

Webinar: **What's New in Femap 2020.2** July 30<sup>th</sup>, 2020

**Host:** Jonathan Hill ATA Engineering, Inc.

**Presenter:** Andy Haines Siemens Digital Industries Software

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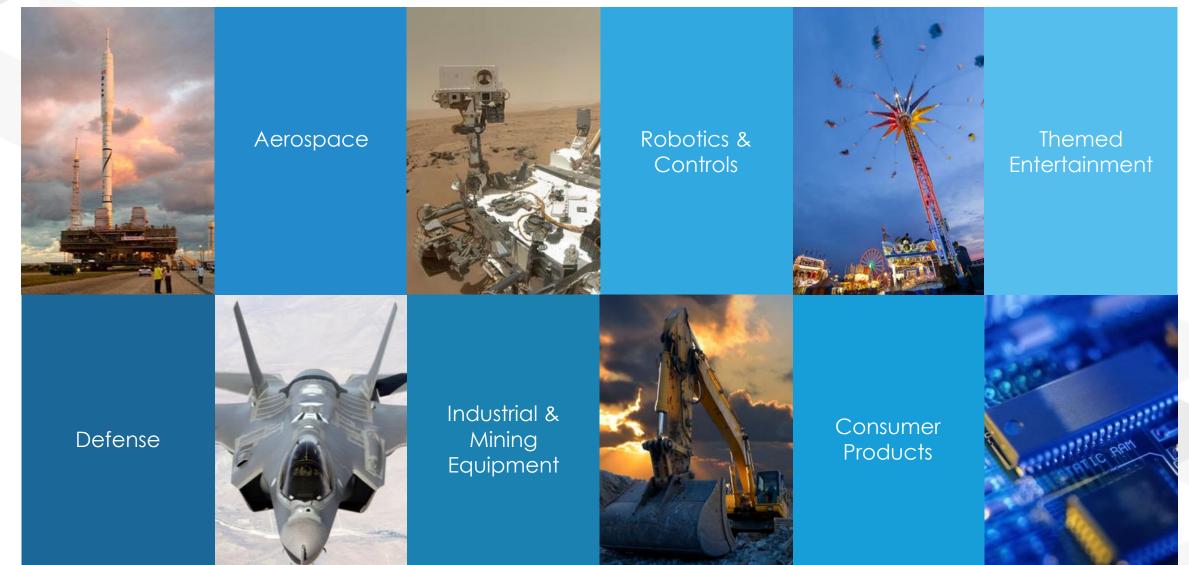
13290 Evening Creek Drive S, San Diego CA 92128

in ata-engineering



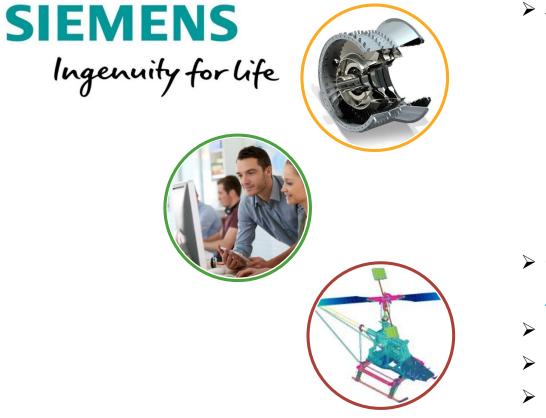
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© 2017 ATA Engineering. All rights reser PRODUCTS ABOUT EVENTS & TRAININ	rved. Web Design by Eyesparks NG SUPPORT NEWS CONTACT SEARCH		Training Videos Tutor	<ul> <li>of Biff to some</li> <li>all was not and allowing and allowing and allowing to some and allowing and allowing and allowing to some allowing allowing allowing allowing allowing allowing to some allowing allowing allowing allowing allowing to some allowing allowing allowing allowing allowing allowing allowing allowing allowing allowing allowing allowing allowing allowing allow</li></ul>
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#### Simcenter Femap v2020.2 What's New

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Where today meets tomorrow.

#### **Simcenter Femap Direction**



35+ Years Dedicated to the Needs of the FEA Analyst!

Maximize efficiency of FEA tasks

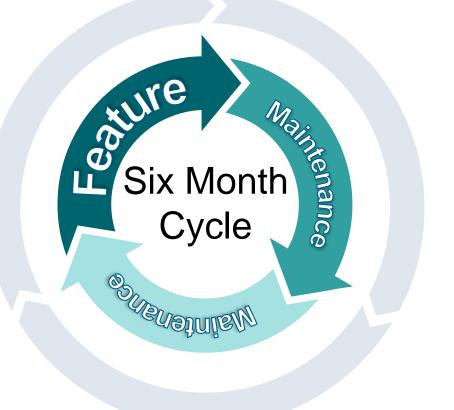
- Efficient creation of high fidelity FE models that accurately represent real-world engineering problems
- Intuitive interpretation of analysis results to improve the design and performance of engineered products

Build upon strong Simcenter Femap capabilities

- Geometry idealization and processing for FE models
- Powerful meshing, model creation and interactive editing
- In-depth support for industry standard solvers
- Flexible customization tools to streamline analysis processes

#### Simcenter Femap Roadmap – Update Release Cadence





**Feature Release Every Six Months** Database Change, UI Updates including Localization, Licensing Updates – April - October

Maintenance Release – If Required Database, UI, Licensing Unchanged – Bug Fixes/Critical Updates Only

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#### Simcenter Femap Roadmap – Update Release Cadence

#### Feature Release – April/October

- New Features
- Expanced Functionality
- Database Changes
- API Expansion
- Will Require Licensing Update, Localization Update

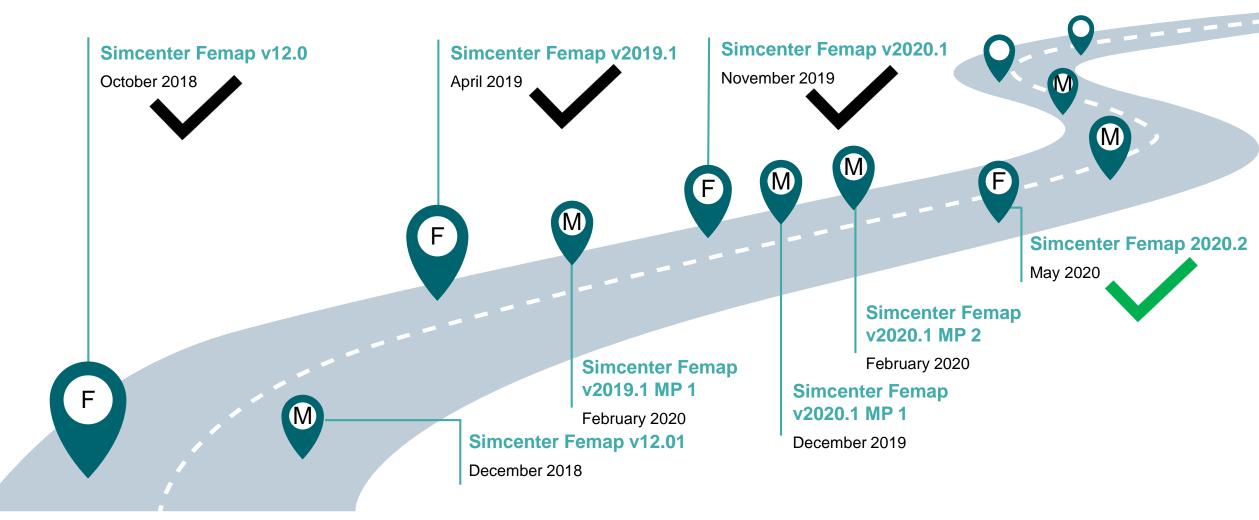
#### **Maintenance Release**

- Bug Fixes
- Minor Enhancements without User Interface Changes
- Working to Modernize Installer Maintenance Releases as Patches, not full Installs
- Simcenter Nastran Update



#### Simcenter Femap v12.0 and Beyond Roadmap





Agenda: Performance Improvements UI and Visualization Preprocessing Meshing Post Processing Solver Support Miscellaneous

## Simcenter Femap v2020.2 – What's New Performance Improvements



- Connect->Automatic command
  - 3x-5x improvement in models with a large number of connections
- Geometry, Copy/Rotate/Reflect: Mesh, Copy/Rotate/Reflect; and Move commands
  - Significant improvements have been made to both the copy/move phase of these commands and the redrawing phase
  - Most noticeable improvement will be in large models when copying small portions of the model...potentially 40x faster.
- Length-based operations on Curves
  - Impacts Mesh Sizing and Coordinate methods such as Along Curve, Length Along and Midpoint by making these methods both Faster and More Accurate
  - Mesh Sizing 2x-3x faster on large model

### Simcenter Femap v2020.2 – What's New Performance Improvements

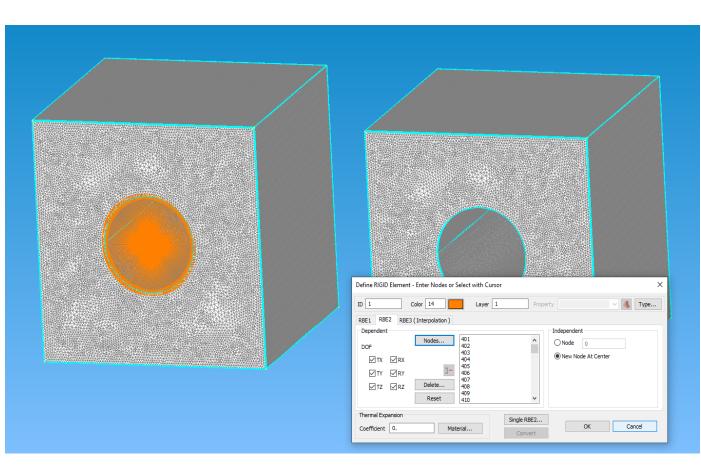


- Commands which can be "Aborted"
  - Many Checking and Listing commands can be aborted while doing computations or listing results.
  - Anywhere from 2x-100x improvement in speed of these commands with only slightly slower abort reaction time
  - Largest improvements in the Tools->Check and Tools->Mass Properties commands
- Output Process
  - **30%+** improvement in the Envelope, Linear Combinations, and RSS combinations
- Nastran Model Read
  - Almost **2x** improvement in importing large input files
- ANSYS Results Read
  - 2x-3x improvement when reading results from non-compressed RST files

## Simcenter Femap v2020.2 – What's New Performance Improvements – Graphics



- Performance
  - Entity creation (especially in PG\*)
  - Minimize free face evaluation
  - Minimize full graphics regenerations
- Creating a single entity when the model is already large was slow in PG\*.
  - Creating a single rigid element in a model with 3.3 million 10-noded tetrahedral elements took 29 seconds in 2020.1, but now takes 0.3 seconds (~95x improvement)
- Some improvement to entity copy in large models but not as significant as in creation



\*PG = Performance Graphics in Simcenter Femap

#### Simcenter Femap v2020.2 – What's New Performance Improvements – Graphics

- Added Crtl-G Group Evaluate option to Graphics tab of File->Preferences, which performs Group->Operations-> Evaluate on all groups currently visible when using Window-> Regenerate (Ctrl+G Shortcut Key). Helps when creating entities into the displayed group.
- Added *Disable Abort* option to *Graphics* tab of File->Preferences to disable checking for user aborts while drawing
- Max VBO MB and Min VBO B are available to specify when Best Possible is enabled
- Improved performance of thumbnail generation for large models from 30 seconds to 10 seconds

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#### Agenda:

Performance Improvements **UI and Visualization** Preprocessing Meshing Post Processing Solver Support Miscellaneous

# Simcenter Femap v2020.2 – What's New UI and Visualization – High DPI Support



#### New Icons

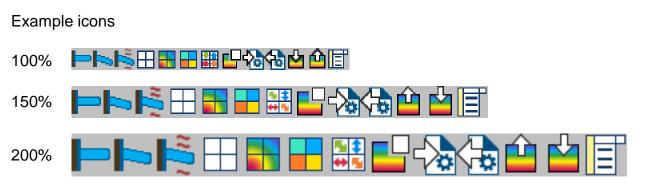
- Icons were redrawn with a modern style and color palette
  - Colors selected to provide enhanced contrast making selection easier
  - Consistent theme throughout Femap
- Designed to maximize familiarity to minimize learning curve

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## Simcenter Femap v2020.2 – What's New UI and Visualization – High DPI Support

New Icons – All 1600+ Completed in v2020.2!

- Vector assets of all icons allow for Femap to fully support high resolution (4K) displays
- UI scaling Full high DPI support in 2020.2 now available!!!
- Other options can be set with Preference:
  - Disabled Femap is drawn at 100% resolution, however text and icons can be small and hard to read
  - Handled by Windows Femap is scaled at the Windows scaling setting via extrapolation; leads to blurry text and blurry text and icons



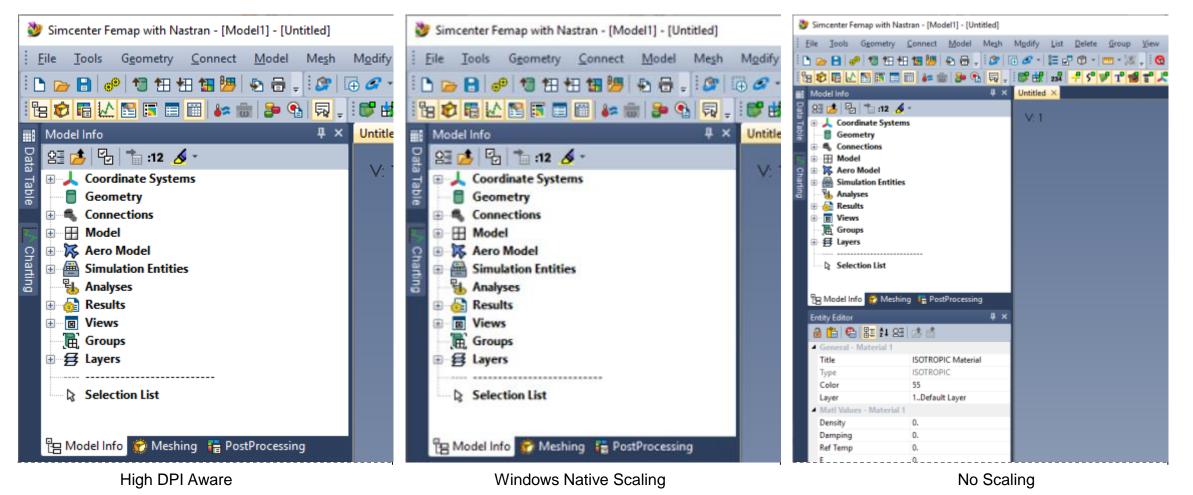
- 100%
- 150%



# Simcenter Femap v2020.2 – What's New UI and Visualization – High DPI Support



High DPI Support - v2020.2 examples on 4k monitor



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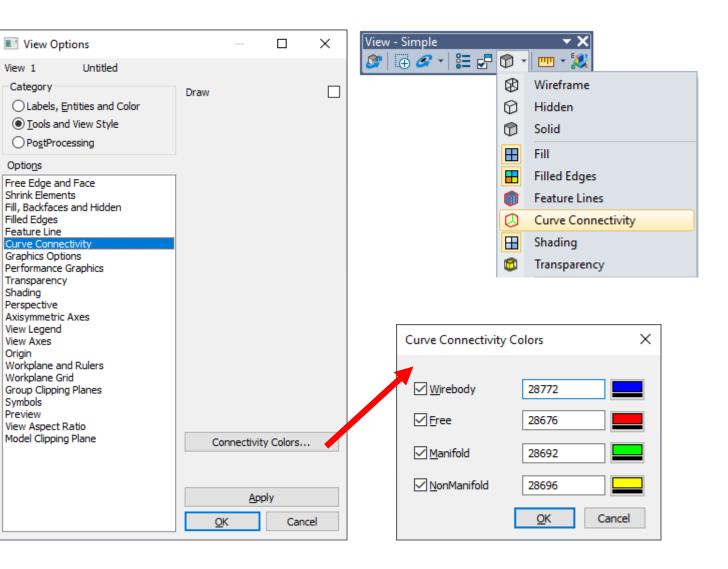
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## Simcenter Femap v2020.2 – What's New UI and Visualization – Curve Connectivity



*Curve Connectivity* in View->Options colors Curves by level of connectivity

- Override curve color based on surface connectivity
  - Free 1 surface attached
  - Manifold 2 surfaces attached
  - NonManifold more than 2 surfaces attached or "T-junction"
  - Wirebody 0 surfaces attached (not common as Wirebody entities cannot be created in Femap)

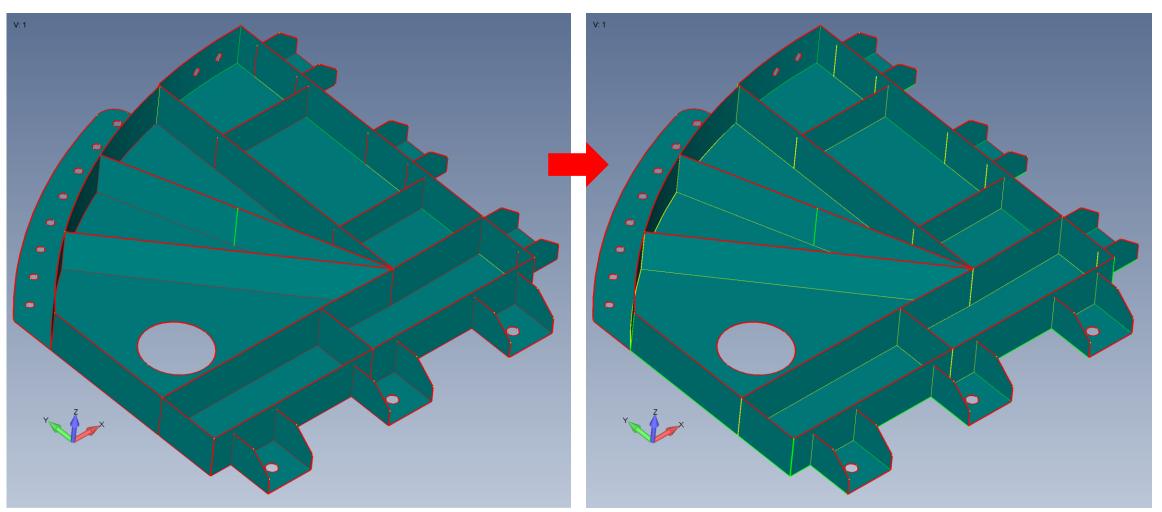


### Simcenter Femap v2020.2 – What's New UI and Visualization – Curve Connectivity



Before NonManifolod Add – No NonManifold Curves Exist

After NonManifolod Add – NonManifold Curves Shown in Yellow



# Simcenter Femap v2020.2 – What's New UI and Visualization – Renumbering



Improved Renumbering commands to provide better control when choosing to offset IDs

- Replaced old "Constant Offset" option with new *Renumbering Options* section
  - Compress Specify Starting ID and optionally Increment
  - Offset To Specify Starting ID
  - Offset By Specify ID Offset

Renumber To	×
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## Simcenter Femap v2020.2 – What's New UI and Visualization – Copy/Save Formats



Enhanced Copy to Clipboard and Save to File commands for the Data Table, Connection Editor, Mesh Point Editor, Function/Table Editor and Entity Editor to copy/save data using formatted HTML.

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Improves formatting when pasting into Office Tools and allows viewing of saved files with standard browsers.

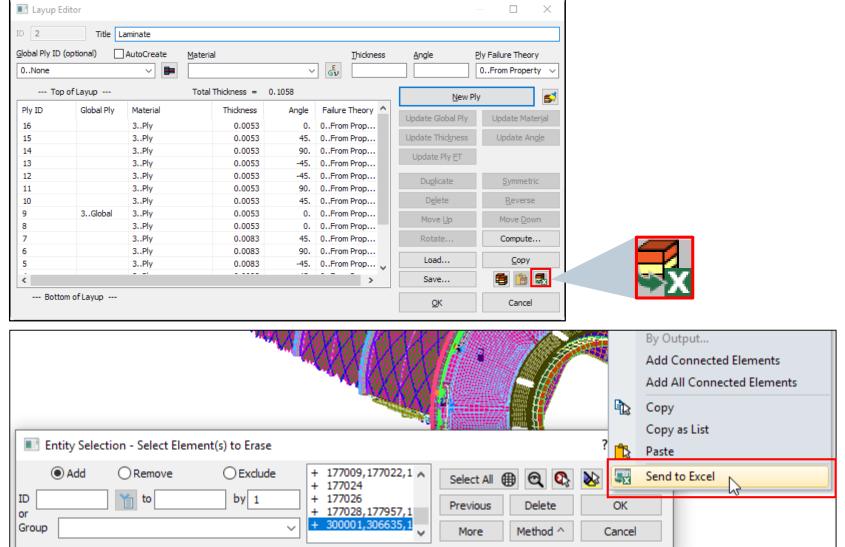
### Simcenter Femap v2020.2 – What's New UI and Visualization – Send to Excel



New technology in Simcenter Femap offers ability to transfer data from dialog boxes and panes directly to Microsoft Excel

Examples of dialog boxes which have *Send to Excel* commands or icons to transfer data are:

- Layup Editor
- Standard Entity Selection



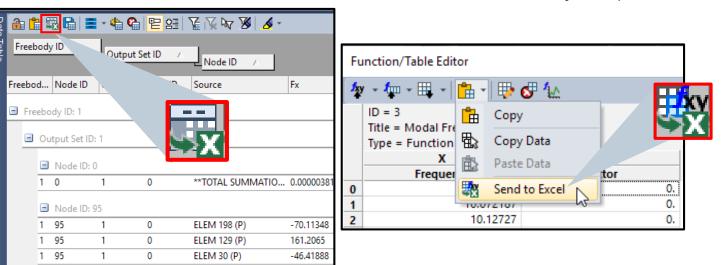
#### Simcenter Femap v2020.2 – What's New UI and Visualization – Send to Excel

Various dockable panes in Femap are now outfitted with *Send to Excel* commands or icons

Typically located next to Copy/Save icons or on *Copy to Clipboard* menu

Data is sent with HTML Formatting

- Organized
- Clean look and feel
- Easy to manipulate column width and other features of the table



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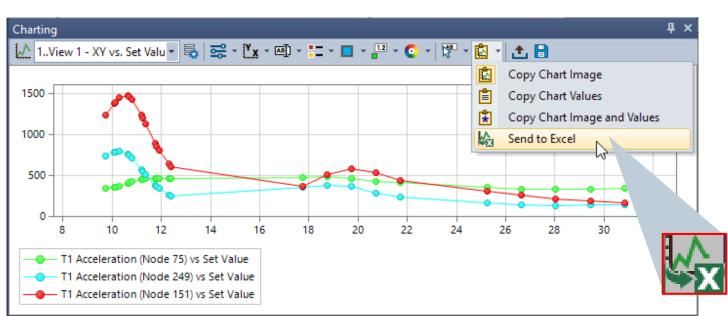


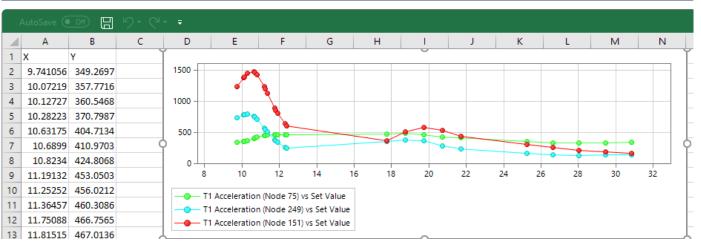
# Simcenter Femap v2020.2 – What's New UI and Visualization – Send to Excel



Send to Excel command in Charting pane simultaneously transfers:

- XY Data Pairs for ALL Data Series currently visible in the *Charting* pane
- Image of Chart





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#### Simcenter Femap v2020.2 – What's New UI and Visualization – Miscellaneous



Updated *Equation Editor* dialog box to be resizable, added context-sensitive help by pressing *F1 key*, and reordered items in the *Functions* list to group similar items together.

Added ELTHK( elemID ; cornerID ), which returns planar element corner thicknesses.

Updated View->Options command to automatically switch *Color Mode* to appropriate "View Color" option after using *Color Palette* to select a color, then clicking *OK* 

Updated selection of solids to allow use of the Select Visible icon, but only selects visible solids, not "Simcenter Femap volumes"

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## Simcenter Femap v2020.2 – What's New UI and Visualization – Miscellaneous



Updated List->Geometry->Curve command to include Arc/Circle center coordinates when *Advanced* option is enabled.

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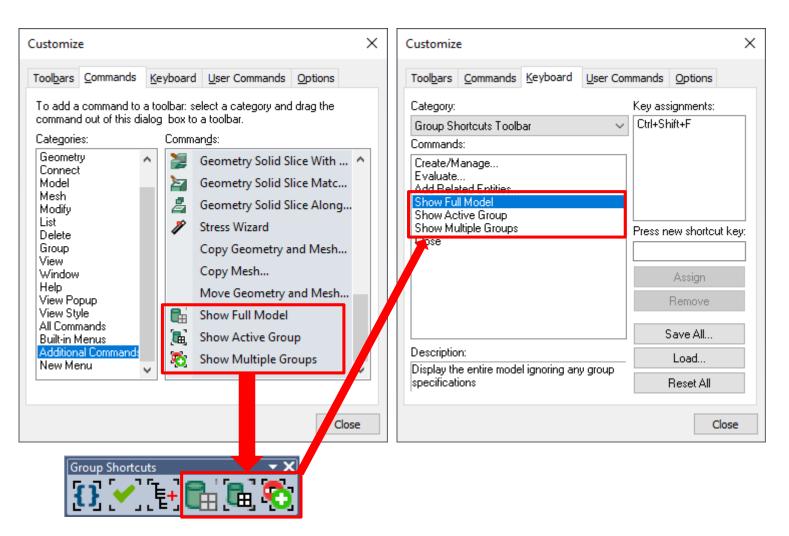
Improved Model->Merge to more cleanly handle cases where user intentionally chooses to overwrite existing entities in the current model.

## Simcenter Femap v2020.2 – What's New UI and Visualization – Miscellaneous



Added ability to use commands on "floating" toolbars (i.e., not "docked") while using another command. It was already possible to use commands on "docked" toolbars in previous versions.

Added "Group Display Mode" (i.e., *Show Full Model, Show Active Group*, and *Show Multiple Groups*) commands under "Additional Commands" on the *Commands* tab of the *Customize* dialog box. Once added to any toolbar, they can also have shortcut keys assigned



#### Agenda:

Performance Improvements UI and Visualization **Preprocessing** Meshing Post Processing Solver Support Miscellaneous

# Simcenter Femap v2020.2 – What's New Preprocessing – Beam Properties



Added Write Zeros at End B (Off=Blank) option for Nastran solvers to Beam Property

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If option is disabled, nothing is written to Nastran input file for that field, which means End B = End A for field

Preview Analysis Input File		
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\$ Femap PropOrient 1 : 9,0,0.,1.,2.,7.,8.,-1.,0.,0.		
\$ Femap PropShape 1 : 9,1,0.9,0.45,0.675,0.09,0.09,0.09		
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\$ Femap PropMethod 2 : 9,0,1,0.3		
\$ Femap PropOrient 2 : 9,0,0.,1.,2.,7.,8.,-1.,0.,0.		
\$ Femap PropShape 2 : 9,1,0.9,0.45,0.675,0.09,0.09,0.09		Analyz
\$ Femap PropMethod 2 : 9,1,1		Analyz
\$ Femap PropOrient 2 : 9,1,0.,1.,2.,7.,8.,-1.,0.,0.	I	- Europe
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+ .5051366.4321888	.0701	<u>D</u> one

# Simcenter Femap v2020.2 – What's New Preprocessing – Tools

**Tools->Parameters** 

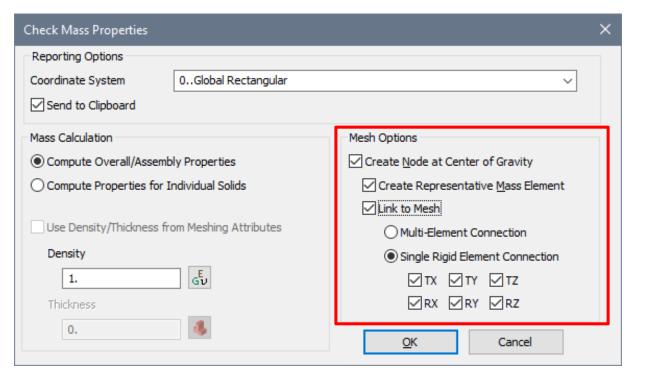
- Added ability to specify Output Coordinate System to use for all newly created nodes
- Added ability to specify Color, Next ID, and Inc for Monitor Points
- Add ability to specify Next ID and Inc for Matrix Input entities

Model Parameters										×
Color and ID Contro										
	Color	Next ID	Inc		Color	Next ID	Inc		Next ID	Inc
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Point	24	1	1	Region	20488	1	1	Load Set	1	1
Curve	120			Connector	14	1	1	Constraint Set	1	1
Combined Curve	20590	1	1	<u>N</u> ode	46	1	1	Function	1	1
Sur <u>f</u> ace	60	1	1	<u>E</u> lement	124	1	1	Group	1	1
<u>B</u> oundary	24642	1	1	Material	55	1	1	Output Set	1	1
Sol <u>i</u> d	66	1	1	Property	110	1	1	Output Format	1	1
Mesh Point	24578	1	1	Aero Panel	124	1	1000	View	2	1
Te <u>x</u> t	124	1	1	Aero Property	110	1		Matrix Input	1	1
Monitor Point	105	1	1	Aero Spline	24696	1	1		-	-
				Aero Surface	24590	1	1			
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P <u>r</u> operty			~	Output Form <u>a</u> t			~	<u>0</u> K	G	ancel

# Simcenter Femap v2020.2 – What's New Preprocessing – Tools

Tools->Mass Properties->Solid Properties

- Added support for multiple solids
- Support copying the listing to the Clipboard in Text, RTF, and HTML format
- Update the listing format to be similar to Tools->Mass Properties->Mesh Properties
- Supported computing overall properties and properties for individual solids.
   "Individual Solids" is only available if you select multiple "true solids" ... no general or sheet bodies.



Added Mesh Options section to connect newly created representative mass element to any number of nodes in an existing mesh using either a single rigid element or multiple elements generated by Mesh->Connect->Closest Link functionality



### Simcenter Femap v2020.2 – What's New Preprocessing – Tools



Tools->Mass Properties->Mesh Properties

- Added support to copy the listing to the Clipboard in Text, RTF, and HTML format
- Added support for Solid Laminates Elements
  - Laminate Layup thicknesses are scaled to match the length of each edge in the layup direction. Each ply is then computed as a "thin" single material brick/wedge with corners at the correct top/bottom ply locations.
- NOTE: CG computations will not match Nastran unless you use PARAM,COUPMASS,1. This is an error in Nastran, not Simcenter Femap. See PR# 9631432. Also, inertias will not match, just like all of the Simcenter Femap inertia computations, we simply use a lumped mass at the centroid and do not account for the inertia of the individual element geometry.

Check Mass Properties		×
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Reporting Options		
Coordinate System	0Global Rectangular	~
List Properties for 1	Individual Elements	
Send to Clipboard		
Mesh Options		
Create Node at To	tal Center of Gravity	<u>о</u> к
Create <u>M</u> ass El	ement	Cancel

#### Simcenter Femap v2020.2 – What's New Preprocessing – Loads and Boundary Conditions



Added ability to create Follower Forces and Follower Moments (Nastran Only)

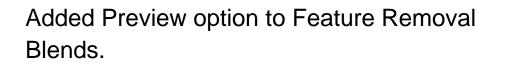
- Define a force or moment in terms of a magnitude and direction nodes
- 2 nodes/points can be specified to define the direction of the of the load terms of a vector.
- 4 nodes/points can be specified to define the direction as normal to a plane
- Both nodal and geometric follower loads can be defined

Create Loads on Nodes			×
Load Set 1 Untitled	ł		
Title	Layer 1	Coord S <u>v</u> s	0Global Rectangular 🗸
Force Follower Force Moment Follower Moment Displacement Enforced Rotation Velocity Rotational Velocity Acceleration Rotational Acceleration 	Direction <ul> <li>Magnitude Only</li> <li>Vector</li> <li>Along Curve</li> <li>Normal to Plane</li> <li>Normal to Surface</li> </ul> Load       Val         Magnitude       0.         Node 1 (G1)		Method  Constant  Variable  Data Surface  Data Surface  Data Surface
Static Fluid Pressure Total Fluid Pressure General Scalar Steam Quality Relative Humidity Fluid Height Condition Unknown Condition	Node 3 (G3) Node 4 (G4)		<u>O</u> K Cancel

#### Agenda:

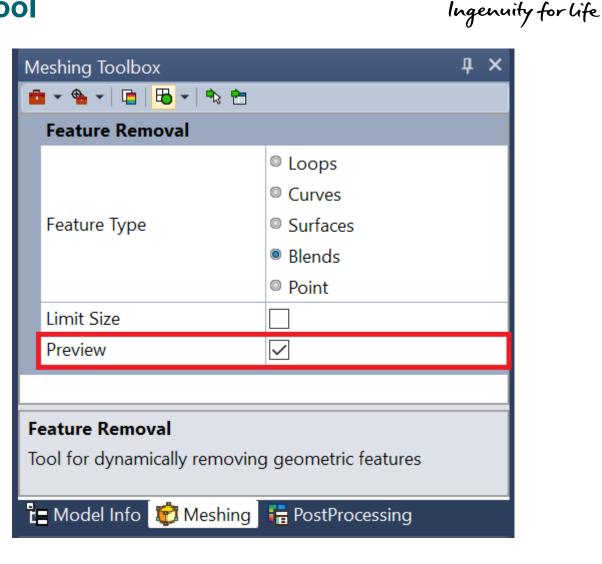
Performance Improvements UI and Visualization Preprocessing **Meshing** Post Processing Solver Support Miscellaneous

## Simcenter Femap v2020.2 – What's New Meshing Toolbox – Feature Removal Tool



- Brings up surface entity select dialog with all found blends highlighted.
- Ability to add or remove specific blends.
- · Can be used with or without Limit Size.

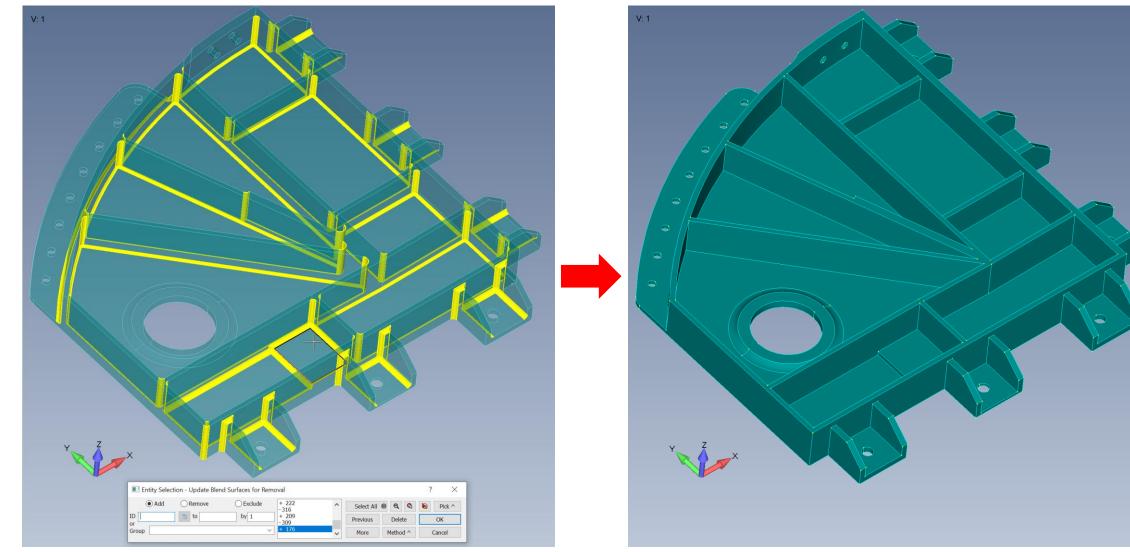
Unrestricted © Siemens 2020



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# Simcenter Femap v2020.2 – What's New Meshing Toolbox – Feature Removal Tool





## Simcenter Femap v2020.2 – What's New Meshing Toolbox – *Geometry Editing* Tool

Added Surface/Replace Face capability to Extend under Geometry Editing.

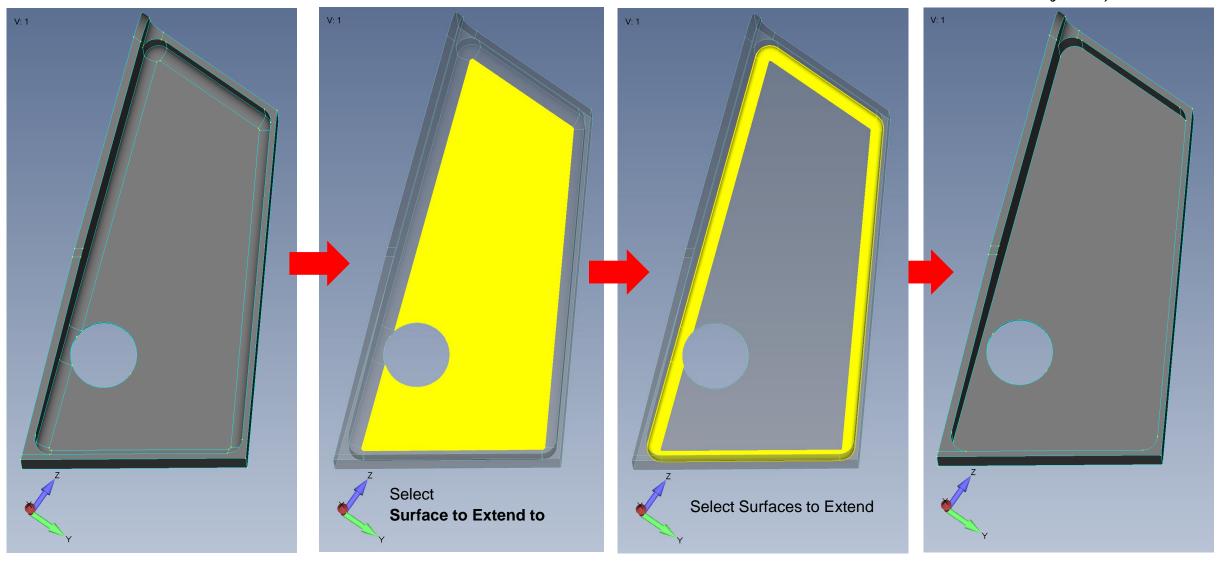
- Extend faces of solid up to selected surface.
- Remove fillets that have failed from blend removal.
- Raise or retract surfaces to main solid to remove features.
- Existing extend commands are now under Curve on Surface.

### SIEMENS Ingenuity for life

Meshing Toolbox	ť	ιx			
💼 🕶 💁 🕶   🛅   🔂 🕶   🗞 🛅					
Geometry Editing					
Operation	<ul> <li>Curve Break</li> <li>Point to Point</li> <li>Point to Edge</li> <li>Edge to Edge</li> <li>Slice</li> <li>Pad</li> <li>Washer</li> <li>Extend</li> <li>Project/Move Point</li> <li>Project Curve</li> </ul>				
Geometry Type	Curve on Surface				
	Surface/Replace Face				
Surface to Extend To	0	<b>V</b> 2			
Geometry Type					
🗄 Model Info 😰 Meshing	PostProcessing				

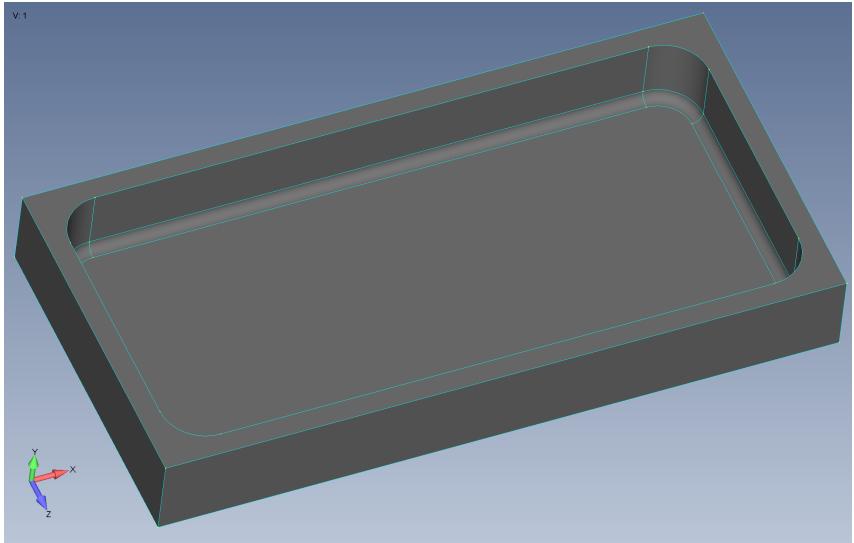
### Simcenter Femap v2020.2 – What's New Geometry Editing Tool – Surface/Replace Face Workflow





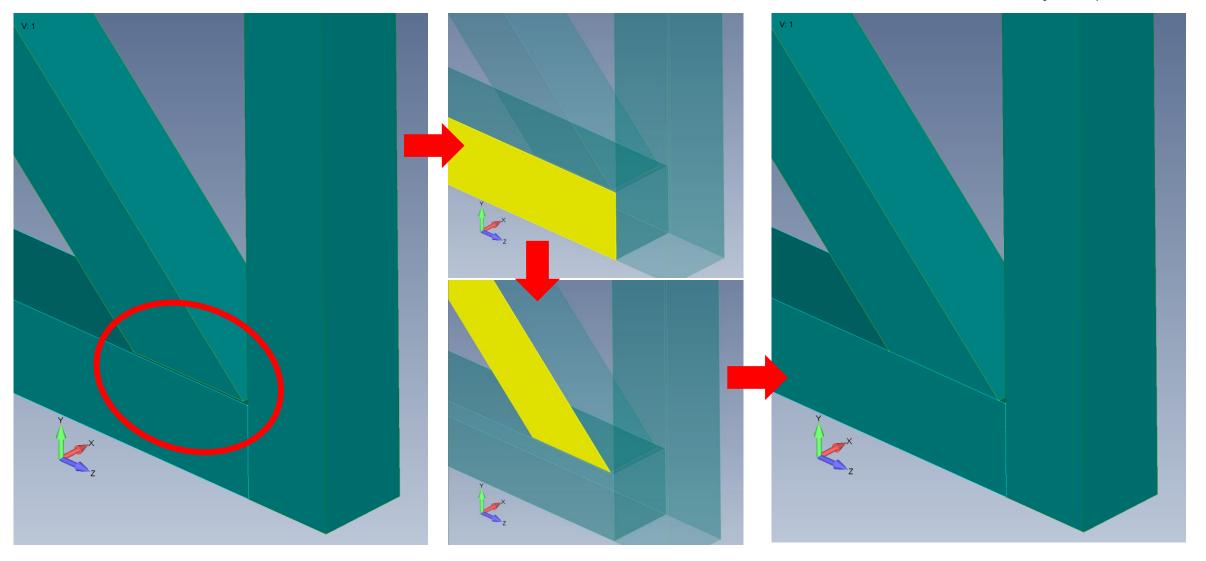
### Simcenter Femap v2020.2 – What's New Geometry Editing Tool – Surface/Replace Face Workflow





### Simcenter Femap v2020.2 – What's New Geometry Editing Tool – Surface/Replace Face Workflow





# Simcenter Femap v2020.2 – What's New Meshing – Mesh Editing



- Updated various Mesh Editing commands to more fully and consistently handle the other entities associated and/or related to the elements being edited
- Commands that have been updated include:
  - Mesh->Editing->Interactive
  - Mesh->Editing->Split
  - Mesh->Editing->Element Refine
  - Mesh->Editing->Edge Split
- Features that are supported across these commands include:
  - Updating Nodal Constraints and Nodal Permanent Constraints
  - Updating Loads (On Faces, Corner Pressures, On Edges, Distributed Line)
  - Updating Regions (both Nodal and Elemental)
  - Updating Tapered Beam Shapes, Beam Offsets, Plate Thickness and Material Direction
  - Updating Groups
  - Updating Geometric Associativity

# Simcenter Femap v2020.2 – What's New Meshing – Miscellaneous



- Mesh Sizing
  - Improved consistency when setting Mesh Sizes on curves using Element Size
  - Previously two curves of seemingly similar length could end up with a different number of elements (+/- 1) due to very small length differences.
- Combined Curve Creation (typically done to improve mesh quality)
  - Only allow creation of Combined Curves if all underlying curves have the same manifold type (i.e., all curves are Free Edge, Manifold, NonManifold or Wirebody).

### Agenda:

Performance Improvements UI and Visualization Preprocessing Meshing **Post Processing** Solver Support Miscellaneous

# Simcenter Femap v2020.2 – What's New Postprocessing – Send to Excel



- List->Output->Results to Excel
- Automatically opens Excel to transfer a variety of Results very quickly
- Take advantage of:
  - Row / Column control
  - Alternate column order
  - Formatting style
  - Transformation of Output Data
- Transfer Nodal and/or Elemental Results at same time

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B			Houespeichertes	C III Kows	On Columns	Custom	
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	👰 5Mode 5, 28.03074 Hz 🛛 🗹 👰 24Case		✓ 3008Bar EndA Axial Force ✓ 3010Bar EndA Torque				
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	🚯 10Mode 10, 33.84494 Hz 🛛 🗹 🚯 29Case	1 26R1 Angular Acceleration	3083Bar EndB Pt1 Bend Stre 3084Bar EndB Pt2 Bend Stre		◯ Into CSys		
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# Simcenter Femap v2020.2 – What's New Postprocessing – Send to Excel

File

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4

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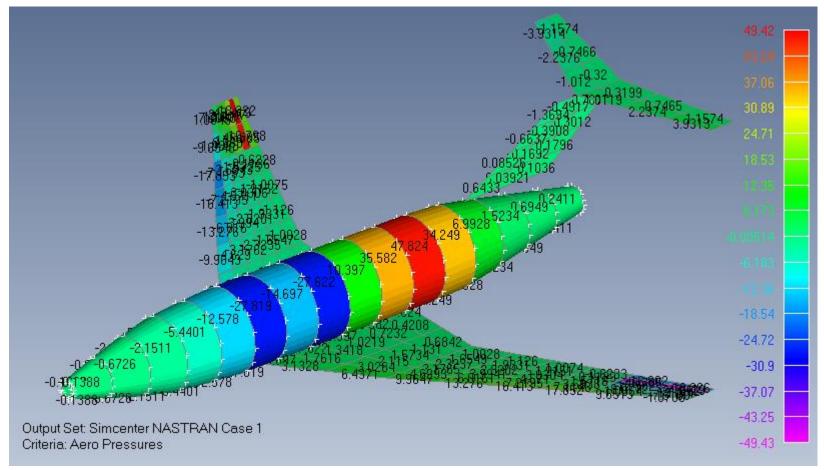
When *Formatting* option is enabled, each worksheet in Excel will include:

- Column Filters
- Frozen Row Heading
- Frozen ID Column
- Nodal and Elemental results organized by different sheets

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						<b></b> Mode 3,	11.25252 Hz								
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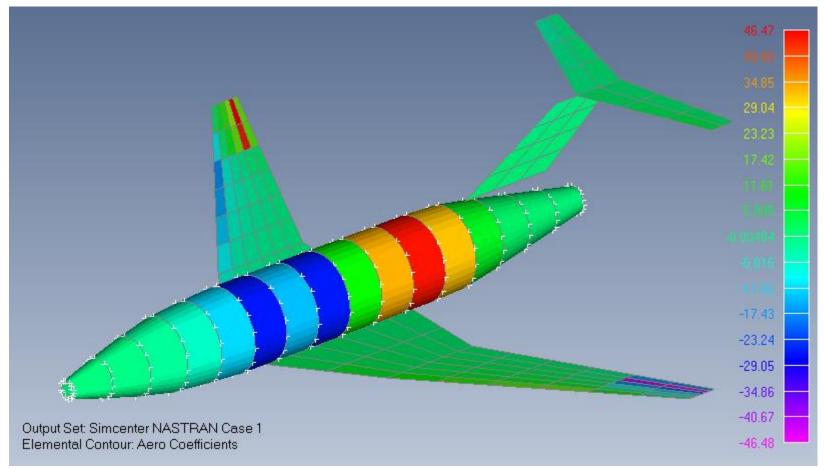


Added support to display Aero Pressures from Static Aeroelasity (SOL 144) analysis (\*.f06 file only)



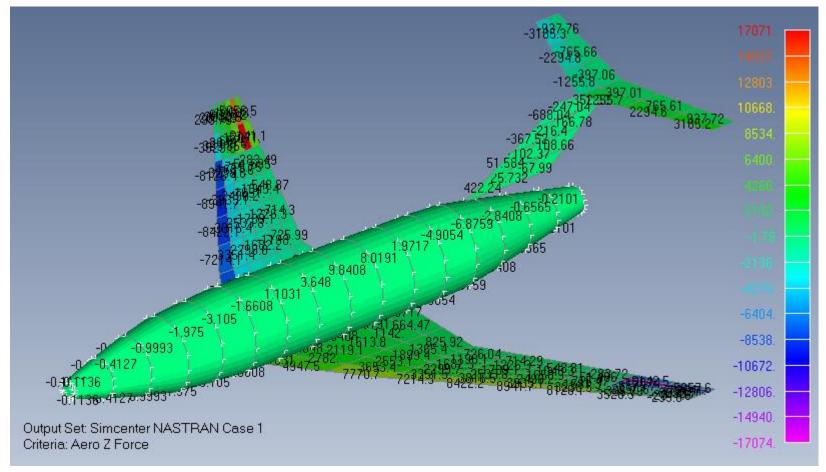


Added support to display Aero Coefficients from Static Aeroelasity (SOL 144) analysis (\*.f06 file only)





Added support to display Aero Forces generated by Static Aeroelasity (SOL 144) analysis (\*.f06 file only)



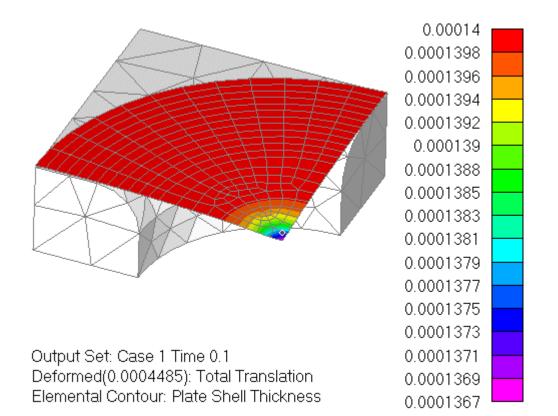
Siemens Digital Industries Software

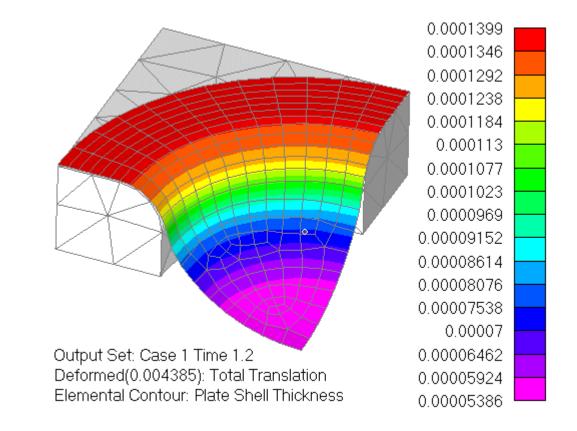


### Added support for Shell Thickness Output (requested by SHELLTHK) from Simcenter Nastran SOL 402

Step 1 Thickness: Max = 1.4E-04; Min 1.367E-04

Step 12 Thickness: Max = 1.399E-04; Min 5.386E-05



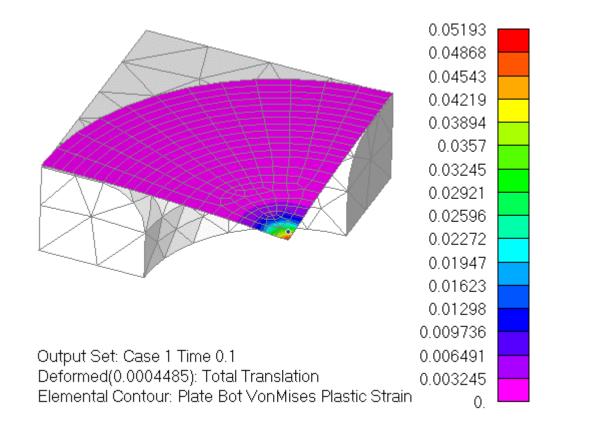


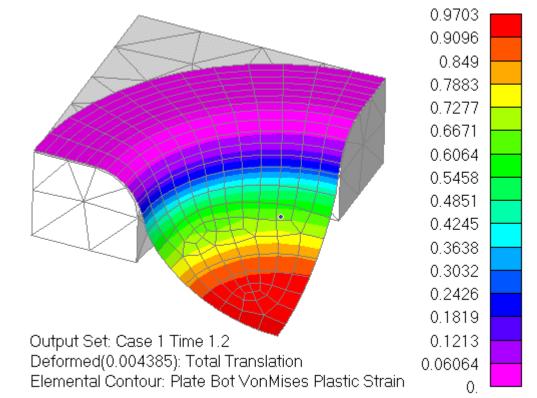


Added support for Plastic Strain Output (requested by PLSTRN) from Simcenter Nastran SOL 401/402

Step 1 Plastic Strain: Max = 0.05193; Min 0.0

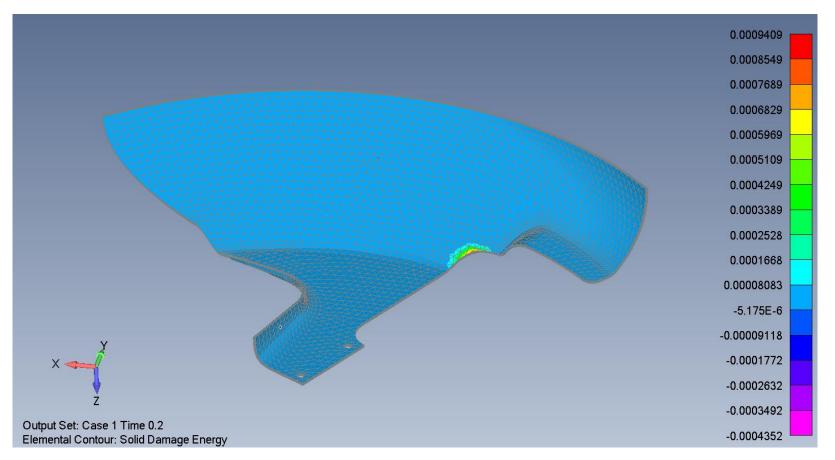
Step 12 Plastic Strain: Max = 0.9703; Min 0.0







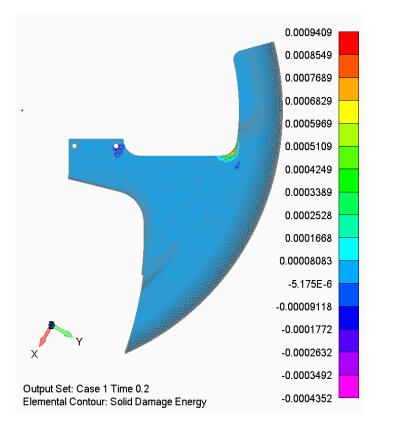
Added support for progressive failure results output (requested by PFRESULTS) from SOL401/SOL402

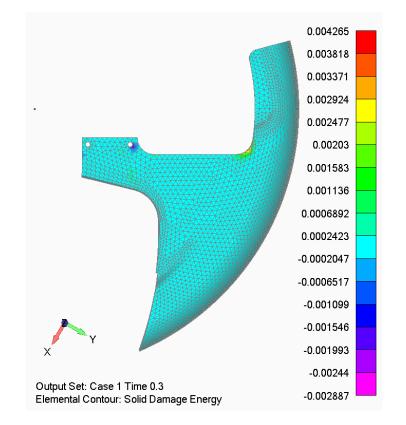




Failure results include Damage Status, Damage Values, Damage Energy, and Crack Density

Time 0.2 Damage Energy: Max = 9.41E-4; Min -0.435E-4 Time 0.3 Damage Energy: Max = 4.27E-3; Min -2.89E-3

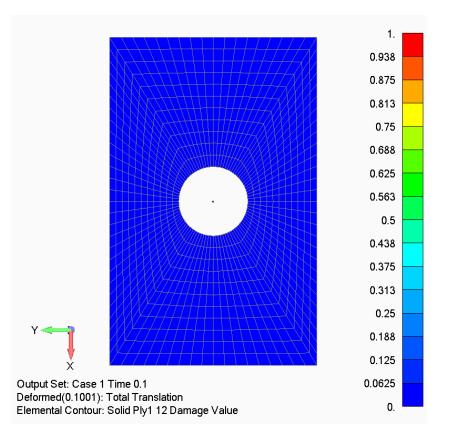




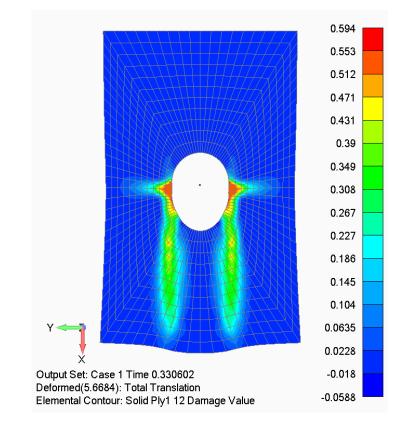


Failure results include Damage Status, Damage Values, Damage Energy, and Crack Density

Step 1 Ply D12: Max = 0.0; Min 0.0



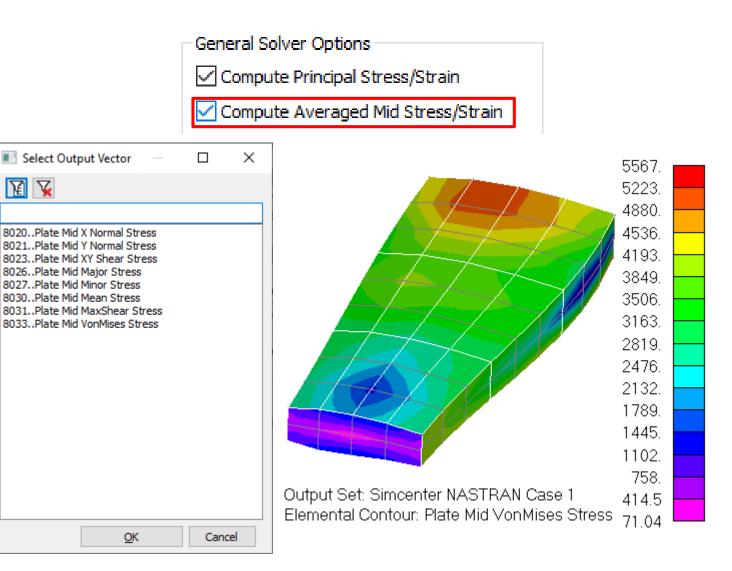
Time 0.33 Ply D12: Max = 5.94E-1; Min -5.88E-2





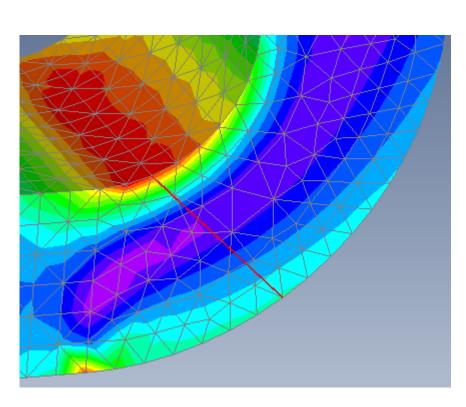
Added an option to *Results* tab of File-> Preferences to allow computing Averaged Midplane Stress and Strain.

- Simple average of Top and Bottom Results.
- Includes computation of Invariants from averaged mid values.
- Supported for Results either Read into the Database or Attached.
- Not supported for Complex Results.



### **Stress Linearization**

- ASME Boiler and Pressure Vessel Code, 2007 SECTION VIII, DIVISION 2, ANNEX 5.1 LINEARIZATION OF STRESS RESULTS FOR STRESS CLASSIFICATION
- Calculates a Linearized Membrane, Linearized Bending, and Peak Stresses along a Stress Classification (SCL)



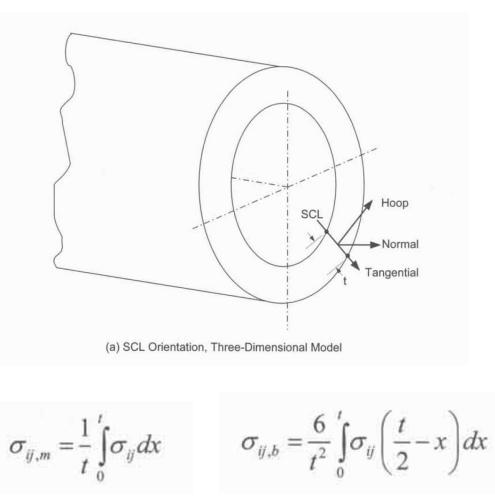


Control Options	
Output Set	1Simcenter NASTRAN Case 1 🗸 👔
	Use nonlinear results
Element Type(s)	O Shell   Solid   Axisymmetric
Stresses	● von Mises Stress ○ Tresca Stress
	Full Component Bending
Nodes	2789 2898
Output	Calculate
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10000	
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0	
0	0.2 0.4 0.6 es Stress, Max Value = 17800.64 me: 1896.69
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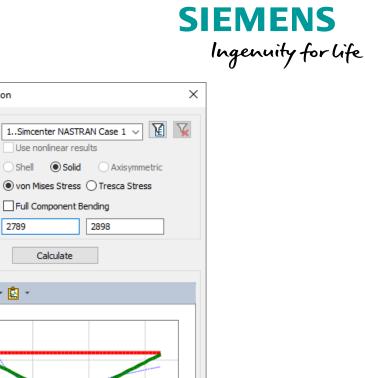
Stress Linearization Process per the ASME Code

- Choice of the SCL is critical, user should be familiar with criteria for a proper SCL as defined in the ASME standard
- Stress tensor extracted from the FEA results is transformed to be aligned with the SCL
- Linearized Membrane Stress tensor components are the average of each along the SCL
- Linearized Bending Stress tensor only includes Hoop and Normal axial stress, and Hoop/Normal shear stress



Stress Linearization Process in Femap

- Choose Output Set
- Choose Linear or Nonlinear Results for the Stress Tensor
- Element Type for Stress Data
- Von Mises or Tresca Stress
- Pick Nodes for the Stress Classification Line (SCL)
- Calculate



Stress Linearization Control Options

Output Set

Stresses

Nodes

Output

10000

0

Copy to Clipboard

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Element Type(s)

2789

0.2

Membrane: 1896.69

Membrane and Bending Bending: 10530.05

SCL from node 2789 to 2898 von Mises Stress

Membrane Stress: 1896.69 | Bending Stress: 10530.05 Maximum Membrane and Bending: 11736.13

von Mises Stress, Max Value = 17800.64

Maximum Membrane and Bending: 11736.13

0.4

0.6

Close

~

**Stress Linearization Results** 

- Chart showing the actual stress along the SCL
- Calculated Membrane, Bending, Membrane + Bending, Maximum Membrane + Bending
- Copy to Clipboard Option
- Exact Data values can also be copied from the Femap Chart

#### **Stress Linearization**

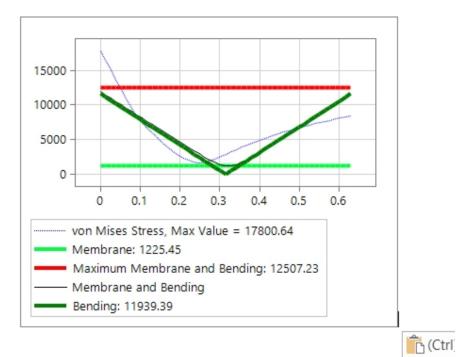
SCL from node 2789 to 2900 von Mises Stress

Membrane Stress: 1225.45 | Bending Stress: 11939.39

Maximum Membrane and Bending: 12507.23

Using Solid Linear Stress Data

Stresses have been transformed from the Material Direction to the SCL.



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**Stress Linearization Notes** 

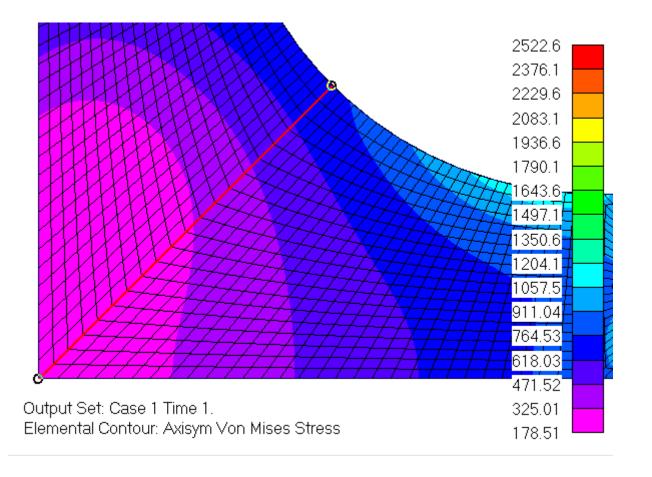
- Full Component Bending option allows you to process the linearization with all components of the stress tensor considered for the bending stress calculations
- Tresca Stress calculates a "Tresca" failure criterion stress value, which is based on the maximum shear stress, the Tresca Stress calculated by the tool is 2 times maximum shear

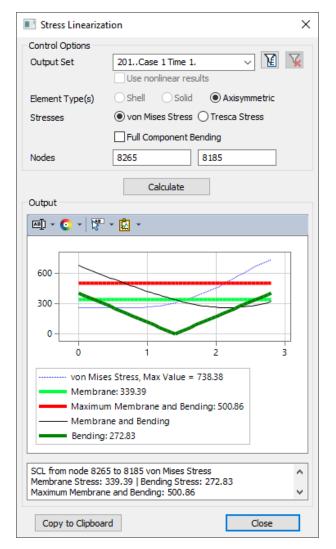
#### $\times$ Stress Linearization Control Options ¥ ¥ Output Set 1...Simcenter NASTRAN Case 1 Use nonlinear results Shell Solid Axisymmetric Element Type(s) von Mises Stress O Tresca Stress Stresses Full Component Bending 2789 2900 Nodes Calculate Output 📼 - 💽 - 🞇 - 🔯 -15000 10000 5000 0 0.2 0.3 0.4 0.5 0 0.1 0.6 von Mises Stress, Max Value = 17800.64 Membrane: 1225.45 Maximum Membrane and Bending: 12507.23 Membrane and Bending Bendina: 11939.39 SCL from node 2789 to 2900 von Mises Stress $\wedge$ Membrane Stress: 1225.45 | Bending Stress: 11939.39 Maximum Membrane and Bending: 12507.23 Copy to Clipboard Close





Stress Classification Line (SCL) from Node 8185 to Node 8265





### Agenda:

Performance Improvements UI and Visualization Preprocessing Meshing Post Processing **Solver Support** Miscellaneous

### Simcenter Femap v2020.2 – What's New **Solver Support – Nastran Solvers**



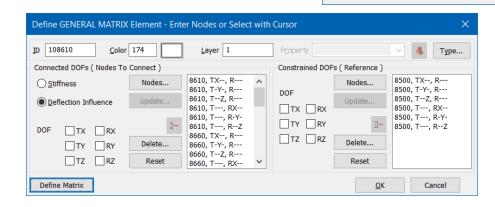
Canc<u>e</u>l

<u>0</u>K

Added support for the General Element capability (GENEL)

- Define a substructure in terms of empirically-determined structural data
- Table interface for defining deflection influence or stiffness matrixes
- Graphical representation drawn that represents the connected DOFs connected to the constrained DOFs

8610, 1	8610, 2	8610, 3	8610, 4	8610, 5	8610, 6
1.8496098E-7					
4.3683599E-9	1.9827996E-7				
8.1577909E-9	1.35986E-7	1.1678696E-7			
-9.122513E-9	-5.994352E-7	-4.578160E-7	3.4509594E-6		
1.6985996E-7	5.1056084E-9	1.0292702E-8	-9.295370E-9	2.0552197E-6	
3.3427403E-7	1.7277304E-9	3.6303409E-9	-5.179189E-9	-1.138419E-6	2.890009
-2.691350E-8	2.093800E-10	-1.052230E-9	-2.457711E-9	-1.734820E-7	1.191730
-5.184617E-9	-5.776719E-8	-4.858070E-8	1.3634997E-7	-2.668321E-9	-7.11560
8.6998675E-9	5.7968101E-8	6.1694948E-8	-1.25253E-7	9.8123394E-9	5.754991
-1.108710E-8	-1.505300E-7	-1.227620E-7	3.4884397E-7	-7.602768E-9	-1.36325
1.7726296E-7	6.2000609E-9	1.0802104E-8	-1.18226E-8	1.0989999E-7	2.824899
1.01767E-7	1.0023598E-8	8.3744673E-9	-2.611611E-8	-2.96721E-7	5.733358
-5.910898E-9	2.9146394E-9	5.2385793E-9	-6.111996E-9	-2.143601E-8	3.599730
-2.382830E-9	1.8070596E-9	2.5149203E-9	-3.389921E-9	-7.099821E-9	1.750280



## Simcenter Femap v2020.2 – What's New Solver Support – Nastran Solvers



Added support for Follower Forces and Follower Moments

- When 2 nodes/points are specified to define the direction of the the load in terms of a vector, writes FORCE1 or MOMENT1
- When 4 nodes/points are specified to define the direction as normal to a plane, writes FORCE2 or MOMENT2
- Typically used by SOL 106, SOL 401, and SOL 402 for analysis which includes large deformation

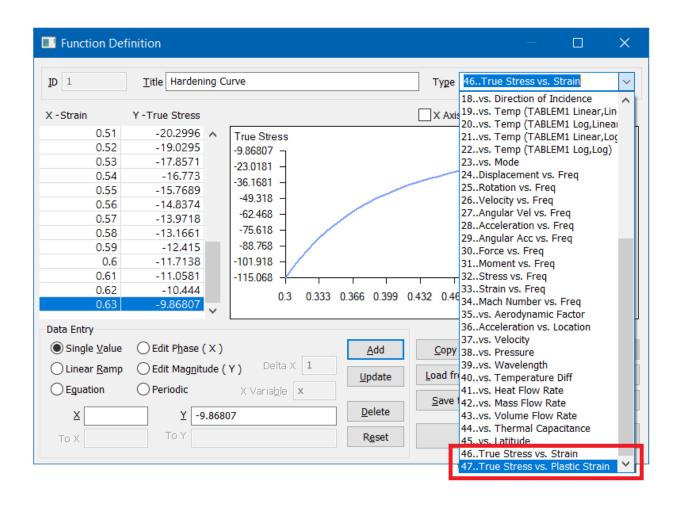
	<u>V</u> alue	Time/Freq Dependence	Data Surface
Magnitude	10.	0None ~ 1	xy
Node 1 (G1)	24	]	
Node 2 (G2)	57	]	
Node 3 (G3)	27	]	
Node 4 (G4)	54	]	
∕ Normal To	Plane	[	<u>O</u> K Cancel
23456			

# Simcenter Femap v2020.2 – What's New Solver Support – Simcenter Nastran



Added new nonlinear contact and control parameters for SOL402

- New function types to specify type of exported stress-strain measures for SOL 402 (engineering vs. true)
- New option to consider thickness and Z-offset for shell elements involved in contact



# Simcenter Femap v2020.2 – What's New Solver Support – Simcenter Nastran



Added support for modeling progressive ply failure for solid laminates (MATDMG)

- New material types to specify unidirectional fiber reinforced ply damage model and enhanced unidirectional ply damage model
- New function type to specify nonlinear damage evolution law for in-plane shear (shear damage vs thermodynamic force)
- Compute damage values, energy, status and crack density to predict failure

Define Material				×
ID 2 Title Sim	. Nastran UD F	Ply Failure (MATDMG) Layer 1		Material Ty <u>p</u> e
Material Type 512Sim	n. Nastran UD I	Ply Failure (MATDMG Sol 401,402)	~	
Material ID - MID	1	Transverse Limit E YS22	0.2	Loa <u>d</u>
Max Damage Value - DMAX	0.999	Coupling Coeff B2	0.6	<u>S</u> ave
3D Effect Parameter - PE	0	Damage Var Coeff B3	0.5	Сор <u>у</u>
E. Threshold (+) - Y11LIMT	25.	Coupling Coeff A	0.6	
E. Threshold (-) - Y11LIMC	2.	Initial Plastic Threshold - LITK	0.1	
Coeff. Parameter - PLYUNI	0	Plastic Law Param BIGK	489.	Next >>
Nonlin. Coefficient (+) - KSIT	3.	Plastic Law Exp EXPN	0.293	<< Prev
Nonlin. Coefficient (-) - KSIC	20.	Transition Thickness - HBAR	0.434333	ZCHEV
Shear E. Limit - YS12	3.	Delay Param ADEL	1.	
Damage Evolution - TID	108NASTR/	Delay Time - TAU	1.E-4	
E.Threshold in Shear - Y012	0.			<u>О</u> К
Shear Critical E YC12	0.			Cancel

# Simcenter Femap v2020.2 – What's New Solver Support – ANSYS Updates

Added several options to *Model Control* section of *ANSYS Command and Model Control* dialog box

- Added Skip Csys, Skip Nodes, Skip Materials, Skip Properties, and Skip Elements - allows user to skip any combination of these entity types entirely during export
- Added Skip Groups allows user to skip writing ESEL, NSEL and CM entries during export
- Added Skip Misc allows user to skip view settings (/VIEW, /ANGLE, /ZOOM, etc), preprocessor commands (/NOPR, /FCOMP, /PREP7, /GOPR, etc), solution settings (/SOLU, ANTYPE, EQSLV, etc), SOLVE, FINISH, etc
- Changed Skip Beam/Bar Cross Sections to Skip Shapes



ANSYS Command and Model Control X
ANSYS Version 10 ANSYS Product 0Default   Command Line   Jobname   Output Directory   Database Memory (MBytes)
Workspace Memory (MBytes)         Other Command Line Inputs         List Input in Output    ( -par1 val1 -par2 val2)
Model Control           Portion of Model to Write           0Entire Model
Skip Csys       Skip Nodes       Skip Materials       Skip Properties         Skip Elements       Skip Groups       Skip Shapes       Skip Misc
Result Control     File Compression Level     1No Compression     ✓
Manual Control         Skip Standard         Start Text (Off)         End Text (Off)         Prev         Next         QK         Cancel

## Simcenter Femap v2020.2 – What's New Solver Support – ANSYS Updates



Added *Result Control* section to select the *File Compression Level* for the ANSYS results file (\*.RST File)

Added ability to read output data contained in ANSYS results files which use "Version 1" compression (ANSYS default)

### Added Manual Control section to:

- ANSYS Command and Model Control
- ANSYS Load Step
- ANSYS Time Step Options
- ANSYS Modal Analysis Options
- ANSYS Harmonic Analysis Options
- ANSYS Random Vibration Analysis Options
- ANSYS Buckling Options
- ANSYS Nonlinear Options
- ANSYS Output Requests

ANSYS Command and Model Com	ntrol X
ANSYS Version 10 ANSY Command Line Jobname	S Product 0Default ~
Output Directory	
Database Memory (MBytes) Workspace Memory (MBytes)	
Other Command Line Inputs	( -par1 val1 -par2 val2)
Model Control Portion of Model to Write	0Entire Model V
Skip Csys Skip Nodes	Skip Materials Skip Properties
Skip Elements Skip Groups	Skip Shapes Skip Misc
Result Control File Compression <u>L</u> evel	1No Compression
Manual Control	Start Text (Off) End Text (Off)
Pre <u>v</u> Ne <u>x</u> t	<u>O</u> K Cance <u>l</u>

# Simcenter Femap v2020.2 – What's New Solver Support – LS-Dyna Updates



Added several options to *Model Control* section of *LS-DYNA Model Option* dialog box

- Added Skip Csys, Skip Nodes, Skip Materials, Skip Properties, and Skip Elements - allows user to skip any combination of these entity types entirely during export
- Added Skip Groups allows user to skip writing \*SET\_ entries during export
- Added Skip Functions allows user to skip writing functions (\*DEFINE\_CURVE entries) during export

LS-DYNA Model Options	×
Export Options	Material Based Plate Parts
Model Control Portion of Model to Write	0Entire Model ~
Skip Csys     Skip Nodes       Skip Elements     Skip Groups	Skip <u>M</u> aterials Skip <u>P</u> roperties
Manual Control	Start Text (Off) End Text (Off)
Prev Ne <u>x</u> t	<u>O</u> K Cancel

 Added Skip Misc – allows user to skip comments starting with "\$", \*KEYWORD, \*TITLE with corresponding "title", \*CONTROL TERMINATION with corresponding value, \*DATABASE\_BINARY\_D3PLOT with corresponding value, \*END, and other entries during export

### Simcenter Femap v2020.2 – What's New Solver Support – LS-Dyna and ABAQUS Updates



Added *LS-Dyna Analysis Monitor* to monitor solver progress, review solver files, and optionally import results

Added support Preserve Load/BC Sets option for ABAQUS

 When enabled, causes imported loads and boundary conditions which reference a SET to create a Load Definition or Constraint Definition in Femap

Added support to write all supported load/constraint types that are contained in a Load/Constraint Definition as a SET entry in the ABAQUS input file, if requested by enabling the *Write All Groups as Sets* option in the *ABAQUS Model Options* dialog box

Messages	Views Gra	phics	User Interface	Database	Solvers
Geometry/Model	Interfaces	Results	Library/Startup	Color	Spaceball
nterface Analysis Type Ion-Femap Neutra nterface Style Enable Old Ar Analysis Monitor (	45Simcenter N 1Static al Version 0Structur nalysis Interfaces Options	lastran 2020.2 al	File Reference File Reference Create Geo Create Ana Create Ana General Solver Run Analys	Options erences on Oper ometry Referen alysis Model Ref alysis Results Re	n ces erences eferences
Automatically Max Lines to Mor		5000		acy Ansys Inter	-
Improve Real Write Alterna Solver Memory ( Scratch Directory	- [	ion 0 efault v	Read Comr	atic Load/BC Se nents as Titles d Synthetic Loa ups from INCLU NCLUDE Statem Bulk Data Entrie	d Sets IDE files ents
Direct Output To			~		
Output Directory					
ABAQUS Options					

### Agenda:

Performance Improvements UI and Visualization Preprocessing Meshing Post Processing Solver Support **Miscellaneous** 

### Simcenter Femap v2020.2 – What's New **API – Control Multiple Femap Sessions**



- API Developers can now control multiple Femap sessions simultaneously
- Including Excel VBA Developers
- Forward-compatible

\_

ProcessID

19336

22476

13704

🖳 Choose Running Femap...

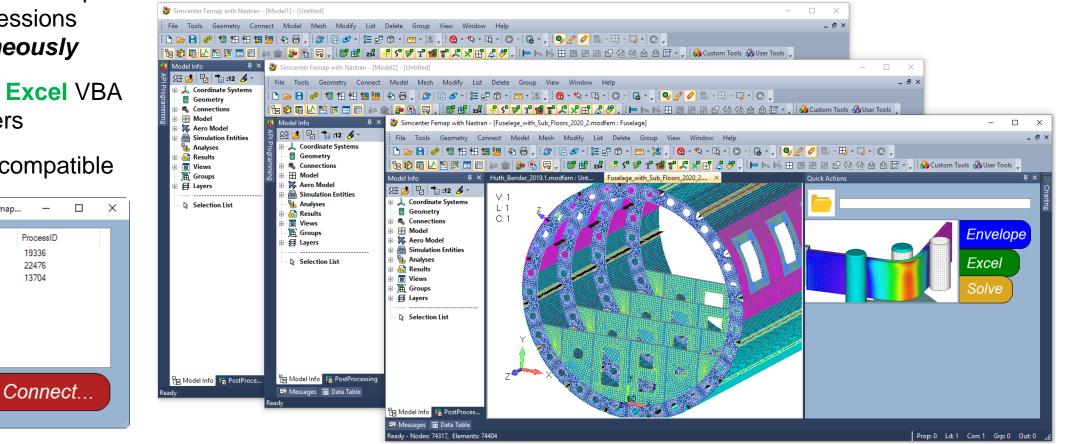
Model Name

Bender Model

Pressure Vessel

Wing Test





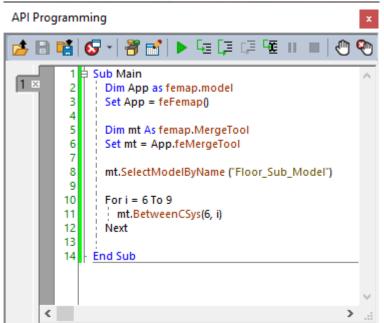
### Unrestricted © Siemens 2020

### Siemens Digital Industries Software

### Simcenter Femap v2020.2 – What's New API

### New Tools

- Added a MergeTool Object (feMergeTool) that is similar to the existing CopyTool and MoveTool, but exposes the capabilities of the File->Merge Command
  - Ability to select From Model by name
  - Methods to toggle individual/groups of entity types to include
  - Method to "Add Related" entities with "Add Associated" option
  - Unique methods for each Orientation/Transform option
  - Properties to specify Options
  - Methods to create "Patterns" of merged entities (not in UI)





### Simcenter Femap v2020.2 – What's New API



### Stress Linearization API Access

- Automate processing of different Stress Linearization scenarios
- Same options as GUI version

### Output from API Script:

Maximum Stress = 17800.6378136816 Membrane Stress = 1225.44895224937 Bending Stress = 11939.3928698333

```
1 🗄 Sub Main
       Dim App as femap.model
       Set App = feFemap()
       Dim fSL As femap.StressLinear
       Set fSL = App.feStressLinear
 8
       fSL.ouSetID = 1
 9
       fSL.nElemType = 0
10
       fSL.ndID1 = 2789
11
       fSL.ndID2 = 2900
12
       fSL.bNonlinearMode = False
       fSL.bFullStressTensor = False
13
14
15
       If fSL.CalcStressLinearization() = FE OK Then
         Msg = "Maximum Stress = " +Str$(fSL.dMaxStress)
16
17
         App.feAppMessage( FCM_NORMAL, Msg )
          Msg = "Membrane Stress = " + Str$(fSL.dMembraneStress)
18
19
         App.feAppMessage( FCM_NORMAL, Msg )
20
         Msg = "Bending Stress = " + Str$(fSL.dBendingStress )
21
         App.feAppMessage( FCM_NORMAL, Msg )
22
       End If
23
24
     End Sub
```

# Simcenter Femap v2020.2 – What's New API



### New Application Methods

- Added feFileGetByName() that returns Model ID of an open model based on its filename.
- Added feEdgesOfFreeFaces() that returns pairs of node IDs along the edges of Free Faces of selected elements.

### New Object Methods

- Added NextOnEntity() method to the LoadGeom, LoadMesh and BCGeom objects and NextOnNode() to the BCEqn object. These new methods allow you to retrieve multiple loads/constraints of different types on multiple entities.
- Added AddNodesOnFreeEdges() and AddNodesOnFreeFaces() to the Set object that add nodes on free edges or faces of selected elements to the Set.
- Added ComputeStdShape2() and ComputeGeneralShape2() to the Property object that allow you to specify whether to compute properties at End A or End B of a tapered beam property.

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