What's New in Simcenter 3D 2019.2
Correlation

Realize innovation.

Using Simcenter 3D and Simcenter Testlab to Validate Designs

Courtesy of CSA DFL

Correlation, Updating & Virtual testing

Reducing Risk with CAE
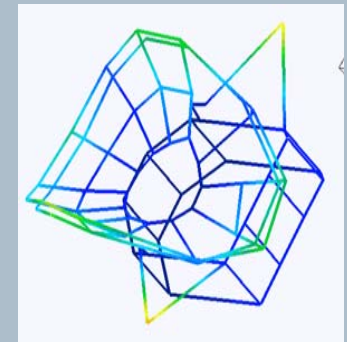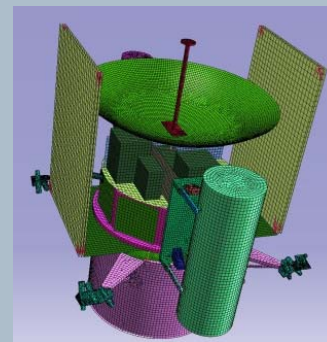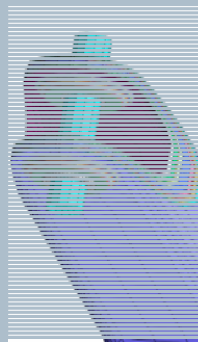
| Component Design | Assembly Design | Dynamic Analysis | Correlation & Updating | Virtual Test Analysis | Certification |

- Standardize on Simcenter 3D and Simcenter Nastran for dynamic simulation
- Correlate analysis results with physical testing using Simcenter Testlab and Simcenter 3D FE Model Correlation
- Update the simulation using Simcenter 3D FE Model Updating
- Perform virtual testing using validated simulation
- Promotes faster development with reduced risk

2019.2 FE Model Correlation and Updating

Migration of Virtual.Lab Correlation & Updating functionality to Simcenter 3D

- Focus of 2019.2 release:
  - Correlation and Pre-Test

Workflow and performance improvements

Enhancements in 2019.2 FE Model Correlation

- FRF Correlation
- Correlation of symmetric models
- Wireframe display of work mode shapes
- Automatic/Manual loading of mode shapes
- Automatic pre-test wireframe generation
- Automatic face normal DOF selection
- New Test Analysis Reference Solution
- Interface with Simcenter Testlab
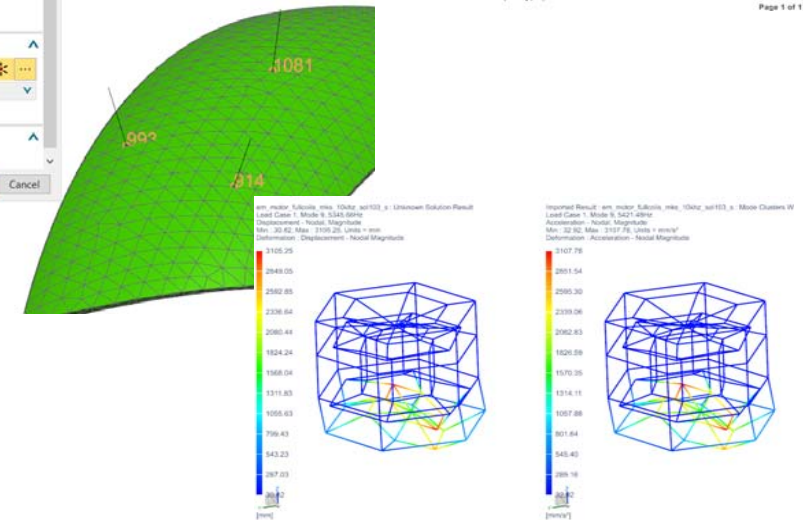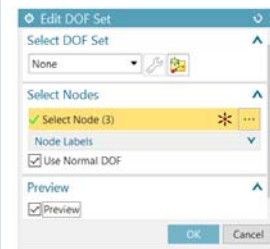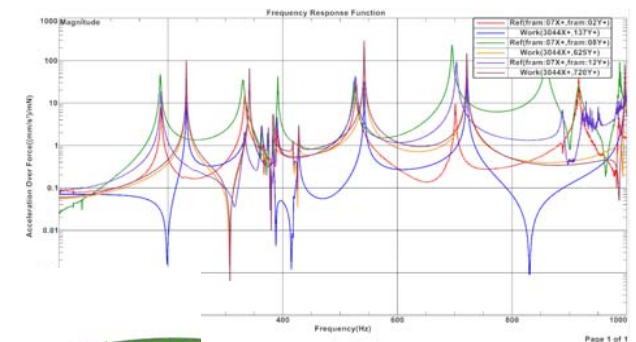
Simcenter 3D FE Model Correlation
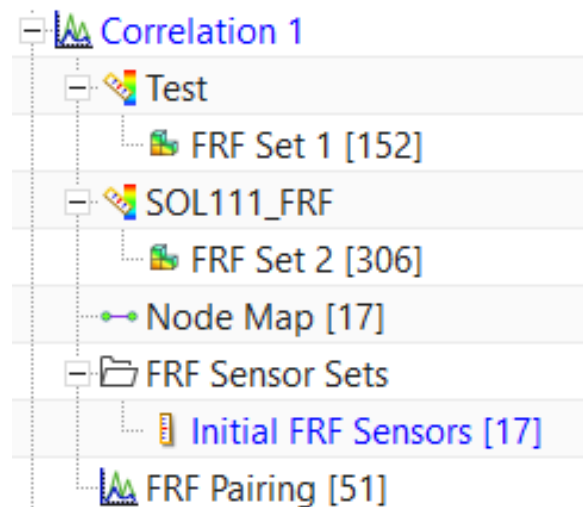## Enhancement: FRF Correlation

New FRF Correlation Solution

- Compare Test (Reference) and Analysis (Work) FRFs
- Supported FRF Analysis Solutions
  - SOL 111 FRF, SOL 108 FRF
  - Simcenter and MSC Nastran
- Supported FRF Test formats
  - UNV, LMS
- Supported Measurements
  - Displacement/Force
  - Velocity/Force
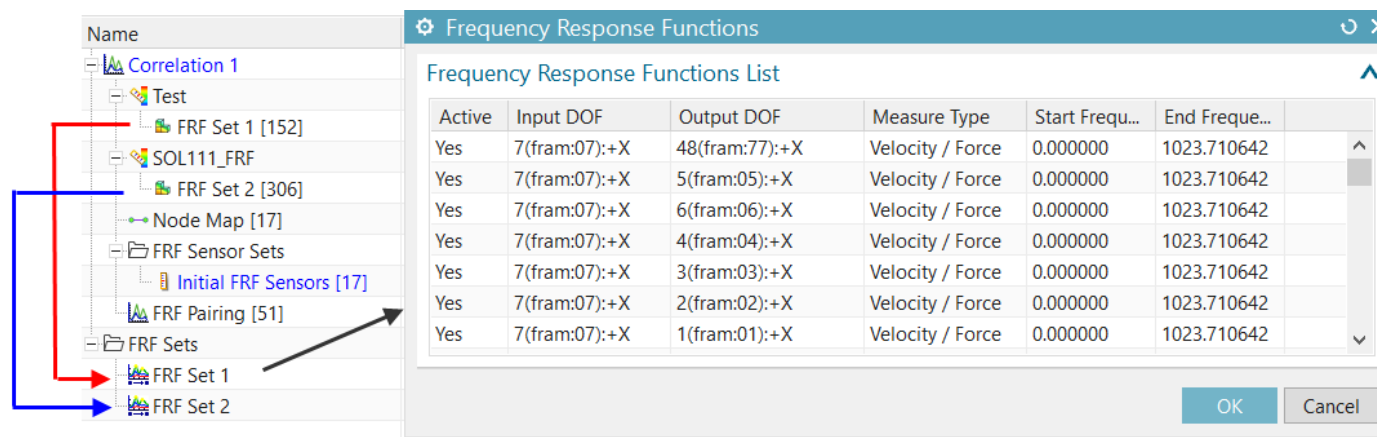 - Acceleration/Force

Benefits

- Directly correlate Test FRFs with Analysis
  - No need to curve-fit and extract modal data
  - Assess mass and stiffness trends
  - Evaluate impact of damping

Simcenter 3D FE Model Correlation
Enhancement: FRF Correlation

New FRF Correlation Solution

- Test and Analysis FRFs are stored in FRF Sets

Benefits

- Common data management with other applications

Siemens PLM Software

Simcenter 3D FE Model Correlation
Enhancement: FRF Correlation

SIEMENS
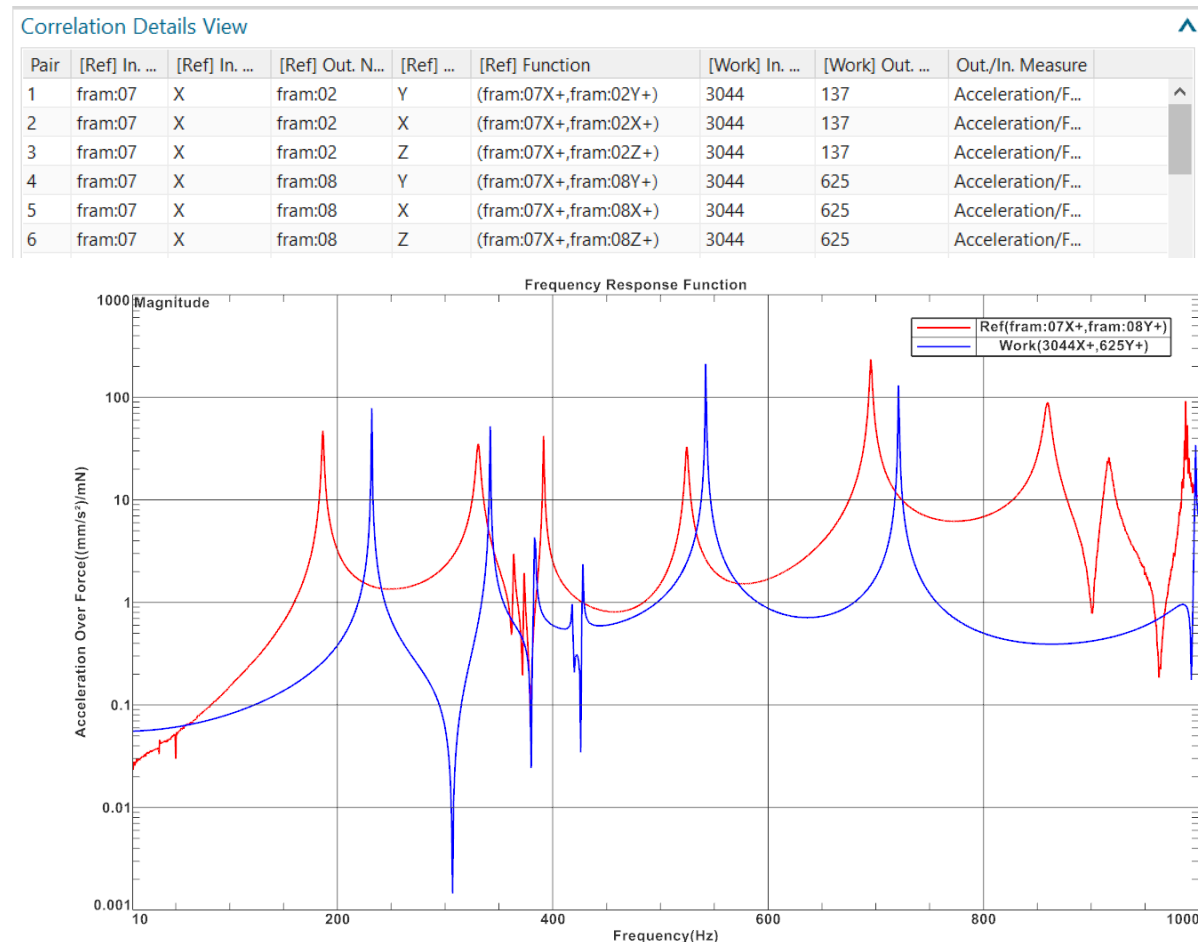*Ingenuity for life*

New FRF Correlation Solution

- FRF pairing based on node map
  - Proximity-based
  - Can be edited
- XY Plots of
  - Work FRFs
  - Reference FRFs
  - Overlays of Work and Reference FRFs
- Optional operations
  - RSS Sum
  - RMS Average

Benefit

- Visual comparison of single or multiple Test and Analysis FRFs

Correlation Details View

Pair	[Ref] In. ...	[Ref] In. ...	[Ref] Out. N...	[Ref] ...	[Ref] Function	[Work] In. ...	[Work] Out. ...	Out./In. Measure
1	fram:07	X	fram:02	Y	(fram:07X+,fram:02Y+)	3044	137	Acceleration/F...
2	fram:07	X	fram:02	X	(fram:07X+,fram:02X+)	3044	137	Acceleration/F...
3	fram:07	X	fram:02	Z	(fram:07X+,fram:02Z+)	3044	137	Acceleration/F...
4	fram:07	X	fram:08	Y	(fram:07X+,fram:08Y+)	3044	625	Acceleration/F...
5	fram:07	X	fram:08	X	(fram:07X+,fram:08X+)	3044	625	Acceleration/F...
6	fram:07	X	fram:08	Z	(fram:07X+,fram:08Z+)	3044	625	Acceleration/F...

Frequency Response Function

Ref(fram:07X+,fram:08Y+)
Work(3044X+,625Y+)

Repeated modes of Symmetric Structures

- Symmetric structures exhibit repeated modes with identical or closely spaced natural frequencies
- The symmetry can be either cyclic or with respect to one or more axes
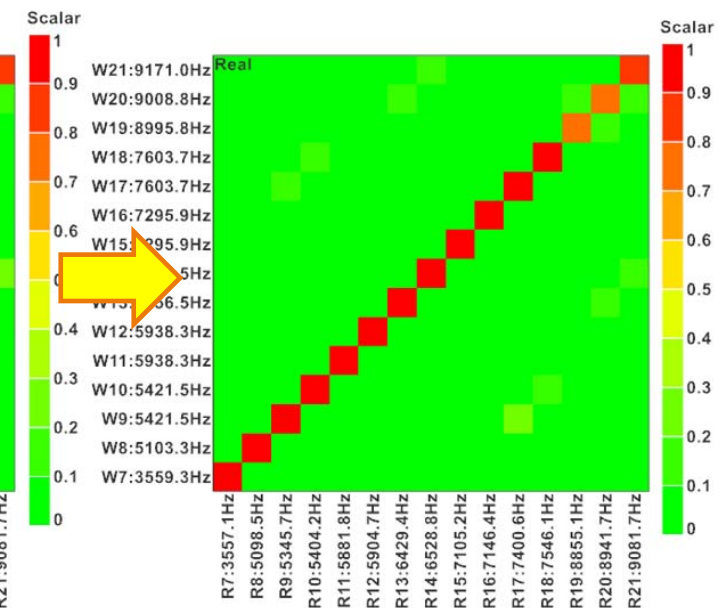- A method is provided that operates on clusters of test and analysis repeated modes

Benefit

- Provide accurate correlation metrics of symmetric structures like wheels and rotors
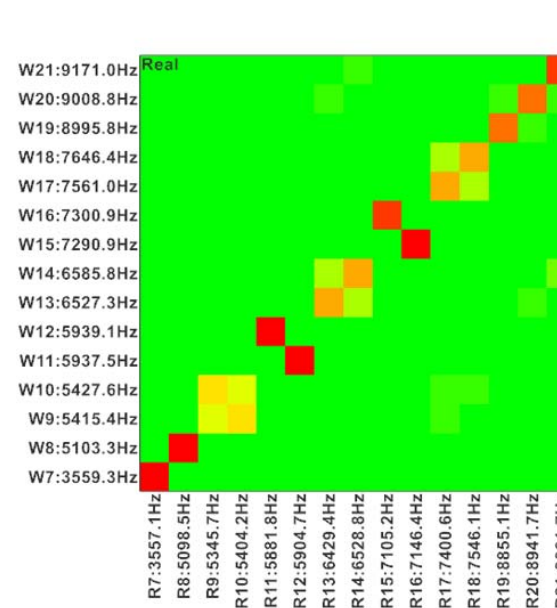
Simcenter 3D FE Model Correlation
Enhancement: Correlation of Symmetric Models

Defining Mode Clusters

- You define clusters of Reference and Work repeated modes
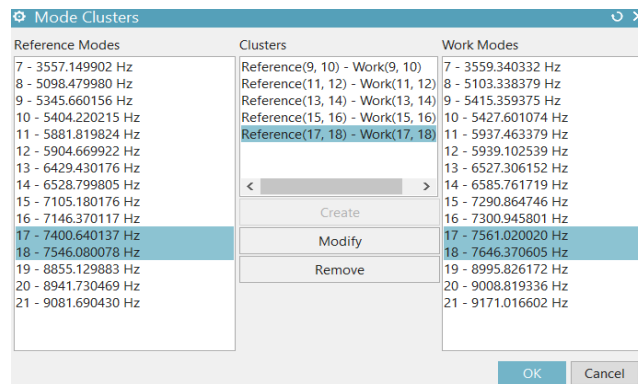
- The software recomputes the clustered Work mode shapes, effectively rotating them to match the Reference mode shapes

Benefits

- **MAC** metric reflects the similarity of the mode shapes
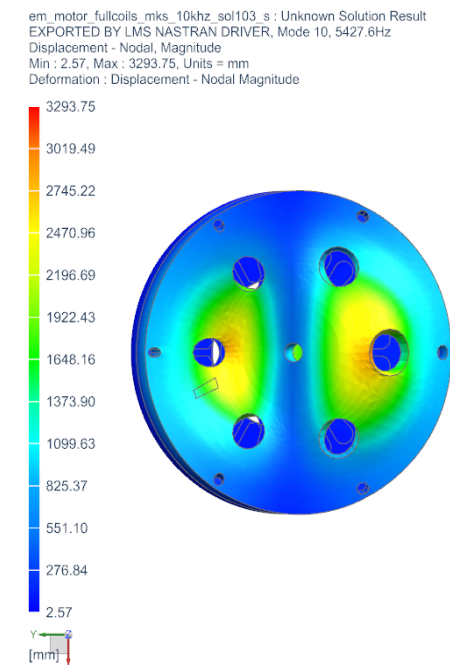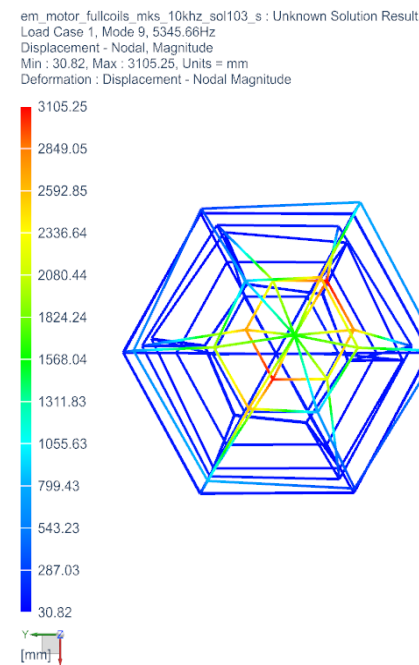
Simcenter 3D FE Model Correlation
## Enhancement: Wireframe display of work mode shapes

Wireframe Work Mode Shape Display

- Software optionally displays Analysis mode shapes on the Test wireframe
  - Using the Correlation node map

Benefits

- Significantly improves animation performance for large models
- Displaying the work mode shapes on the test wireframe promotes understanding of the MAC results

Siemens PLM Software
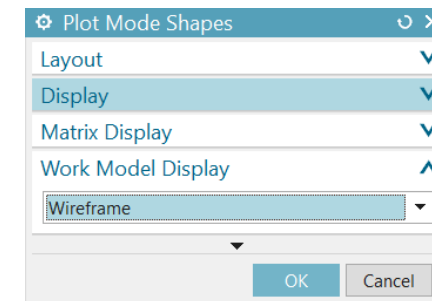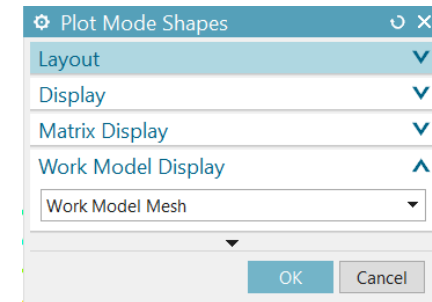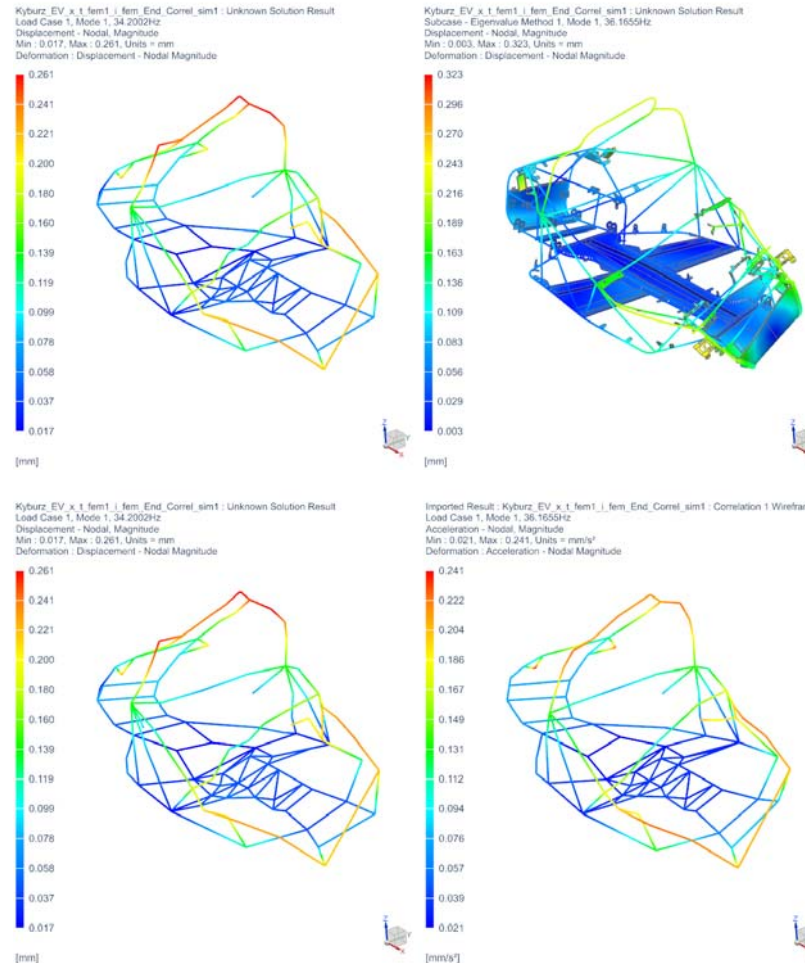
Simcenter 3D FE Model Correlation
Enhancement: Automatic/Manual loading of mode shapes

Mode Shape Loading

- By default, Modal Correlation and Model Update solutions load the Reference and Work mode shapes when the SIM file is opened
- New customer default prevents automatic loading
  - User manually selects with solution(s) for which shapes must be loaded
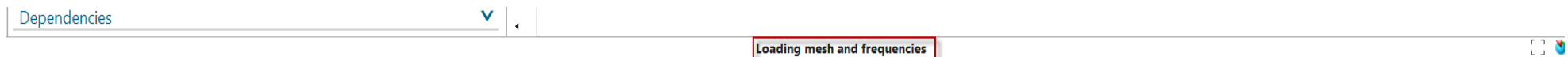
Benefit

- Reduces the time to open the SIM file for large models or with many Correlation and Model Update solutions

Siemens PLM Software

Simcenter 3D FE Model Correlation
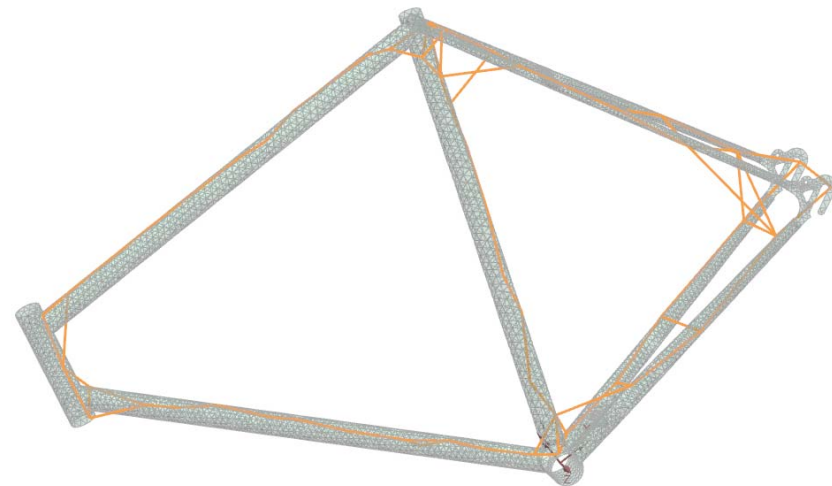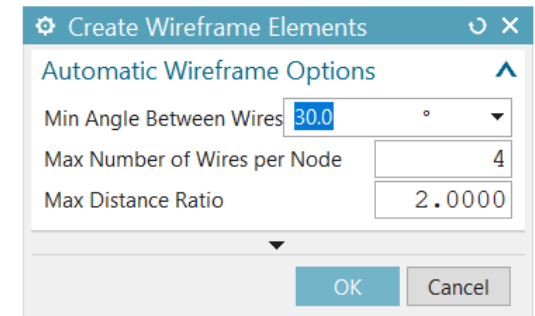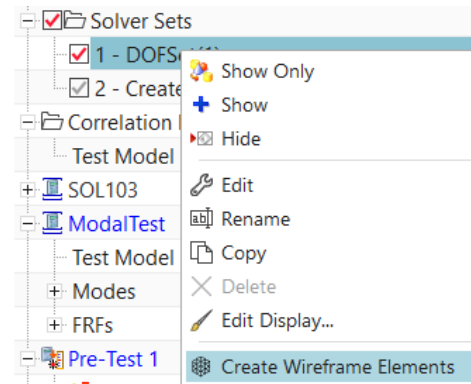## Enhancement: Automatic Pre-Test wireframe generation

Pre-Test Wireframe Creation

- Wireframes can be created using the following methods:
  - Automatic
  - Manual
  - Hybrid

Benefits

- Automatic option provides significant time savings for the novice user
- Hybrid option provides efficient method of creating customized wireframes

Siemens PLM Software

**Automatic Detection of Face Normal**

- Software automatically detects the normal direction for nodes on:
  - 2D meshes
  - Free faces of 3D meshes

Face Normal Validation

- Arrow display

Benefits

- Sensors are often installed normal to the test artcile face(s) by the Test Engineer
- Significant time savings compared to manual method of defining nodal coordinate system
- Instant visual feedback
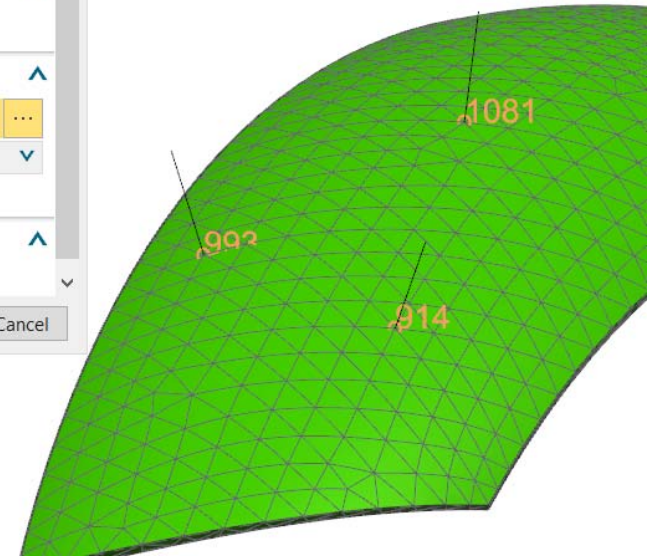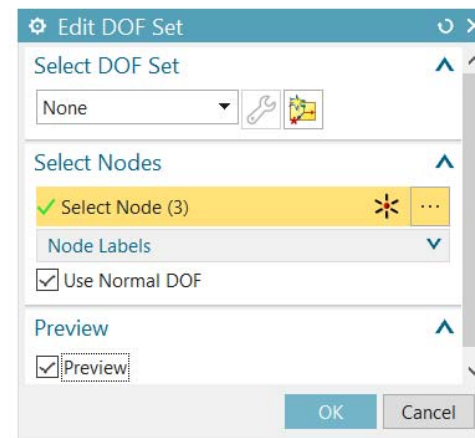
Simcenter 3D FE Model Correlation
Enhancement: New Test Analysis Reference Solution

Test Analysis Reference Solution combines

- Analysis mode shapes
  - Using local coordinate systems
  - At selected DOFs
- Wireframe
  - Manually or automatically generated

TARS created from either

- Pre-test Configuration
- DOF set

Benefits

- Streamlined interface with Test
- Can be correlated with analysis work solution
  - Mode shape metrics evaluated at TARS DOFs
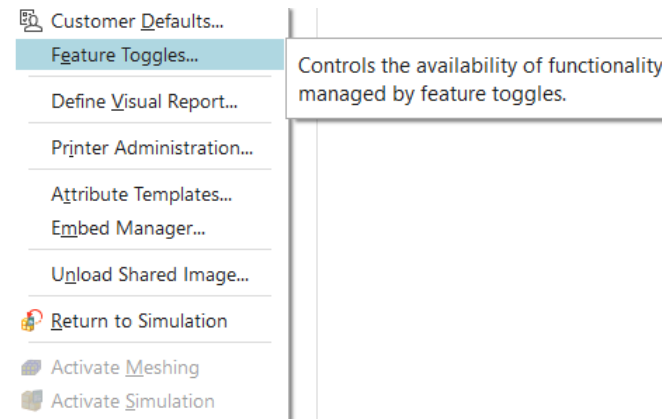
Simcenter 3D FE Model Correlation
Enhancement: Interface with Simcenter Testlab

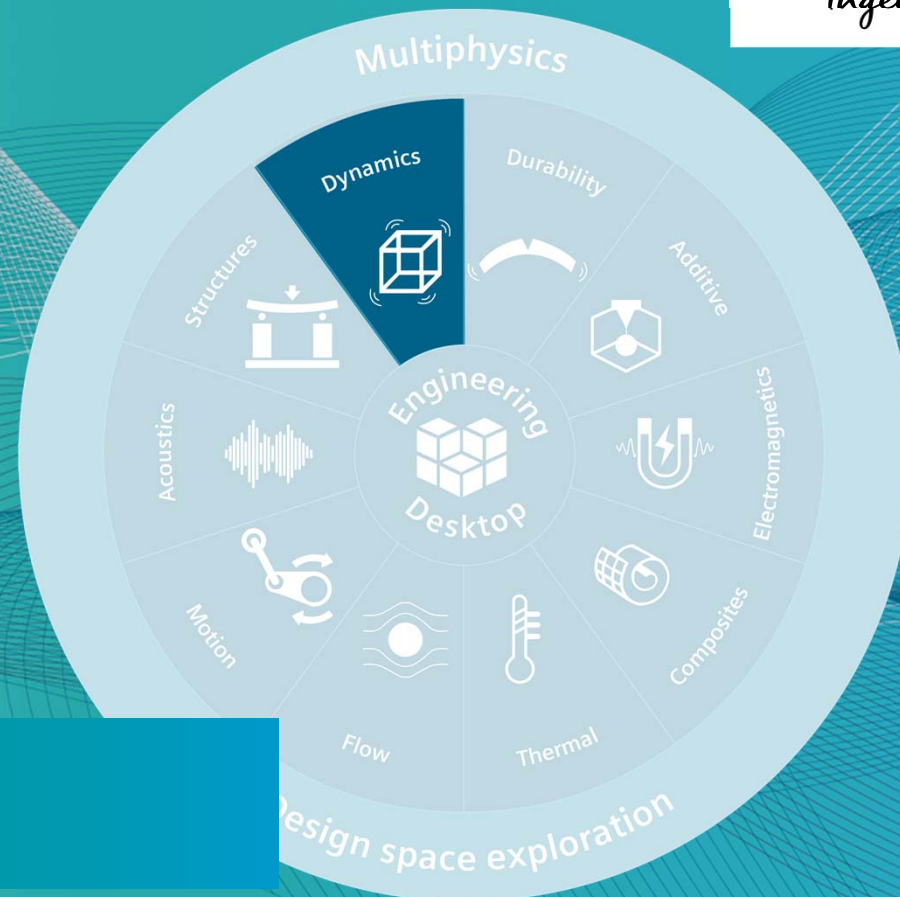**Test Analysis Reference Solution**

can be exported to Test in:

- UNV format
  - Baseline format
- VL2TL format
  - Hidden and undocumented in 2019.2
  - Can be enabled using new Feature Toggles

Benefits

- Streamlined interface with Test

Thank You!

Realize innovation.