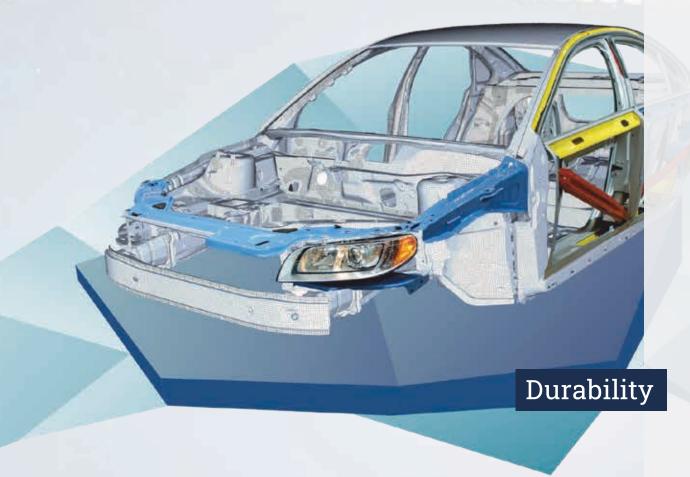


Latest & future developments for Durability analysis and for analysis of structures made of Composites

physics on screen

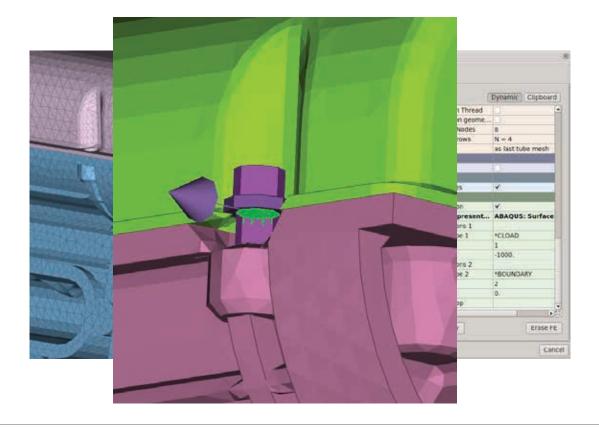






### Assembly

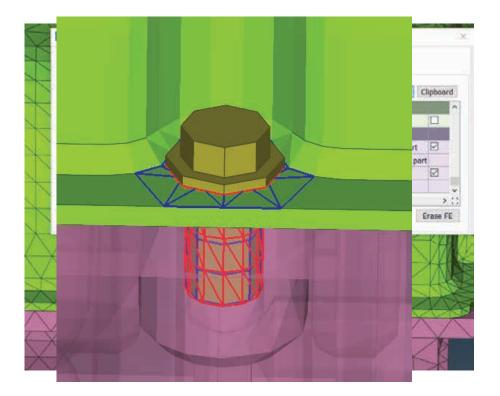
### **Bolt Connections**



Pretension through SOLID BOLT FE representation

- Automatic generation of Pretension parametrically to the Solid Bolt thread length
- Appropriate steps and loading conditions
- Compliant with numerous solvers

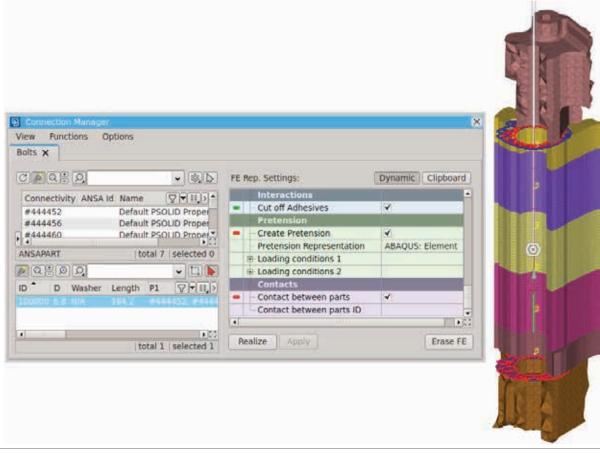
### **Bolt Connections**



Contacts through SOLID BOLT FE Representation

- Contact between head and top part
- Contact between head and thread
- Tied contact between thread and last part
- Available for Abaqus, Ansys, Nastran

### **Bolt Connections**



Pretension and Contacts for BOLT ON SOLID – FE Representation

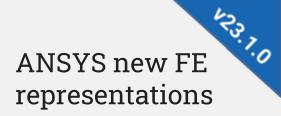
Pretension on beams

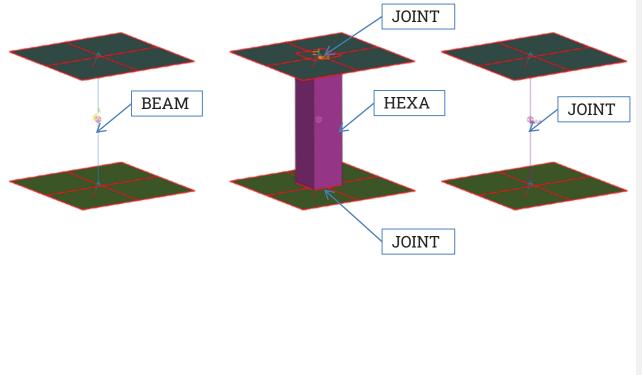
Appropriate Steps and loading conditions

Contacts between connectivity parts

Supported for Abaqus, Ansys, Nastran NX and Pam-Crash

### Spotweld Connections





- ANSYS BEAM contact
- ANSYS HEXA contact
- > ANSYS JOINT contact

### **Contact Interfaces**

Sulf-la Erelline
Nices Dation
Selection X
Hame         M         Add Germatility (9 + 3)) *           Shart_10_T+4mm to Fart_20_T+3mm 1 - Coolact s 4         Slave Set           ** (Part_10_T+4mm to Fart_20_T+3mm 1_1         1         S235()           ** (Part_10_T+4mm to Fart_20_T+3mm 1_2         3         S235()           **         **         **         **           **         **         **         **           **         **         **         **           **         **         **           **         **         **           **         **         **           **         **         **
tela(2)
iets Doend Shrink Acazons Modily File
Meuslize Contact surfaces distance.
Previous Next Close

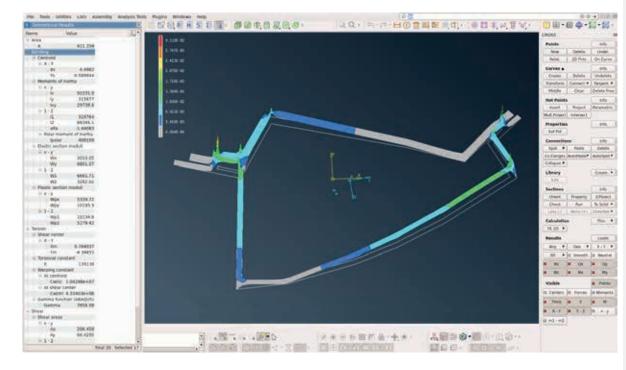
Node to Surface contacts through Contact Assistant

- Automatic detection based on proximity
- Flipping Surfaces
- Inspection of surfaces contents



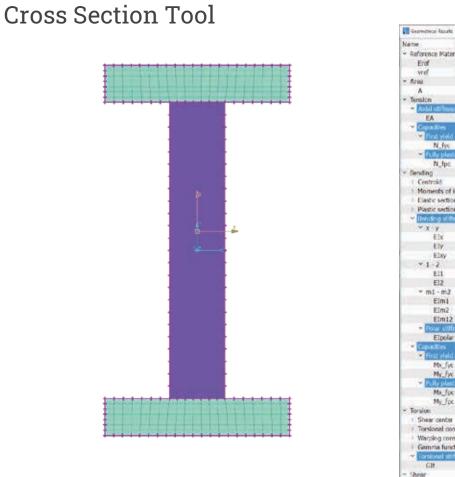
Cross sections

### **Cross Section Tool**



## کېږې New Cross Sections Solver – FE 2D

 Cross sectional properties of thin and solid sections calculated with FE 2D analysis



開め Value. · Reference Material Eref 70000 weel 0.33 168 - ENGINE EA: 1.176e+07 11880 N\_fyc 26450 N\_tpc Centroid Moments of inertia Elastic section moduli Plastic section moduli Y X Y Elx 7.548884+08 7.752014+07 Ely 0.0122156 Elxy × 1 - 2 E11 7.548886+08 EIZ 7.25201e+07 \* m1 - m2 EIm1 Elm2 Elm12 Elpolar 8.27406++08 Mx fvc 181950 My\_fx 37986.7 Ma Jpc 223920 My for 10789 1 Shear center Torsional constant Warping constant Gemma function (ABAQUS) 8.54085++06 Glt

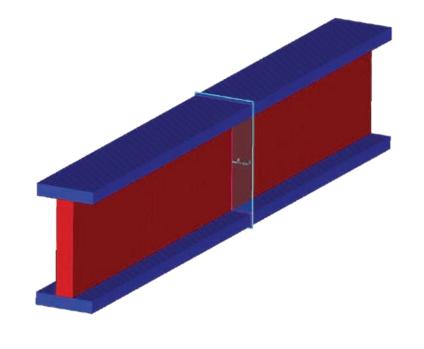
- 20

Cross Section Results

- First Yield capacities N\_fyc, Mx\_fyc, My\_fyc
- Fully Plastic capacities N\_fpc, Mx\_fpc, My\_fpc

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### **Cross Section Tool**

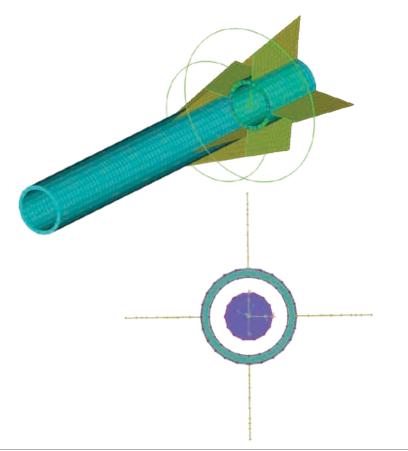


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wef	0.93	
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lay	5.73119	
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Ym	980116e-09	
Torsional ci		
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	010.710	

Calculation of Non Homogeneous Solid Cross Sections

Supported in FE & FE 2D cross solvers

### **Cross Section Tool**

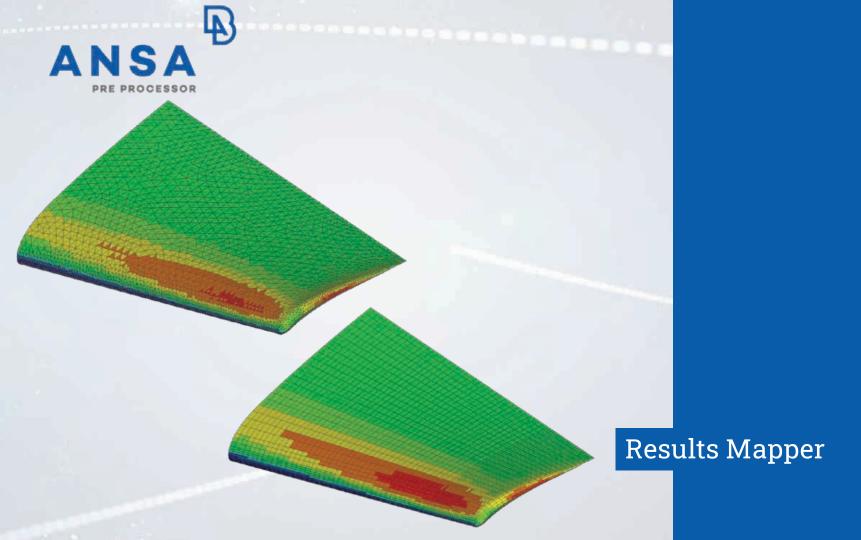


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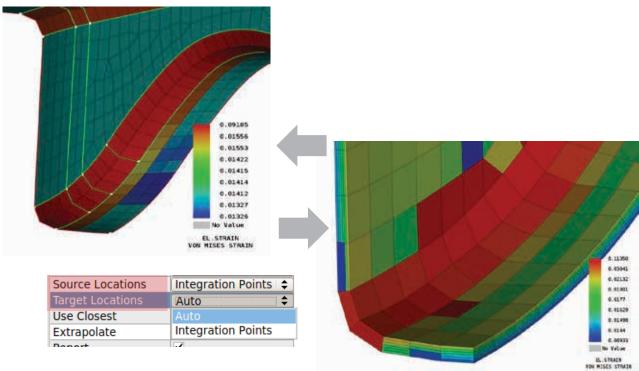
دي. Cross Section tool

#### FE Solver:

 Calculation of Mixed Thin-Solid cross sections



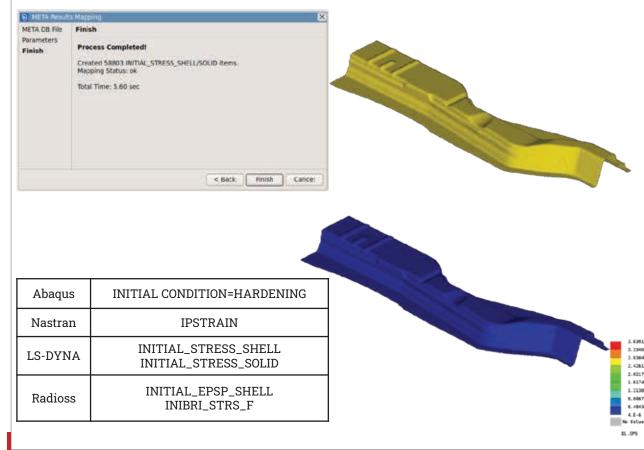
### **Results Mapper Tool**



Result Mapper Tool on Integration Points

- Results on integration points over thickness of shells or solids can be used for mapping
- Available both for source and target model
- Supported with RBF method

### **Results Mapper Tool**



**META Results** Mapping plugin

Mapping of Equivalent **Plastic Strains** 

- Results of META Db:  $\geq$
- EPS

3.63919

3.73494

2.83848

2,42613 2.62177 1.45742

1.21307

0.008712

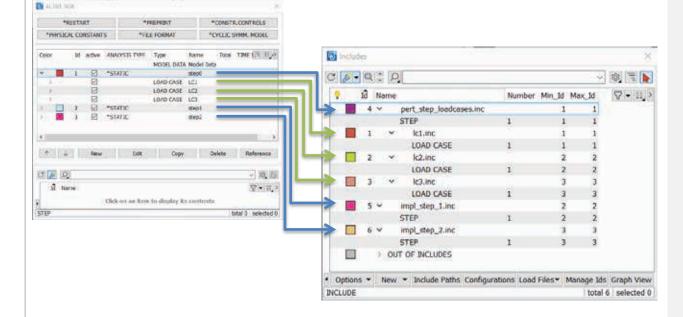
0.484358

4.5.4

- PEEQ
- EquivalentPlasticStrain
- > Map to initial condition solver entities for Abagus, Nastran, LS-DYNA, Radioss



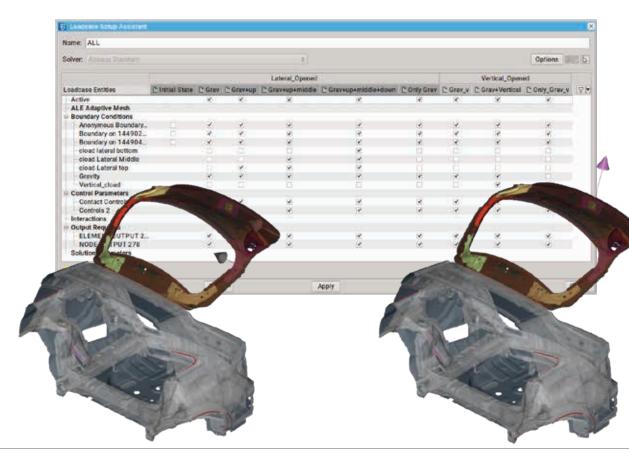
Specific Solver Features & Techniques



### ABAQUS \*STEP and \*LOADCASE to Includes

Step and Loadcase keywords can now be split to separate include files

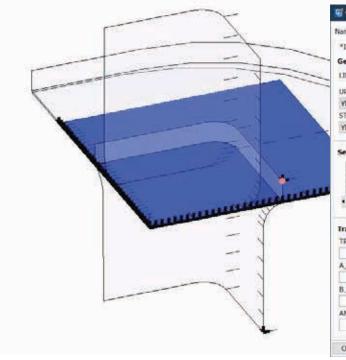
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# Building an evolution analysis

- Set up Multiple nonlinear load cases
- \*MANIFEST available in: Step Manager

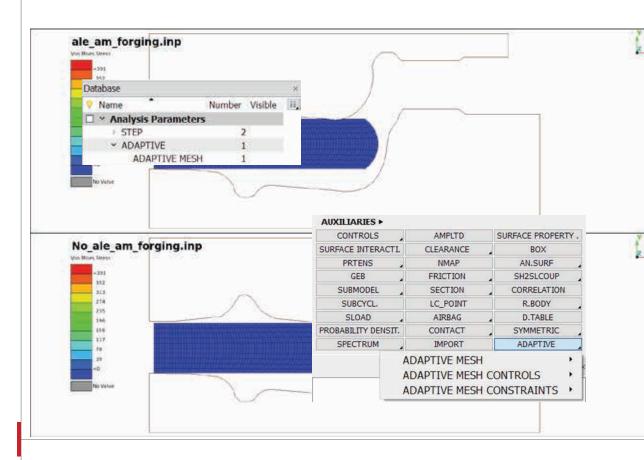
Loadcase Assistant



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Transferring results between analyses

- Support of \*IMPORT
- > Example:
  - 1. Deep drawing with Abaqus/Explicit
  - 2. \*IMPORT deformed geometry and stresses
  - 3. Spring back with Abaqus/Standard



Enabling the adaptive mesh technique

> Define an adaptive mesh domain

Supported: \*ADAPTIVE MESH \*ADAPTIVE MESH CONSTRAINTS \*ADAPTIVE MESH CONTROLS

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### Marc Module

Entities	Define Parameters	
Section Node Section Vector Parameters	Create Point Lo. • Magn	1000
Finish	LOADCASE OPTIONS	1
	Create Fixed Di * Magn.	
	LOADCASE OPTIONS	2
	Show Selected Elements	
	Calculate Contacts	



Marc Pretension Assistant

- Automatic generation of pretension respective keywords
- Definitions of appropriate loadcases
- Auto-Detection of contacts around solid bolt

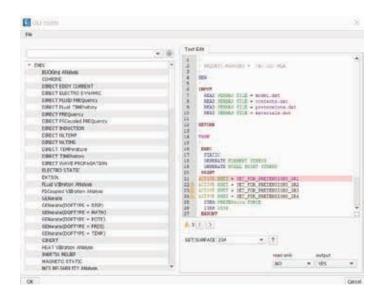
### Permas Module

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CK	Game

## کې. Contact Flanges improvements

- Definition of Load parameters for contacts, pretensions and Pressfit
- Springs to restrain rigid body motion

### Permas Module



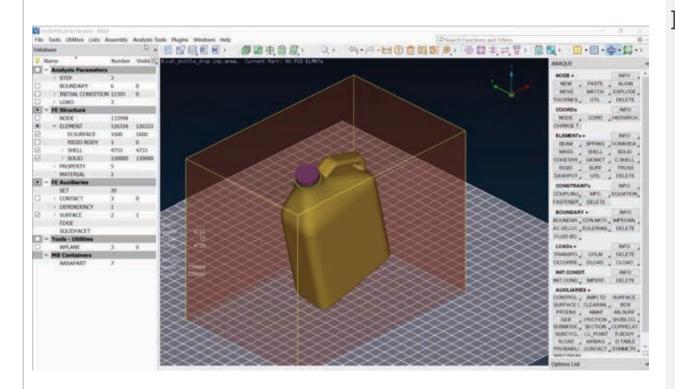
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230 SET_10R_SHEET15_801H	NIET	
229 SET_FOR_W/T55_TOP	NIET	
238 SET_FOR_W/T26_10P	NIET	
217 SET_FOR_WITLS_TOP	HIST	
216 SET_FOR_SCREWEL_HEAD	NSET	
225 SET FOR SCHEWISE HEAD	NIET	
234 SET FOR SCREWAS HEAD	NET	
222 SET_FOR_SOREA/25_HEAD	1067	
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### **UCI Editor**



Interactive
 Communication of
 Database Browsers Sets
 List with Activated
 Sets

### **Common feature for Solver Modules**



### Direct job submission

- > Submit
- > Execute

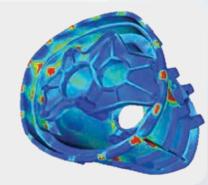
### > Monitor

- Data Check
- Available in Abaqus, Ansys, Marc, Nastran, Optistruct, Permas

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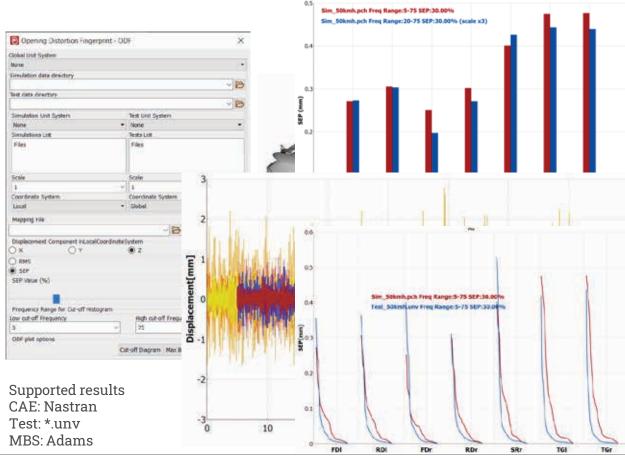






## META Toolbars

### User Toolbars

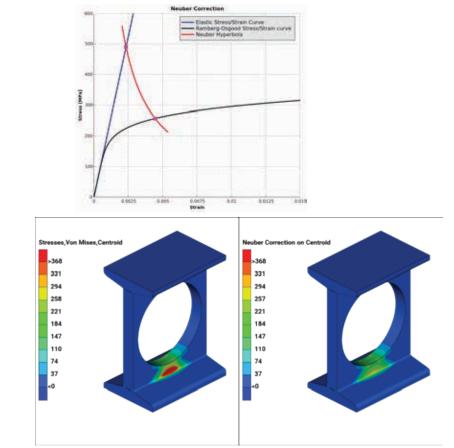


### ODF – Opening Distortion Fingerprint

- Body stiffness evaluation through the distortion of closure openings
- Based on dynamic simulations/ measurements
- Evaluation of distortion per opening :
  - Max bar chart
  - Over frequency range
- Direct comparison measurement/ computation

PP.I.

### User Toolbars





- New User Toolbar
- Calculate the equivalent plastic stress from a linear elastic analysis

### Composites Modeling & Analysis

BETA

### Composites

Short Fiber Options Continuous Mesh RVE	Fiber Options Multilayer Options Generate Using Solid intersection	•		
Homogenized Material	Isotropic			
Creace contacts at interface	Create contacts at layers interface	1		
	1			
	1	10		
<ul> <li>Create periodic BCs</li> </ul>	Shear-KZ	10		
Cieate	Delete			
			· · · · · · · · · · · · · · · · · · ·	10
ОК		Carcel		

دی. Homogenization Tool. RVE Generation

- Periodic Boundary Conditions for generated RVEs
- Ready to run RVE models are created for:
- EPILYSIS
- Nastran
- Abaqus
- Ansys
- LS-DYNA (Implicit)
- PAM-CRASH (Implicit)

### Composites

Short Fiber Options	Continuous Fiber Options	Multilayer Op	tions Generat	e External	RVE			
Select model with RVE			0 status Media			٥		
RVE Dimensions (X,Y,	Z)	500.		500.		500.		
Actions	Axial-X					•		
Apply								
Post / Nonlinear FE H	omogenization							
Solved filename C:\U	lsers\demo\External_RVE_	solved.inp						
Apply							-	0511-0023
			Non linear FE Ho Choose curve type					
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ок		ſ	Strain         St           1         0.           2         0.0036           3         0.00721           4         0.01858           5         0.01453           6         0.018209           7         0.021891           8         0.025577           9         0.032956           10         0.032956           11         0.036649	87961 35095 97396 87497 4.5768 85565 47332 00393	120 100 \$80 50 40 20 0	AtroStrain11Str derStrain11Stre konogenieedStr	eoII hini 1Stress II	0.03 0.035 0

# Homogenization Tool: RVE

- External RVE Model treatment
- > Pre:
  - Mesh Geometry
  - Apply Periodic BCs
  - Solve with Epilysis for Linear FE Homogenization
- > Post:
  - Nonlinear FE Homogenization from solved RVE models

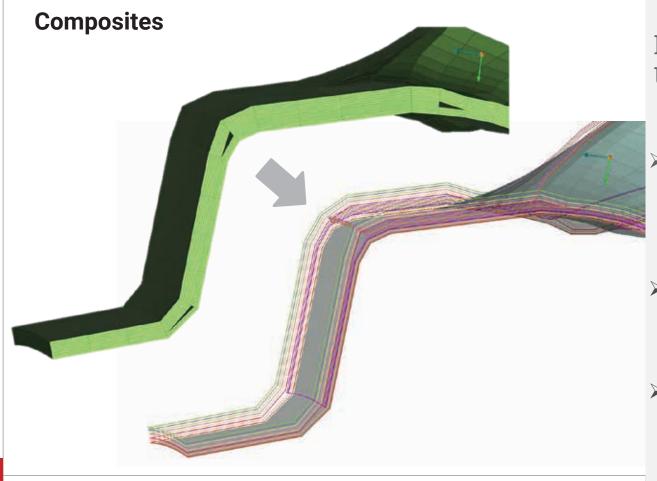
#### **Composites**

## DAY 2 THURSDAY JUNE 15, 2023 - Afternoon Sessions

### 15:00 - 15:30

Introducing the redesigned Representative Volume Element (RVE) Generator Tool Vangelis Palaiokastritis



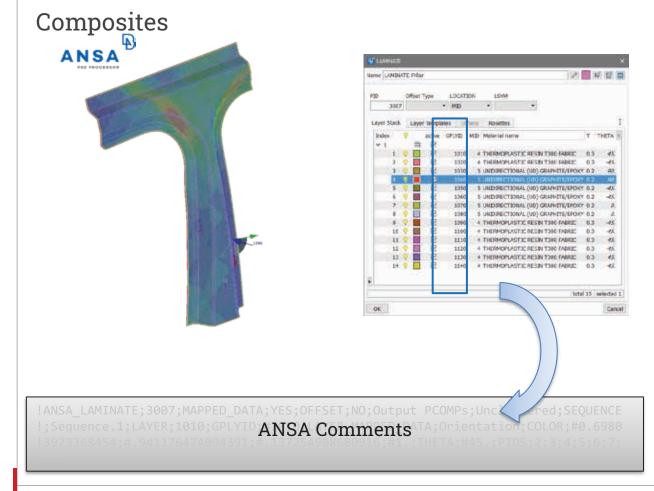


Laminate Tool: Unvolumize

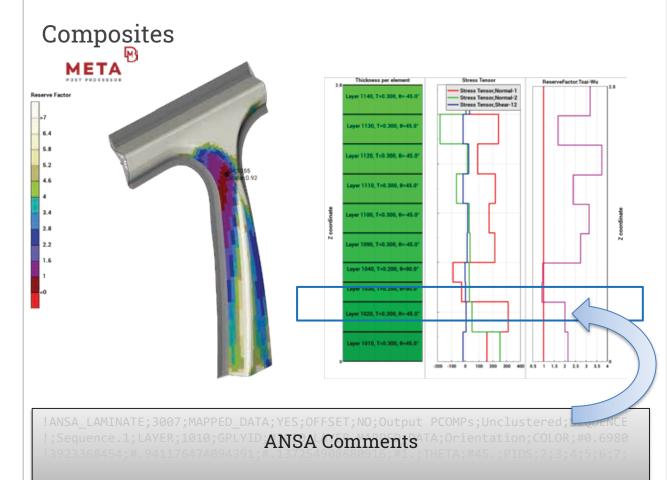
- Generate shell composites from respective solid composites
- Available for both single element and per ply stacking definitions
- Accessible from Laminate Tool and Database Browser

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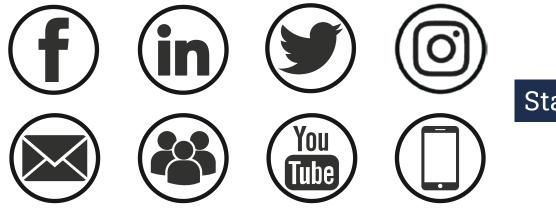
- Lamination information through ANSA comments inside the Ansys .cdb
- Input: Recreate initial laminate structures



Mapping composite results to Ansys Laminates

- Retrieve Lamination information from ANSA comments inside the Ansys .cdb
- Recreate initial laminate structures





### Stay connected

www.beta-cae.com