancel Card Name PLOAD1		Care Name PCOAD4	Pz 0 N/m 🔍 🗣
		OK Apply Cancel	Card Name - R (MD)
OK Apply Capacity			
OK Apply Cancel			OK Apply Cancel

- 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 🛛 💙 🗖 🗙			
Name			
Hydrostatic(1)			
Faces to Create Hydrostatic Pressur 🗚			
🗸 Select Object (1)			
Excluded			
Liquid Surface			
✓ Specify Vector (1)			
Reverse Direction			
♥ Specify Point (1)			
Properties A			
Liquid Density 1e-006 kg/m			
Gravitation Con: 9810 mm/:			
Surface Pressur 1000 N/mr 🗸 🗣			
Card Name PLOAD4			
OK Apply Cancel			

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





Loads – Gravity

<u>∔</u> 🛠	
-	

ر Gravity را Cravity	×	N Gravity 3 -	>
Туре	^	Туре	^
Magnitude and direction		Gravity	J
Name	\mathbf{N}	Name	
Gravity(1)		Gravity(1)	
Model to Create Acceleration On	\	Model to Create Acceleration On	
Select Object (0)		🗸 Select Object (0)	
Magnitude /	N	Direction	
Acceleration 9810 mm/		Coordinate System Global	
Direction	\mathbf{x}	Components Cartesian	
🗸 Specify Vector (1)		Ax 0 Cylindrical Spherical	
Reverse Direction		Ay 0 mm/:▼ ♥	
Card Name GRAV	1	A2 [-9010 [mm/!]	
OK Apply Cancel]	Card Name GRAV)



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	<u> ఎ</u> – ×
Name	^
Centrifugal(1)	
Model to Create Centrif	ugal Load On 🔥
🞸 Select Object (0)	
Direction	^
🗸 Specify Vector (1)	👥 ᡝ 🔽
Reverse Direction	1
Y Specify Point (1)	
Properties	^
Angular Acceler 1000	degr 🔻 🗣
Angular Velocity 0	degr 🔽 🗣
ard Name RFORCE	

Cancel

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



Loads – Constant Temperature



Temperature Load	ა - x
Name	^
Temperature(1)	
Model Objects to Assign Tempera	tu 🗚
🐓 Select Object (1)	
Excluded	V
Magnitude	^
Temperature 100 C	•
Card Name TEMP	
OK Apply C	ancel

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



Simulation Navigator
Name
🖶 block_sim 1
⊝ 🕮 block_fem 1
Block_fem1_i.prt
🕀 🗹 Polygon Geometry
🕀 🗹 🆄 3D Collectors
Simulation Object Container
🚊 🖬 🤁 Load Container
✓ O Temperature(1)
Constraint Container

Nodal Force Location

ø

	ForceLocation(1)	<u>ວ</u> – ×	
	ForceLocation(1)		
	Model Objects to Create No	dal For 🗚	
	Y Select Object (1)	↔	
	Degrees of Freedom	^	
	DOF1 💉 Nodal	Force 🔽	
	DOF2	Force	
2	DOF3		
	DOF4		
	DOF5 🖉 None		X/X
	DOF6 🖉 None		
	All None		
	All Nodal Force		
	Card Name USET1,U3		
	OK Apply	Cancel	

- 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



N User Defined Cor	nstraint りニメ	🔪 User De
Туре	•	Туре
SPC		SPC1
Name	^	Name
UserDefined(1)		UserDe
Model Objects to C	onstrain 🔨	Model Ob
Select Object (1)	→	🗸 Select
Excluded	V	Exclude
Direction	^	Direction
Displacement CSYS (Existing	Displacem
Degrees of freedom	•	Degrees
DOF1	📂 Displacement 🔽	DOF1
10	mm 🔽 🗣	DOF2
DOF2	🚰 Fixed 🔽	DOF3
DOF3	🚆 Fixed 🔽	DOF4
DOF4	🚰 Fixed 🔽	DOF5
DOF5	🚰 Fixed 🔽	DOF6
DOF6	🗙 Rotation 🔽	All Free
10	degr 🔽 🗣	All Fixed
All Free	e	Card Name
All Fixed		
Card Name SPC		
ОК	Apply Cancel	

Solution User Defined Co	nstraint 🛛 🗆 🗙
Туре	^
SPC1	
Name	
UserDefined(1)	
Model Objects to	Constrain 🔨
🖋 Select Object (1)	→
Excluded	V
Direction	•
Displacement CSYS	Existing
Degrees of freedor	n A
DOF1	Fixed
DOF2	🔊 Free 🔽
DOF3	🔊 Free 🔽
DOF4	🔊 Free 🔽
DOF5	🔊 Free 🔽
DOF6	Fixed 🔽
All Free	
All Fixed	
Card Name SPC1	
ОК	Apply Cancel

User Defined Constraints

 Free, Fixed or Displacement

- Cartesian, Cylindrical or Spherical coordinate system
- Managed in Constraint Container

Simulation Navigator	
Name	
Block_sim1	
⊡ 🕮 block_fem 1	
- @ block_fem1_i.prt	
🕀 🗹 Polygon Geometry	
🕀 🗹 🖄 3D Collectors	
Simulation Object Container	
🖙 🛱 Load Container	
🖻 🖬 🏣 Constraint Container	

Constraints – Enforced Displacement

A. 🕹	
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💺 🃚	
🍅 🏟	
1	

уре	^	Туре		
Magnitude and direction		Compo	nents	
Name	~	Name		
enforced(1)		Model Obj	ects to Cons	train
lodel Objects to Constrain	^	🗸 Select (Object (1)	
Select Object (1)	•	Excluded	ł	
Excluded	v	Direction		
rection		Displaceme	ent CSYS Exi	sting
		Degrees of	f freedon Car	ting tesian
Specify Vector (1)	-	DOF1	10 Cyl	indrical
arse Direction	*	DOF2	0 Spn	mm T
nitude	^	DOF3	0	
acement 10 mm 💌	•	DOF4	0	degr
ement Coordinate System	8	DOF5	0	degr
lame SPCD		DOF6	0	degr
OK Apply Cance	-	Card Name	SPCD	
			OK Ap	oply Ca
inforced Displacement Co J	- x			
ie	~			
Normal				
ie	^			
orced(1)	0			

+

V

nn 💌 🗣

Select Object (1)

Excluded

Magnitude

Displacement

Card Name SPCD

Displacement Coordinate System CORD2R

OK Apply Cancel

Enforced E	lisplacem	ent Co 🗟	x = x
Туре			~
Componer	nts		-
Name			V
Model Objec	ts to Cons	train	^
🗸 Select Obj	ject (1)		•
Excluded			V
Direction			•
Displacement	CSYS Exi	sting	
Degrees of f	reedon Car	ting tesian	- 1
DOF1	10 Cyl	ndrical	
DOF2	0	nn 🛛	
DOF3	0		
DOF4	0	degr	•
DOF5	0	degr	
DOF6	0	degr	•
Card Name SP	CD		_
ОК	A¢	ply Car	icel

- **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

Simulation Navigator				
Name				
🖶 block_sim 1				
⊝ 🕮 block_fem 1				
→ @ block_fem 1_i.prt				
🕀 🗹 Polygon Geometry				
🕀 🗹 🖉 3D Collectors				
Simulation Object Container				
🛛 🕀 Load Container				
🖹 🖬 🛱 Constraint Container				
₩ O Fixed(1)				
- ₩ O NoTrans(1)				

Constraints – Simply Supported



🔪 Simply Supported Constrai 🥥 💳 🗙	
Туре	
C Directed	
Name	
SimpleSupport(1)	
Model Objects to Constrain	
✓ Select Object (1)	
Excluded	
Select Object (0)	
Direction	
Specify Vector (1)	
Reverse Direction	
Displacement Coordinate System CORD2R	
Card Name SPC	
OK Apply Cancel	

🔉 Simply Supported Constrai 🥥 💳 🗙
Туре
Normal simply supported
Name A
SimpleSupport(1)
Model Objects to Constrain
Select Object (1)
Excluded 🔨
Select Object (0)
Displacement Coordinate System CORD2R Card Name SPC
OK Apply Cancel

- 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	ა = x
Name	^
(Pin(1)	
Cylindrical Face to Constrain	^
Y Select Object (1)	
Excluded	~
Y Select Object (0)	♦
Displacement Coordinate System CC Card Name SPC	RD2C
OK Apply	Cancel

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



Simulation Navigator
Name
🚰 block_sim 1
🕀 🌐 block_fem 1
- @ block_fem1_i.prt
🕀 🗹 Polygon Geometry
🕀 🗹 🌆 3D Collectors
🔤 🗹 🛱 Simulation Object Container
- 🗹 🚝 Load Container
🖻 🖬 🏣 Constraint Container

Constraints – Cylindrical

A. 🕹	
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4	
1	
3	

Name Cylindrical (1) Cylindrical Face to Constrain Select Object (1) Excluded Select Object (0) Components Radial Growth Select Object (0) Components Radial Growth Axial Rotation Axial Rotation Fixed Axial Growth Fixed All Free Axial Growth CORD2C Card Name SPC OK Apply Cancel	Cylindrical Con	straint 🥥 🗌 .
Cylindrical (1) Cylindrical Face to Constrain Cylindrical Face to Constrain Cylindrical Face to Constrain Components Components Components Components Cadial Growth Components Cadial Growth Cylindrical Cordinate System Component Componen	Name	~
Cylindrical Face to Constrain	Cylindrical (1)
 Select Object (1) Excluded Select Object (0) Components Radial Growth Displacement (2) mm (2) Axial Rotation (3) Free Axial Growth (2) (3) Fixed (4) (5) Fixed (1) (2) (1) (2) (2) (2) (3) (4) (4) (5) (5) (5) (6) (7) (7)	Cylindrical Face t	o Constrain
Excluded Select Object (0) Components Radial Growth 2 Axial Rotation Axial Rotation Axial Growth Axial Growth Axial Growth Axial Growth Axial Growth Axial Growth Axial Growth Corport CORD2C CORD2C CORD2C Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corport Corpor	🐓 Select Object (1) 🔁
✓ Select Object (0) Components Radial Growth 2 mm<	Excluded	٨
Components Image: Component status Radial Growth Image: Displacement status 2 mm Axial Rotation Image: Free Axial Growth Image: Fixed Axial Growth Image: Fixed All Free Image: Fixed All Fixed Image: Fixed Sisplacement Coordinate System CORD2C Image: Growth Image: Fixed Image: Growth Image: Fixed <t< td=""><td>🗸 Select Object</td><td>: (0)</td></t<>	🗸 Select Object	: (0)
Radial Growth Displacement 2 mm Axial Rotation Image: Free Axial Growth Image: Fixed All Free Image: Fixed All Fixed Image: Fixed Splacement Coordinate System CORD2C ard Name SPC	Components	^
2 mm mm Imm Imm </td <td>Radial Growth</td> <td>📂 Displacement 🔽</td>	Radial Growth	📂 Displacement 🔽
Axial Rotation Axial Growth All Free All Fixed Displacement Coordinate System CORD2C Cord Cord Cord Cord Cord Cord Cord Cord	2	mm 🔽 🗣
Axial Growth All Free All Fixed Displacement Coordinate System CORD2C Card Name SPC Concel	Axial Rotation	🔊 Free 🔽
All Free All Fixed isplacement Coordinate System CORD2C ard Name SPC OK Apply Cancel	Axial Growth	Fixed 🔽
All Fixed	All Free	2
Displacement Coordinate System CORD2C Card Name SPC OK Apply Cancel	All Fixed	
Card Name SPC)isplacement Coord	inate System CORD2C
OK Apply Cancel	Card Name SPC	
	ОК	Apply Cancel

- 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



Simulation Navigator	
Name	
🚰 block_sim 1	
⊝ 🕮 block_fem 1	
- @ block_fem1_i.prt	
🕀 🗹 Polygon Geometry	
🕀 🗹 🕅 3D Collectors	
Simulation Object Container	
🖓 🕂 Load Container	
🚊 🗹 🚔 Constraint Container	

Constraints – Symmetric



Symmetric Constraint 🥥 🗖 🗙
Name
Symmetric(1)
Coplanar Faces to Constrain
🗸 Select Object (1)
Excluded A
✔ Select Object (0)
Displacement Coordinate System CORD2R Card Name SPC
OK Apply Cancel

- Symmetric Constraint
- Managed in the Constraint Container



Simulation Navigator
Name
Block_sim1
.⊡ 🕮 block_fem 1
- @ block_fem1_i.prt
🕀 🗹 Polygon Geometry
🕀 🗹 🕂 3D Collectors
Simulation Object Container
🕀 Load Container
🖻 🖬 🏣 Constraint Container

Constraints – Anti-Symmetric



Anti-Symmetric Constraint 🛛 🗖 🗙
Name
AntiSymmetric(1)
Coplanar Faces to Constrain
🗸 Select Object (1)
Excluded A
✓ Select Object (0)
Displacement Coordinate System CORD2R Card Name SPC
OK Apply Cancel

- Anti-Symmetric Constraint
- Managed in the Constraint Container



Simulation Navigator	
Name	
🖶 block_sim 1	
⊝ 🌐 block_fem 1	
- @ block_fem1_i.prt	
🕀 🗹 Polygon Geometry	
🗄 🖬 🌆 3D Collectors	
Simulation Object Container	
- 🕀 Load Container	
🖮 🖬 🏣 Constraint Container	

Constraints – Velocity

	Velocity 3 - X	
1 🥂	Туре	
	🔁 Magnitude and direction 🔽	Magnitude and
	Name	Normal
	velocity(1)	Components
	Model Objects to Constrain	
a 😽	✓ Select Object (1)	
	Excluded V	
ते 🚳	Direction	
	🗸 Specify Vector (1)	
	Reverse Direction	
~ ~~	Magnitude 🔨	
4	Velocity 10 mm/:	
	Velocity Coordinate System	
1 24 2	Card Name SPCD	
	OK Apply Cancel	

Velocity Constraint

rection

- 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

-	Acce
2 - C	Туре
	😫 Mag
	Name
	accel
	Model
Se 2	🗸 Sel
	Exclu
	Directi
AR OF	🐓 Spe
	Revers
YN 🕰	Magnit
As A	Accele
	Accelera
	Card Nam
	6
$\mathcal{A} \mathcal{A}$	

Acceleration	×
Туре	
Magnitude and direction	Y Magnitude and direc
Name	Mormal 🔤 Components
acceleration(1)	
Model Objects to Constrain	
✓ Select Object (1)	
Excluded	
Direction A	
✓ Specify Vector (1)	
Reverse Direction	
Magnitude 🔨	
Acceleration 10 mm/:	
Acceleration Coordinate System CORD2R	
Card Name SPCD	
OK Apply Cancel	

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



	🔪 Manual Coupling	9	ఎ – ×	
	Туре		^	
0	Coupled DOF		- 6	Coupled DOF
	Name		≶	Constraint Equat
4	Manual Couplin	ng (1)		
.	Independent		~	
2	🞸 Select Object (1))	*	
	Dependent		~	
	🖋 Select Object (1))	*	
	Excluded		V	
2	Degrees of Freedo	m	~	
	DOF1	On 🔁		
	DOF2	off آھي		
1	DOF3	off آھي		
	DOF4	off آھي		
	DOF5	On 🔁		
	DOF6	📇 On		
2	All Off		2	
	All On			
	Card Name MPC			
	ок (Apply	Cancel	

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

Simulation Navigator
Name
🖀 model1_sim1
⊡ 🕮 model1_fem 1
🕀 🖅 model1_fem1_i
🕀 🗹 Polygon Geometry
🕀 🗹 🐼 2D Collectors
🕀 🗹 🕂 3D Collectors
🔤 🗹 🛱 Simulation Object Container
- ₩ Hoad Container
🖻 🖬 🙀 Constraint Container

Constraints – Enforced Motion Location



EnforcedMotion	Location(1) 🎝 🗖 🗙		
Name	•		
EnforcedMotion	nLocation(1)		
Model Objects to	Create Enforced		
Select Object (1)	→		
Direction	~		
Displacement CSYS	Existing		
Degrees of Freedo	m A		
DOF1	🚰 Enforced		
DOF2	🔊 Free 🔽		
DOF3	🔊 Free 🔽		
DOF4	🔊 Free 🔽		
DOF5	🔊 Free 🔽		
DOF6	🔊 Free 🔽		
All Free			
All Enforced			
Card Name SPC and USET,U2			
ОК	Apply Cancel		

- 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

🔉 Override N	🔪 Override Mesh Collector A 🥥 💳 🗙				
Override Mes	Override Mesh Collector Attributes				
Physical Pro	operty	^			
🗌 Туре	PSOLID	- 10			
Name	A PSOLID1	✓ blank			
		PSOLID2			

Simulation Navigat	or	Simu
Name		Nam
Yoke_sim 1		📥 Ya
🖃 🌐 Yoke_fem 1		
📄 🗇 Yoke_fem 1	_i	ė
🚽 🐨 Yoke.pr	t	
🕀 🗹 Polygon Ge	eometry	
😑 🗹 🌆 3D Colle	ectors	E
🖻 - 🗹 Solid(
₩ 3d	Edit Attribute Overrides	
- M - A Simulation	Display Settings	
- M 律 Load Cont	Select All	
Constrain	Sort Alphabetically	
🖻 📇 Solution 1	Information	
- 🗹 🛱 Simula	Check All	·



- 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

N Units Manager	×		
		Length	
Measure Length		Area	=
Measure	`	Volume	
		Mass	
Unit Name	MilliMeter 🔽	Mass Density	
Unit Display Manua		Fatigue Strength Coefficient	
Unit Display Name	mm	Time	
Description		Angle	
		Velocity	
millimeters		Acceleration	
		Force	
Conversion Parameters		Force Per Unit Length	-
Conversion Equation: $Unit = (a) * (mm)$	+ (b)		
Multiplication Factor (a)	1,0000	Coefficient per Unit Length	*
		Moment of Inertia (Area)	
Addition Factor (b)	0.0000	Viscous Damping	
Default Unit	,	Energy	
		Power	
New Unit		Momentum	
		Temperature Gradient	
Delete Unit		Energy per Unit Mass	
		Dissipation Rate of Energy per Unit Mass	-
Update Unit		Mass Flux	=
		Mass per Unit Length	
	Close	Mass per Unit Area	*



Units Converter				
Quanti	ity	Fatigue Stre	ength Coefficient	~
From		1.0000	N/mm^2(MPa)	~
То	14	15.0376	lbf/in^2(psi)	~
				Close

Units Manager create Custom Units for various Measures

Units Converter

A.Formati Date arrent. ****** ingth As1 umé lass. flace Detta Fatigue : 1.00 dele. Velocity Accelerat 0000 force les ----mett Stress train

> train Er train Er

Convection Thermal (Thermal) Specific

Angular Angula

Heat Flor Thermal | Mass Mom

Heat Gen Thermal (nducta Thermal | Mass Flor Jolume F. Temperatu requency Coefficie Moment of Viscous 1 Energy over omentum Temperati Energy pe Dissipati Magg Flux Mass per Mass per

8				
on listing created by r	gwills			
() () () () () () () () () () () () () (06/12/2006 10188128			
ork pert +	CildsyMills/Demo_Stuff/XKK/multipl/	barre/block_sis	G3-#18	
1777 A	genzywillegu			

	Unit Hane	Stepley Name	Description	
	Aut 1 (Minters			
	Reparate 11 Malan		STITISTICS STORES	
	Constant 1110eter	im." 3	allietare olded	
	Rilogram	80	atiograms	
121	RilogranFerCubiHilliMeter	82/10112	Wildorane per millimeter miket	
crength Coefficient	NewtonFerigoaratillitietes	H/mm*2 (MFe)	Newtons per millinater againsd	
	Second	.880.	seconds	
	Tegrees	degrees	degrees	
	MillimeterFerDerood	min/ arec	millimeters per second	
4.0%	HillDieterFerDquareleven#	int/ant/2	millimeters per second egisted.	
	Sevia:	12	Sevizia	
Dait Length	HestotePerMillineter	21/849	Pertute per millimeter	
	NewtonFerSquareMt11tHetes	It/mm*J(MFe)	Sevicie per millimeter equesed	
	Severallilineter	10-rm	Sevic-millimeters	
	HevicoPerSquareHillineter	8/mm*2 (BPA)	Sevions per millineter squares	
5-177	Strett Metrici	707/701	millimeters per millimeter	
arry	Strails Straight Straight	A CONTRACTOR OF A CONTRACTOR O	Several diligences and lighter of all	
and beneri	Palating		Palaine	
	Hast Flue Havened	-10.0mm*1	Marra per millingter science	
n Coefficient	ConvectionCoefficient Metric2	N/nm^2-C	Watta per millimeter squared per degree Celsi	
Conductivity	ThermalConductivity Metric2	W/mm-C	Watts per millimeter per degree Centrigade	
xpansion Coefficient	ThermalExpansion Metrici	1/C	Expansion coefficient per degree Celsius	
Heat	SpecificHeat Metric2	J/kg-K	Joules per Kilogram per degree Kelvin	
elocity	DegreesPerSecond	degrees/sec	degrees per second	
cceleration	DegreesPerSecondSquared	degrees/sec^2	degrees per second squared	
ife	DutyCycles	DutyCycles	Duty Cycles	
Rate	HeatFlow_Metric2	W	Watt	
nergy	ThermalEnergy_Metric2	3	Joule	
nt of Inertia	RilogramMilliMeterSquared	kg-mm^2	kilogram - millimeter squared	
iscosity	DynamicViscosity_Metric2	kg/mm-sec	kilograms per millimeter per second	
ration	HeatGeneration_Metric2	W/mm"3	Watts per millimeter cube	
onductance	InermalConductance_Metric2	W/C W/mm-C	Watts per degree Celsius	
het per onre sengen	Thermal Resistance Nerricz	r/x	degraes Calsius per Mart	
2ste	KilogramPerSecond	kn/aec	kilograms per second	
ow Bate	CubicMilliMeterPerSecond	mm*3/and	millimeters cubed per second	
re Difference	CelsiusDifference	C	Celsius	
F	hertz	Hz	hertz	
nt per Unit Length	CoefficientPerHilliMeter	1/mm	coefficient per millimeter	
Inertia (Area)	MilliMeterFourth	mm*4	millimeters fourth	
lamping	KilogramPerSecond	kg/sec	kilograms per second	
	Joule	2	Joule	
	Watt	N	Watt	
	KilogramMeterPerSecond	kg-m/aec	kilogram-meter per second	
re Gradient	CelsiusFerMilliMeter	C/mm	Celsius per millimeter	
r Unit Hass	EnergyPerHass_Hetric1	mm^2/sec^2	millimeters squared per second squared	
on save of Energy per Un	it DissipationRate_Metricl	nm"2/sec"3	millimeters squared per second cubed	
Tais Tasarb	Massflux Metrici	xg/sec-nm-2	kilograms per second per millimeter squared	
Unit Area	KilogramPerMilliMeter	kg/mm	kilograms per millimeter	
ANTE 19120	versite and covered the coroling ten	wy/ men al	standiona has meretanings adopted	

Unit Selection

S Force	ວ – ×		
Туре	~		
🏷 Magnitude a	and direction		
Name	V		
Model Objects	to Create Force On		
* Select Obje	ct (0)		
Excluded	V		
Magnitude	^		
Force	100 N 🔽 🕹		
Direction	<u>M</u> easure ■		
***	Field		
* Specify Vec	f(x) F <u>u</u> nction		
Reverse Directi	ዿ Link <u>E</u> xisting Field		
Distribution Make <u>C</u> onstant			
Card Name FORCE			
ОК	Apply Cancel		

Examples

- 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

m	radians	mN	mN/mm^2(kPa)	kg/m^3	m/sec^2
mm	degrees	Ν	N/mm^2(MPa)	kg/mm^3	mm/sec^2
in		lbf	Pa(N/m^2)	lbf-sec^2/in^4	in/sec^2
ft	m N-m m	C	lbf/in^2(psi)	Slugs/ft^3	ft/sec^2
cm	N-m m	F	lbf/ft^2	lbm/in^3	gs
km	N-m	r V	bars	t/m^3	
mi	lbf-in		atmospheres	t/mm^3	
micron	lbf-ft	ĸ			
nm	rev/sec^2				
angstrom	rev/min^2				
	degrees/se	c^2			
	radians/sec	^2			

N Create Ta	🔍 Create Table Field 🛛 🔍 🗖 🗙					
Table Field	Table Field					
Nam e		ij (ij) 🗙				
Row ID	time (sec)	pressure (mN/				
1	1	10				
2	3	25				
3	5	35				
Values						
		OK Cancel				

Boundary Condition Magnitude – Table Field

Matl Field	ns Expressior		Table Based	Existing Variabl	g Named es
Field Var	iables				×
Listed Fiel	ds			√ <i>f(x)</i>	
Name	Field	Units	Domain	Independent	1
force	Force by Time	mN	Time	tim e	
े त		F		C	OK Cancel

Tables Field

 User selected Dependant and Independent columns

🔪 Edit Table	Field		ఎ − ×		
Table Field					
Name Force by Time					
Row ID	time (sec)	force (mN) *			
1	1	65			
2	2	100			
3	3	135			
4	4	150			
5	5	185			
6	б	200			
Values Values					
OK Cancel					

Boundary Condition Magnitude – Function Field

Create Math Expression Field	ు − x
Expression Field	
Name[sys_field201	
	Unit Type Force 💌
Dependent Variable force	× nn 💌
Expression ug_fieldVar("Force by Time", "force") ug_var("time")	X
/w w ii 🛄 -	
	OK Cancel

Insert Funct	ion	Insert Function	
nter Keywords to	Search for a l	Enter Keywords to Search for a Function	
r Choose a Cate	gory math	Or Choose a Category mechanics	
Function Name	Return	Function Name	Return
ibs	Number	ug_averagePower	Number
rccos	Number	ug_centrifugalForce	Number
rcsin	Number	ug_circularMotionCentripetalAcceleration	Number
irctan	Number	ug_frequency	Number
irctan2	Number	ug_frictionForce	Number
eiling	Integer	ug_G	Number
:05	Number	ug_gravitationalPotentialEnergy	Number
loor	Integer	ug_impulse1	Number
ypcos	Number	ug_impulse2	Number
typsin	Number	ug_linearKineticEnergy	Number
iyptan	Number	ug_linearMotionDisplacement	Number
og	Number	ug_linearMotionFinalVelocity1	Number
og10	Number	ug_linearMotionFinalVelocity2	Number
1ax	Number	ug_momentum	Number
ninimum	Number	ug_newtonMotionSecondLaw	Number
bot	Number	ug_pendulumFrequency	Number
pi	Number	ug_pendulumPeriod	Number
ound	Integer	ug_period	Number
in	Number	ug_power	Number
qrt	Number	ug_springPeriod	Number
an	Number	ug_springPotentialEnergy	Number
		ug_springRestoringForce	Number
		ug_torque	Number
		ug_workDone	Number

r Choose a Category beams	3
Function Name	Return
ig_centerLoadBendingStressMaximum	Number
ug_centerLoadDisplacement	Number
ug_centerLoadDisplacementMaximum	Number
ug_centerLoadMoment	Number
ug_centerLoadMomentMaximum	Number
ug_centerLoadShearForce	Number
ug_centerLoadShearForceMaximum	Number
ug_centerLoadSlope	Number
ug_centerLoadSlopeMaximum	Number
ug_circularAreaMomentOfInertia	Number
ug_intermediateLoadBendingStressMaximum	Number
ug_intermediateLoadDisplacement	Number
ug_intermediateLoadDisplacementMaximum	Number
ug_intermediateLoadMoment	Number
ug_intermediateLoadMomentMaximum	Number
ug_intermediateLoadShearForce	Number
ug_intermediateLoadShearForceMaximum	Number
ug_intermediateLoadSlope	Number
ug_intermediateLoadSlopeMaximum	Number
ig_symmetricLoadBendingStressMaximum	Number
ug_symmetricLoadDisplacement	Number
ag_symmetricLoadDisplacementMaximum	Number
ug_symmetricLoadMoment	Number
ig symmetricLoadMomentMaximum	Number
ug_symmetricLoadShearForce	Number
in summatrici and Shaarf areaMavimum	Number
formation about the Selected Function:	
alculates the maximum bending stress under the return dimensionality is Stress.	a center load.
equires: Number: Length of Beam	
tequires: Number: Length of Beam Number: Load on Beam	
tequires: Number: Length of Beam Number: Load on Beam Number: Distance from Neutral Axis to Extrem Number: Distance from Neutral Axis to Extrem	te Fibers
tequires: Number: Length of Beam Number: Load on Beam Number: Distance from Neutral Axis to Extrem Number: Moment of Inertia	ne Fibers

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



N Create Solution					
Name:		Solution			
Solver	NX NASTRAN				
Analysis Type	Structural				
Solution Type	SESTATIC 101 - Single Constraint				
Automatically Create Step or Subcase					
SESTATIC 101 - Single Constraint 🗸 🗸 🗸 🗸 🗸 V					
OK Apply Cancel					

C 1		CLC T
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
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



Simulation Navigator

Name	Environment	Description
🖶 block_sim 1	Active: NX NASTRAN - T	
⊕ 🖽 block_fem 1	Default: NX NASTRAN	
🔤 🗹 🛱 Simulation Object C		
🕀 🗹 🥰 Load Container		
🗄 🖬 🛱 constraint Container		
🕀 📇 Linear Statics 1	NX NASTRAN - Structural	SESTATIC 101 - Single Constraint
🕀 📇 Linear Ststics 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



- Subcase availability and options will vary according to the active Solver and Solution type
- Each Solution can have multiple Subcases

Subcase

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1

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Cancel

Thermal Output

Apply

Subcase · Loads, Constraints

Boundary Condition Field Evaluation

Label

Output Requests

Evaluation Time

Evaluation Frequency

- Loads can be used in any combination of Subcases
- Subcases can include Pre-Loads like Thermal results from a previous solve


Solution – Attributes

OK Apply Cancel

Edit Solution J = X	
lame: Linear S	
olver: NX NASTRAN	
analysis Type: Structural	N Edit S
olution Type: SESTATIC 101 - Single Constraint	Name:
Automatically Create Step or Subcase	Solver NX
SESTATIC TOT - Single Constraint	Analysis T
General Contact	Solution T
Description	Automa
Tria	SESTATI
	Genera
Subube	
System Cells None 💌 🎮 🚱	Max Ite
Viterative Solver	Max Ite
Max Job Time 999	Penalty
Bulk Data Listing	Penalty
Output Requests Output Request 😾 🚱	Contac
Parameters None 💌 🔎 🚱	Allowal
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Ignore Material Temperature Dependence	Contac
Default Temperature 20 C • 🐳	Contac
Boundary Condition Field Evaluation	Initial D
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	Refine
OK Apply Cancel	Numbe

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	٩	•	options will vary	according	to the activ	е
			Solver and Solut	ion type	Simulation Navigator	
Edit Solution	ა -	×			Name	Enviro
me:	Linear S				block_sim1	Active:
iver: NX NASTRAN		1 🖪	K Edit Solution J = X		🕀 🌐 block_fem 1	Default
alysis Type: Structural			Name: Normal M		- 🗹 🍄 Simulation Object C	
lution Type: SESTATIC 101 - Single Co	onstraint		Solver, NX NASTRAN		🕀 🗹 👯 Load Container	
Automatically Create Step or Subcas	e		Analysis Type: Structural		🕀 🗹 🚔 Constraint Container	
ESTATIC TOT - Single Constraint	· · · · · · · · · · · · · · · · · · ·		Solution Type: SEMODES 103		🕀 📇 Linear Statics 1	NX NAS
General Contact		н.	Automatically Create Step or Subcase		Create Subcase	
Max Iterations Force Loop	10	н.	SEMODES 103		□ • • • • • • • • • • • • • • • • • • •	s
Max Iterations Status Loop	20	н.	Description		Solver Parameters	i
Penalty Normal Direction	10	н.	Title		Rename	
Penalty Tangential Direction	1	н.	Subtitle			
Contact Force Tolerance	0.01	н.	System Cells None 💌 🔎 😭			heck
Allowable Contact Changes	0	U.	Max Job Time 999	N Edit Solution	3 = x	ICCK
Minimum Percentage	100	н.	Bulk Data Listing	Name:	Thermal Report	
Shell Thickness Offset	Include 🔽	н.	Output Requests Output Request 😴 🔊 😤	Solver: NX NASTRAN	t Object	
Contact Status	Start from Previous	н.	Parameters None 💌 🔎 🚳	Analysis Type: Thermal	1011	TINA INA
Contact Stress Averaging	Inclusive 🔽	н.	Real Eigenvalue Extraction Data Lanczos	Solution Type: NLSCSH 153		
Initial Penetration / gap	Calculate from geor	н.	Lanczos Method None 👿 🔎 😭	Automatically Create Step or NLSCSH 153	Subcase	
Refine Source Region Mesh	Refine		Flat Shell Rz Stiffness Factor	Devenienten		
Number of Contact Evaluation Points	Increased Number		Ignore Material Temperature Dependence	Description		
)			Default Temperature 20 C -	Title		
				Subtitle		

v

System Cells

Max Job Time

Bulk Data Listing

Default Initialization Temperature 20

Geometric Surface Element Form CHSDYE

Boundary Condition Field Evaluation

OK

Output Requests

Parameters

Boundary Condition Field Evaluation

OK Apply Cancel

Colution Attributes availability

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None

None

999

Thermal Output 👻 🔊 🚰

T

Apply Cancel

Solution – Parameters



Current Solver: NX NASTRAN Solve Options Formatting Options License Type Solver Executable	
Solve Options Formatting Options License Type Desktop Solver Executable A	
License Type Desktop Solver Executable	
Solver Executable	
Use environment variable UGII_NX_NASTRAN	
User Specified	
C:\UGS\NXNastran\5.0\bin\nastranw.ex	
Solver Version	
Use environment variable UGII_NX_NASTRAN_VERSION	Í
User Specified 5	
memory 400MB	
old	
scratch yes	
sdirectory	
OK Apply Cancel	



Solver Parameters	ა -	×
Current Solver: NX NASTRAN		
Solve Options Formatting Options		_
System Cells Format Name		
Bulk Options	•	
Performance		
Field Format Small Field		
Exponential Format NASTRAN		
Real Data Precision Maximum		
Card Description None		
Real Data Filter		
Real Filter Value		
J		
		-
OK Apply	Cancel	J
	_	_

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



Solution – Comprehensive Check



Nodel (Check	
	Comprehensive 🔽	
🛃 Detailed	Element Shapes	
List Fail	Liement Outlines Nodes	
List All E	2D Element Normals	
	Comprehensive	
	Reset Display	
R	eselect Objects to Chec	k
ОК	Apply Back	Cancel

i Information	
Ele Edit	
Information listing created by Date Current work part Node name	: gwills : 07/12/2006 12:57:54 : C:\GuyMills\Demo_Stuff\NX4\multi; : gbhitwillsyu
Solution Comprehensiv	ve Check Error Summary
Solver is NX NASTRAN	
Environment: NX NASTRAN - Stru	ictural
Solution is SESTATIC 101 - Sin	ngle Constraint
Mesh-Based Errors Summary	
Total: 0 error and 0 warning	
Material-Based Errors Summary	
Total: 0 error and 0 warning	
Solution-Based Errors Summary	
Iterative Solver Option Nore than 80 percent of the ele It is therefore recommended the	ements in this model are 3D elements at you turn CN the Iterative Solver.
Total: 0 error and 0 warning	
Load/BC-Based Errors Summary	
Total: 0 error and 0 warning	
Nastran Model Check Completed	
4	

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



Solution – Report Before Solve



Solution – Solve the Active Solution

10		N Solve X	
		Submit Solve Solve	
		Write Solver Input File	
		Edit Solution Attributes Edit Input File & Solve	
		Edit Solver Parameters	
		OK Back Cancel	
-	TextPad - [- [C:\GuyWill:\Demo_StufFIXX4multiple_parts\yoke_assy_sim1-solution_1.dat]	
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	1	L-1000000000000000000000000000000000000	
٩	3	S- NX 4 NASTRAN TRANSLATOR S- FOR NX NASTRAN VERSION 4	
	5670	 INPUT FILE: yoke_assy_sial-solutice_1.dat EXPORTED: AT 13:30:10 ON 7-Dec-2006 FEM FILE: C:\CuyYills\Dec_Stuff\XXi\altiple_parts\Yoke Ass 	y_feal.fea
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4	39	S. EXECUTIVE CONTROL	
4	41 42	3+355333553335533355555555555555555555	
45	44	IU. NASIRAN, YONG_SSSY_SINI-SOLUTION_1 SOL 101 TIME 999	
5 For	Help press i	(5) 1 1 Evel Or By	ck Sunci Reci
P.F.	CHERY, BALERS L	Peac OVE BO	and opened where

- Solve the Active Solution options
 - Solve interactively (eg using NX Nastran Desktop)
 - Write (export) the solver input file for further job editing or queue management
 - Solve interactively an existing Input file (ie Restart)
 - Edit the Input file and solve directly (useful at add extra Solver specific entries)





SIM Part – Post-Processing

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UGS PLM Software

NX – Integrated Post Processing

Post



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

	N Animation X
	Animate Result 🔽
	Style Linear
<	Number of Frames 8
	Synchronize delay for all post views Delay (mS) 200 1
п	OK [Yeks Assy_sim1 Sulution Result Load Case 1, Static Step Displacement - Nodal, Magnitude Min 0:0008+000, vm Determotion : Disp
	6.255e-002
	5.2124-002
	4_6914-902
	4.170+-002
	3.649e-002
	3 127e-002
	2.606e-002
	2.065e-002
	1:584e-002
	1.042e-302
	0.0004+000

- 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 X Display Color Bar Edges & Faces Annotation	 Post View Display Options
\sim	Color Display Smooth Banded Element	Styles
8	Deformation Result Iso-Line Iso-Surface Cubes	► Contours
A	Display on Free Faces	► Elements
A		 Isolines, Isosurfaces
•	OK Apply Cancel	Result Set Selection Mark – Arrow, Cube, Sphere, Tensor
	Display Color Bar Edges & Faces Annotation Color Display Smooth Result	► Absolute or scaled values
	Deformation Result Show undeformed model	Load Case 1 ▼ Displacement - Nodal ▼ Magnitude ▼ Coordinate System for results calculation
	Display on Free Faces Options	Cooordinate System Absolute Rectangular Units mm Scale 1.0000 Work Rectangular Work Collindical Work Rectangular
	OK Apply Cancel	Absolute Value Work Spherical Local OK Apply Back Cancel

Results – Post View Display

	N Bost View		Arrow Plot
			Allow Hot
	Display Color Bar Edges & Faces Annotation		Load Case 1 🔽
	Color Display Arrows 🔽 Result		Displacement - Nodal
2			X Y Z Magnitude
K 🛛	Deformation Result		
-	Show undeformed model		
<u> </u>	Synchronize Color Display and Deformation		Cooordinate S1 Absolute Rectangular 🔽
X	Display on Free Faces		Units mm 🔽
			Scale 1.0000
			Absolute Value
2.1			
	OK Apply Cancel		
	·		Size Result S.00 % Model
			Colo Colorbar
			Style Line
			OK Apply Back Cancel
	N Isoline Plot	NE	Element Plot
l l			
	Load Case 1		oad Case 1
	Displacement - Nodal		Displacement - Nodal
	Magnitude 🔽		Magnitude 🔽
	Cooordinate System Absolute Rectangular	El	ement Criterion Average 🔽
	Units mm		
	Scale 1.0000	Co	ooordinate System Absolute Rectangular 🔽
	Absolute Value	Ur	nits mm
		Se	cale 1.0000
	OK Apply Back Cancel	At	osolute Value
			OK Apply Back Cancel

Post View Display Options

×

Results Plot options vary according to the Display type

Tensor Plot
Load Case 1 Stress - Element-Nodal Max Shear
Draw Marks at Nodes
Cooordinate System Absolute Rectangular Units N/mm^2(MPa) Scale 1.0000 Absolute Value
Hide Marks Size Result S.00 % Model Colo Colorbar Style Line Detailed
OK Apply Back Cancel

Results – Post View Display

23% -	N Post View
	Display Color Bar Edges & Faces Annotation
\sim	Color Display Smooth Result
	Show undeformed model
	Synchronize Color Display and Deformation
A	Display on Cutting Plane Options Free Faces
	Cutting Plane
	OK Apply Cancel
	🔪 Cutting Plane 🛛 🗙
	Cutting Plane
•	Cutting Plane X Cut Plane Absolute Rectangular Y Show Feature Edges Absolute Cylindrical Absolute Spherical Work Rectangular Clip Side Negative Work Spherical Work Spherical Y = 0.00000
•	Cutting Plane X Cut Plane Absolute Rectangular Y Show Feature Edges Absolute Cylindrical Show Clipped Ghost Work Rectangular V = 0.00[00] -18.9 14.7

N Deformation	X
Load Case 1	
Displacement - Nodal	
Scale 10.0000 % Model 🔽	
OK Apply Back Cancel)

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



Results – Post View Color Bar

[[

-	N Post View	
	Display Color Bar Edges & Faces Annotation	►
	Show legend Detailed	Detailed
?	Result Min 0.0000000000 O Displayed Max 0.062546037137	Header Only
Ľ	Levels 12 Underflow Scale Automatic Underflow	
	OK Apply Cancel	Yoke Assy_sim1 : Solution 1 Result Load Case 1, Static Step 1 Displacement - Nodal, Magnitude Min : 0.000e+000, Max : 6.255e-002, mm Deformation : Displacement - Nodal
Þ	Structural Automatic Temperature Linear Gray Scale Log	5.000e-002 ZC
	N Post View	4.000e-002
	Display Color Bar Edges & Faces Annotation	
	Show legend Detailed	3.500e-002
	Result Min 0.010	3.000e-002
	Specified Max 0.050	2.500e-002
	Levels 8 Scale Automatic Overflow	2.000e-002
	Spectrum Structural V Invert Spectrum	1.500e-002 x
	OK Apply Cancel	1.000e-002

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

Results – Post View Edges & Faces

	N Post View
	Display Color Bar Edges & Faces Annotation
	Primary Display
$\overline{\mathbf{a}}$	Edges External Color
5	Faces Opaque Color
	Undeformed Display
	Edges Feature Color
7	Faces Translucent Color
<u> </u>	OK Apply Cancel
<u> </u>	

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









Results – Identify

🔪 Iden	tify		×			
Nedel	D It.	Rich from Model		Pick from Node IDs	1 Model s	
Nodal	kesults	Pick from Model		By Resul	t Range	
Mark S	election	Mark Result Valu	ies 💌	N Max R	esuit values sult Values	
Pick	Single 🔽	Dimension A	iny 🔽	Any		
Selectio	on: 1 Item		_	1D 2D		
	Values	NodeID		3D		
Min Max	5.551e-002 0.000e+000	22663 22663		Single		
Sum	5.551e-002		v	Feature	Face	
	₽ 🔒	2 🗙 🚺		Feature	Edge	
			lose			
N Iden	rtify		×			
Nodal	Results	Pick from Model				
Mark S	election	Mark Result Valu	ies 🔽			
Pick	Mesh 🔽	Dimension A	ny 🔽	Identify	/	
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	Values	NodeID		Mark Selec	ction	ľ
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-	Values	NodeID				
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Sum	6 231e-001	20020	~			

Identify to probe and display nodal and elemental information

Results

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By Result Range

NodeID 19275 23326

Mark Result Values 🔽

- n Max, or n Min Result values
- Result Range
- Selected data saved to Excel for further study

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4 Load Case: SUBCASE: STATIC LOADS 1 5 Iteration/Moi SUBCASE: STATIC LOADS 1 Loads 7 Units: mm 8 Node ID X Coord NY Coord Nodal Z Coord Nod X Y Z Magnitude 10 11 15107 21.688E+0 -1.529E+0 10.733E+0 54.162E-3 -26.673E-6 -26.374E-3 60.260E-3 11 15107 21.688E+0 -1.502E+0 10.733E+0 54.162E-3 -26.673E-6 -26.376E-3 60.260E-3 13 15118 21.688E+0 -3.026E+0 10.431E+0 53.944E-3 10.559E-6 -26.377E-3 60.260E-3 14 15125 21.688E+0 -3.026E+0 10.431E+0 53.947E-3 44.811E-6 -26.377E-3 60.305E-3 15 15125 21.688E+0 -3.026E+0 10.431E+0 53.97E-3 44.811E-6 -26.377E-3 60.265E-3 15 15125 21.688E+0 -3.281E+0 4.655E+0 49.335E-3 -36.66E-6	3										
5 Iteration/Mo: SUBCASE - STATIC LOADS 1 Loads 6 Result: Displacement - Nodal 7 Units: mm 8 Magnitude 9 Node ID X Coord N/Y Coord Nodal Z Coord Nod X Y Z Magnitude 10 11 15107 21.688E+0 -1.529E+0 10.733E+0 54.162E-3 -2.673E-6 -26.376E-3 60.260E-3 12 15108 21.688E+0 -3.028E+0 10.733E+0 54.162E-3 -16.633E-6 -26.376E-3 60.260E-3 13 15118 21.688E+0 -3.028E+0 10.431E+0 53.944E-3 10.559E-6 -26.377E-3 60.267E-3 14 15125 21.688E+0 -40.099E+3 10.835E-0 54.264E-3 -16.332E-3 60.057E-3 15 15126 21.688E+0 -2.996E+0 10.441E+0 53.957E-3 48.811E-6 -26.377E-3 60.356E-3 16 17149 32.667E+0 -3.281E+0 4.6552+0 49.315E-3 -27.952E-6 -34.81E-3 <	4	Load Case	11	SUBCASE ·	STATIC LOADS	1					
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7 Units : mm 8 X Coord NVY Coord Nodal Z Coord Nod X Y Z Magnitude 10 1 15107 21.688E+0 -1.529E+0 10.733E+0 54.182E-3 -2.673E-6 -26.374E-3 60.260E-3 11 15107 21.688E+0 -1.502E+0 10.733E+0 54.182E-3 -2.673E-6 -26.376E-3 60.260E-3 12 15108 21.688E+0 -3.026E+0 10.431E+0 53.94E-3 10.559E-6 -26.376E-3 60.260E-3 14 15125 21.688E+0 -14.09E-3 10.35E+0 54.264E-3 -16.833E-6 -26.377E-3 60.35E-3 15 15125 21.688E+0 -3.281E+0 4.655E+0 49.335E-3 -26.637E-3 50.05FE-3 16 17149 32.667E+0 -3.281E+0 4.655E+0 49.335E-3 -28.664E-6 -35.337E-3 60.265E-3 18 17775 32.067E+0 -3.281E+0 5.401E+0 49.915E-3 -27.952E-6 -33.392E-3 60.449E-3	6	Result :		Displaceme	nt - Nodal						
6 10 Node ID X Coord N/Y Coord Nodal Z Coord Nod X Y Z Magnitude 10 1 15107 21.688E+0 -1.529E+0 10.733E+0 54.182E-3 -2.673E-6 -26.376E-3 60.260E-3 60.260E-3 12 15108 21.688E+0 -1.502E+0 10.733E+0 54.182E-3 -12.673E-6 -26.376E-3 60.260E-3 60.260E-3 60.260E-3 60.260E-3 60.260E-3 60.260E-3 60.260E-3 60.261E-3	7	Units :	_	mm			_				
9 Mode ID X Coord NY Coord Nodal Z Coord NodaX 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 54.182E-3 -2.673E-6 -26.374E-3 60.260E-3 13 15118 21.688E+0 -3.02E+0 10.738E+0 54.182E-3 -3.1219E-6 -26.376E-3 60.267E-3 60.247E-3 60.335E-3 60.34E-3 16.359E-6 -26.376E-3 60.34E-3 15.352E-3 60.267E-3 60.335E-3 60.353E-3 60.353E-3 16.352E-3 21.688E+0 -14.089E-3 10.835E+0 54.264E-3 -16.833E-6 -26.377E-3 60.335E-3 16.352 17.32E-3 60.355E-3 10.247E-3 10.395E-0 48.795E-3 -28.64E-6 -35.37E-3 60.265E-3 17.7150 32.667E+0 -3.241E+0 4.655E-0 49.315E-3 -26.666E-6 -33.38E-3 60.247E-3 10.395E-0 14.811E-6 10.326E-2 10.345E-3 10.345E-3	8	No. 40. 100	_			7.0			14	-	
10 11 15107 21.688E+0 -1.529E+0 10.733E+0 54.162E-3 -2.673E-6 -26.376E-3 60.260E-3 12 15108 21.688E+0 1.502E+0 10.738E+0 54.162E-3 -2.673E-6 -26.376E-3 60.260E-3 13 15118 21.688E+0 -3.028E+0 10.431E+0 53.344E-3 10.559E-6 -26.376E-3 60.267E-3 14 15125 21.688E+0 -4.099E-3 10.856E+0 54.264E-3 -16.833E-6 -26.377E-3 60.044E-3 15 15125 21.688E+0 -2.998E+0 10.441E+0 53.97E-3 44.811E-6 -26.377E-3 60.057E-3 16 17149 32.667E+0 -3.281E+0 4.655E+0 49.335E-3 -28.64E-6 -35.37E-3 60.065E-3 17 17150 32.667E+0 -3.281E+0 4.652E+0 49.335E-3 -28.64E-6 -35.37E-3 60.0427E-3 18 17775 32.027E+0 -3.31E+0 6.4526+0 49.9156-3 -27.952E-6 -34.817E-3 60.0427E-3	9	Node ID		X Coord No	Y Coord Nodal	2 Coord	Nod	×	۲	2	Magnitude
11 15107 21 680E+0 1.52E+0 10 134 16102 24 633E+2 64 129E+6 24 129E+6 26 37E+2 64 135 13 15118 21.688E+0 -3.026E+0 10.431E+0 53.944E-3 10.559E-6 -26.37E+2 60.39E+2 60.39E+2 30.35E+3 60.044E-3 16 17149 32.667E+0 -3.281E+0 4.655E+0 49.335E-3 -28.664E+6 -35.337E-3 60.665E+3 17 17150 32.667E+0 -3.281E+0 4.655E+0 49.335E-3 -28.664E+6 -35.337E-3 60.665E+3 18 17776 32.267E+0 -3.381E+0 64.632E+0 49.335E-3 27.952E+6 -34.815-3 60.345E-3 60.345E-3 60.345E-3 60.345E-3 60.33.292E-3 60.4815-3 60.33.292E-3 60.4815-3 60.33.292E-3 60.4815-3 60.33.292E-3	10	16107		24 6995 -0	1.6000-0	10 7336	.0	64 ABOR 0	2 6726 6	26.2746.2	60 000E 0
12 15 106 21.000E+0 1.302E+0 10.138E+0 53.04E-3 10.559E-6 26.37E-3 60.30E-3 60.257E-3 13 15116 21.688E+0 -3.02E+0 10.431E+0 53.94E-3 10.559E-6 26.377E-3 60.335E-3 60.335E-3 60.335E-3 15 15126 21.688E+0 -2.998E+0 10.441E+0 53.957E-3 44.811E-6 26.377E-3 60.335E-3 60.657E-3 16 17149 32.667E+0 -3.281E+0 4.655E+0 48.75E-3 28.81E-6 45.337E-3 60.65E5-3 17 17150 32.667E+0 -3.281E+0 4.655E+0 48.75E-3 28.81E-6 -35.337E-3 60.247E-3 18 17176 32.021E+0 -3.310E+0 4.629E+0 49.315E-3 -27.952E-6 -34.81E-3 60.335E-3 20 18125 30.193E+0 -1.637E+0 5.401E+0 49.954E-3 -26.669E-6 -33.328E-3 60.4385E-3 21 18126 30.839E+0 -4.671E+0 5.01E+0 49.9755-3 -26.818E-6 -33.30E-	42	10107	-	21.000E+0	1.523040	10.733E	+0	04.10ZE+3	-2.073E-0	-20.314E-3	60 260E-3
15 16 16 21.030E+0 -5.020E+0 16.331E+0 26.245E+3 16.833E+6 -26.377E+3 60.335E+3 15 15125 21.668E+0 -2.999E+0 10.441E+0 53.957E+3 44.811E+6 -26.377E+3 60.355E+3 15 15126 21.668E+0 2.999E+0 10.441E+0 53.957E+3 -44.811E+6 -26.377E+3 60.057E+3 16 17149 32.667E+0 -3.281E+0 4.655E+0 49.335E+3 -28.64E+6 -35.337E+3 60.065E+3 17 17160 32.667E+0 -4.027E+0 3.990E+0 48.795E+3 -28.64E+6 -35.337E+3 60.365E+3 18 17776 32.021E+0 -3.318E+0 4.629E+0 49.95E+3 -26.69EE+6 -33.854E+3 60.365E+3 20 18125 30.193E+0 -1.637E+0 5.401E+0 49.954E+3 -26.69EE+6 -33.385E+3 60.443E+3 21 18125 30.193E+0 -1.637E+0 5.401E+0 49.979E+3 -26.818E+6 -33.302E+3 60.044E+3	12	10100		21.666E+0	2.0265+0	10.736E	+0	53 044E-3	10 5595 6	-20.370E-3	60.044E-3
15 15/125 21.688E+0 2.998E+0 10.441E+0 53.957E-3 44.811E-6 26.377E-3 60.057E-3 16 17149 32.667E+0 -3.281E+0 4.655E+0 49.335E-3 28.664E-6 -35.337E-3 60.065E-3 17 17150 32.667E+0 -4.027E+0 3.990E+0 48.795E-3 -28.664E-6 -35.337E-3 60.065E-3 18 17776 32.027E+0 -3.318E+0 4.652E+0 49.335E-3 -27.952E-6 -34.817E-3 60.247E-3 19 18124 30.839E+0 -1.631E+0 5.415E+0 49.915E-3 -27.952E-6 -34.817E-3 60.043E-3 20 18125 30.192E+0 -1.631E+0 5.415E+0 49.943E-3 -26.696E-6 -33.854E-3 60.043E-3 21 18125 30.193E+0 -1.671E+0 5.401E+0 49.943E-3 -26.992E-6 -33.854E-3 60.043E-3 21 18132 30.193E+0 -1.674E+3 5.444E+0 49.979E-3 -26.818E-6 -33.302B-3 60.074E-3 22	14	16125		21.000E+0	-14.089E-3	10.4316	+0	54 264E-3	-16.833E-6	-20.303E-3	60.335E-3
16 17 149 32.667E+0 -3.281E+0 4.655E+0 49.335E-3 -28.664E-6 -35.337E-3 60.685E-3 17 17150 32.667E+0 -4.027E+0 3.900E+0 48.795E-3 -28.664E-6 -35.337E-3 60.685E-3 18 17176 32.021E+0 -3.316E+0 4.629E+0 49.755E-3 -28.81E-6 -34.013E-3 60.685E-3 19 18124 30.839E+0 -1.631E+0 5.415E+0 49.945E-3 -26.664E-6 -33.83E-3 60.345E-3 20 18125 30.939E+0 -1.631E+0 5.415E+0 49.943E-3 -26.664E-6 -33.328E-3 60.438E-3 21 18126 30.839E+0 -1.671E+0 5.401E+0 49.943E-3 -26.019E-6 -33.330E-3 60.043E-3 21 18126 30.839E+0 442.315E-3 5.668E+0 50.079E-3 -26.292E-6 -33.85E-3 60.449E-3 22 18133 30.092E+0 312.674E-3 5.668E+0 50.079E-3 -26.818E-6 -33.30E-3 60.044E-3 23	15	16126	-	21 688E+0	2 998E+0	10 441E	+0	63 957E-3	-44 811E-6	-26 373E-3	60.057E-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 17776 32.021E+0 -3.316E+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 -26.666E-6 -33.854E-3 60.345E-3 20 18125 30.839E+0 -643.315E-3 5.568E+0 59.075E-3 -26.092E-6 -33.854E-3 60.449E-3 21 18125 30.839E+0 -643.315E-3 5.568E+0 50.075E-3 -26.992E-6 -33.30E-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 18132 30.193E+0 16.24E+0 5.671E+0 50.171E-3 -20.44E-6 -33.330E-3 60.074E-3 24 18134 30.193E+0 -681.138E-3 5.666E+0 50.078E-3 -23.42E-6 -33.330E-3 60.155E-3 24 <th>16</th> <th>17149</th> <th></th> <th>32.667E+0</th> <th>-3.281E+0</th> <th>4.655E</th> <th>+0</th> <th>49 335E-3</th> <th>-28.664E-6</th> <th>-35.337E-3</th> <th>60.685E-3</th>	16	17149		32.667E+0	-3.281E+0	4.655E	+0	49 335E-3	-28.664E-6	-35.337E-3	60.685E-3
18 17176 32.021E+0 -3.318E+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 -26.696E-6 -33.854E-3 60.345E-3 20 18125 30.193E+0 -1.671E+0 5.415E+0 49.943E-3 -26.696E-6 -33.854E-3 60.043E-3 21 18125 30.939E+0 -463.315E-3 5.568E+0 50.079E-3 -26.818E-6 -33.302E-3 60.043E-3 22 18132 30.939E+0 312.674E-3 5.444E+0 49.979E-3 -26.818E-6 -33.30E-3 60.074E-3 23 18132 30.193E+0 1.624E+0 5.617E+0 50.121E-3 -23.246E-6 -33.30E-3 60.074E-3 24 18134 30.193E+0 1.624E+0 5.068E+0 50.078E-3 -24.242E-6 -33.30E-3 60.155E-3 24 18134 30.193E+0 -681.138E-3 5.068E+0 50.078E-3 -63.42E-6 -33.30E-3 60.155E-3 25	17	17150		32.667E+0	-4.027E+0	3.990E	+0	48.795E-3	-28.881E-6	-35.337E-3	60.247E-3
19 18124 30.839E+0 -1.631E+0 5.415E+0 49.954E-3 -26.696E-6 -33.854E-3 60.345E-3 20 18125 30.192E+0 -1.671E+0 5.401E+0 49.954E-3 -26.019E-6 -33.329E-3 60.043E-3 21 18125 30.939E+0 -46.31315E-3 5.568E+0 50.079E-3 -26.818E-6 -33.330E-3 60.043E-3 22 18132 30.193E+0 312.674E-3 5.444E+0 50.079E-3 -26.818E-6 -33.330E-3 60.074E-3 23 18133 32.027E+0 1.624E+0 5.617E-0 50.121E-3 -22.46E-6 -34.816E-3 61.026E-3 24 18134 30.193E+0 -681.138E-3 5.668E+0 50.078E-3 -24.24E-6 -34.330E-3 60.055E-3 24 18134 30.193E+0 -681.138E-3 5.668E+0 50.078E-3 -2.42E-6 -33.330E-3 60.055E-3 25 15077 25.67E+0 -2.377E+0 5.081E+0 49.882E-3-28.555E-6 -5.33.330E-3 60.958E-3 <th>18</th> <th>17176</th> <th></th> <th>32.021E+0</th> <th>-3.318E+0</th> <th>4.629E</th> <th>+0</th> <th>49.315E-3</th> <th>-27.952E-6</th> <th>-34.813E-3</th> <th>60.365E-3</th>	18	17176		32.021E+0	-3.318E+0	4.629E	+0	49.315E-3	-27.952E-6	-34.813E-3	60.365E-3
20 18125 30.193E+0 -1.671E+0 5.401E+0 49.943E-3 -26.019E-6 -33.329E-3 60.043E-3 21 18125 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 -28.481E-6 -34.816E-3 61.026E-3 24 18133 32.021E+0 -641.138E-3 5.568E+0 50.077E-3 -26.342E-6 -33.30E-3 60.074E-3 24 18134 30.193E+0 -681.138E-3 5.566E+0 50.077E-3 -26.342E-6 -33.30E-3 60.155E-3 25 19507 32.667E+0 -2.377E+0 5.081E+0 49.682E-3 -28.55E-6 -35.338E-3 60.968E-3	19	18124		30.839E+0	-1.631E+0	5.415E	+0	49.954E-3	-26.696E-6	-33.854E-3	60.345E-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 30.192E+0 312.674E-3 5.444E+0 49.979E-3 -26.818E-6 -33.30E-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 5.568E+0 50.077E-3 -26.842E-6 -33.300E-3 60.155E-3 24 18134 30.193E+0 -681.138E-3 5.568E+0 50.077E-3 -28.42E-6 -33.30E-3 60.155E-3 25 19507 32.667E+0 -2.377E+0 5.081E+0 49.682E-3 -28.55E-6 -35.338E-3 60.968E-3	20	18125		30.193E+0	-1.671E+0	5.401E	+0	49.943E-3	-26.019E-6	-33.329E-3	60.043E-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 -20.46E-6 -33.330E-3 60.074E-3 24 18134 30.193E+0 -681.138E-3 5.566E+0 50.078E-3 -26.42E-6 -33.330E-3 60.155E-3 25 19507 32.667E+0 -2.377E+0 5.081E+0 49.822E-3 -28.55E-6 -35.330E-3 60.958E-3	21	18126		30.839E+0	-643.315E-3	5.568E	+0	50.079E-3	-26.929E-6	-33.854E-3	60.449E-3
23 18133 32.021E+0 1.624E+0 5.617E+0 50.121E-3 2.424E+6 3.4816E-3 61.026E-3 24 18134 30.193E+0 -681.138E-3 5.566E+0 50.078E-3 -26.342E-6 -33.330E-3 60.155E-3 25 19507 32.667E+0 -2.377E+0 5.081E+0 49.682E-3 25.55E-6 -35.338E-3 60.988E-3	22	18132		30.193E+0	312.674E-3	5.444E	+0	49.979E-3	-26.818E-6	-33.330E-3	60.074E-3
24 18134 30.193E+0 -681.138E-3 5.566E+0 50.078E-3 -26.342E-6 -33.330E-3 60.155E-3 25 19507 32.667E+0 -2.377E+0 5.081E+0 49.682E-3 -28.555E-6 -35.338E-3 60.968E-3	23	18133		32.021E+0	1.624E+0	5.617E	+0	50.121E-3	-28.246E-6	-34.816E-3	61.026E-3
25 19507 32.667E+0 -2.377E+0 5.081E+0 49.682E-3 -28.555E-6 -35.338E-3 60.968E-3	24	18134		30.193E+0	-681.138E-3	5.566E	+0	50.078E-3	-26.342E-6	-33.330E-3	60.155E-3
	25	19507		32.667E+0	-2.377E+0	5.081E	+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



ost Processing Navigator	ø
Name	
Yoke Assy_Modes_sim1	^
Solution 1	
Mode 1, 2.742e-003 Hz	
Mode 2, 2.203e-003 Hz	
Hode 3, 1,170e-003 Hz	
- Mode 4, 1,212e-003 Hz	
Displacement - Nodal	
Rotation - Nodal	
Stress - Element-Nodal	
Strain - Flement-Nodal	
Strain Energy Density - Elemental	
Mode 5, 1 684e-003 Hz	
B Displacement - Nodal	
(2) Se Potation - Nodal	
Strass - Element Nodal	
(2) Strain - Element Nodal	
Constraint - Element - Notal	
Strain Energy Density - Elemental	
Mode 0, 2.942e-003 Hz	
Displacement - Nodal	
Rotation - Nodal	
Stress · Element-Nodal	
🕃 👪 Strain - Element-Nodal	
Strain Energy Density - Elemental	
Mode 7, 6.914e+003 Hz	
Displacement - Nodal	
Rotation - Nodal	
El Stress - Element-Nodal	
🛞 🛃 Strain - Element-Nodal	
① Strain Energy Density - Elemental	
Mode 8, 8.622e+003 Hz	
B Displacement - Nodal	
🛞 🛃 Rotation - Nodal	
🕀 🏧 Stress - Element-Nodal	
🛞 🛃 Strain - Element-Nodal	
🖲 🛃 Strain Energy Density - Elemental	
B Mode 9, 1.108e+004 Hz	
🕀 🎦 Displacement - Nodal	
🛞 🛃 Rotation - Nodal	
🛞 🔂 Stress - Element Nodal	
🛞 🛃 Strain - Element-Nodal	
🕀 🎂 Strain Energy Density - Elemental	
Mode 10, 1.243e+004 Hz	
Imported Results	
Viewports	
Eringe Plots	
Post View 1	×
	>

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

Post-Processing Navigator	Post-Processing Navigator						
Name	Description						
🏰 Yoke Assy_sim1							
🕀 😳 🃇 Solution 1	NX NASTRAN, Structu	ural,					
🚰 Imported Results							
Viewports							
🖃 📘 Fringe Plots							
🖻 🚳 Post View 1	Displacement, Yoke	Ass					
🖃 🗹 3D Elements							
	Material ID = 1, Prope	rty					
3d_mesh(2)	Material ID = 2, Prope	rty					
🖻 🚺 Fringe Plots							
🖹 🗰 Post View 2	(MASTER) Displaceme	ent,					
🖻 🗹 3D Elements							
₩ 3d_mesh(1)	Material ID = 1, Prope	rty					
🖸 3d_mesh(2)	Material ID = 2, Prope	rty					
🍓 Templates							
💬 🛱 Smooth Contours							
🖾 🛱 Iso Surfaces							



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

🚊 Mode	8, 8.622	2e+003 Hz		
÷. 🔂	Displac	ement-No	al	
÷. 🔂	Rot	Apply		
÷. 🎦	Str	Plot	dal	
÷• 👪	Str	Overlay	lal	
÷. 🔂	Strain E	nergy Dens	it	
🚊 Mode	9, 1.108	8e+004 Hz		
÷. 🔂	Displac	ement - No	dal	
÷• 🌆	Rotation	n - Nodal		
÷. 🔂	Stress -	Element-No	odal	
÷. 🔂	Strain -	Element-No	dal	
÷ 🔂	Strain E	nergy Dens	it	
🗄 Mode	10, 1.24	43e+004 H:	z	
🌽 Imported I	Results			
Viewports				
🖃 📕 Fringe	Plots			
÷ 🔾 🖾	Post Vie	w 2		Displacement, Yoke Assy_Modes
÷ 😐 🚳	Post Vie	w 4		(MASTER) Displacement, Yoke Ass

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





Plotting Paths



Ares & Element Setempting ALC: NO 7.636-003 2.44 12.44 4.44

Poth Length (mm

Paths defined by

- Node labels
- Screen selection
- Edge selection



Plotting Paths



Name 🔺	Туре
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_1PostGraphs.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



Divisions			
Type Auto	o Units/Grid	Ticks/Grid	
Frequency 🛃	0.0000	4 🌲	
Time 🗹	0.0000	4 🗢	
RPM 🗹	0.0000	4 🌲	
Order 🗹	0.0000	4 🗢	
Magnitude 📃	0.0000	5 🗢	
Phase 🛃	0.0000	4	
Real 🗹	0.0000	4	
Imaginary 🛃	0.0000	4	
dB Axis 🛛 🛃	0.0000	4	
All Other X 🛃	0.0000	4	
All Other Y 🛃	0.0000	4	
All Other Z 🛃	0.0000	4 🗢	
All Other Z	0.0000	4 🗢	

- 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

· · · · · · · · · · · · · · · · · · ·] · 💠 🔶 Į	
	X = 3.528E+ Real= 4,775E+	-001 -000
	X - 3.638E+001 Y - 5.244E+000	
	X - 3.307E+001 Y - 3.749E+000	
	X - 3.087(+001 Y - 2.798(+000	
	28.48 37.48	

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







208

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	De Bu ber Jhnam Des De				-	200	~	
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Images Comment								

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

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Customer Defaults – General

Simulation General Model Preparation Mesh Display Node and Element Display Mesh Controls Boundary Condition Display Threshold Values - NASTRAN Threshold Values - ANSYS Threshold Values - ABAQUS	Environment Solution FE M Application Solver Analysis Type NASTRAN Solver for Pre-NX3	Model Create) FE Model and S Ad NX NASTRAN Struc Scenarios t FEM and Simulation in Advance	Model and Simulation Create Advanced Simulation ASTRAN	
Threshold Values - NX Thermal / Flow Threshold Values - NX ELECTRONIC SY Threshold Values - NX SPACE SYSTEMS Meshing NASTRAN ANSYS ABAQUS Analysis Post Processor	Import Laminate Data into	the NX Laminate Product		<u>୧</u> ୧

General

- Default Solver
 Language
- Creation of the four simulation files

Customer Defaults – Model Preparation

in ulation				
Ceneral	iuealize reature	Compound Objects		
Model Preparation	Tangential Edge	Angle	4	5.0 deg ?
Mesh Display	Hele Discusses			
Node and Element Display	Hole Diameter		[10.0	
Mesh Controls	Blend Radius		5.0	mm Metric ?
Boundary Condition Display	Tinu Free Ares			
Threshold Values - NASTRAN	Tiny Face Area		[9.0	mm-2 Metric Y
Threshold Values - ANSYS	Thin Face Width		3.0	mm Metric ?
Threshold Values - ABAQUS			· · · ·	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Threshold Values - NX Thermal / Flow				
- Threshold Values - NX ELECTRONIC SY				
Threshold Values - NX SPACE SYSTEMS				
Meshing				
NASTRAN				
ANSYS				
ABAQUS				
Analysis				
Post Processor				
	-			

Model Preparation

 Default values for CAE Topology creation

Customer Defaults – Mesh Display

nulation	3D Mesh 2D Mesh 1D Mesh OD Mesh Contact Mesh Mesh Doint	
General	35 Mesh 25 Mesh 15 Mesh 05 Mesh Contact Mesh Mesh Fonte	
Model Preparation	Color	?
Mesh Disolay	ur det	
Node and Element Display	width	💌 🗳
Mesh Controls	Edge Color When Shaded	2
Boundary Condition Display		
Threshold Values - NASTRAN	Display Internal Edges	?
Threshold Values - ANSYS		
Threshold Values - ABAQUS	Element Shrink Percentage	% ?
Threshold Values - NX Thermal / Flow	0	
Threshold Values - NX ELECTRONIC SY		
Threshold Values - NX SPACE SYSTEMS	0	100
Meshing		
NASTRAN		
ANSYS		
ABAQUS		
Analysis		
Post Processor		

Mesh Display

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

Customer Defaults – Node & Element Display

Defaults Level Us	er Default Lock State Unlocked	Part Units Metric 🔽 🏘 📢
imulation	All	
General		0
Model Preparation	Node Marker	<u>(</u>)
Mesh Display	None ODot OAsterisk	
Node and Element Display	Node Color	2
Mesh Controls		
Boundary Condition Display	Element Display Quality	2
- Threshold Values - NASTRAN	Ocoarse OMedium Sine	181
Threshold Values - ANSYS		
Threshold Values - ABAQUS		
Threshold Values - NX Thermal / Flow		
Threshold Values - NX ELECTRONIC SY		
Threshold Values - NX SPACE SYSTEMS		
Meshing		
NASTRAN		
ANSYS		
ABAQUS		
Analysis		
Post Processor		

Node & Element
 Display

- Node style
- Element display quality
Customer Defaults – Mesh Controls

imulation 🔨	All	
General		
Model Preparation	Global Edge Density	
Mesh Display	Color	?
Node and Element Display	e de la contra de la	
Mesh Controls	Symbol Scale	<u> </u>
Boundary Condition Display	20	
Threshold Values - NASTRAN	0	
Threshold Values - ANSYS	1	100
Threshold Values - ABAQUS		
Threshold Values - NX Thermal / Flow	Mapped Mesh Edge Density	
Threshold Values - NX ELECTRONIC SY	Color	?
Threshold Values - NX SPACE SYSTEMS		
Meshing	Symbol Scale	<u>(</u>)
NASTRAN	10	
ANSYS	0	1
ABAQUS	1	100
Analysis		
Post Processor 🗸 🗸	Face Density	and the second se
· · · · · · · · · · · · · · · · · · ·	Color	2

Mesh Control defaults

Customer Defaults – Boundary Condition Display

21 1		
Simulation 🔨	All	
General		
Model Preparation	Colors	
Mesh Display	Constraints	?
Node and Element Display	1 P	
Mesh Controls	Loads	
Boundary Condition Display	Simulation Objects	2
- Threshold Values - NASTRAN		
Threshold Values - ANSYS	Expanded Display	
Threshold Values - ABAQUS		
Threshold Values - NX Thermal / Flow	Constraints	2
- Threshold Values - NX ELECTRONIC SY	Loads	2
Threshold Values - NX SPACE SYSTEMS		<u>~</u>
Meshing	Simulation Objects	2
NASTRAN		
- ANSYS	Line Width	
ABAQUS	Display	
Analysis		_
Post Processor	Graphic Symbol	?
	- Namo	6 💌

Boundary Condition Display

 Defaults for color, line width and style

Customer Defaults – Threshold Values Nastran

Simulation	^	I	Hex20		Wedge6		Wedge 1	5
General		Tri3	Tri6	Quad4	Quad8	Tetra4	Tetral0	Hexa
Model Preparation			-					
- Mesh Display		Check	Aspect Ratio	0				2
Node and Element Display		Aspect Ra	tio				(F. O	าเอ้
Mesh Controls							[3.0	_ _
Boundary Condition Display		Check	Skew					?
Threshold Values - NASTRAN		Skew				(co o de	
Threshold Values - ANSYS		SILCHY				ļ	00.0	a 🖒
Threshold Values - ABAQUS		Check	Jacobian Rat	tio				?
Threshold Values - NX Thermal / Flow	Č.	Incohine Patio						
- Threshold Values - NX ELECTRONIC S	Y -	Jacobianik	auo				5.0	J 🗳 🛛
Threshold Values - NX SPACE SYSTEM	IS	Check	Jacobian Zei	ro				?
Meshing								- a
NASTRAN		Jacobian 2	ero				[0.0	JЩ
ANSYS		Check	2D Minimum	/Maximum An	igle			2
ABAQUS						1		
Analysis	Υ.,	2D Minimu	im Angle				20.0 de	9 [[
Post Processor	V	2D Maximu	um Angle			ſ	120 0 de	eq 🧿
č			15.13			1	120.0	

Threshold Values – Nastran

 Element quality check threshold values for Tri, Quad, Tet, Hex and Wedge element types

Customer Defaults – Meshing

imulation 🔨	All	
General	Land the second	
Model Preparation	Element Name Format	2
- Mesh Display	General OLanguage-Specific	
Node and Element Display	Tiny Edge Tolerance	n mm Metric 9
Mesh Controls	They Edge Polerance	
Boundary Condition Display	Abstracted Geometry Color	[]
- Threshold Values - NASTRAN		
Threshold Values - ANSYS	2D Mesh Maximum Jacobian	5.0 ?
Threshold Values - ABAQUS	2D Mark Uniternal Interking	
Threshold Values - NX Thermal / Flow	SD Mesh Maximum Jacobian	20.0
- Threshold Values - NX ELECTRONIC SY	Tet Mesh Small Feature (% of element size)	100 % 2
Threshold Values - NX SPACE SYSTEMS		
Meshing	2D Mesh Small Feature (% of element size)	10.0 % ?
NASTRAN	Marga Edgas	
ANSYS	I Morge Luges	L.
ABAQUS	Vertex Angle	15.0 ?
Analysis		~~
Post Processor	Mesh Transition	2

Meshing

 General defaults for the meshing task

Customer Defaults – Analysis

imulation 🔥	Optimization Fatigue	
General		
Model Preparation	Model	?] 🔒
Mesh Display	Goodman OGerber	
Node and Element Display	Mathad	D
Mesh Controls	Method	S
Boundary Condition Display	Amplitude and Mean	
- Threshold Values - NASTRAN	Amplitude	
Threshold Values - ANSYS	Mean	
Threshold Values - ABAQUS	Mean Stress Model	2
Threshold Values - NX Thermal / Flow	Conduct	
- Threshold Values - NX ELECTRONIC SY	Goodman	
Threshold Values - NX SPACE SYSTEMS	Soderberg	
Meshing	Gerber	
NASTRAN	Morrow	
ANSYS	None	
ABAQUS	Cualic Madel	0
Analysis		
Post Processor 🗸 🗸	Kamberg-Osgood	
	OPower-Hardening	×

Analysis

 General and specific for Optimization and Fatigue (Durability)

Customer Defaults – Post Processor

mulation 🔨	Font Report Other		
General			
Model Preparation	Font	BLOCK	FONT 🔽 💽
Mesh Display	Font Size		mm Matric O
Node and Element Display	Tone size	2.5	
Mesh Controls		2.5	
Boundary Condition Display	-	9	
Threshold Values - NASTRAN	1.0		4.0
Threshold Values - ANSYS	Bold		?
Threshold Values - ABAQUS			~
Threshold Values - NX Thermal / Flow	Ad Ad Ad		
Threshold Values - NX ELECTRONIC SY			Q
Threshold Values - NX SPACE SYSTEMS			L.
Meshing	Italic Slant		deg ?
NASTRAN		20.0	-1
ANSYS		<u>_</u>	
ABAQUS	.0		40.0
Analysis			
Post Processor			
*			

Post Processor

- Defaults for text display
- Report file names





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