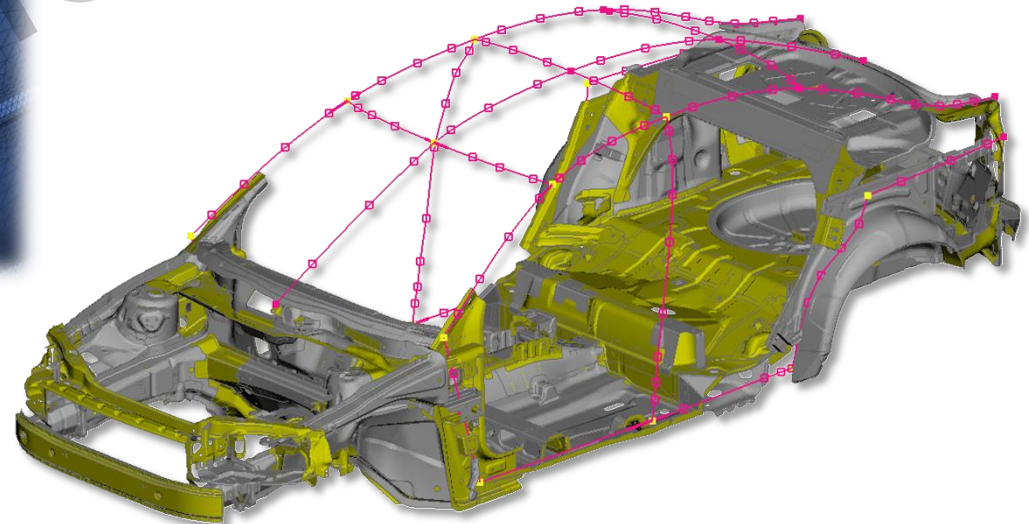
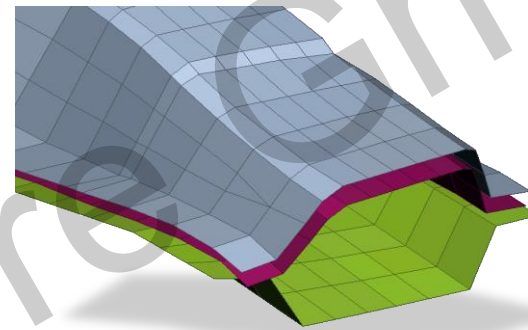
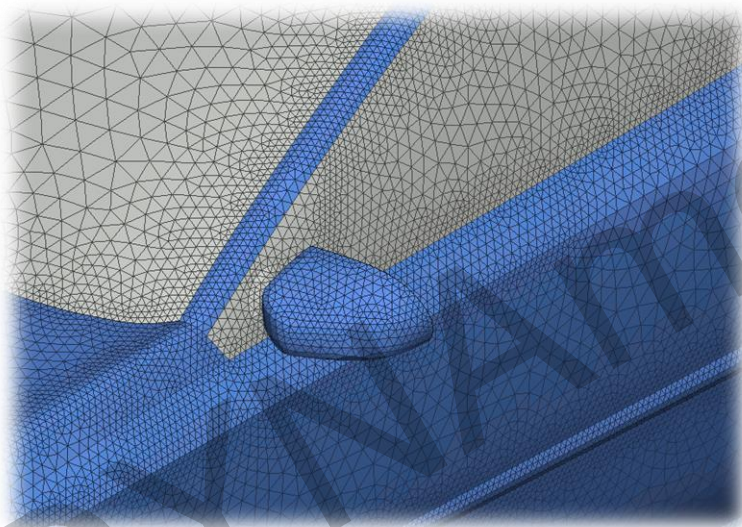


Model Parameterization in ANSA



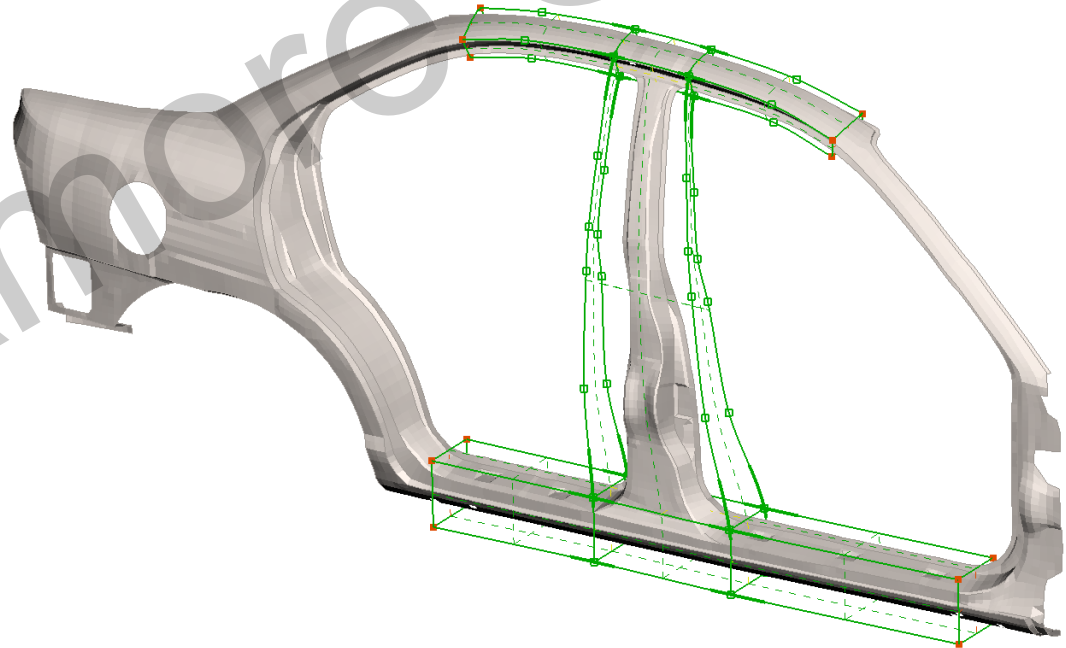
Dirk Dreißig
Mail: ansa@lasso.de

Types of Parameterization

DYNAMORE GmbH

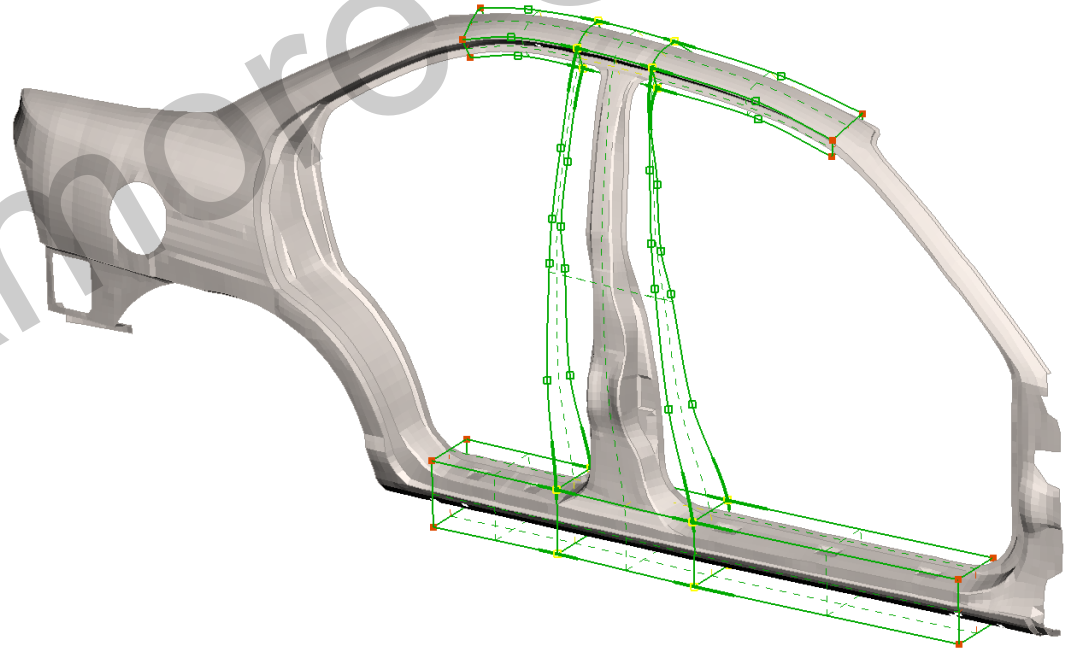
Types of Parameterization

- Shape modification (e.g. position of B-pillar)
→ Morphing



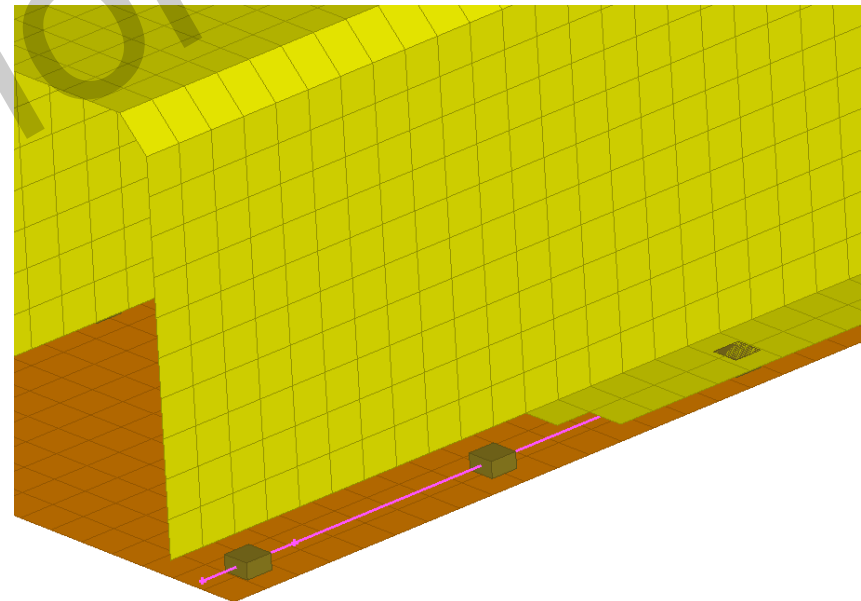
Types of Parameterization

- Shape modification (e.g. position of B-pillar)
→ Morphing



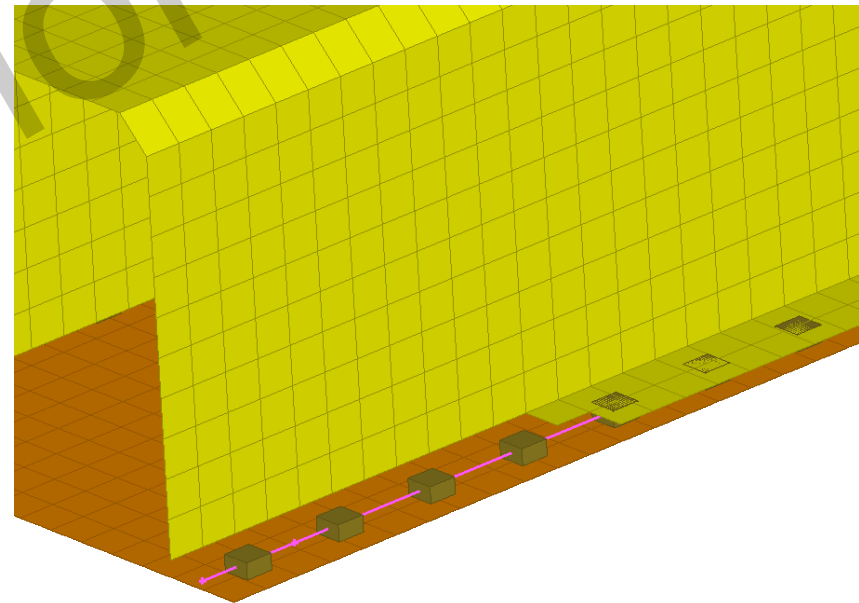
Types of Parameterization

- Shape modification (e.g. position of B-pillar)
 - Morphing
- Modification of solver card entries (e.g. property thickness, used material, connection properties)
 - ANSA Parameter



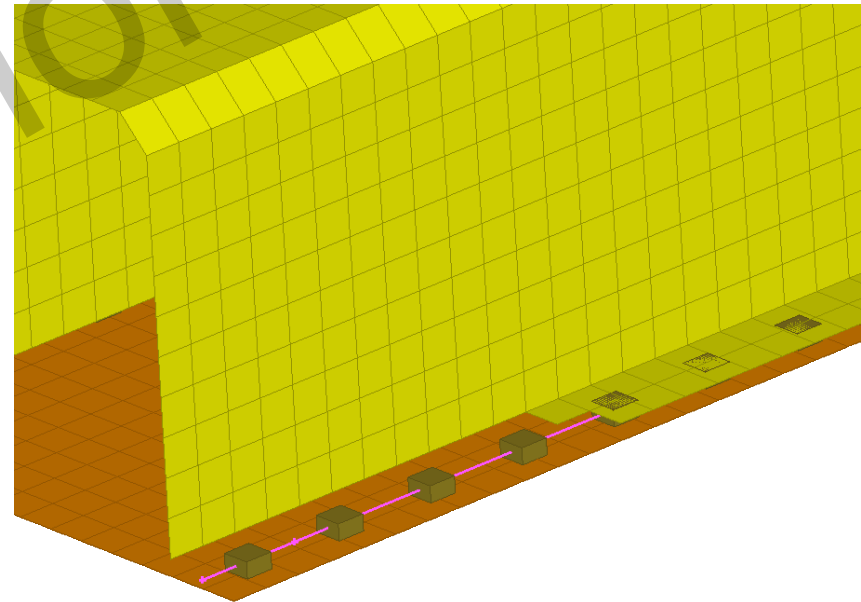
Types of Parameterization

- Shape modification (e.g. position of B-pillar)
 - Morphing
- Modification of solver card entries (e.g. property thickness, used material, connection properties)
 - ANSA Parameter



Types of Parameterization

- Shape modification (e.g. position of B-pillar)
 - Morphing
- Modification of solver card entries (e.g. property thickness, used material, connection properties)
 - ANSA Parameter
- Anything else
 - Scripting



Morphing

DYNAMORE GmbH

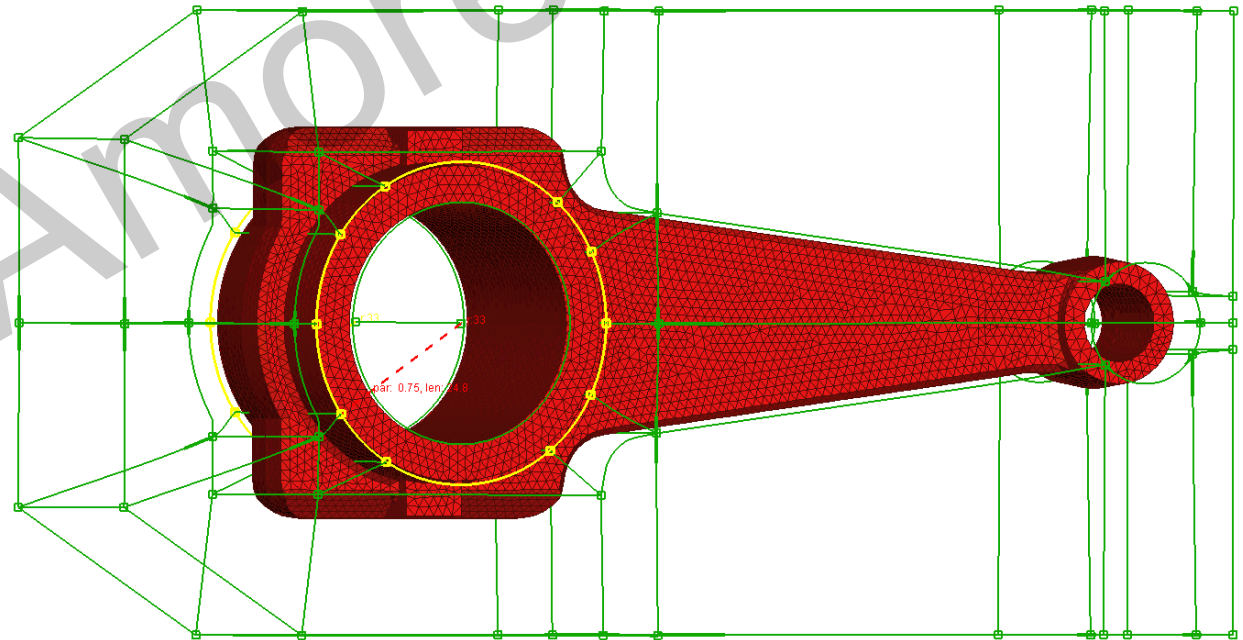
Morphing

- Applicable on FE- and Geometry models
- Two main methods:

DYNAMORE GmbH

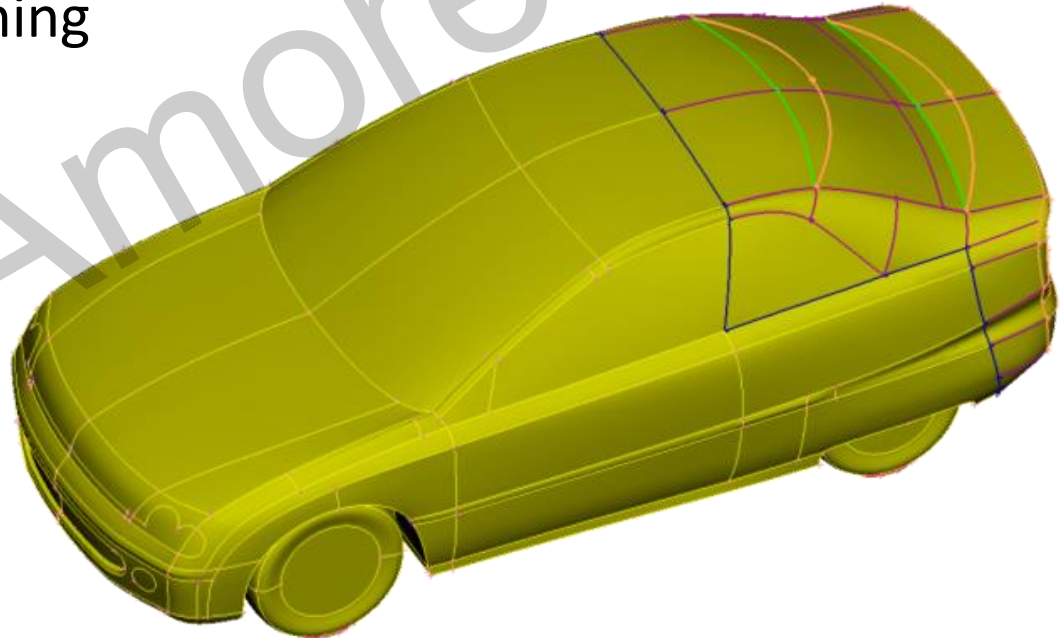
Morphing

- Applicable on FE- and Geometry models
- Two main methods:
 - Using Morphing Boxes



Morphing

- Applicable on FE- and Geometry models
- Two main methods:
 - Using Morphing Boxes
 - Direct Morphing



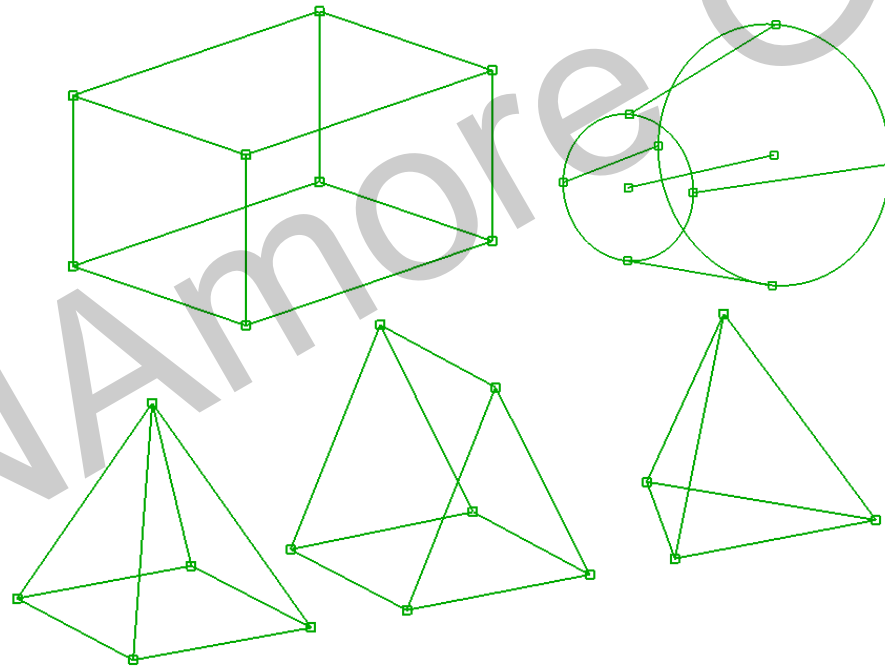
Morphing

- Applicable on FE- and Geometry models
- Two main methods:
 - Using Morphing Boxes
 - Direct Morphing



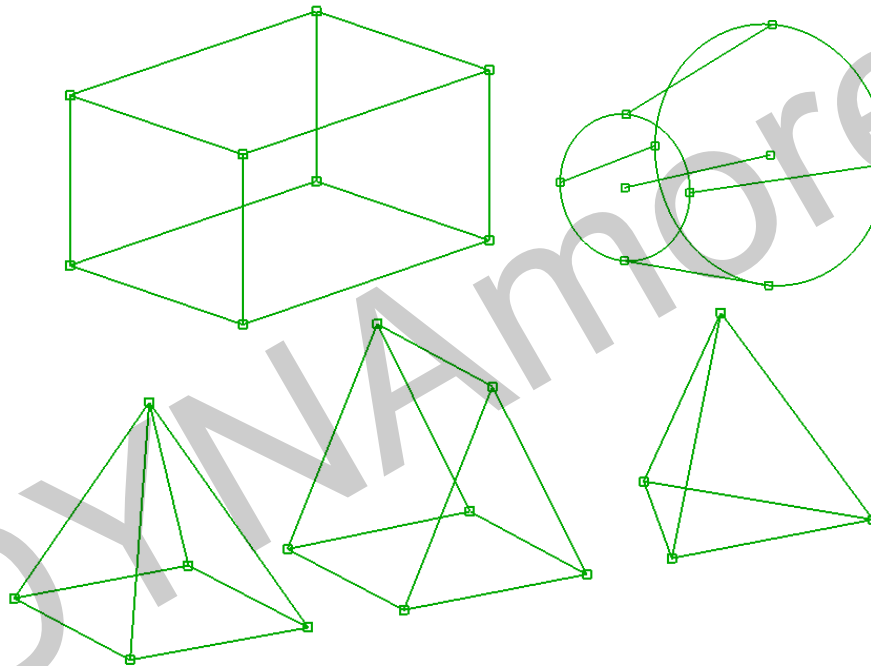
Box Morphing

Types of boxes



Box Morphing

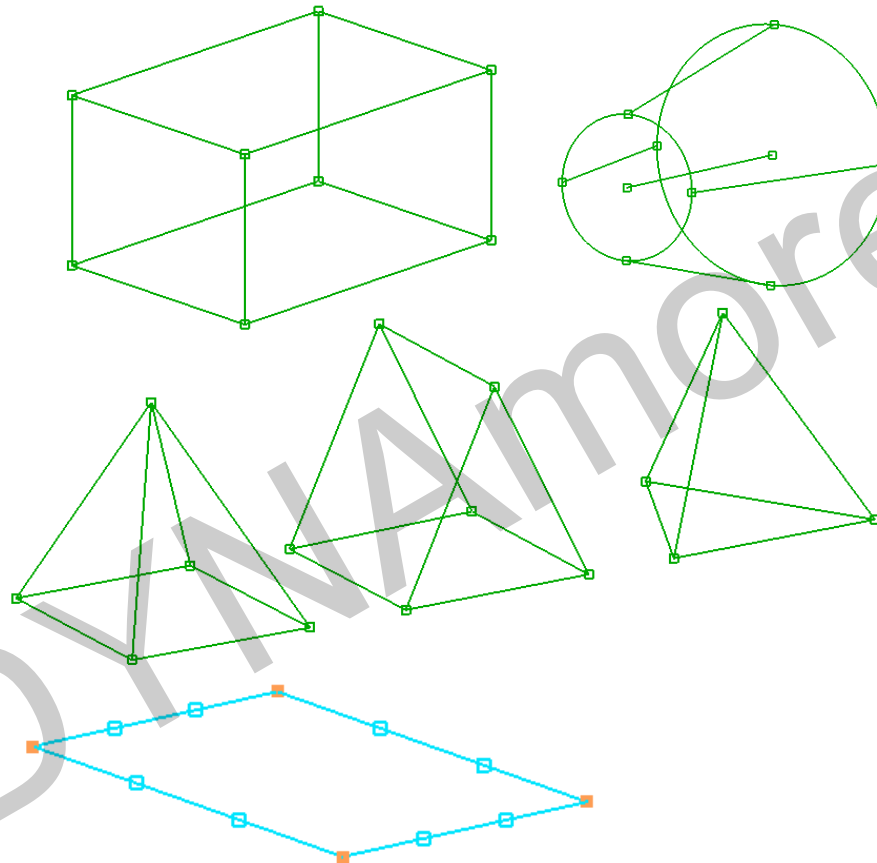
Types of boxes



- 3D
 - Hexa
 - Penta
 - Tetra
 - Pyramid
 - Cylindrical

Box Morphing

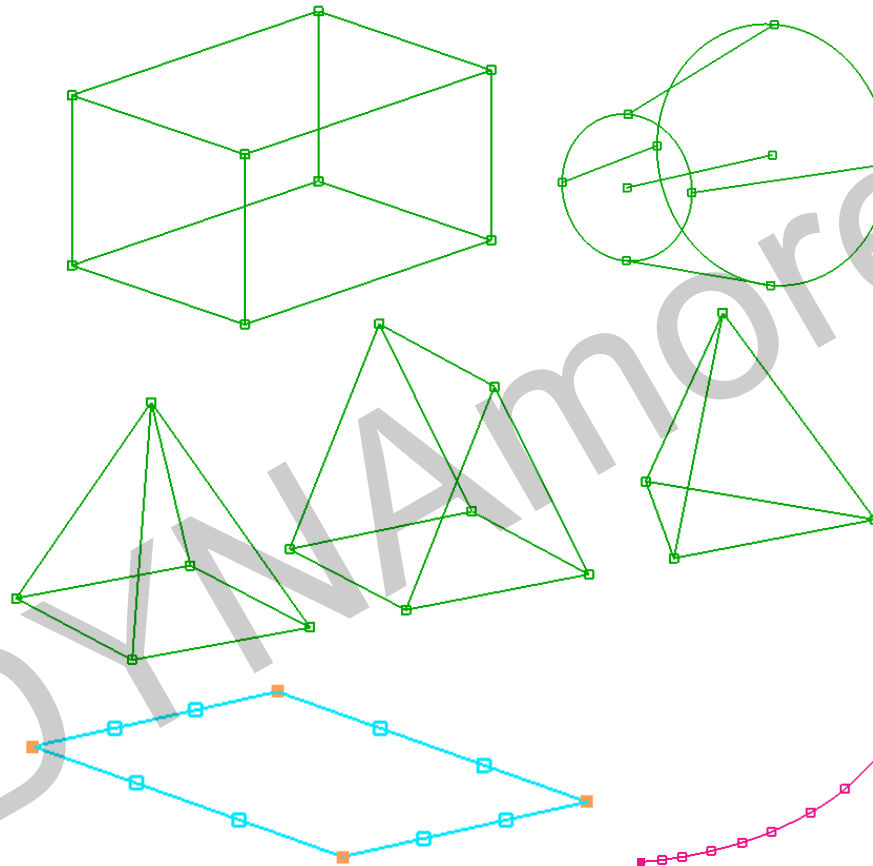
Types of boxes



- 3D
 - Hexa
 - Penta
 - Tetra
 - Pyramid
 - Cylindrical
- 2D (specific thickness)

Box Morphing

Types of boxes

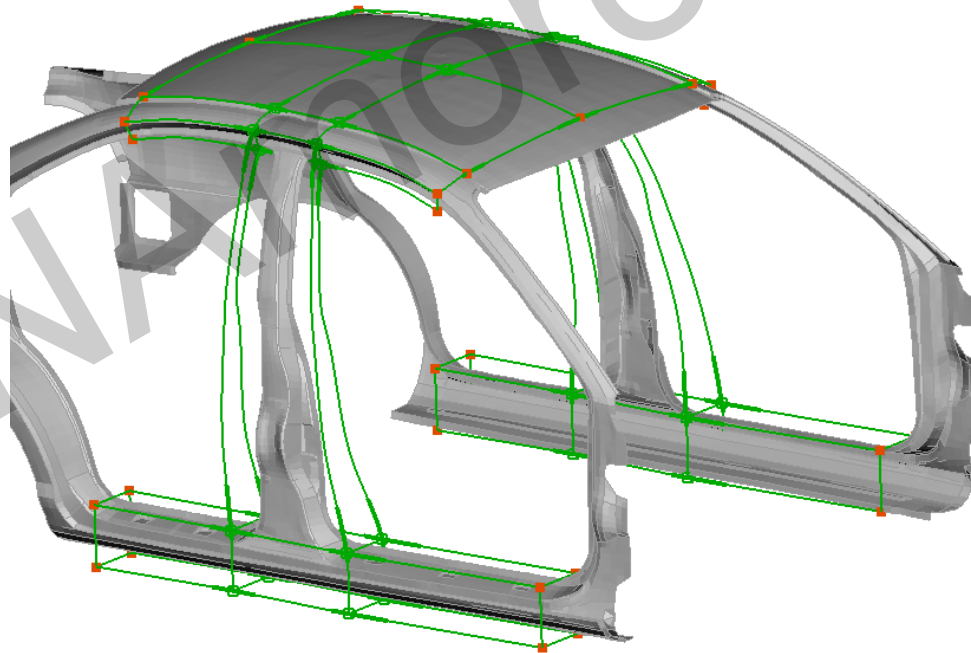


- 3D
 - Hexa
 - Penta
 - Tetra
 - Pyramid
 - Cylindrical
- 2D (specific thickness)
- 1D (specific diameter)

Box Morphing

Approach 1

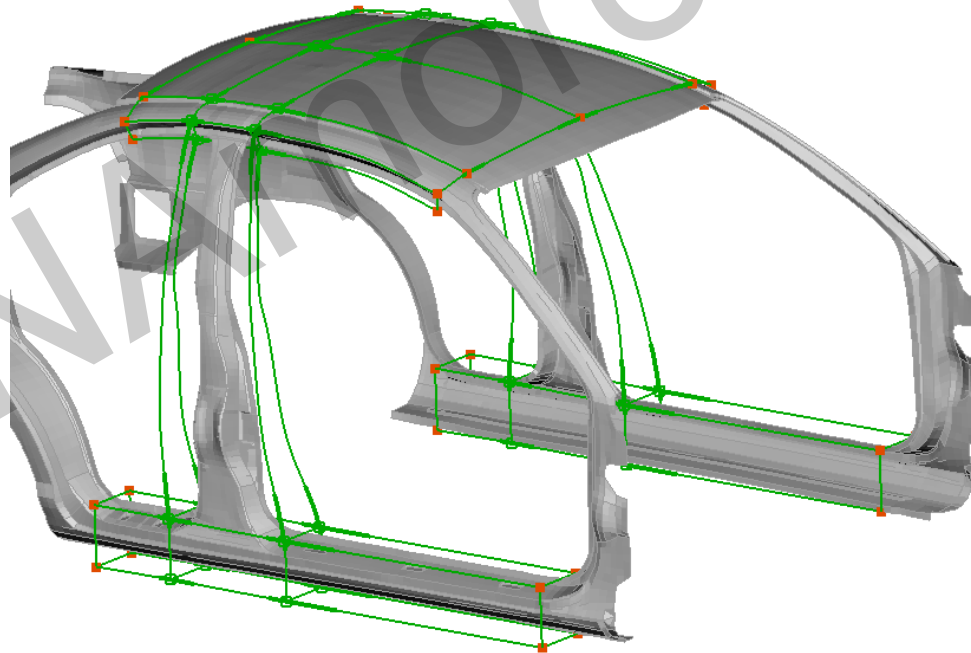
- Multiple boxes, following the shape of the structure
- Moving / sliding of control points reshapes the model
- **Rough modification** of model shape



Box Morphing

Approach 1

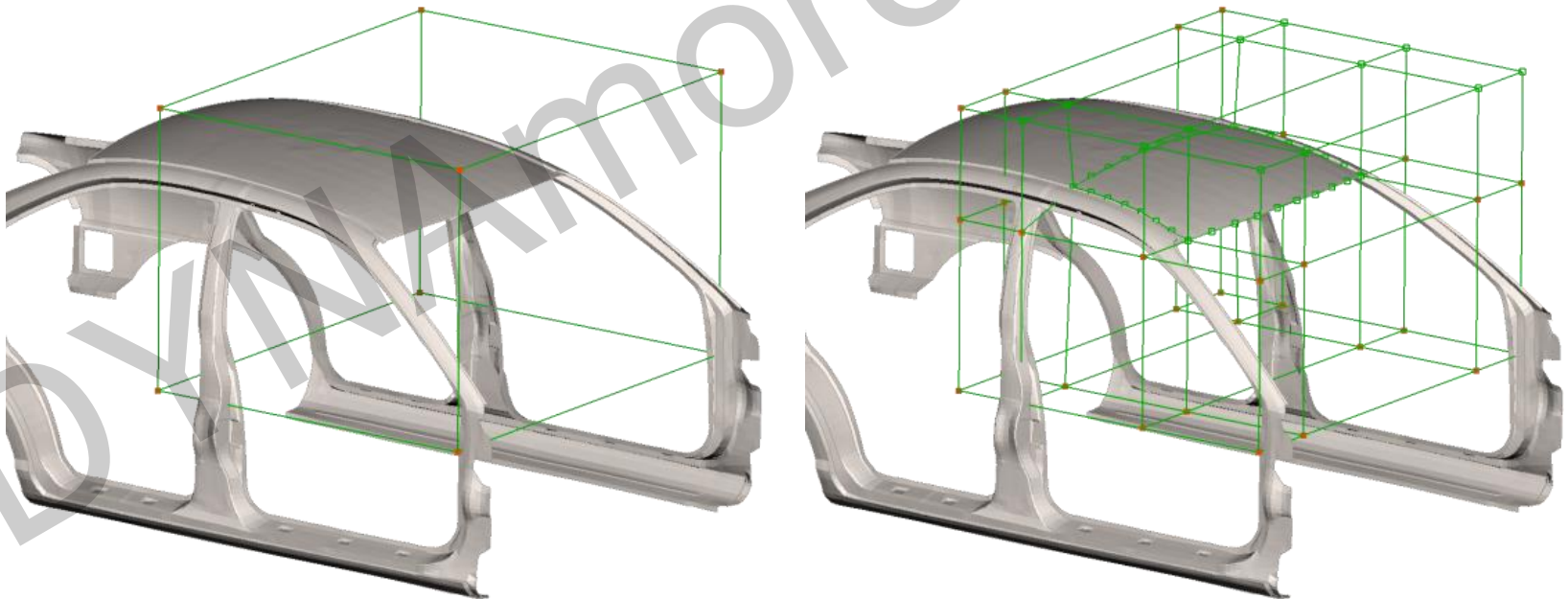
- Multiple boxes, following the shape of the structure
- Moving / sliding of control points reshapes the model
- **Rough modification** of model shape



Box Morphing

Approach 2

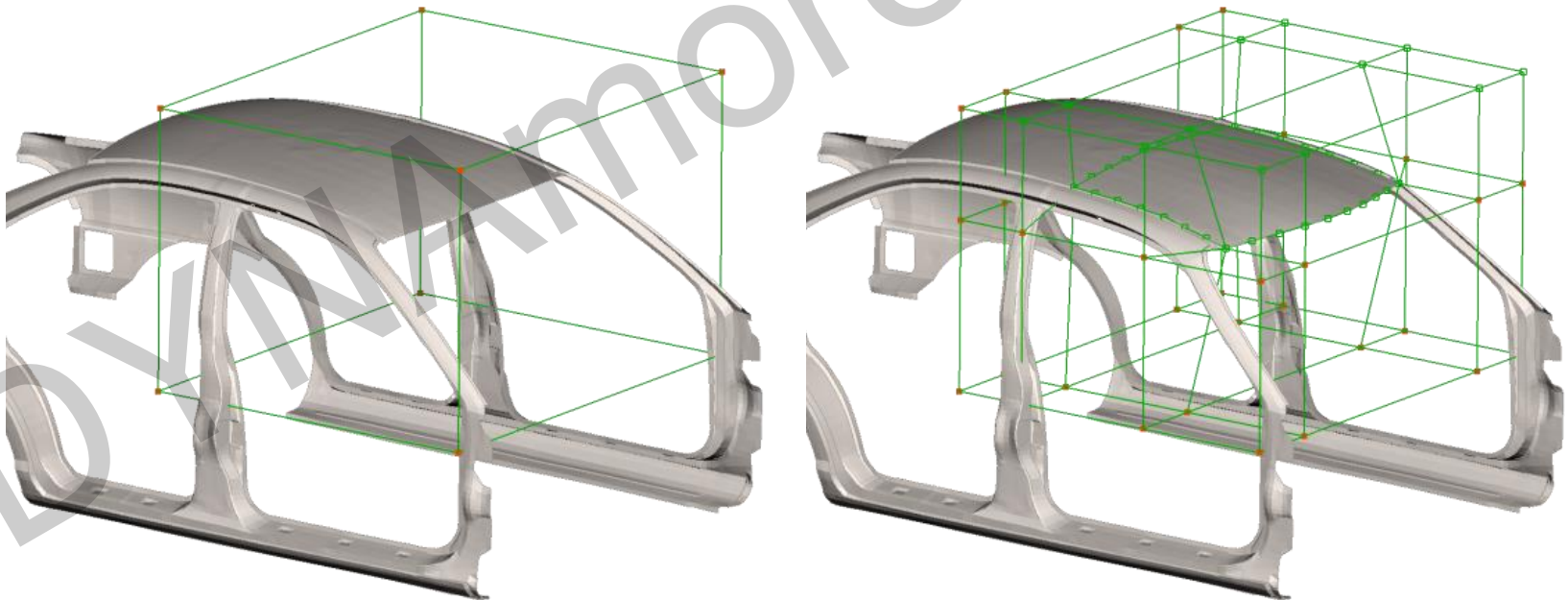
- Single box, split into many whose edges fit on feature lines
- Surrounding boxes as buffer zones
- Precise modification of model shape



Box Morphing

Approach 2

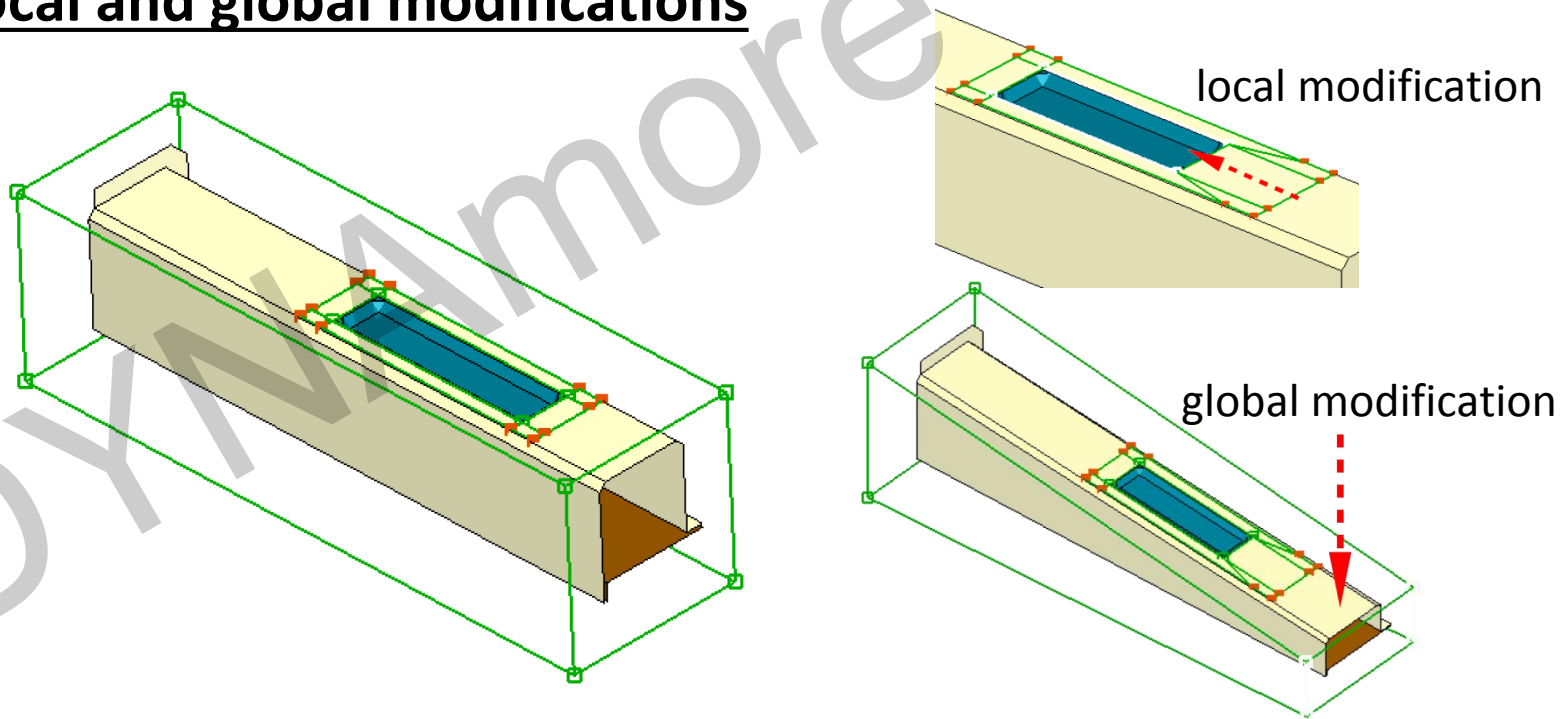
- Single box, split into many whose edges fit on feature lines
- Surrounding boxes as buffer zones
- Precise modification of model shape



Box Morphing

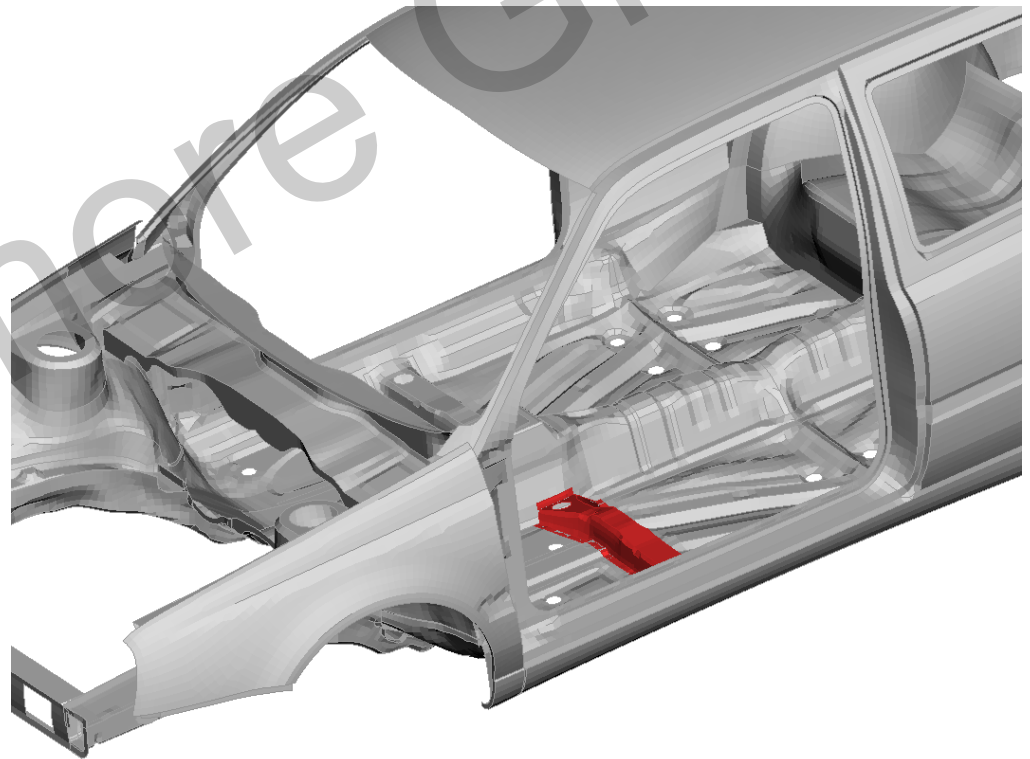
Approach 3

- Box in Box
- Separate groups of boxes handle different features
- **Local and global modifications**



Box Morphing

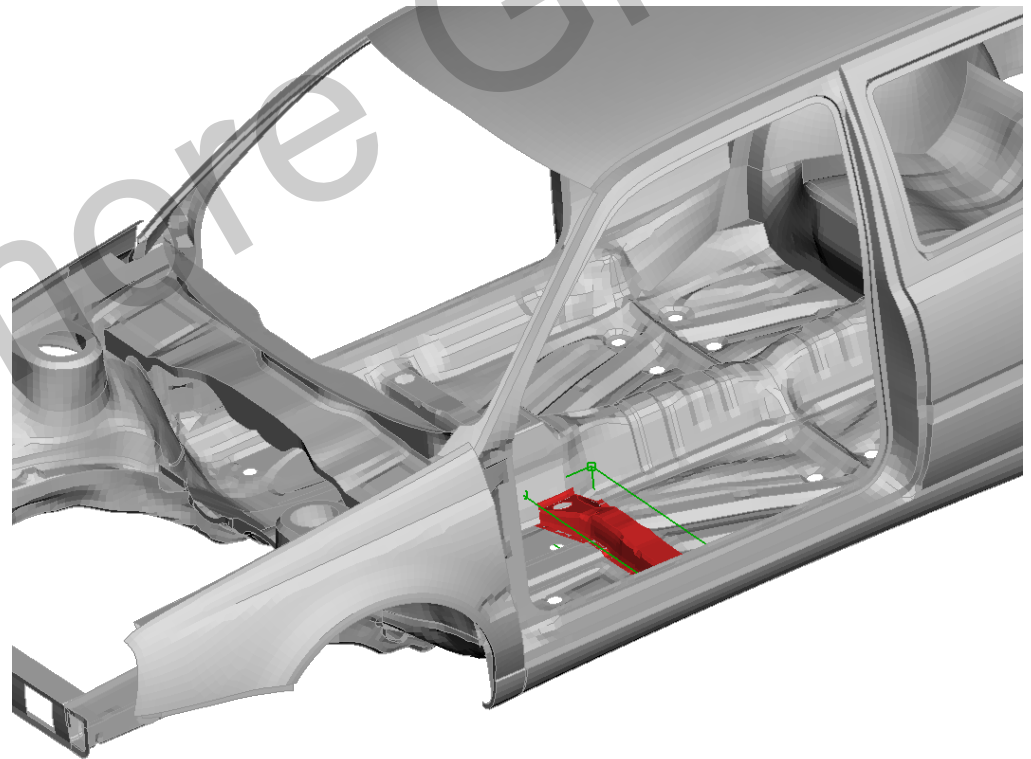
Creation of Boxes



Box Morphing

Creation of Boxes

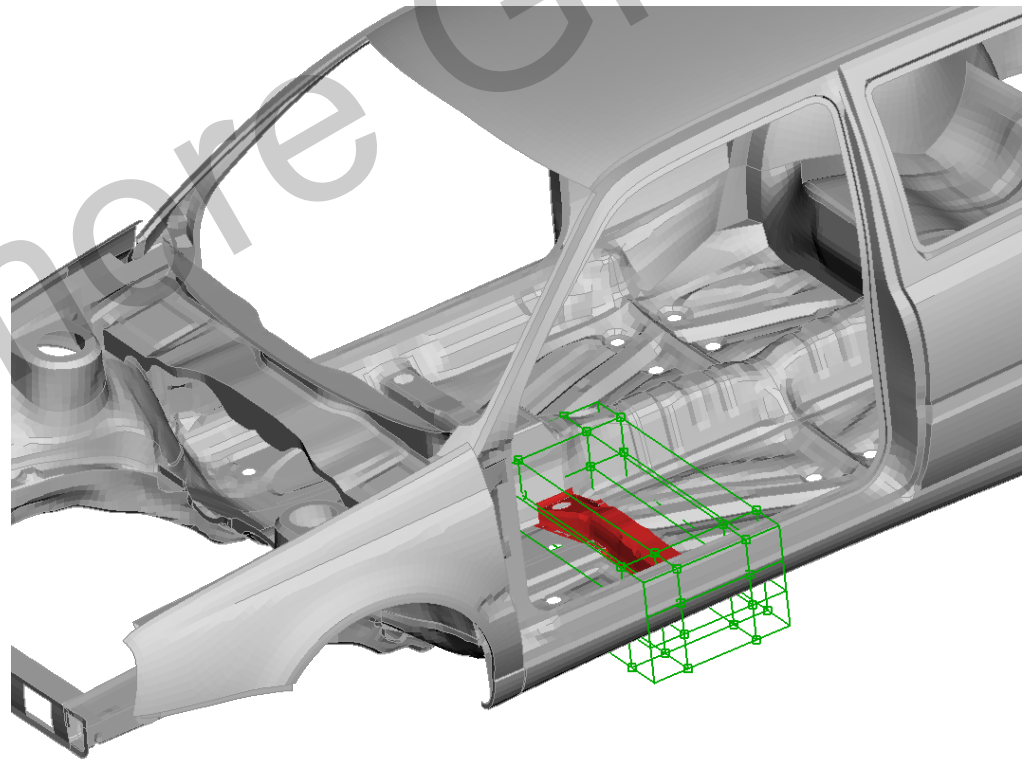
- Around Entities



Box Morphing

Creation of Boxes

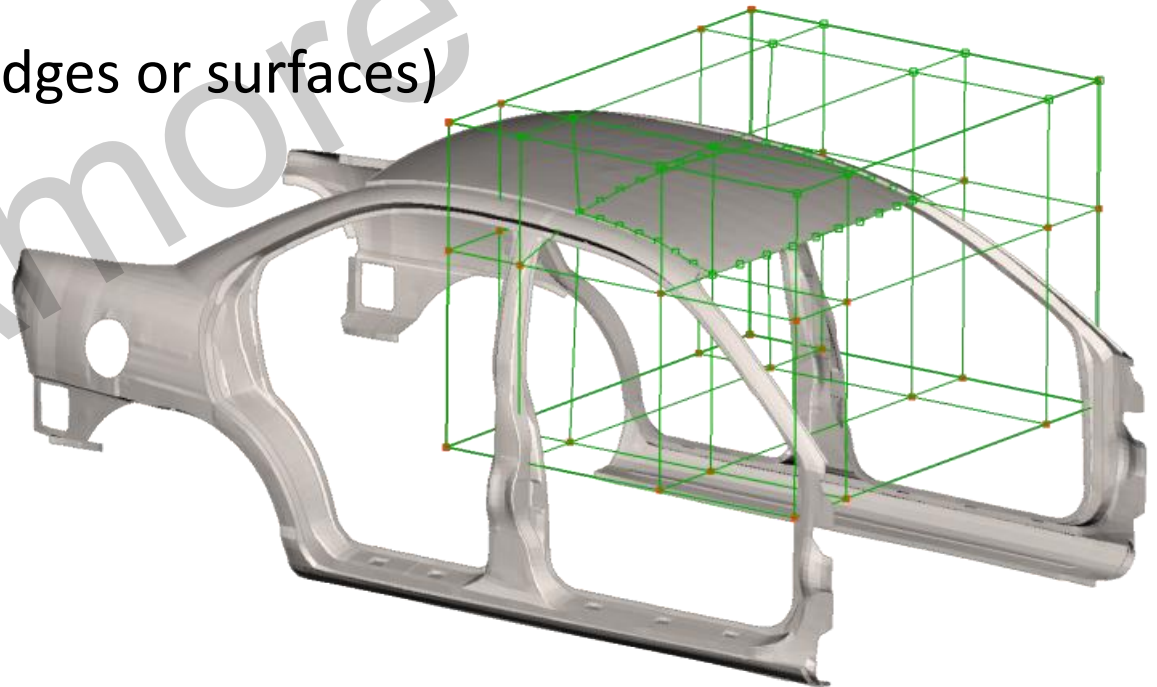
- Around Entities
- Buffer Zones



Box Morphing

Creation of Boxes

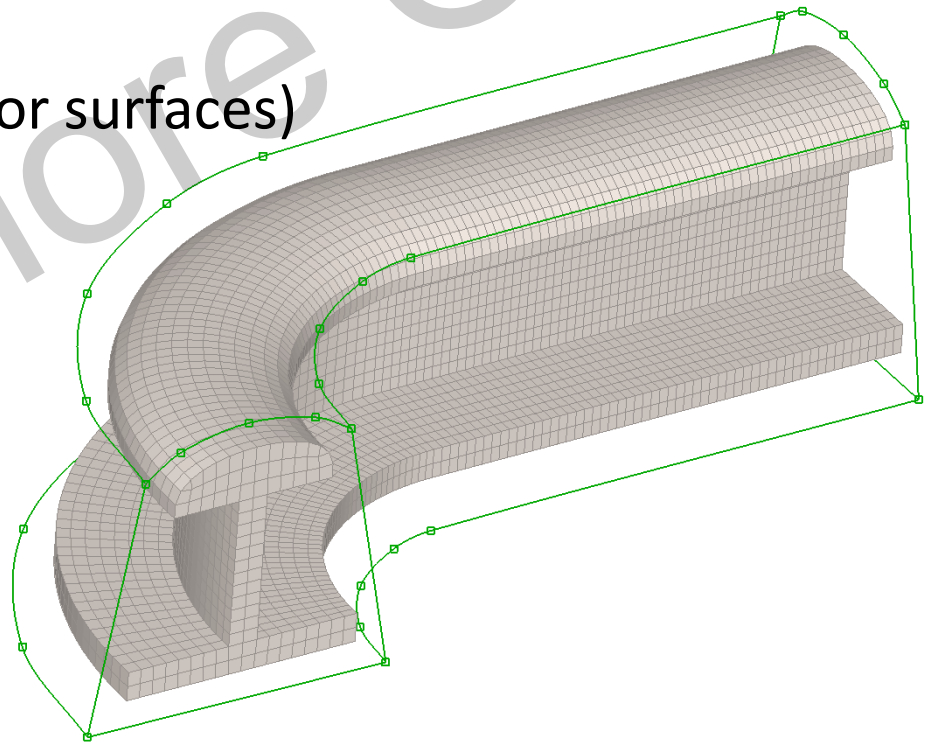
- Around Entities
- Buffer Zones
- Split + Fit (onto edges or surfaces)



Box Morphing

Creation of Boxes

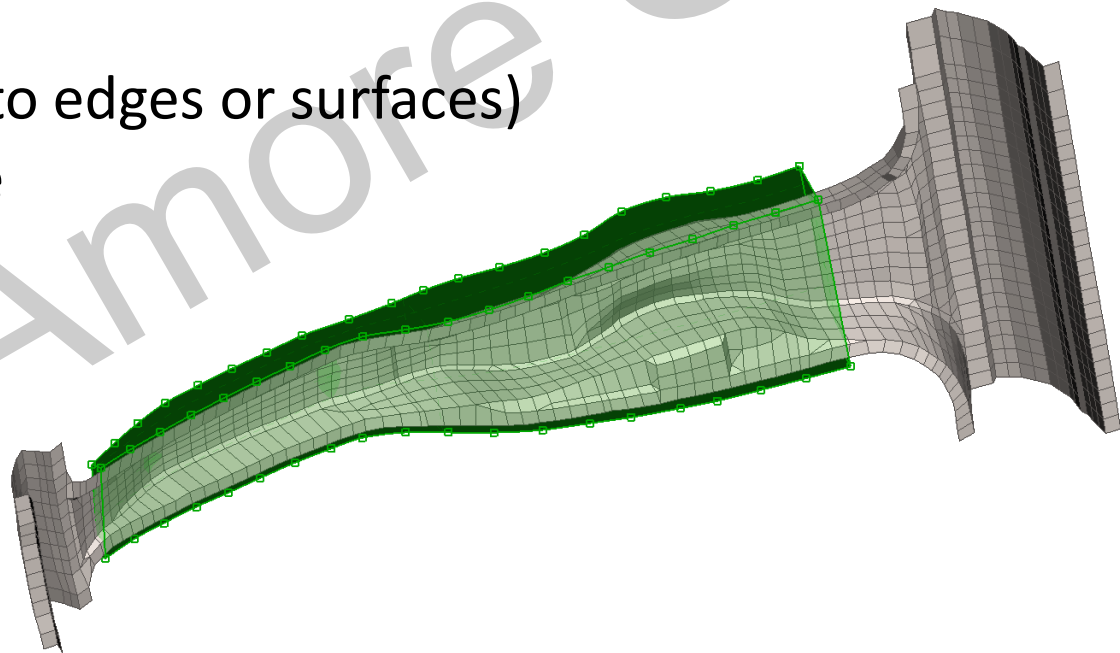
- Around Entities
- Buffer Zones
- Split + Fit (onto edges or surfaces)
- Sweep / Glide



Box Morphing

Creation of Boxes

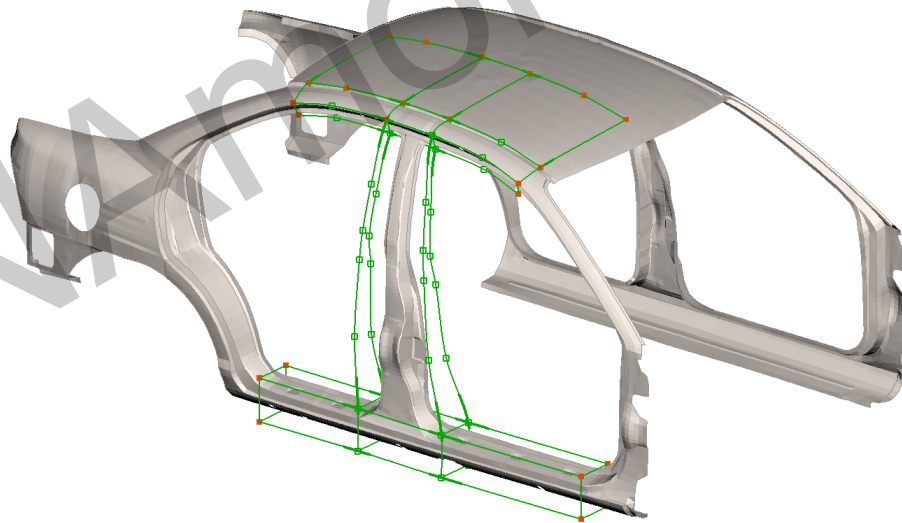
- Around Entities
- Buffer Zones
- Split + Fit (onto edges or surfaces)
- Sweep / Glide
- Adapt
- etc.



Box Morphing

Linked Morphing Boxes

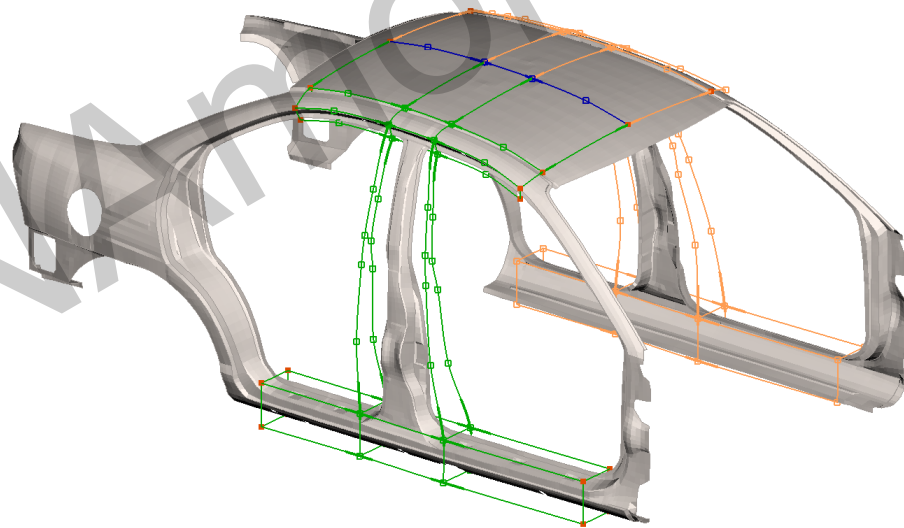
- Taking advantage of model symmetry
- Link according symmetry-/mirror plane, rotation axis or translation vector



Box Morphing

Linked Morphing Boxes

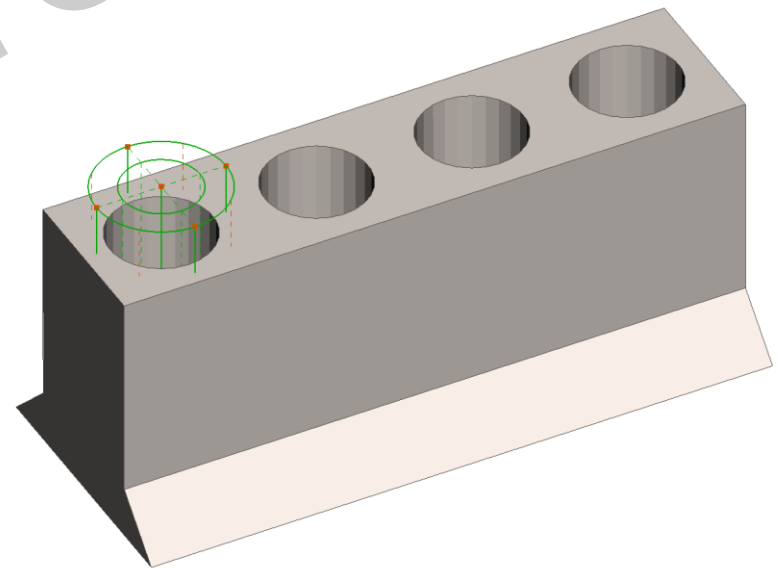
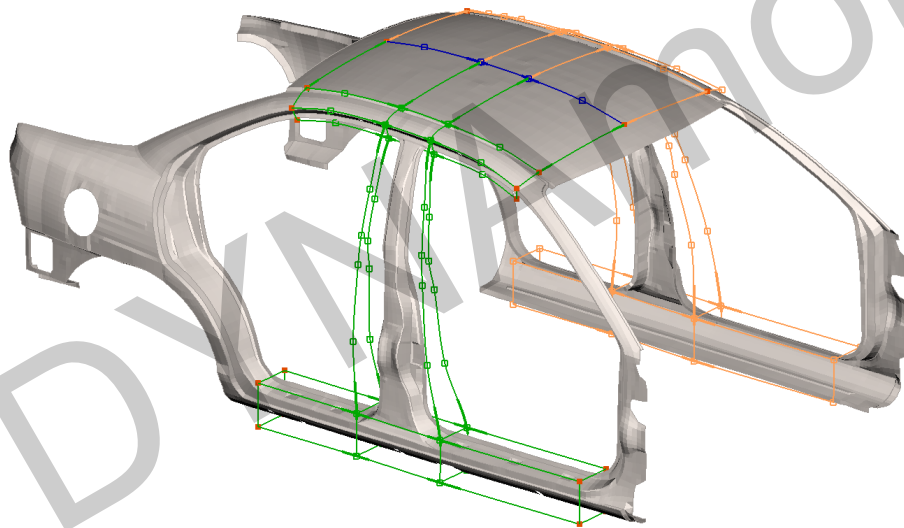
- Taking advantage of model symmetry
- Link according symmetry-/mirror plane, rotation axis or translation vector



Box Morphing

Linked Morphing Boxes

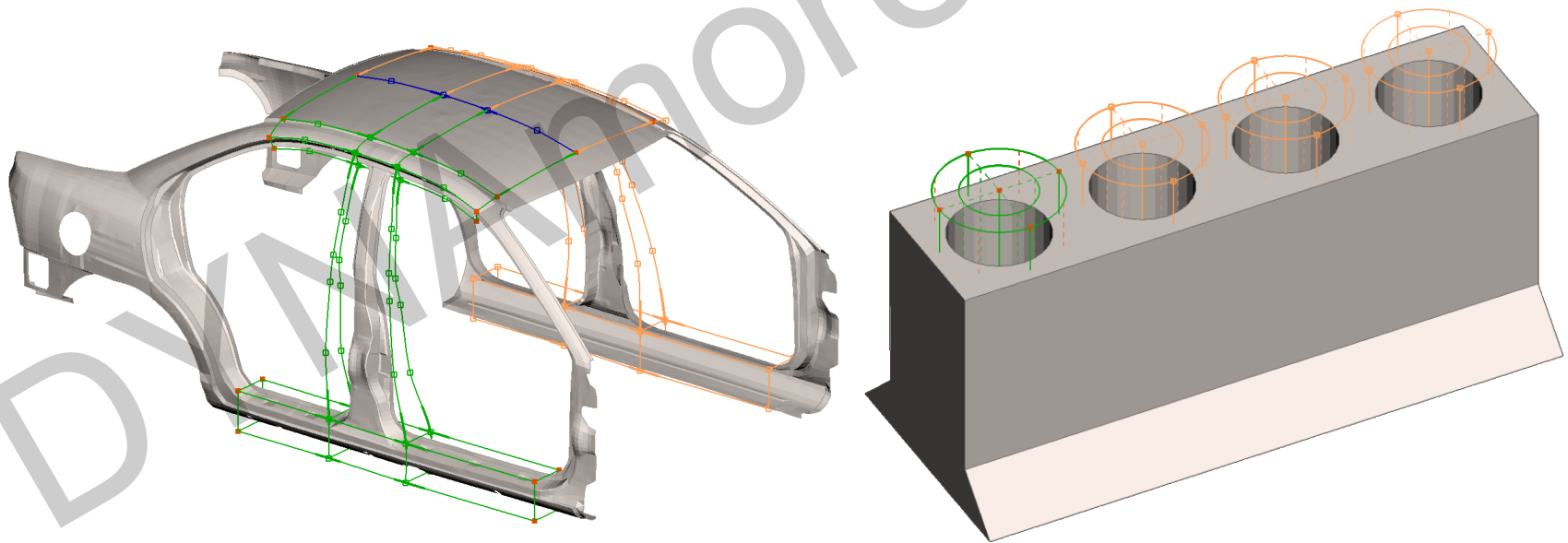
- Taking advantage of model symmetry
- Link according symmetry-/mirror plane, rotation axis or translation vector



Box Morphing

Linked Morphing Boxes

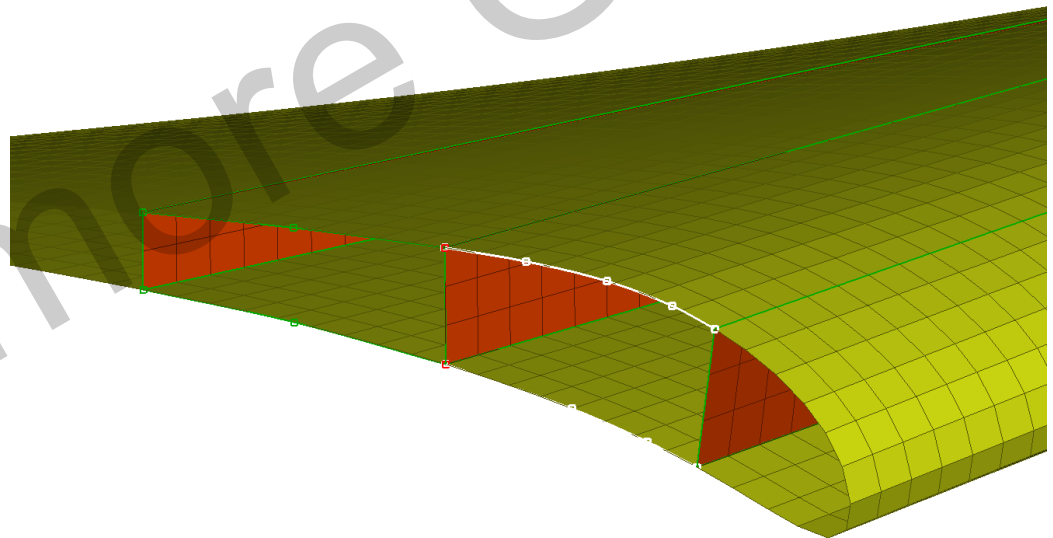
- Taking advantage of model symmetry
- Link according symmetry-/mirror plane, rotation axis or translation vector



Box Morphing

Modification of Boxes

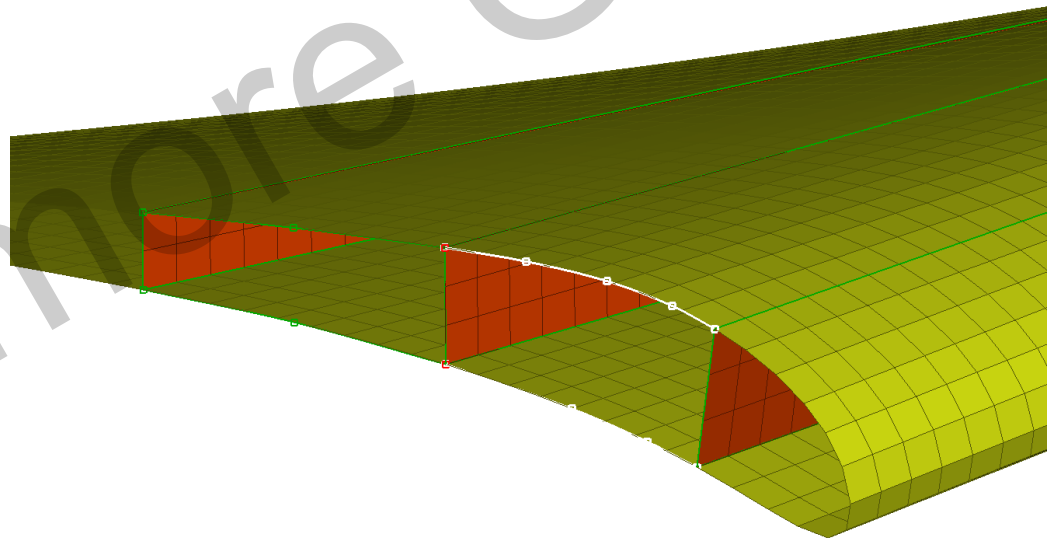
- Move (Translate, Rotate)
- Slide / Extend



Box Morphing

Modification of Boxes

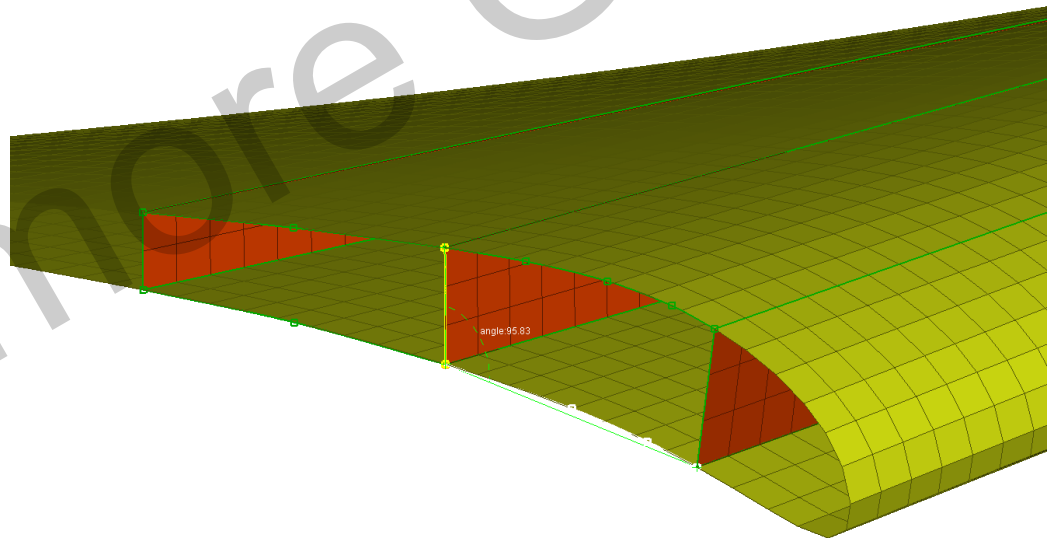
- Move (Translate, Rotate)
- Slide / Extend



Box Morphing

Modification of Boxes

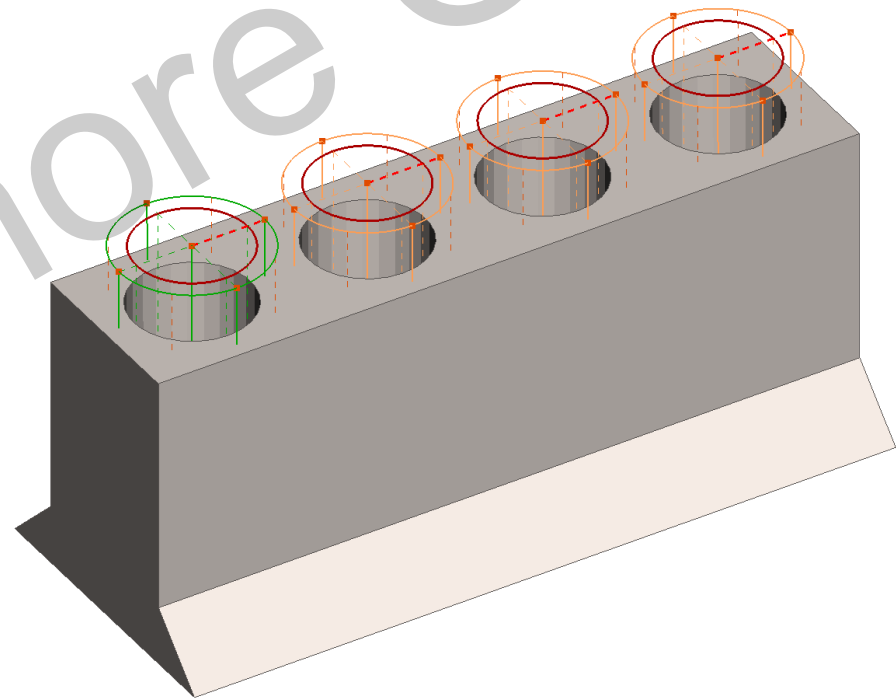
- Move (Translate, Rotate)
- Slide / Extend
- Angle



Box Morphing

Modification of Boxes

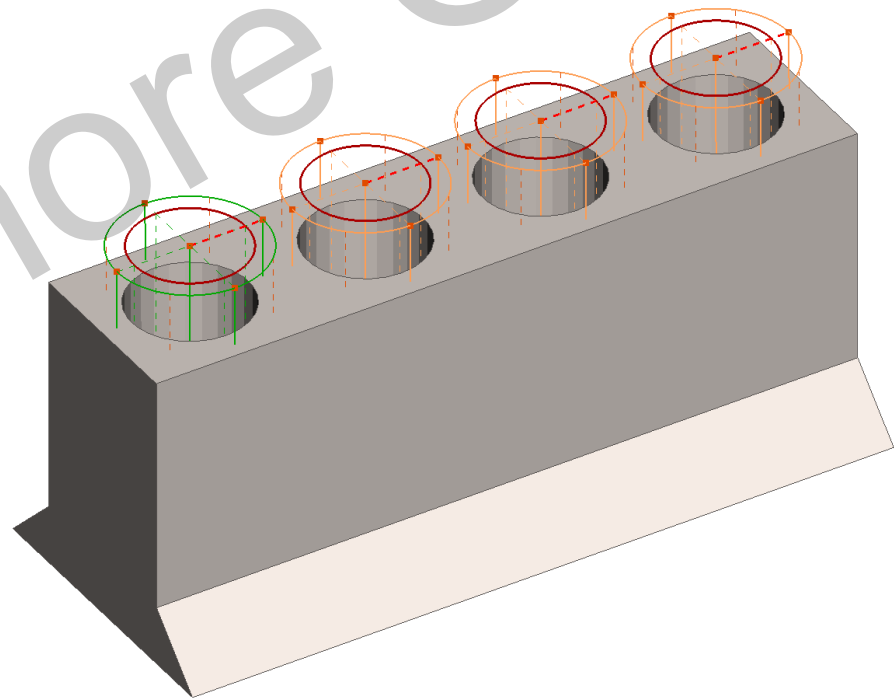
- Move (Translate, Rotate)
- Slide / Extend
- Angle
- Fit (edges, surfaces)
- Radius



Box Morphing

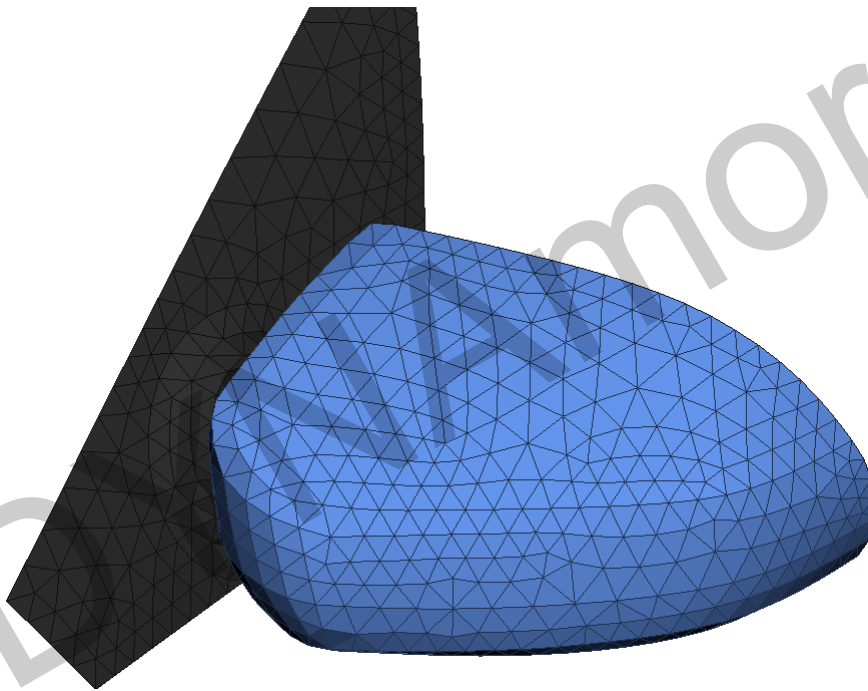
Modification of Boxes

- Move (Translate, Rotate)
- Slide / Extend
- Angle
- Fit (edges, surfaces)
- Radius
- etc.



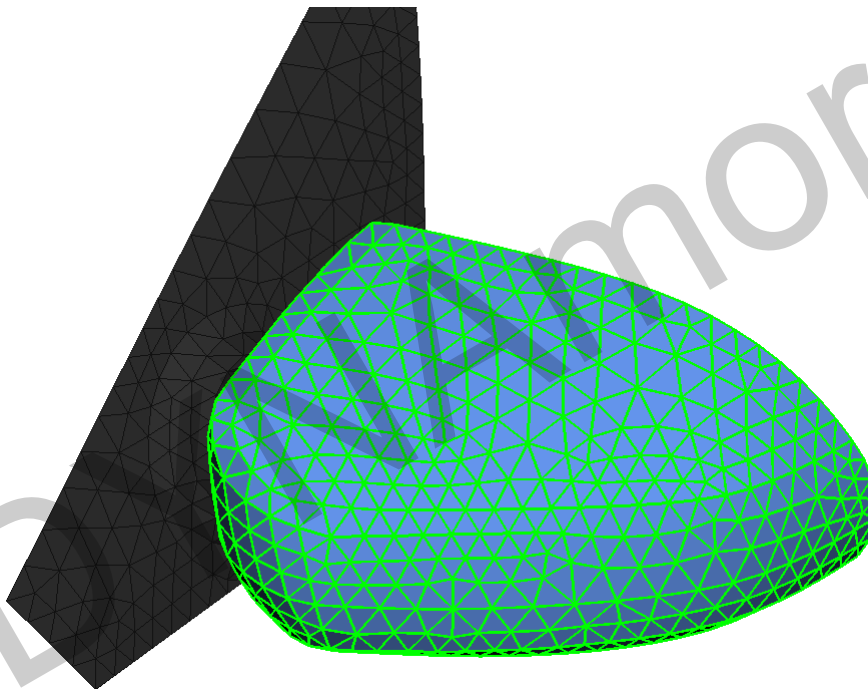
Direct Morphing

Translate, rotate or scale FE-mesh or Geometry entities



Direct Morphing

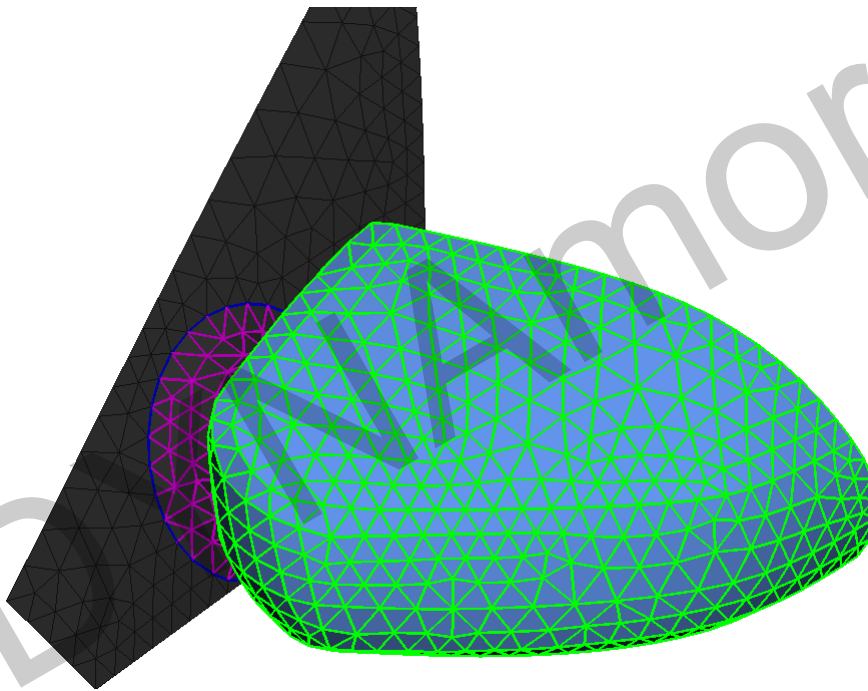
Translate, rotate or scale FE-mesh or Geometry entities



- Control Entities

Direct Morphing

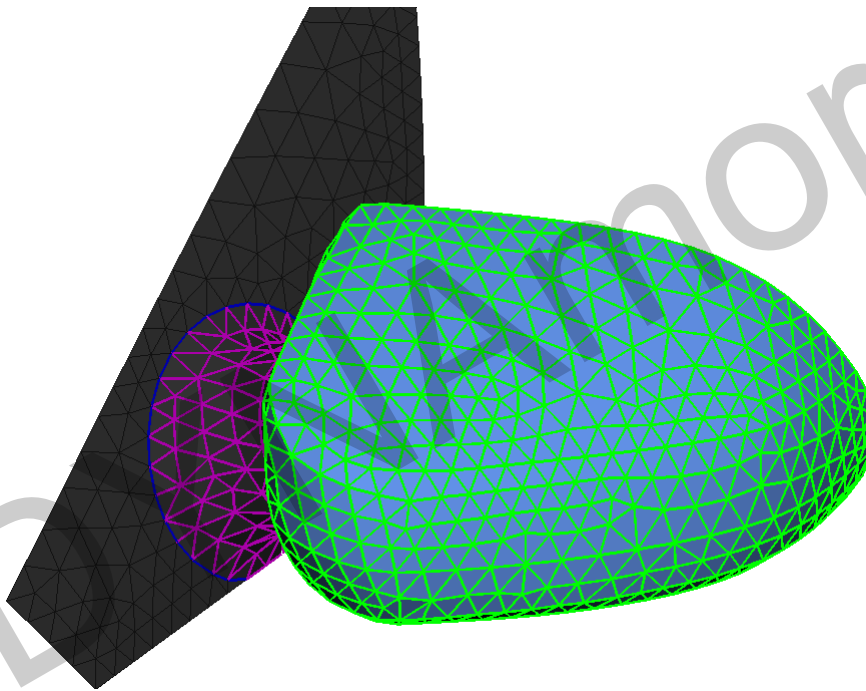
Translate, rotate or scale FE-mesh or Geometry entities



- Control Entities
- Morphed Entities
- Boundary

Direct Morphing

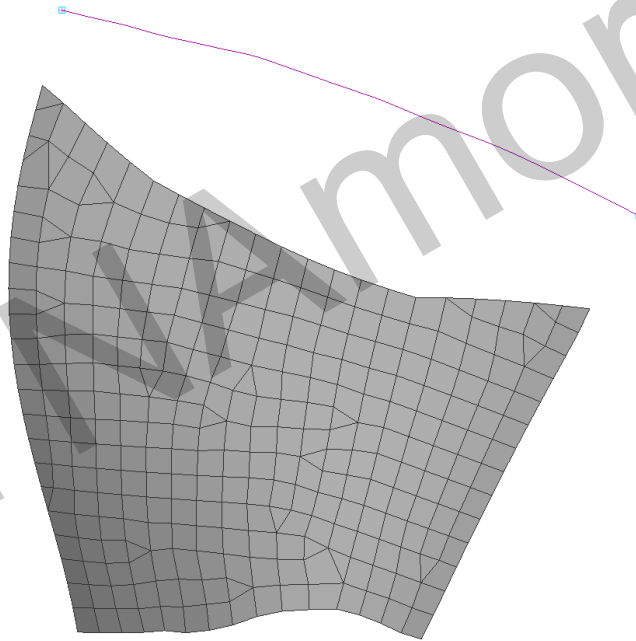
Translate, rotate or scale FE-mesh or Geometry entities



- Control Entities
- Morphed Entities
- Boundary
- Morphing

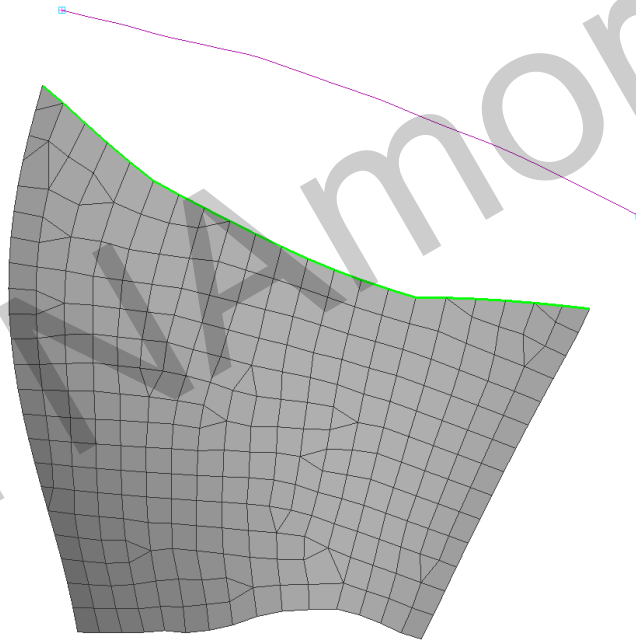
Direct Morphing

Snap **FE** or geometry edges to **single** or multiple target curves



Direct Morphing

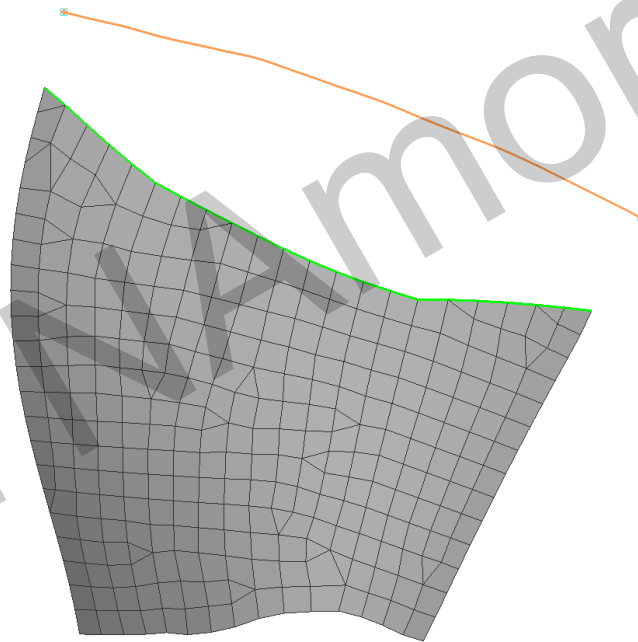
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin

Direct Morphing

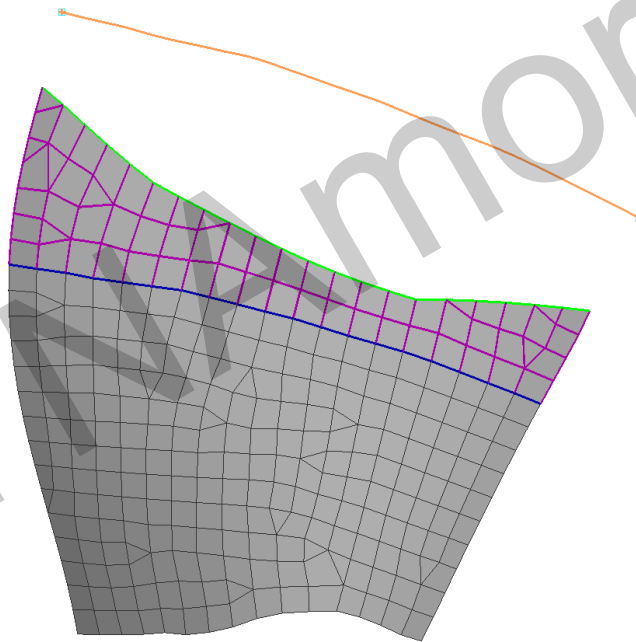
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target

Direct Morphing

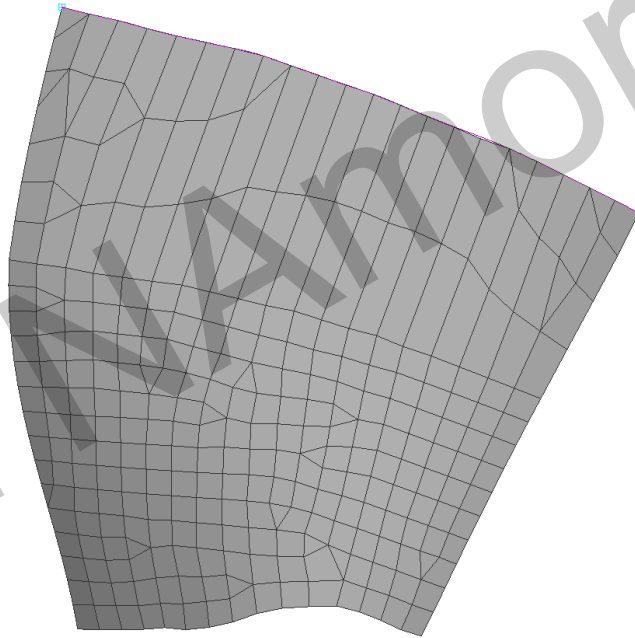
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target
- Morphed Entities
- Boundary

Direct Morphing

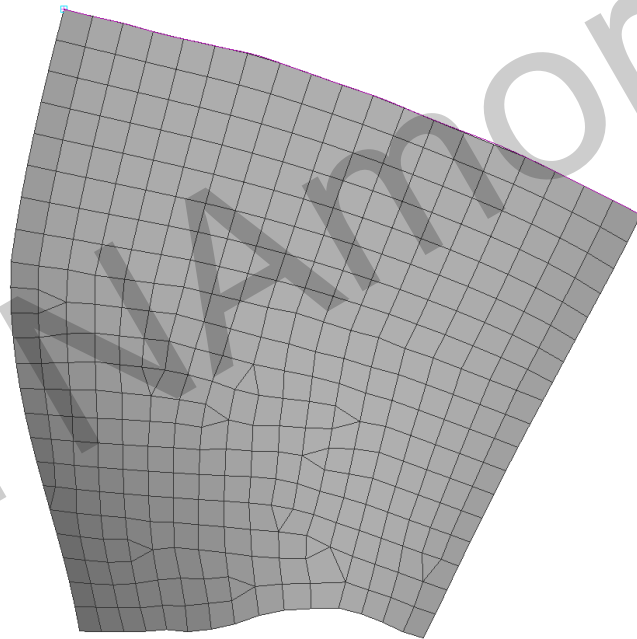
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target
- Morphed Entities
- Boundary
- Morphing

Direct Morphing

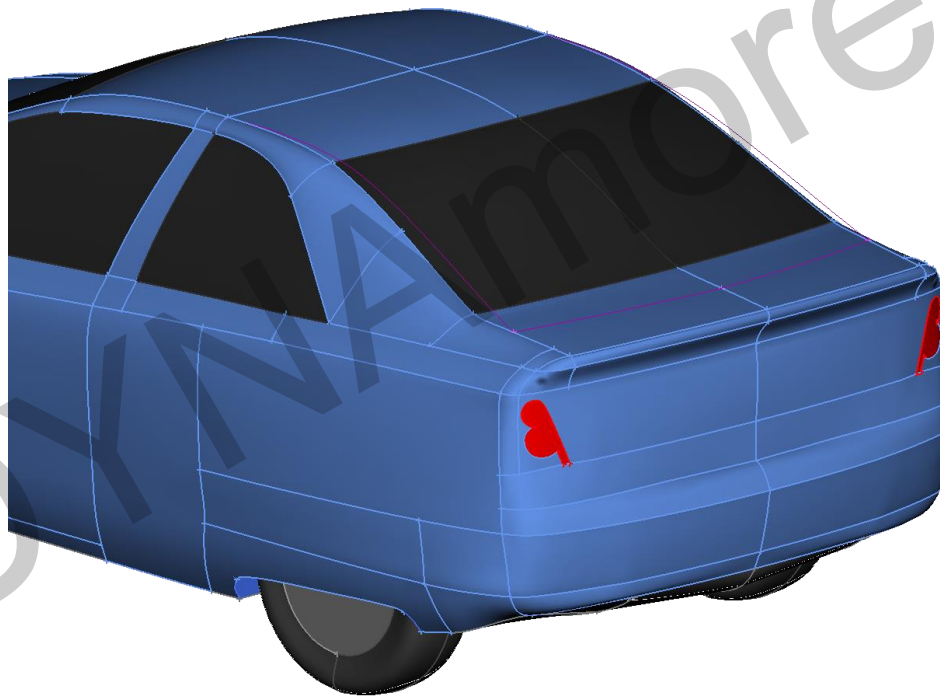
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target
- Morphed Entities
- Boundary
- Morphing
- Reconstruct (optional)

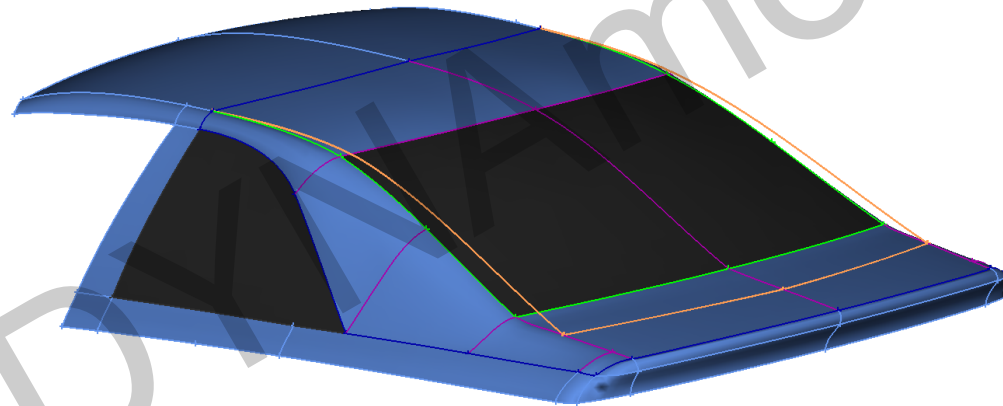
Direct Morphing

Snap FE or geometry edges to single or multiple target curves



Direct Morphing

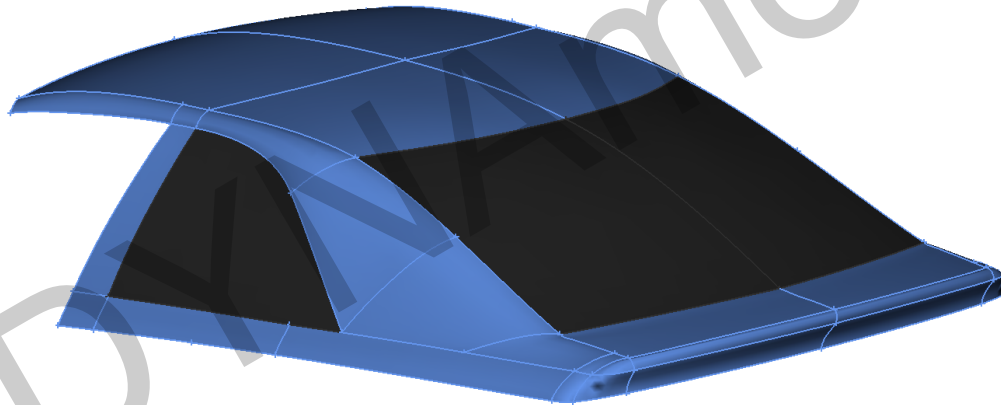
Snap FE or **geometry** edges to single or **multiple** target curves



- Origin
- Target
- Morphed Entities
- Boundary

Direct Morphing

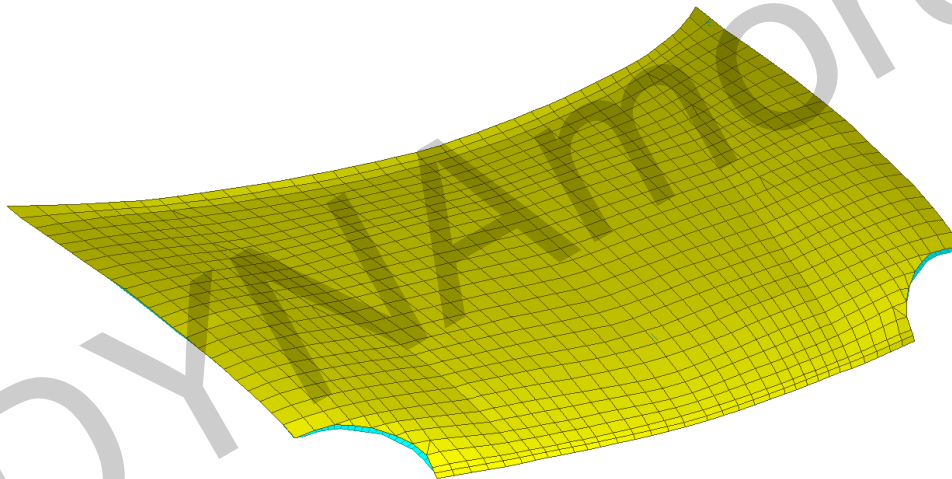
Snap FE or **geometry** edges to single or **multiple** target curves



- Origin
- Target
- Morphed Entities
- Boundary
- Morphing

Direct Morphing

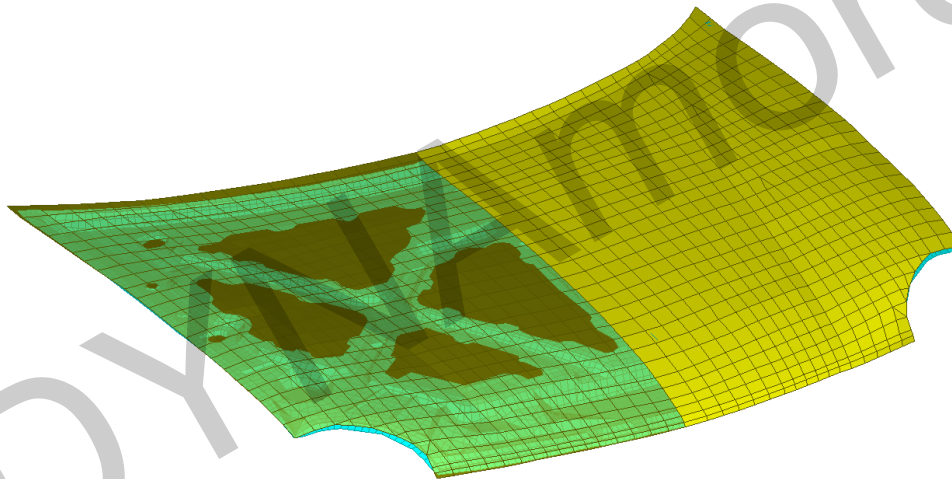
Fit surfaces – e.g. fit existing FE-mesh to new CAD-geometry



- Original FE-surface

Direct Morphing

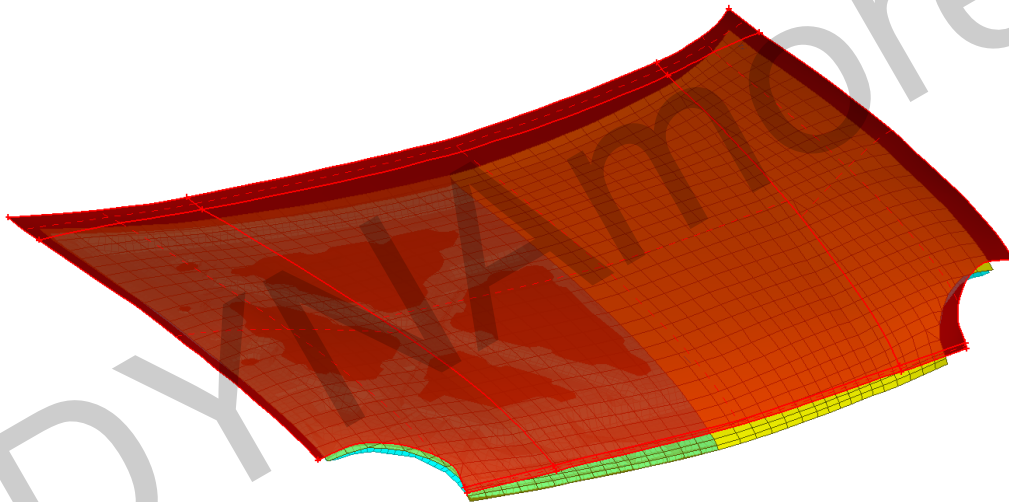
Fit surfaces – e.g. fit existing FE-mesh to new CAD-geometry



- Original FE-surface (with additional underlying parts)

Direct Morphing

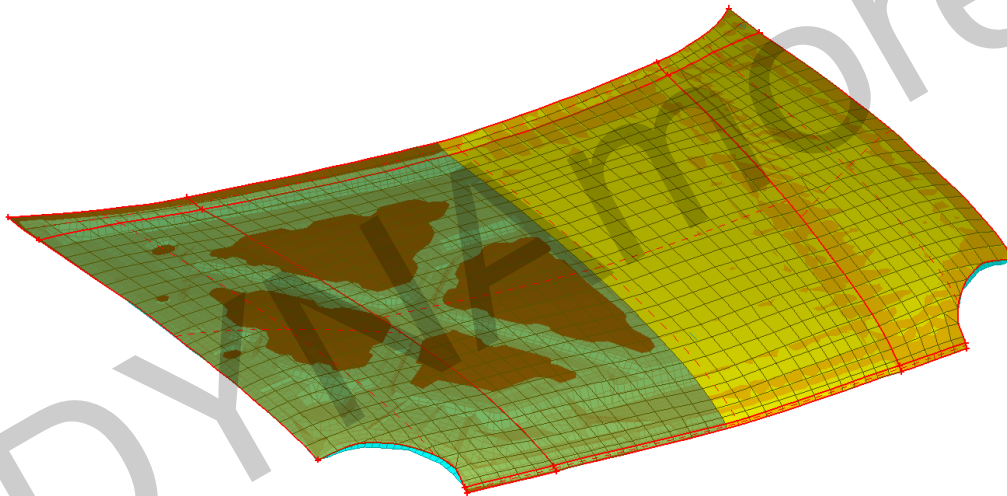
Fit surfaces – e.g. fit existing FE-mesh to new CAD-geometry



- Original FE-surface (with additional underlying parts)
- Target CAD-surface

Direct Morphing

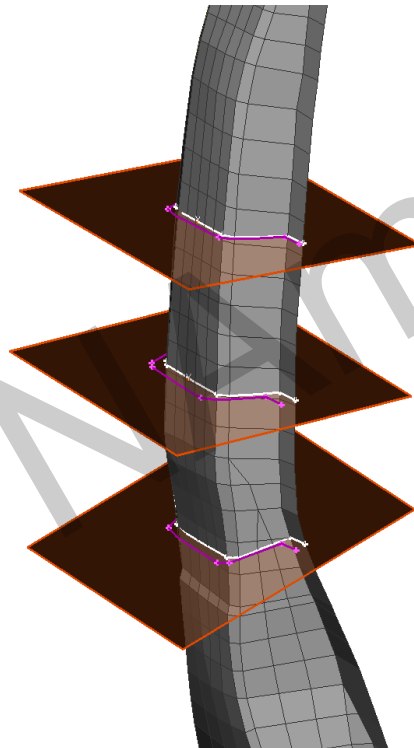
Fit surfaces – e.g. fit existing FE-mesh to new CAD-geometry



- Original FE-surface (with additional underlying parts)
- Target CAD-surface
- Morphing

Direct Morphing

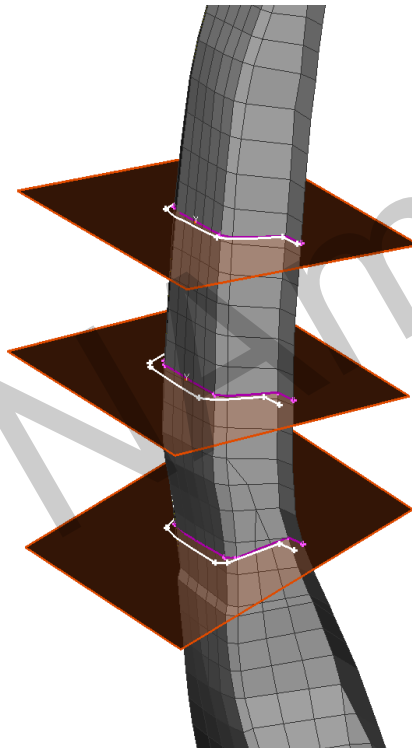
Fit cross sections (applicable on FE-mesh and geometry)



- Original cross section

Direct Morphing

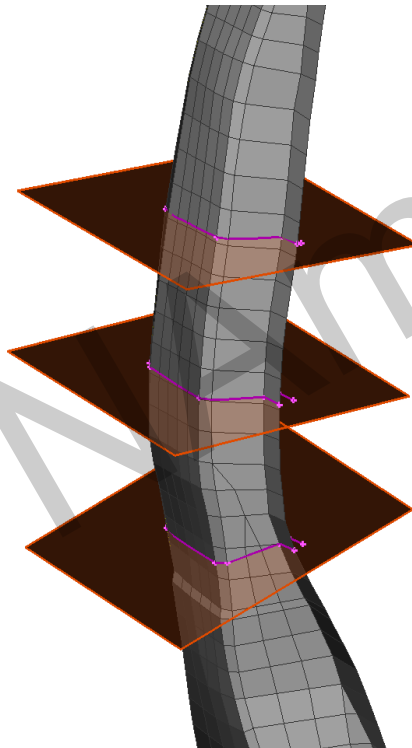
Fit cross sections (applicable on FE-mesh and geometry)



- Original cross section
- Target cross section

Direct Morphing

Fit cross sections (applicable on FE-mesh and geometry)



- Original cross section
- Target cross section
- Morphing

Direct Morphing

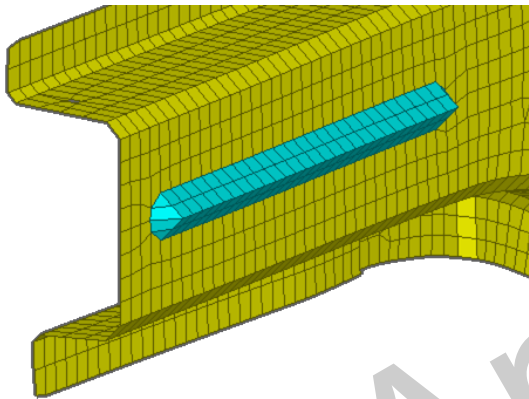
Generation & modification of beads and embosses

DYNAMORE GmbH

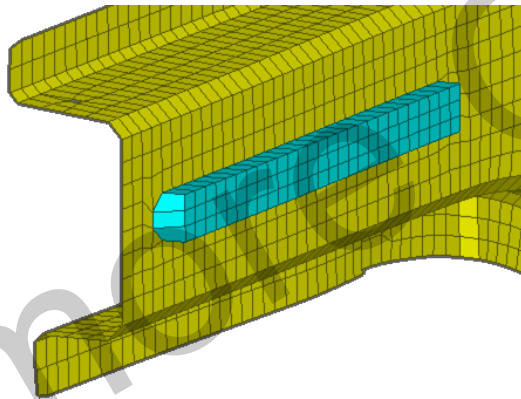
Direct Morphing

Generation & modification of beads and embosses

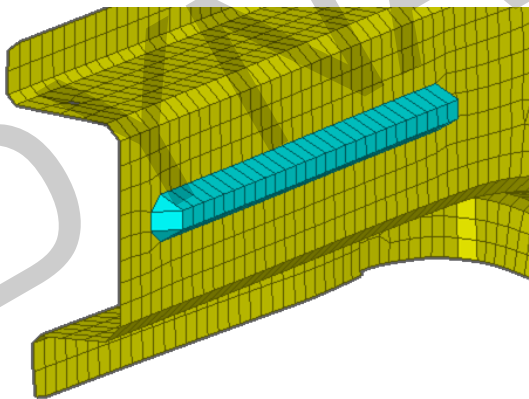
Triangular-shape



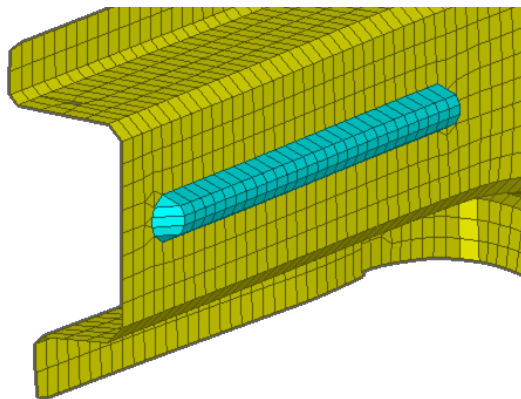
Box-shape



Trapezoidal-shape



Ellipse-shape



Depress ✖

Width:

Height:

Rows:

Offset mode: Towards yellow side

Element length

Average 5.0038

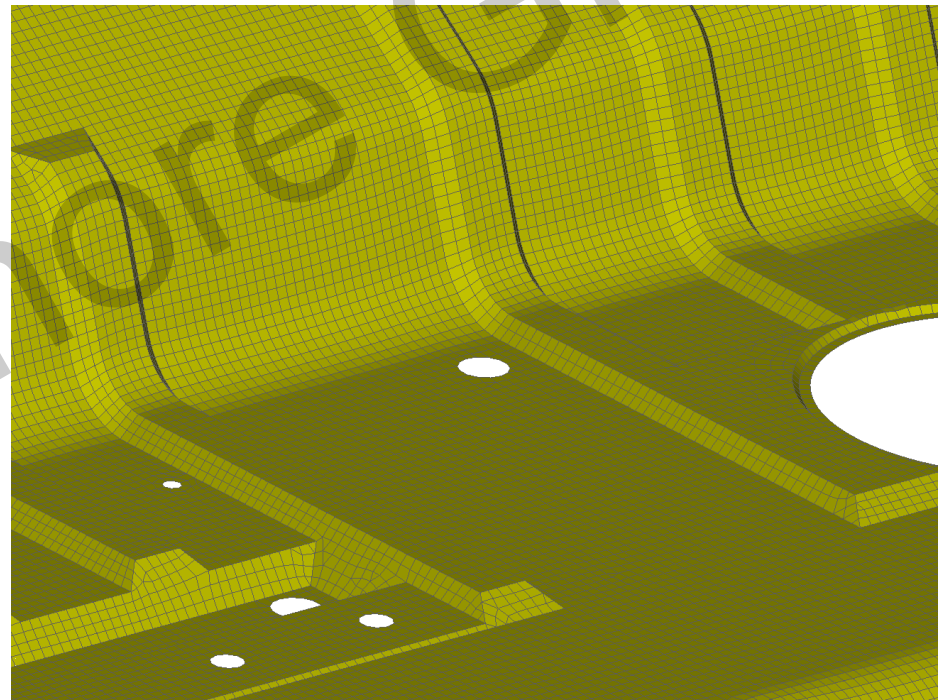
Type: Ellipse

Flat width:

Back
Next

Direct Morphing

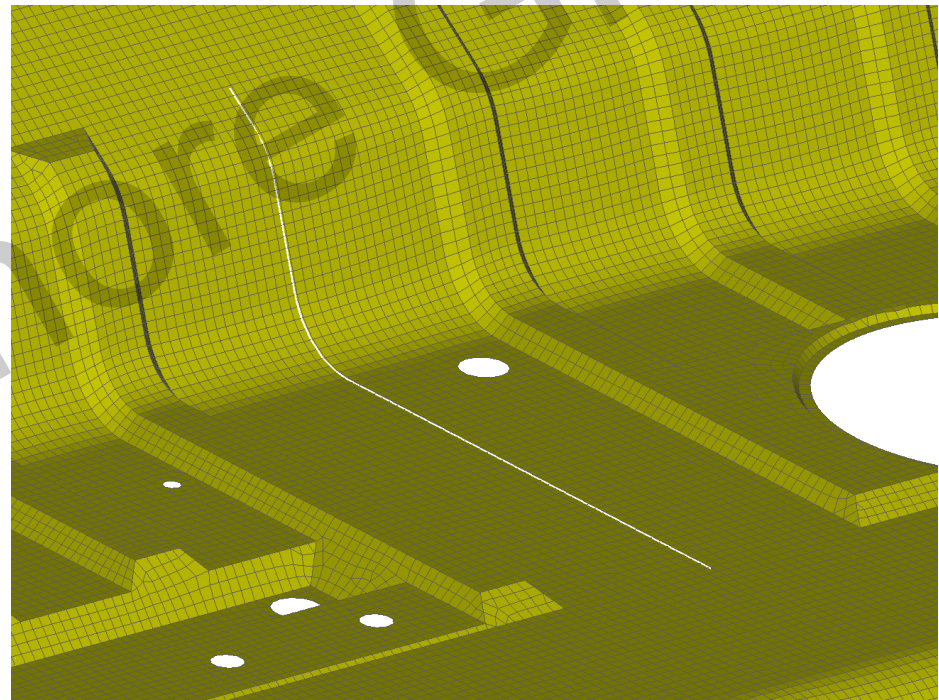
Generation & modification of beads and embosses



Direct Morphing

Generation & modification of beads and embosses

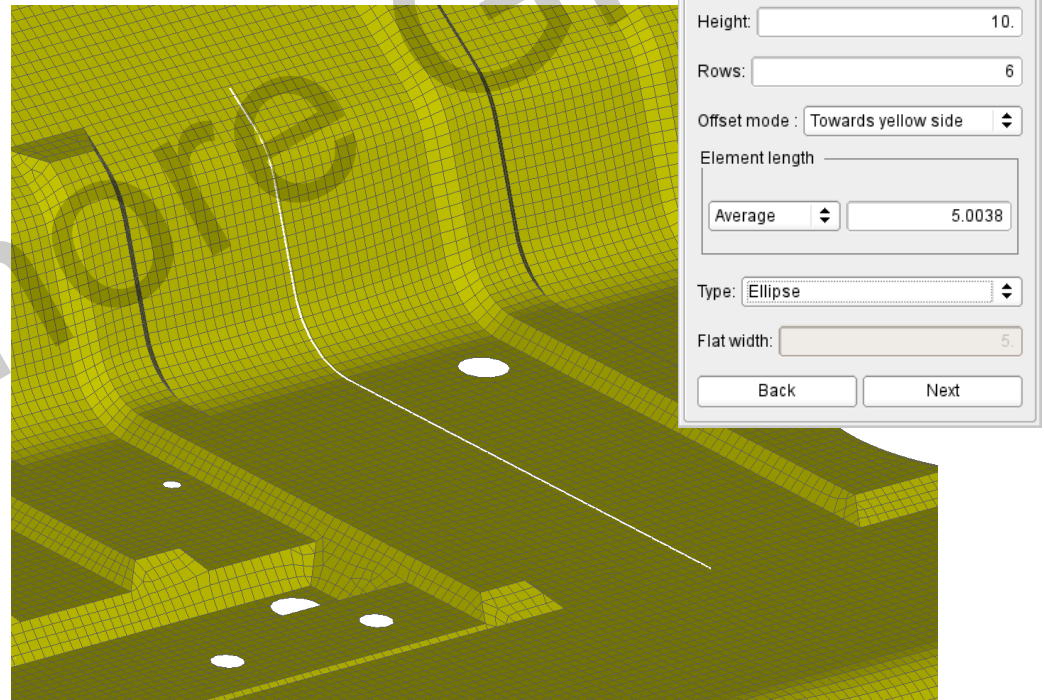
Curves



Direct Morphing

Generation & modification of beads and embosses

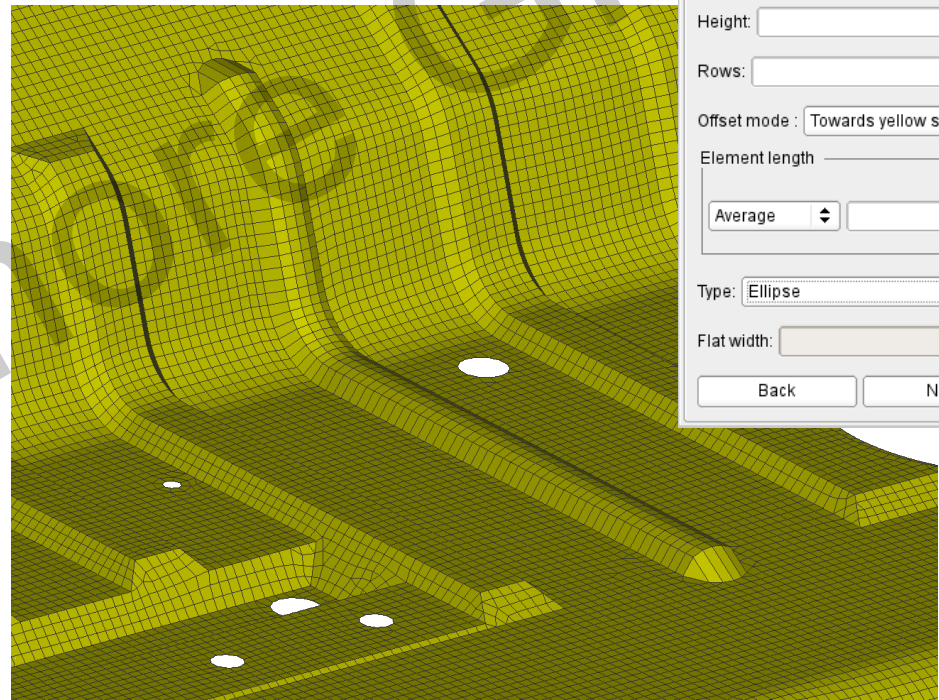
Curves
↓
Depress Parameter



Direct Morphing

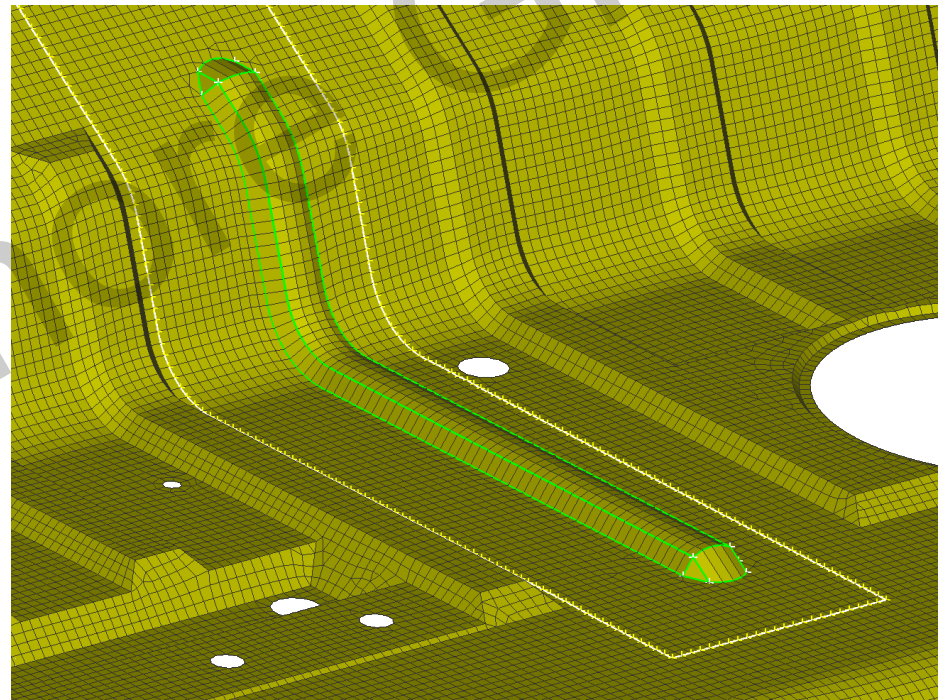
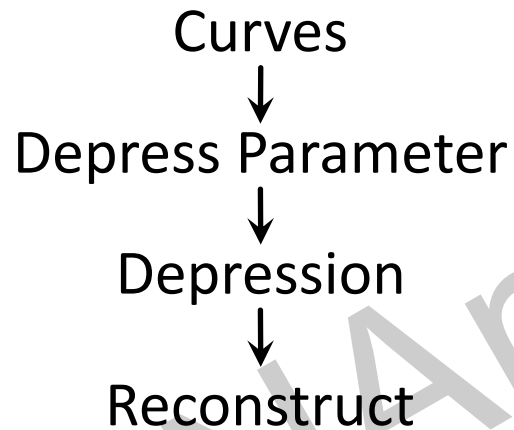
Generation & modification of beads and embosses

Curves
↓
Depress Parameter
↓
Depression



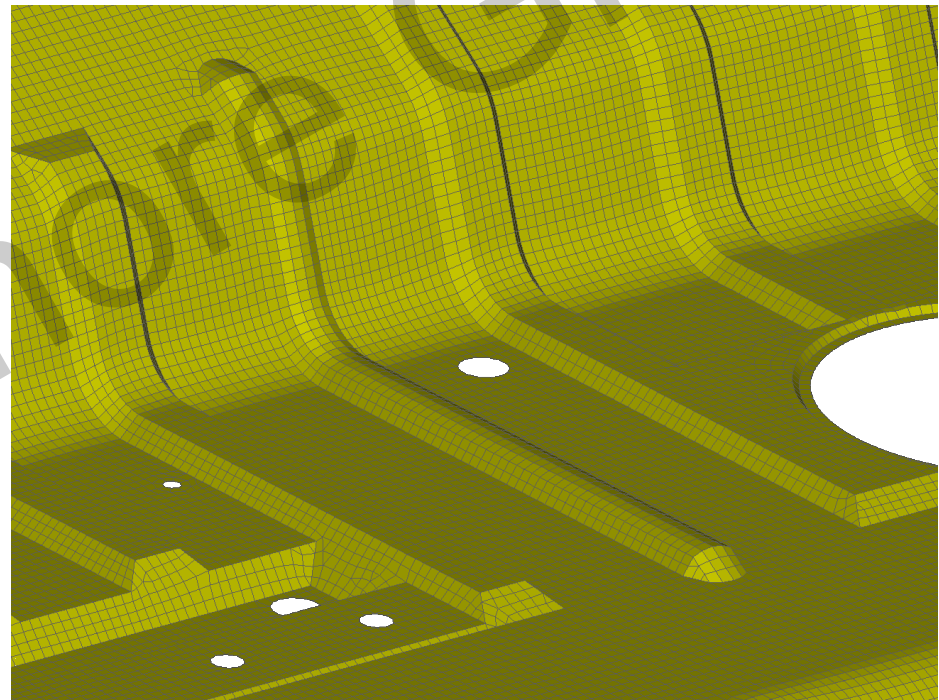
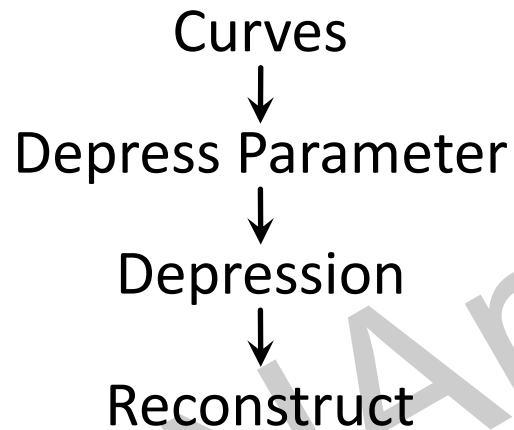
Direct Morphing

Generation & modification of beads and embosses



Direct Morphing

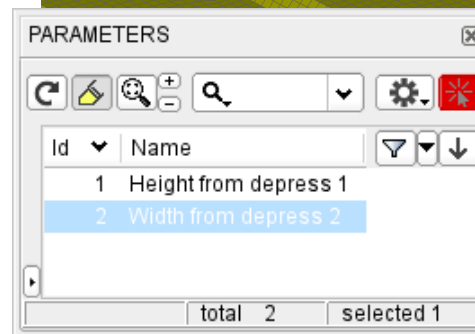
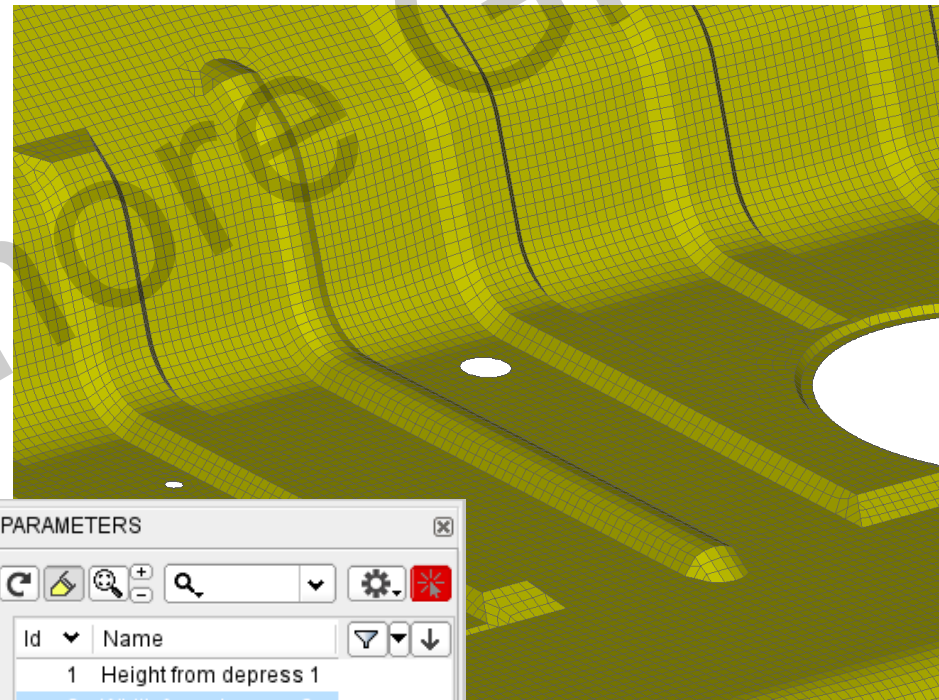
Generation & modification of beads and embosses



Direct Morphing

Generation & modification of beads and embosses

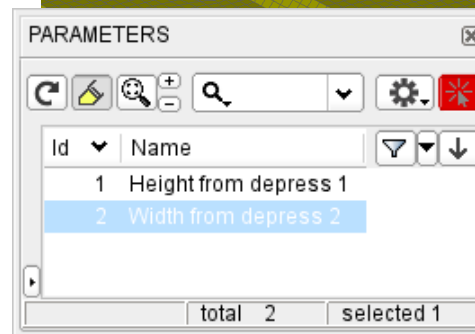
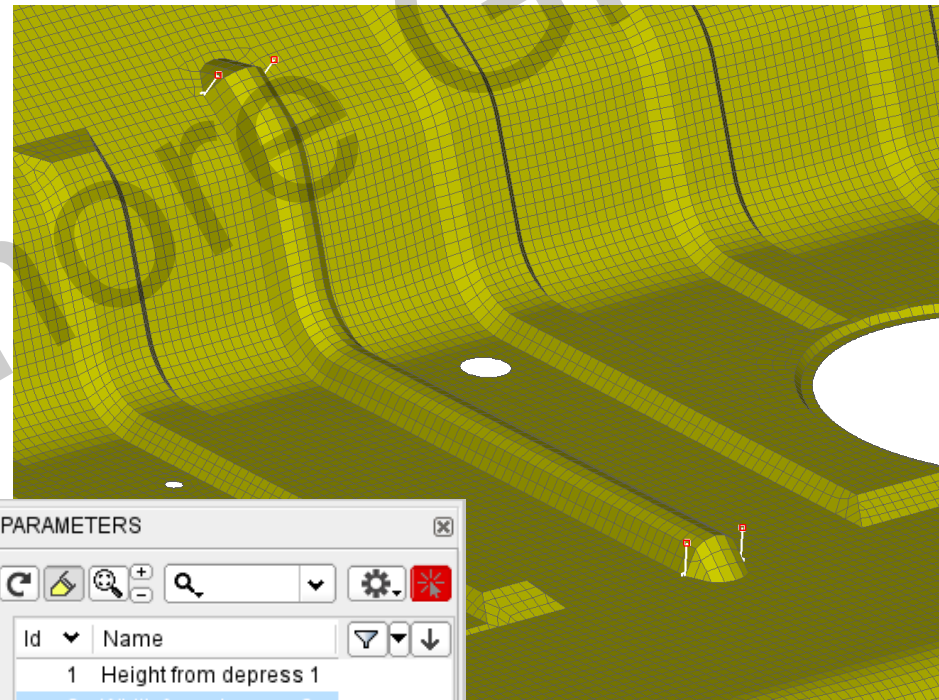
Curves
↓
Depress Parameter
↓
Depression
↓
Reconstruct
↓
Auto-created morph
boxes and parameters



Direct Morphing

Generation & modification of beads and embosses

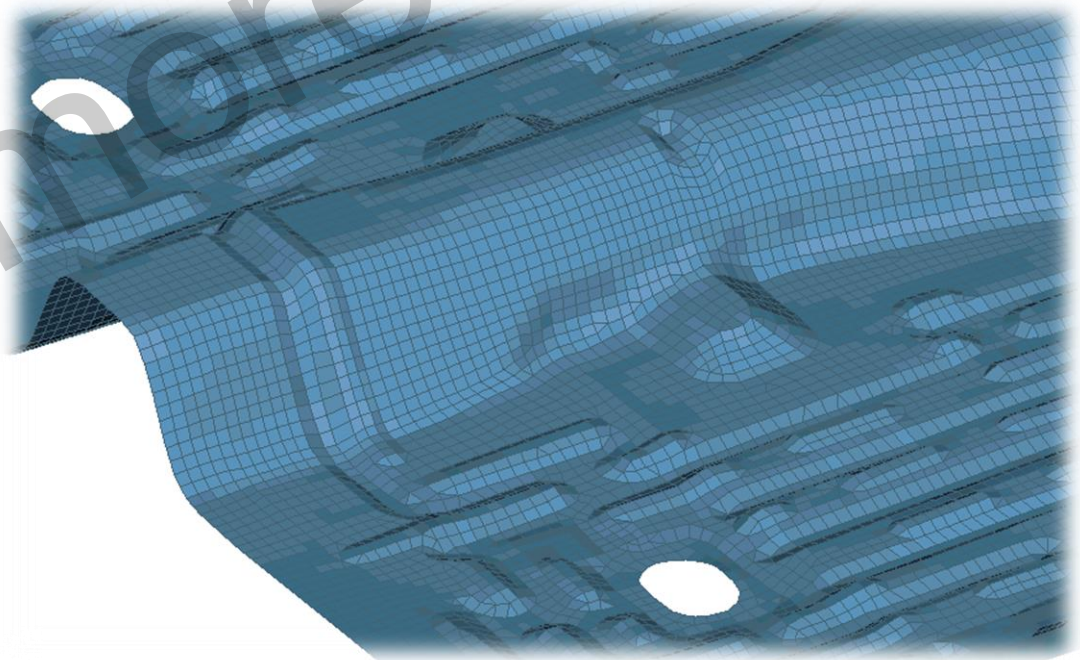
Curves
↓
Depress Parameter
↓
Depression
↓
Reconstruct
↓
Auto-created morph
boxes and parameters



Direct Morphing

Slide Feature

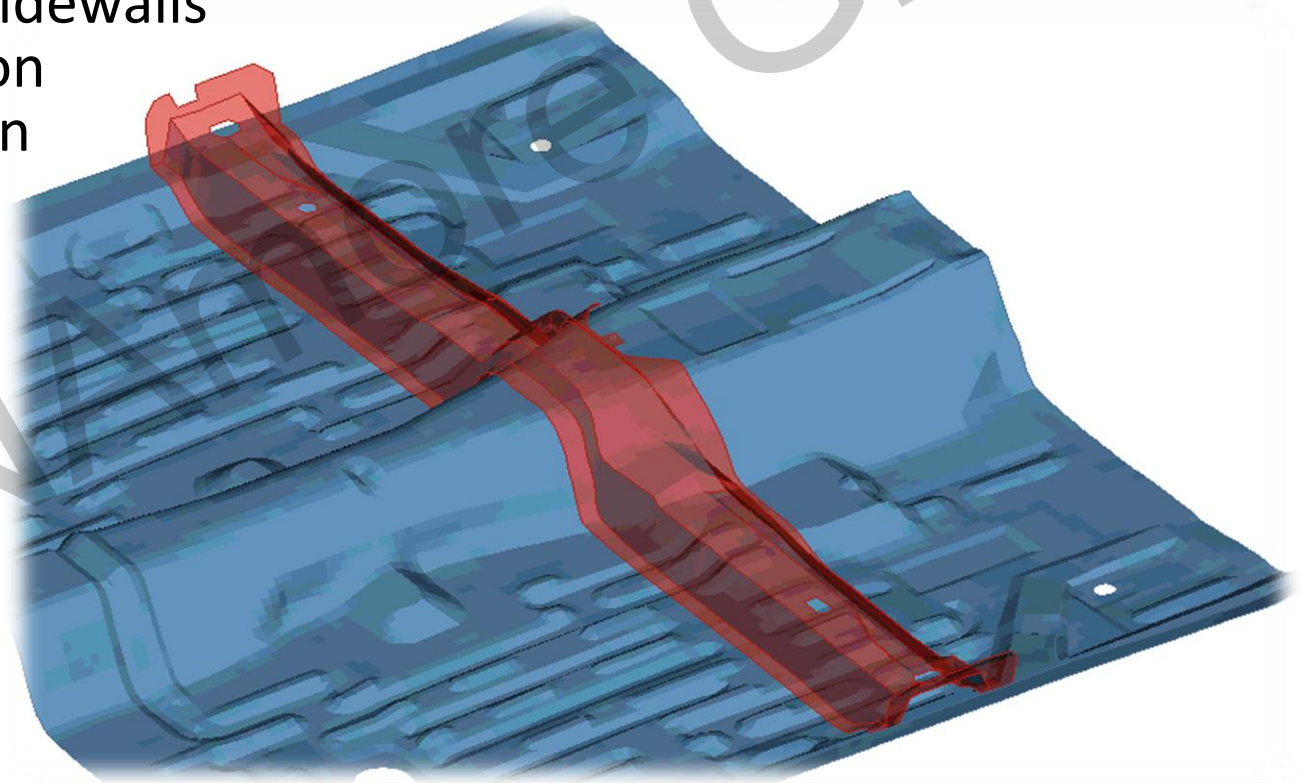
- Features of any shape (e.g. holes, beads, ribs) slide on underlying surface
- Mesh of origin and target areas is reconstructed
- Features are moved or copied



Direct Morphing

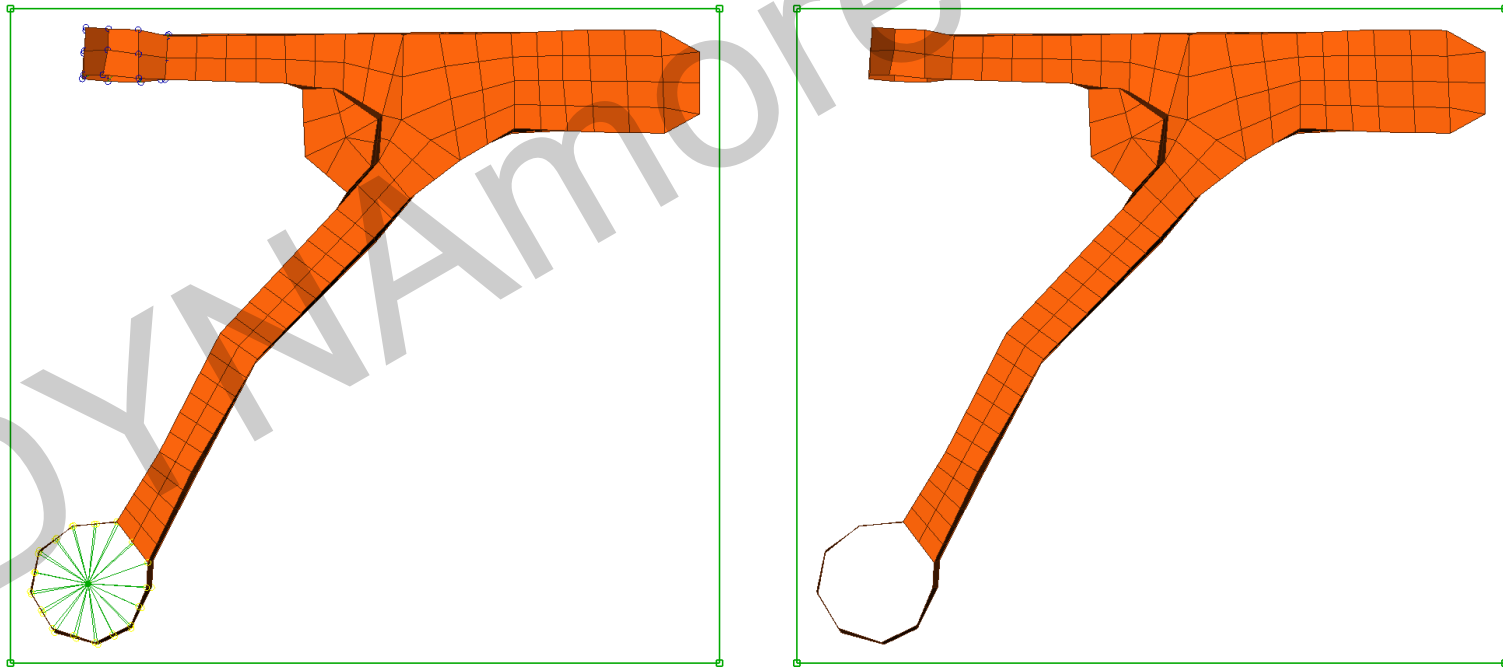
Slide Member

- Movement of members on their underlying surface
- Flanges and sidewalls are adapted on target position



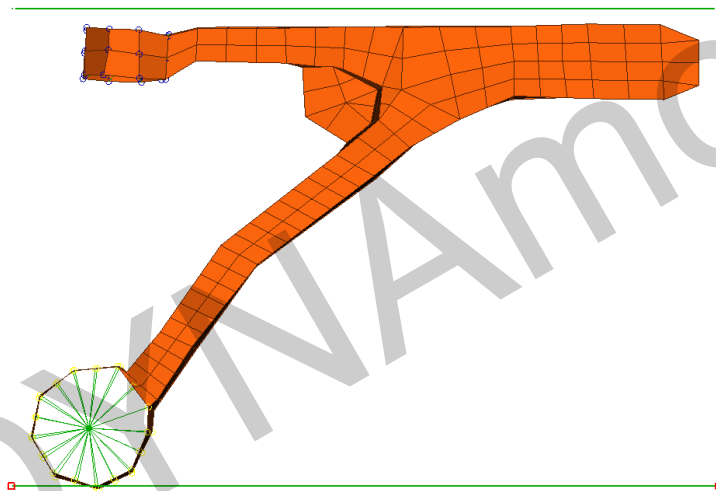
Morphing Constraints – Nested Elements

- Applicable for Box and Direct Morphing
- Rigidize or freeze features during morphing actions

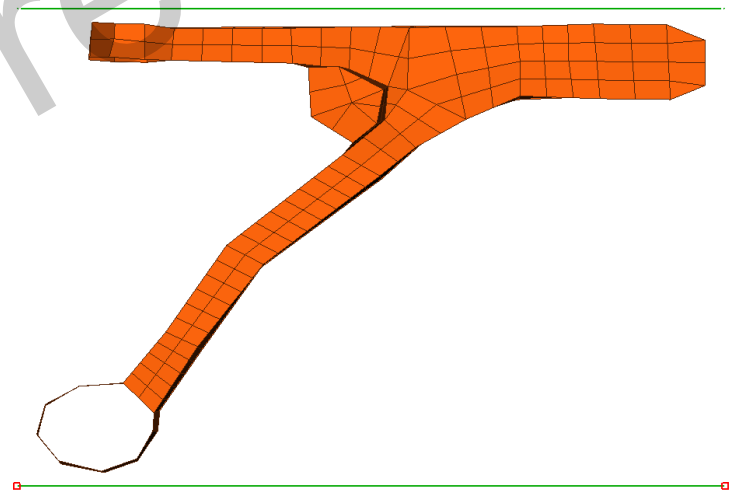


Morphing Constraints – Nested Elements

- Applicable for Box and Direct Morphing
- Rigidize or freeze features during morphing actions



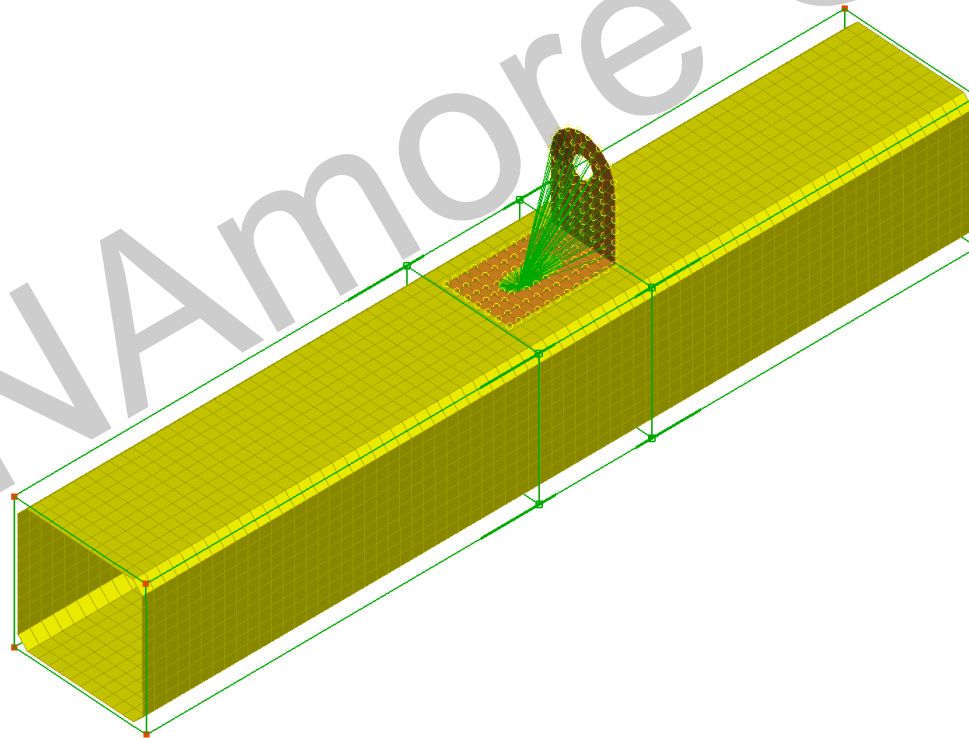
With Nested Elements



Without Nested Elements

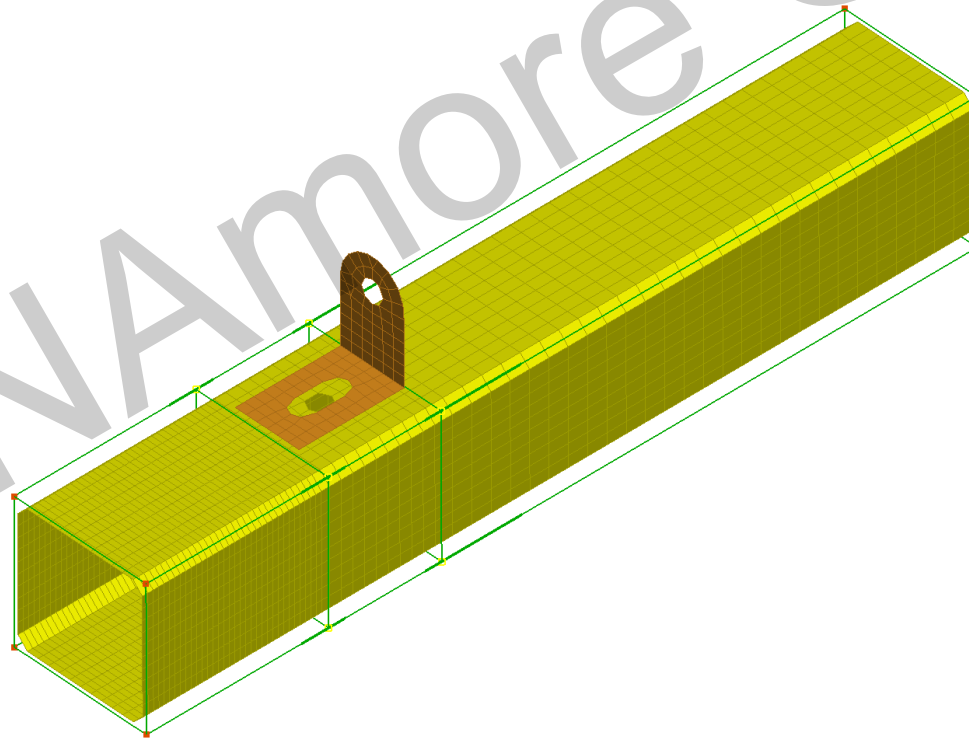
Morphing Constraints – Nested Elements

- Applicable for Box and Direct Morphing
- Rigidize or freeze features during morphing actions



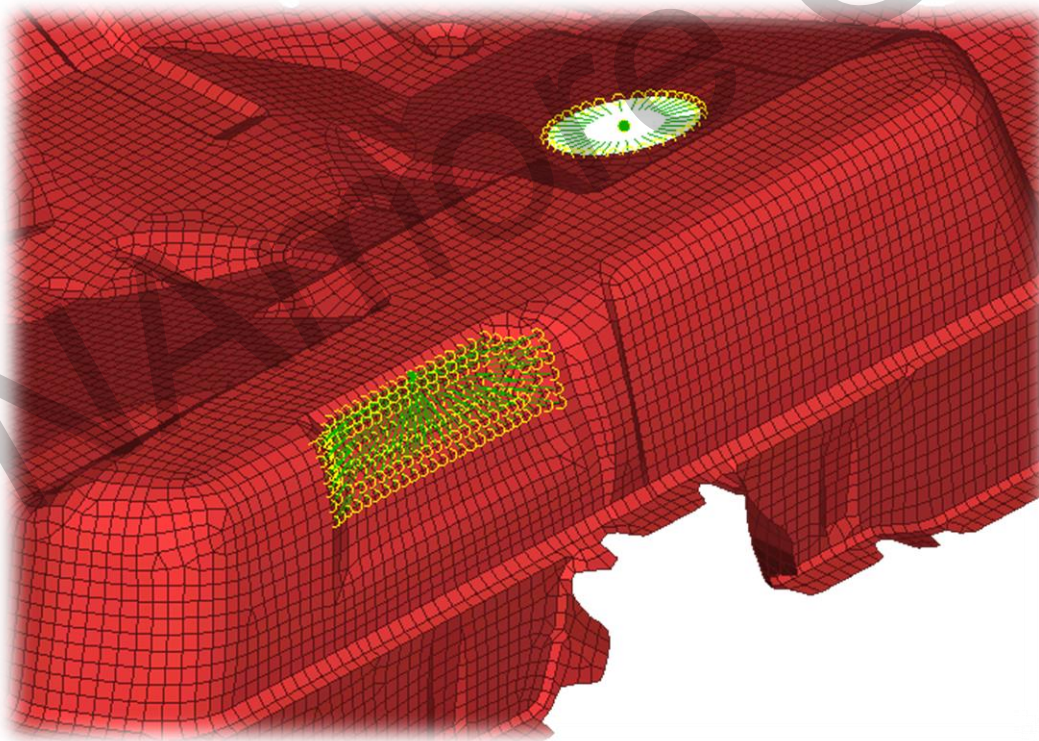
Morphing Constraints – Nested Elements

- Applicable for Box and Direct Morphing
- Rigidize or freeze features during morphing actions



Morphing Constraints – Nested Elements

- Applicable for Box and Direct Morphing
- Rigidize or freeze features during morphing actions



Record Morphing Actions

Deformation Parameter

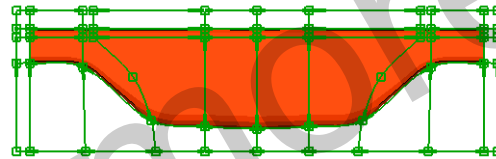
- Records any Box or Direct Morphing action
- Get any interpolation / extrapolation between undeformed and deformed shape with a single parameter

DYNAMORE GmbH

Record Morphing Actions

Deformation Parameter

- Records any Box or Direct Morphing action
- Get any interpolation / extrapolation between undeformed and deformed shape with a single parameter

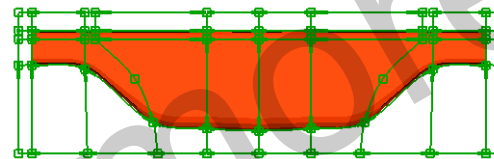


Initial shape – start recording

Record Morphing Actions

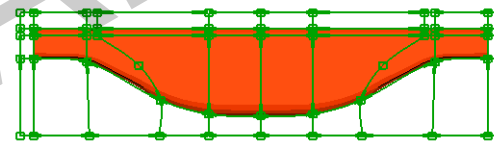
Deformation Parameter

- Records any Box or Direct Morphing action
- Get any interpolation / extrapolation between undeformed and deformed shape with a single parameter

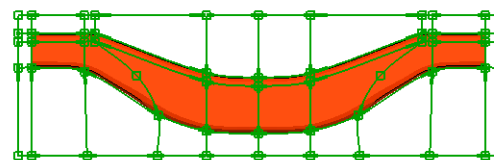


Initial shape – start recording

Edge Fit



Move Free

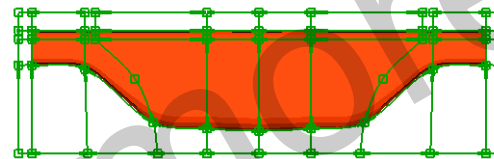


Deformed shape – stop recording

Record Morphing Actions

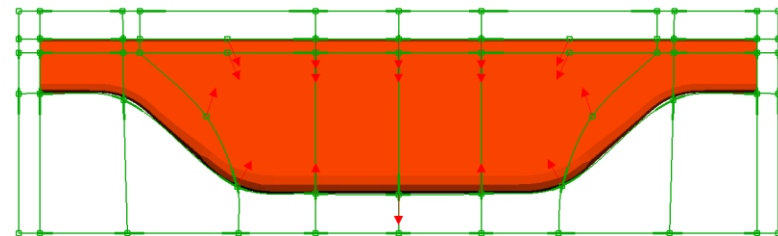
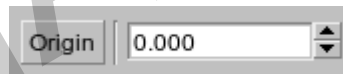
Deformation Parameter

- Records any Box or Direct Morphing action
- Get any interpolation / extrapolation between undeformed and deformed shape with a single parameter



Initial shape – start recording

**Deformation
Parameter**

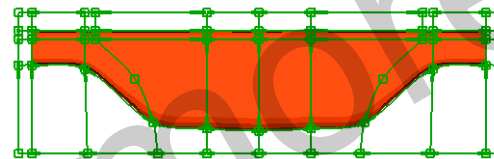


Deformed shape – stop recording

Record Morphing Actions

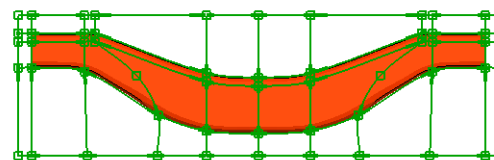
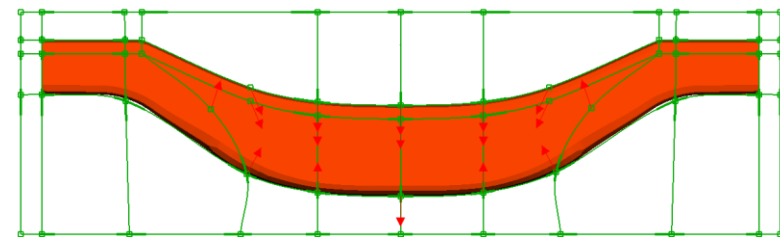
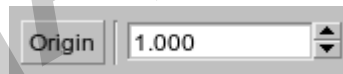
Deformation Parameter

- Records any Box or Direct Morphing action
- Get any interpolation / extrapolation between undeformed and deformed shape with a single parameter



Initial shape – start recording

**Deformation
Parameter**



Deformed shape – stop recording

Mapping of Deformations

DYNAMORE GmbH

Mapping of Deformations

- Morph according existing deformation field:
 - Deformation Parameter
 - History States
 - DESVAR of Nastran SOL 200
 - Text file

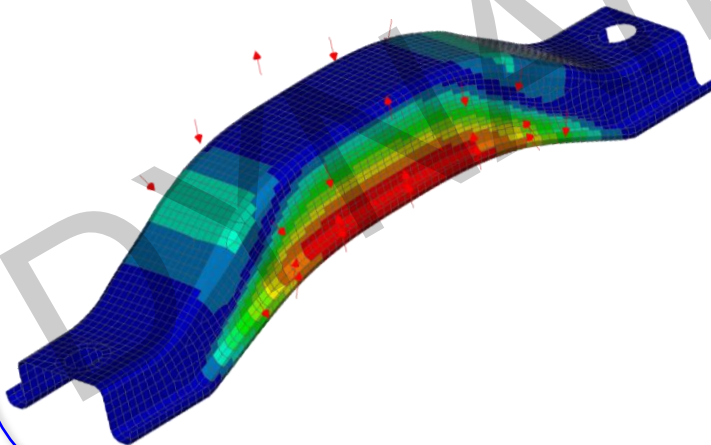
DYNAMORE GmbH

Mapping of Deformations

- Morph according existing deformation field:
 - Deformation Parameter
 - History States
 - DESVAR of Nastran SOL 200
 - Text file
- E.g. Modify geometry according optimized FE-model

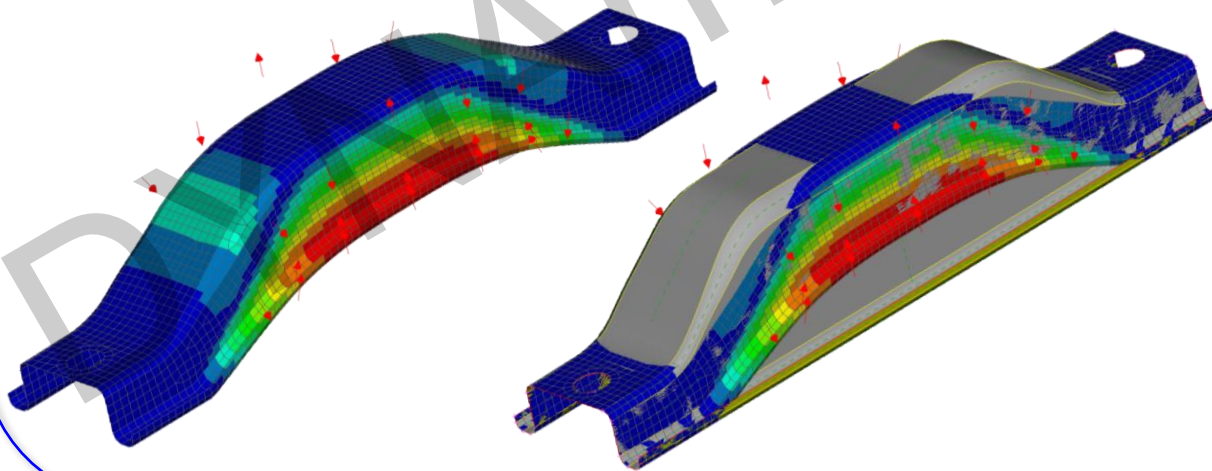
Mapping of Deformations

- Morph according existing deformation field:
 - Deformation Parameter
 - History States
 - DESVAR of Nastran SOL 200
 - Text file
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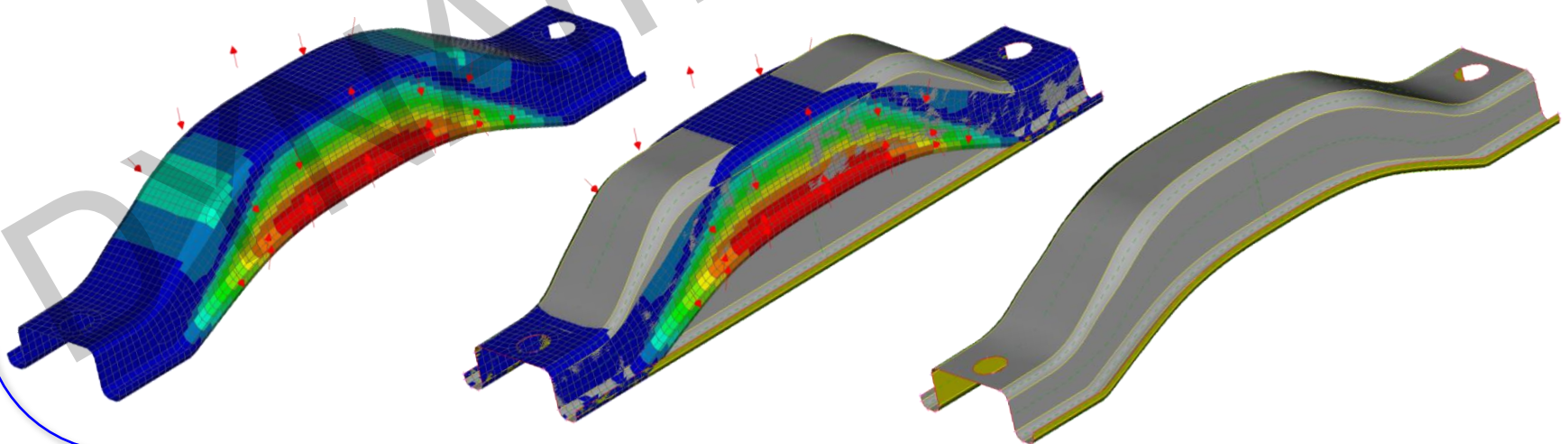
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Mapping of Deformations

- Morph according existing deformation field:
 - Deformation Parameter
 - History States
 - DESVAR of Nastran SOL 200
 - Text file
- E.g. Modify geometry according optimized FE-model



Functionalities assisting Morphing

3D Points and Curves

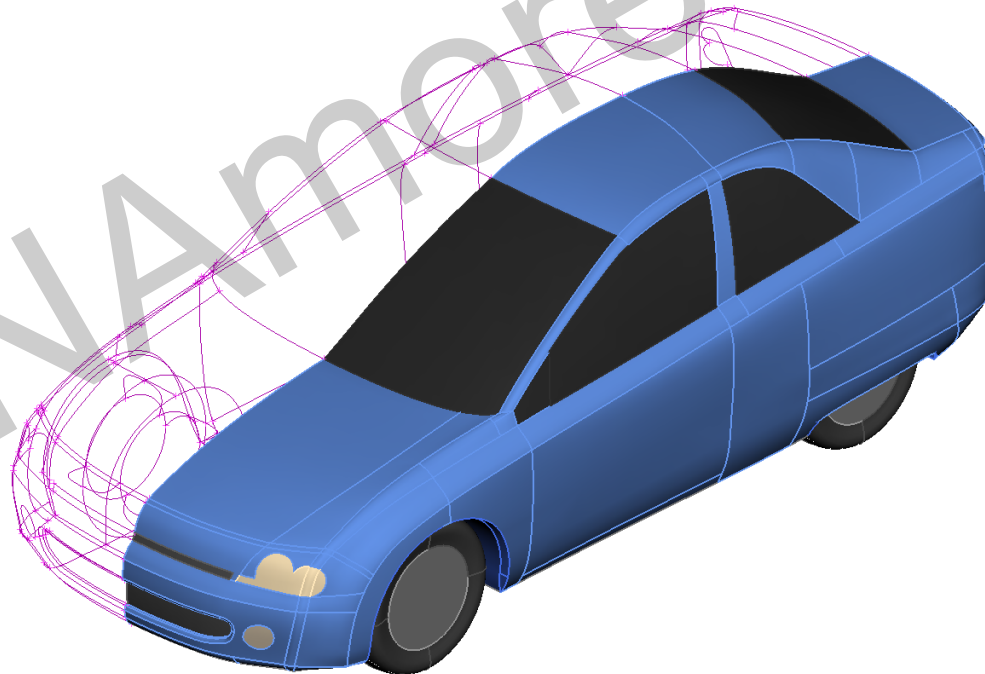
- Act as initial or target positions for fittings
- Suitable for Box and Direct Morphing
- Obtained from FE mesh or CAD geometry



Functionalities assisting Morphing

3D Points and Curves

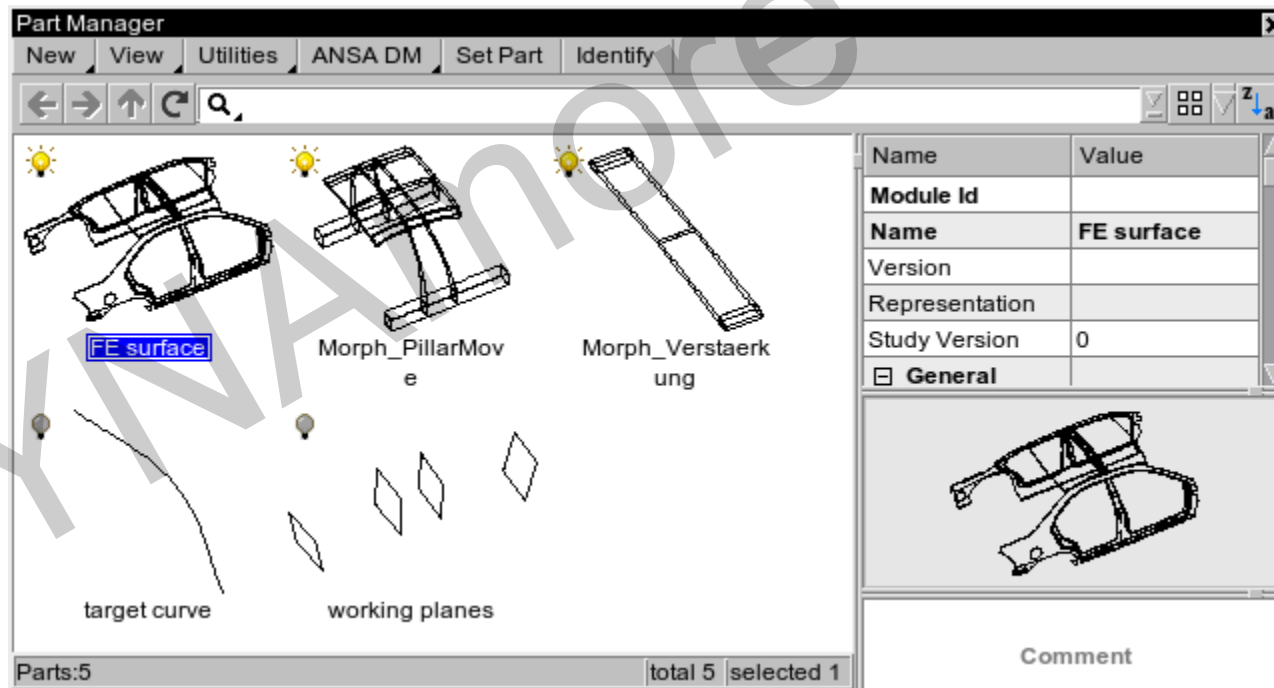
- Act as initial or target positions for fittings
- Suitable for Box and Direct Morphing
- Obtained from FE mesh or CAD geometry



Functionalities assisting Morphing

Part Manager

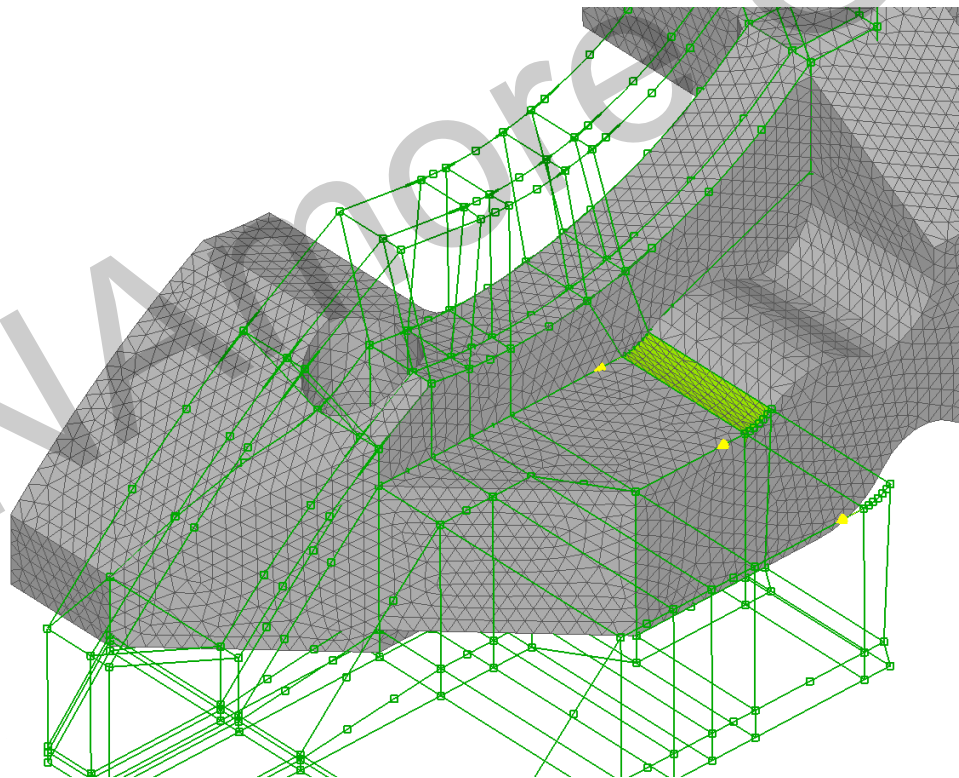
- Useful for Box Morphing (esp. complex configurations)
- To organize morph contents



Functionalities assisting Morphing

Reconstruct / Smooth morphed mesh

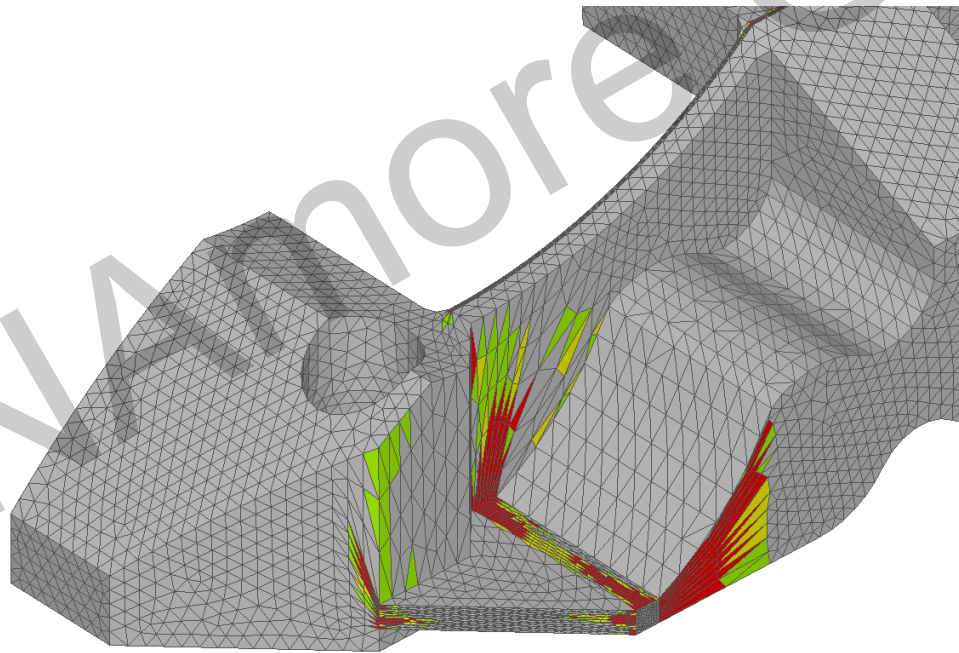
- Suitable for Box and Direct Morphing
- Improve mesh after morphing with large deformations



Functionalities assisting Morphing

Reconstruct / Smooth morphed mesh

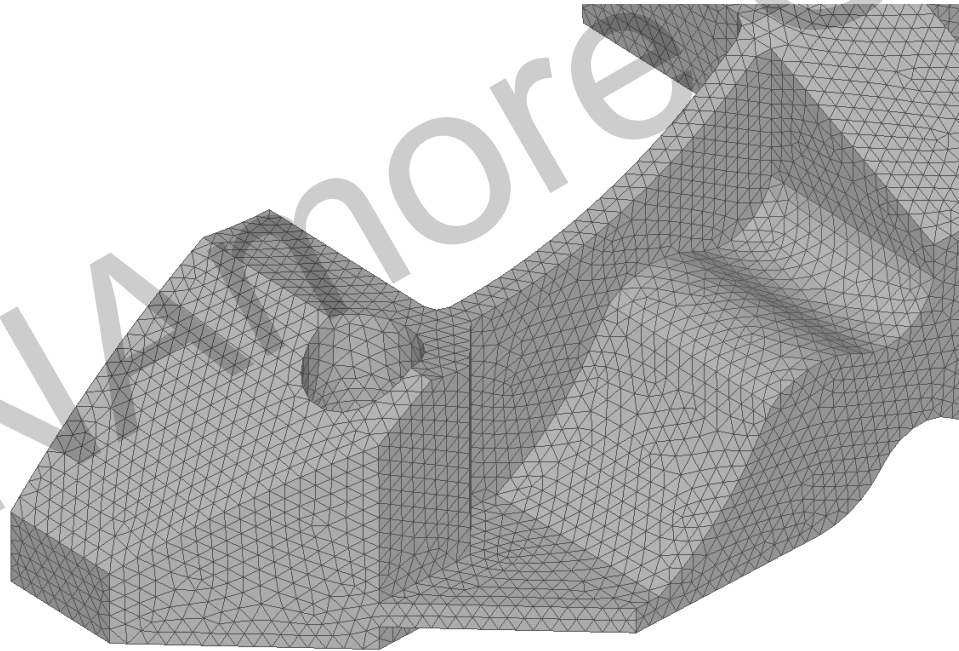
- Suitable for Box and Direct Morphing
- Improve mesh after morphing with large deformations



Functionalities assisting Morphing

Reconstruct / Smooth morphed mesh

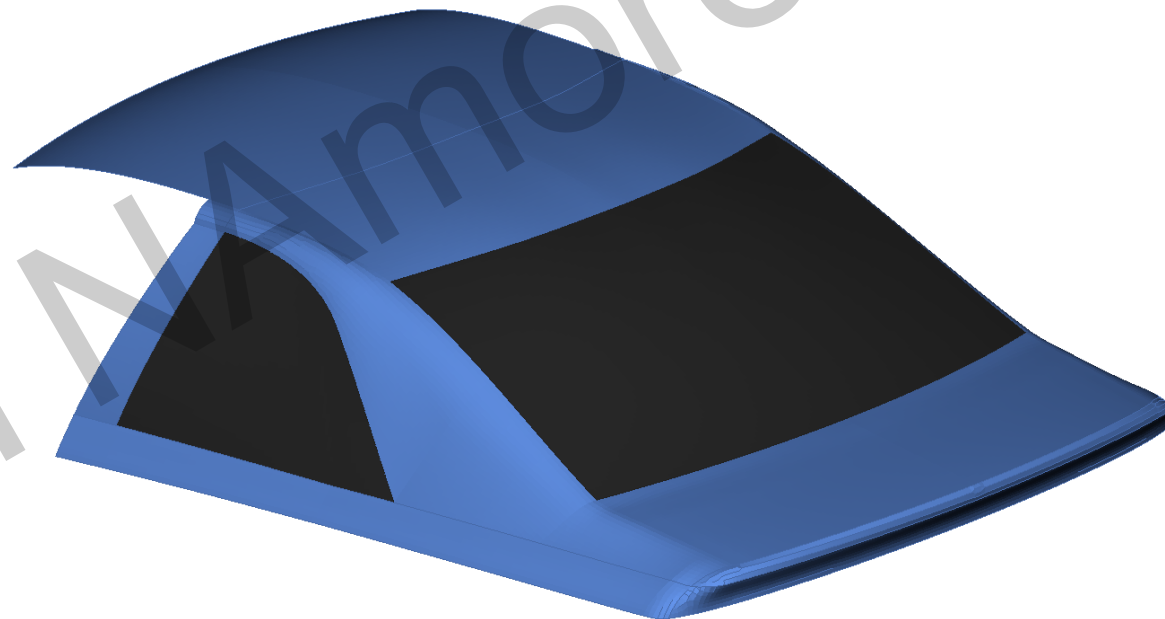
- Suitable for Box and Direct Morphing
- Improve mesh after morphing with large deformations



Functionalities assisting Morphing

Visualize Morphing Deviations

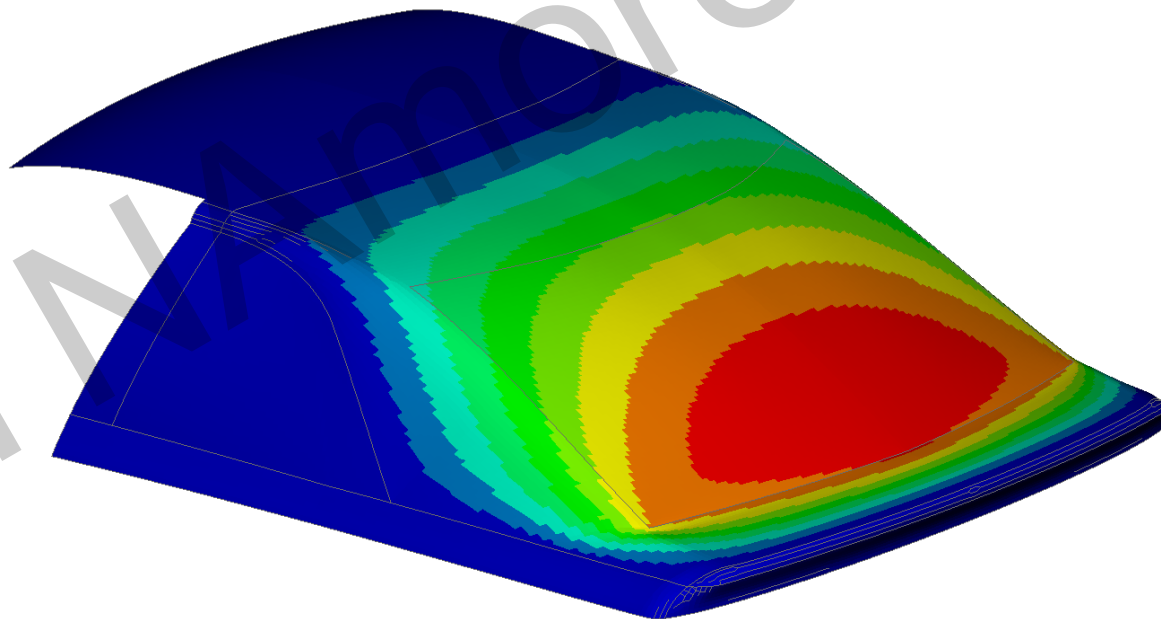
- Suitable for Box and Direct Morphing
- Measurement Tool
- Fringe Plot of deformed shape



Functionalities assisting Morphing

Visualize Morphing Deviations

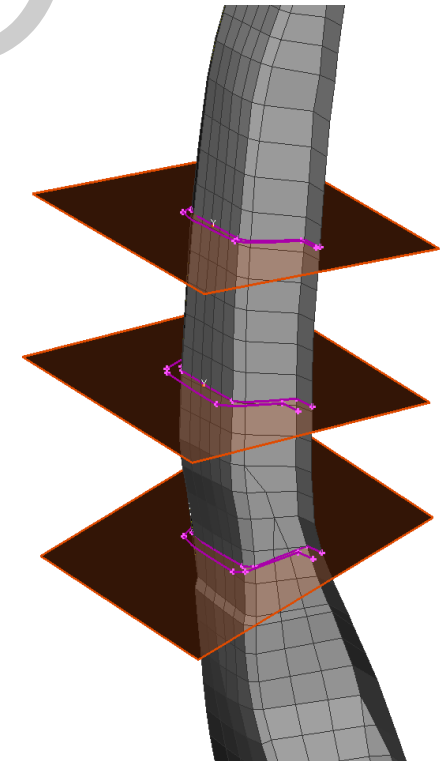
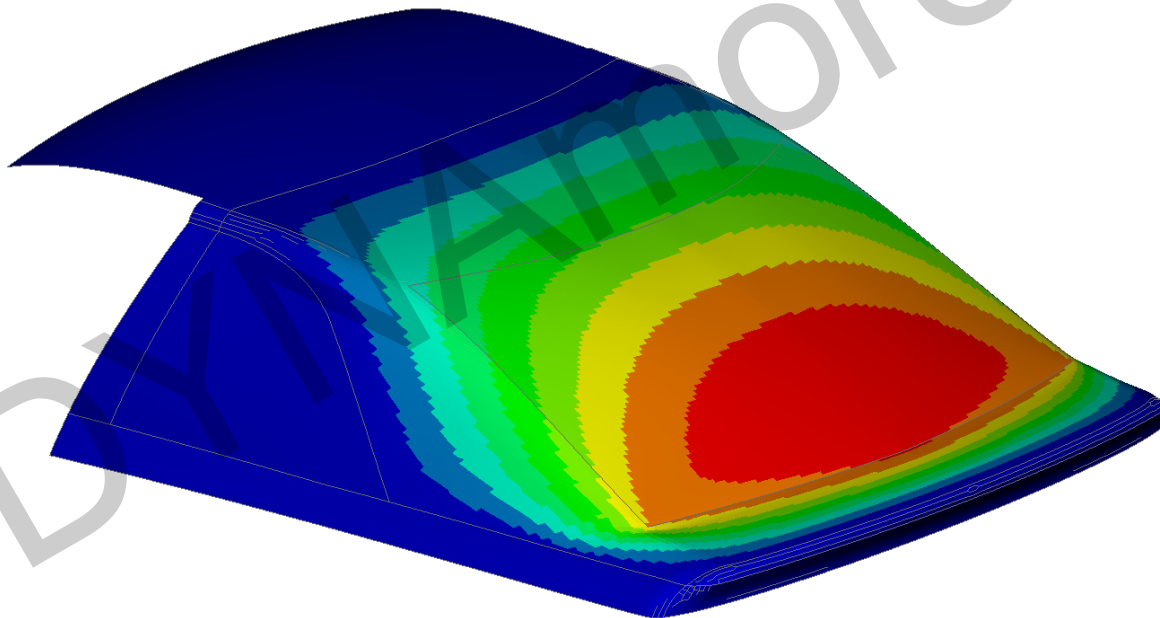
- Suitable for Box and Direct Morphing
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Functionalities assisting Morphing

Visualize Morphing Deviations

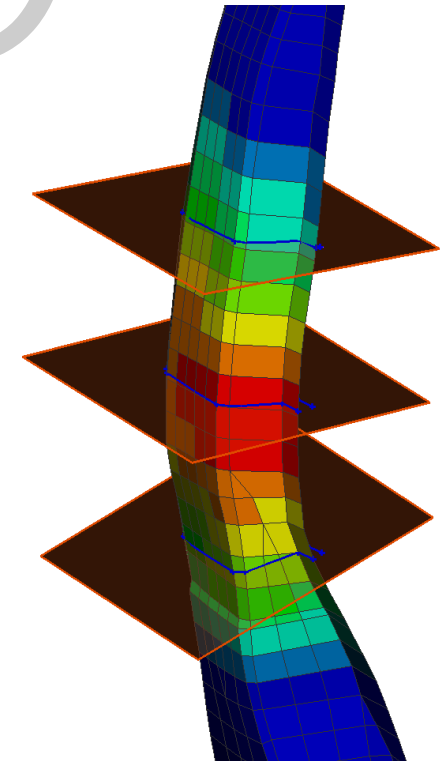
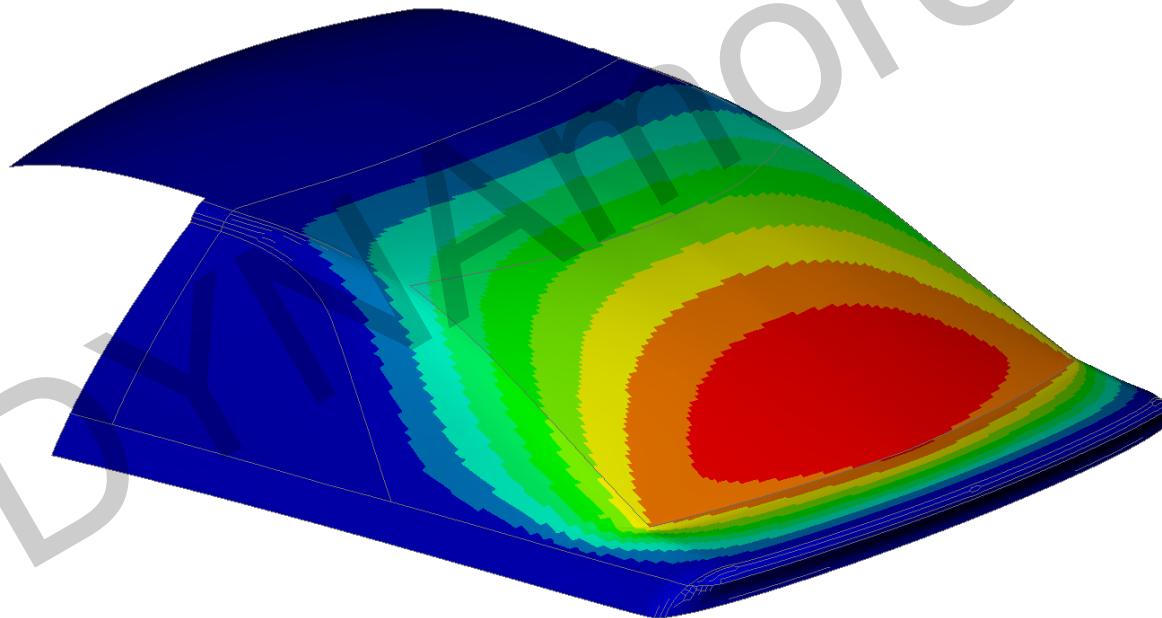
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Functionalities assisting Morphing

Visualize Morphing Deviations

- Suitable for Box and Direct Morphing
- Measurement Tool
- Fringe Plot of deformed shape



ANSA Parameter

- For parameterization of solver card entries

*DLOAD [DLOAD]

Name

FROZEN_DELETE

STEP	OP	AMPLITUDE	STEADY STATE LOADING
1	NEW		

by ELSET LOAD TYPE magn(EID)

Comment

ANSA Parameter

- For parameterization of solver card entries
- Different types; Expressions

*DLOAD [DLOAD]

Name

FROZEN_DELETE

STEP	OP	AMPLITUDE	STEADY STATE	LOADING
1	NEW	<input type="text"/>		
by	ELSET	LOAD TYPE	magn(EID)	
<input type="text" value="set"/>	3	P	<input type="text"/>	

Comment

OK Cancel

A_PARAMETER

Id	Name	Value	Expression	Type
1	ignite	10.		Real
2	ignite1	5.	ignite * 0.5	Real
3	friction	0.15		Real

total 3 selected 0

ANSA Parameter

- For parameterization of solver card entries
- Different types; Expressions

*DLOAD [DLOAD]

Name

FROZEN_DELETE
NO

STEP	OP	AMPLITUDE	STEADY STATE	LOADING
1	NEW	<input type="text"/>		
by	ELSET	LOAD TYPE	magn(EID)	
set	3	P	=ignite1	

Comment
=ignite1

OK Cancel

A_PARAMETER

Id	Name	Value	Expression	Type
1	ignite	10.		Real
2	ignite1	5.	ignite * 0.5	Real
3	friction	0.15		Real

total 3 selected 1

ANSA Parameter

- For parameterization of solver card entries
- Different types; Expressions
- Import from / Export to *PARAMETER

*DLOAD [DLOAD]

Name

FROZEN_DELETE
NO

STEP	OP	AMPLITUDE	STEADY STATE	LOADING
1	NEW	<input type="text"/>		

by set 3 P =ignite1

Comment

=ignite1

OK Cancel

A_PARAMETER

Id	Name	Value	Expression	Type
1	ignite	10.		Real
2	ignite1	5.	ignite * 0.5	Real
3	friction	0.15		Real

total 3 selected 1

```

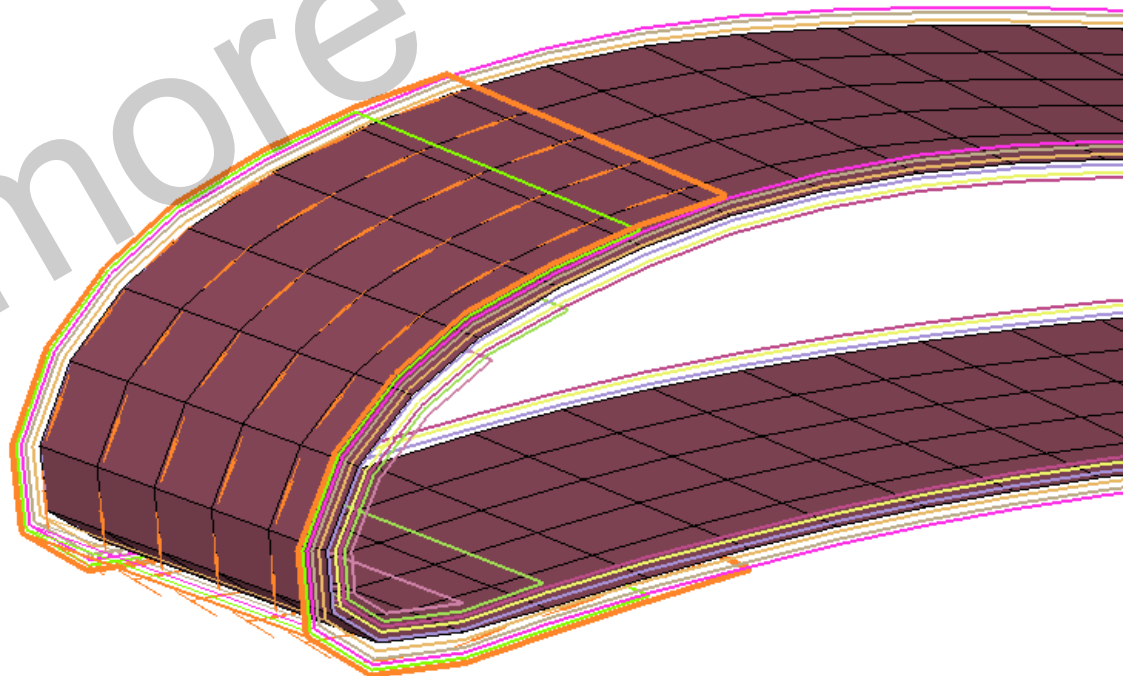
**
*PARAMETER
ignite = 10.0
ignite1 = ignite * 0.5
friction = 0.15
**
**
*DSLOAD, OP=NEW
S_zkd_zuenden_zy6, P, <ignite1>
S_brennraum_zy6, P, <ignite>

```

ANSA Parameter

- For parameterization of composite properties, e.g.:

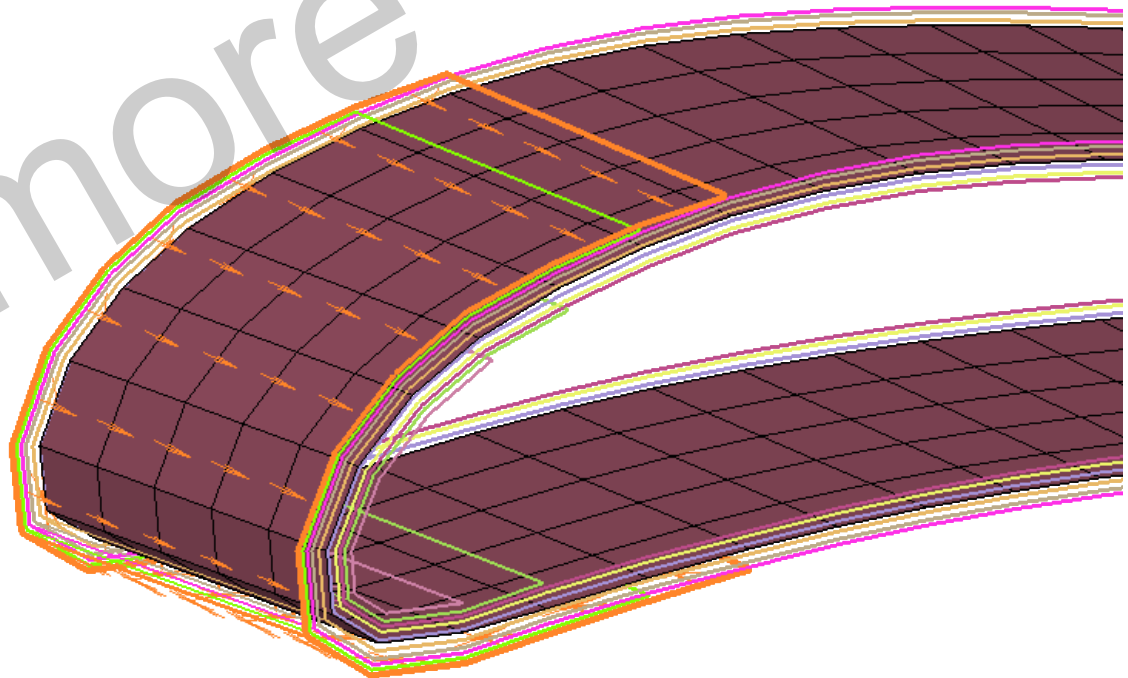
Layers				
PID	Z0	NSM	S	
1				
AVA	Type	T	THETA	m:
1	Sequence			
1	Layer	0.2	90.	
2	Layer	0.1	-45.	
3	Layer	0.1	45.	
4	Layer	0.2	0.	
5	Layer	0.2	0.	
6	Layer	0.1	45.	
7	Layer	0.1	-45.	
8	Layer	0.2	90.	



ANSA Parameter

- For parameterization of composite properties, e.g.:
 - fabric orientation

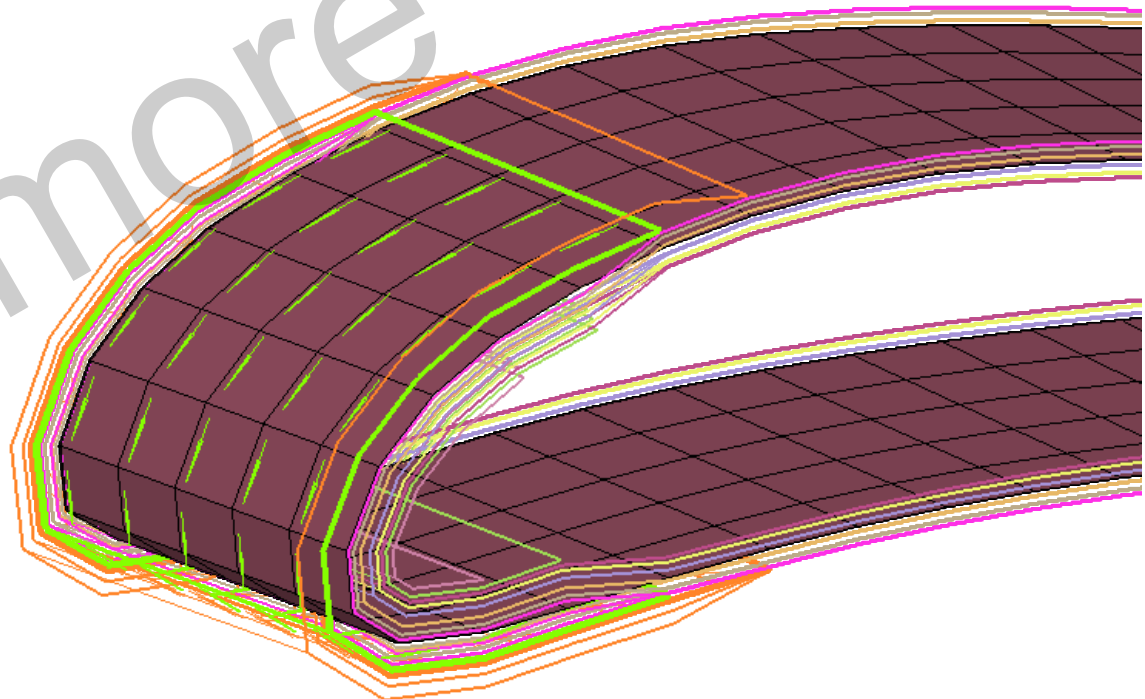
Layers				
PID	Z0	NSM	S	
1				
AVA	Type	T	THETA	m:
1	Sequence			
1	Layer	0.2	90.	
2	Layer	0.1	-45.	
3	Layer	0.1	45.	
4	Layer	0.2	0.	
5	Layer	0.2	0.	
6	Layer	0.1	45.	
7	Layer	0.1	-45.	
8	Layer	0.2	90.	



ANSA Parameter

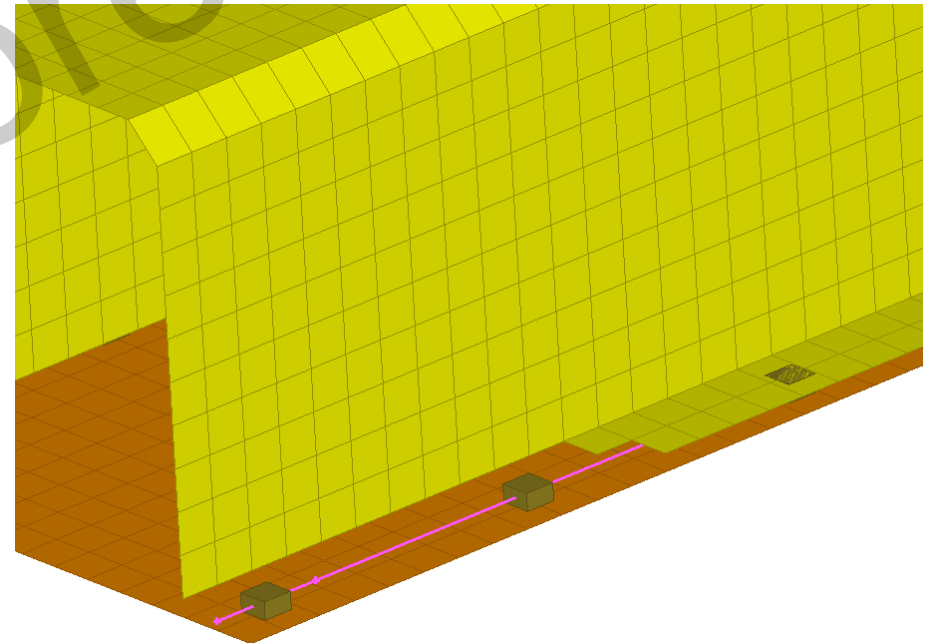
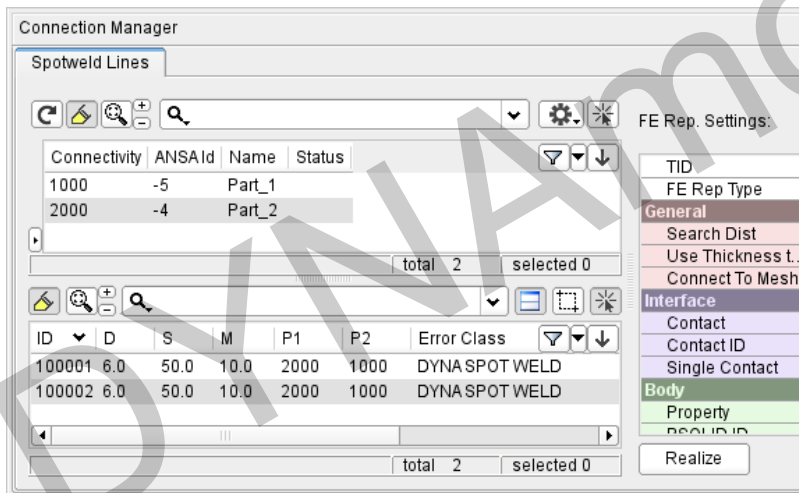
- For parameterization of composite properties, e.g.:
 - fabric orientation
 - layer thickness

Layers				
PID	Z0	NSM	S	
1				
AVA	Type	T	THETA	m:
1	Sequence			
1	Layer	0.2	90.	
2	Layer	0.1	-45.	
3	Layer	0.1	45.	
4	Layer	0.2	0.	
5	Layer	0.2	0.	
6	Layer	0.1	45.	
7	Layer	0.1	-45.	
8	Layer	0.2	90.	



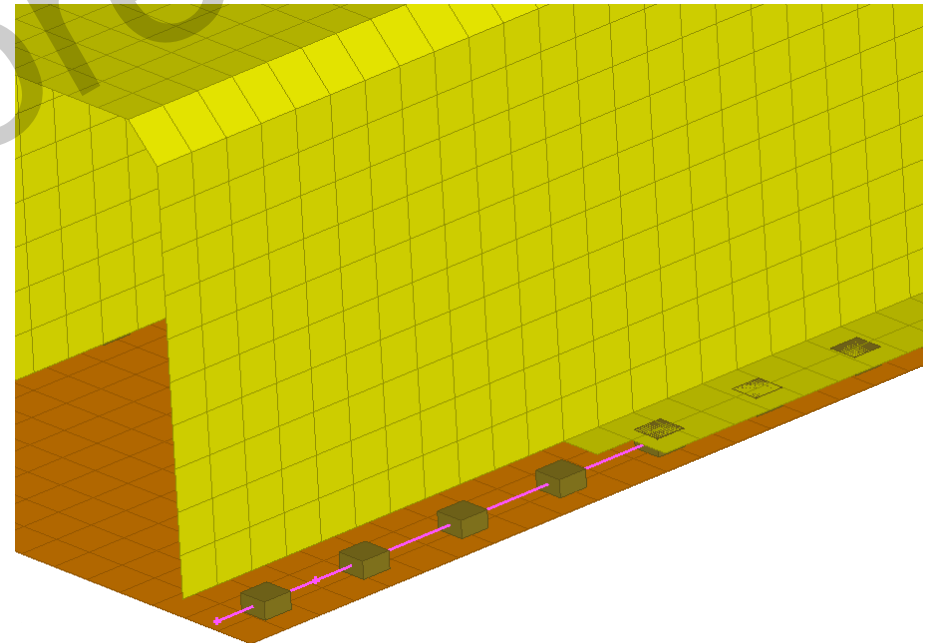
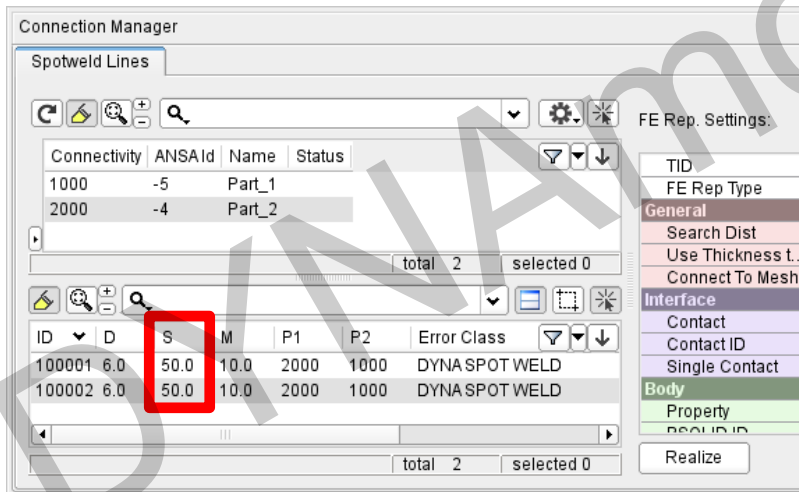
ANSA Parameter

- For parameterization of connection properties, e.g.:



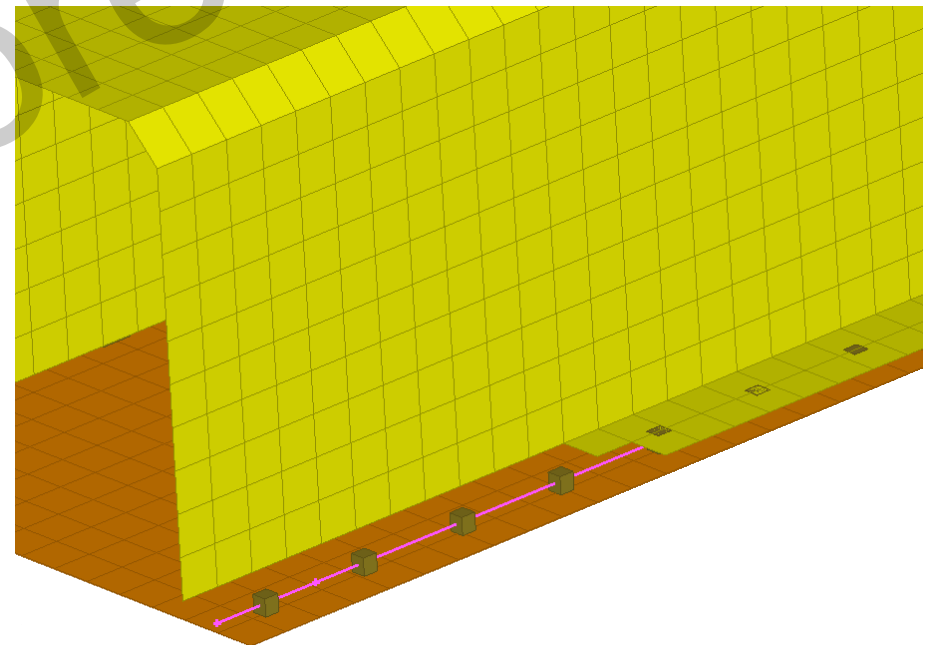
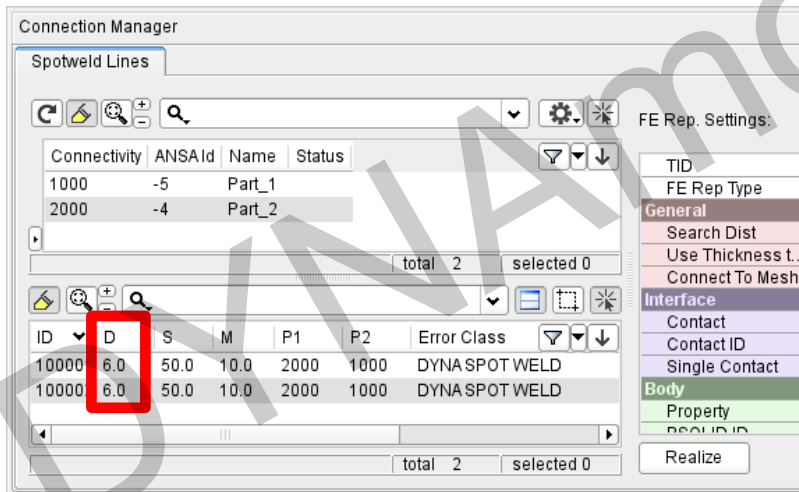
ANSA Parameter

- For parameterization of connection properties, e.g.:
 - distance between weld spots

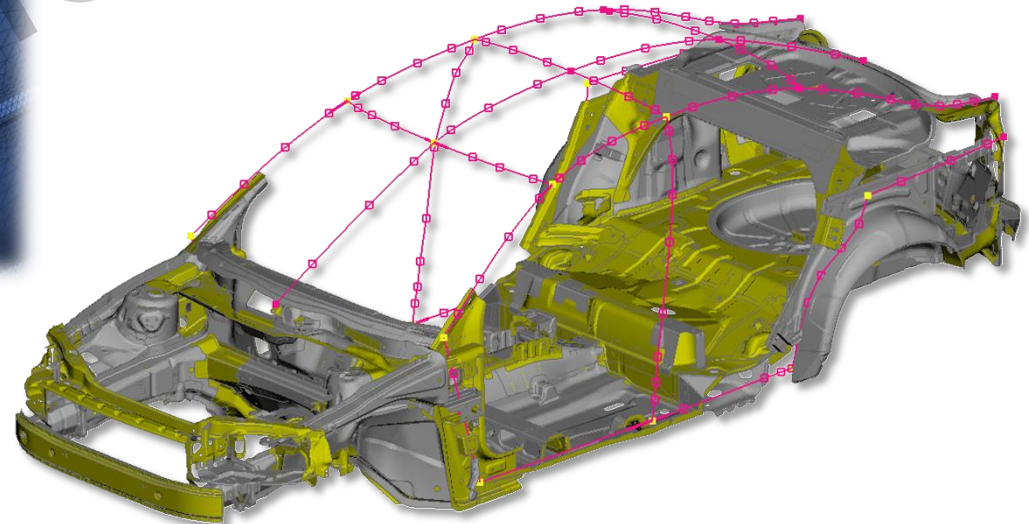
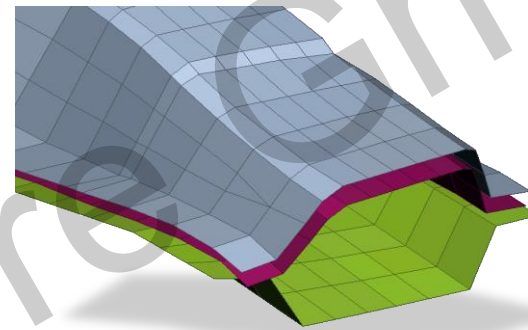
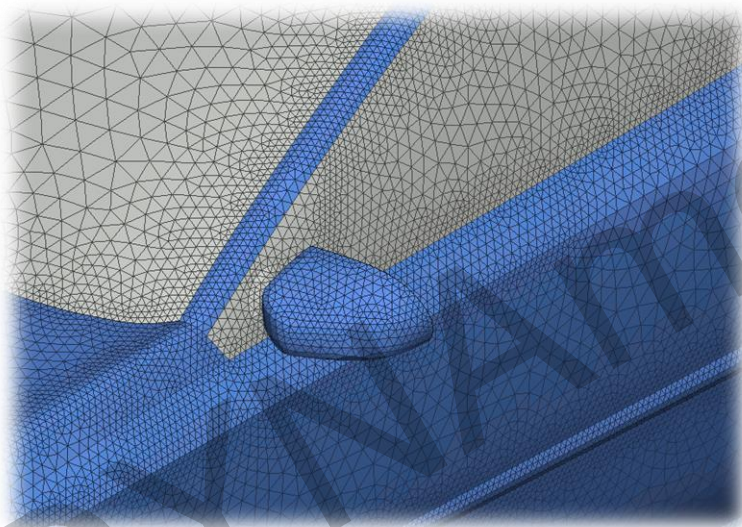


ANSA Parameter

- For parameterization of connection properties, e.g.:
 - distance between weld spots
 - diameter of weld spots



Ευχαριστώ πολύ



Web: www.lasso.de

Mail: ansa@lasso.de