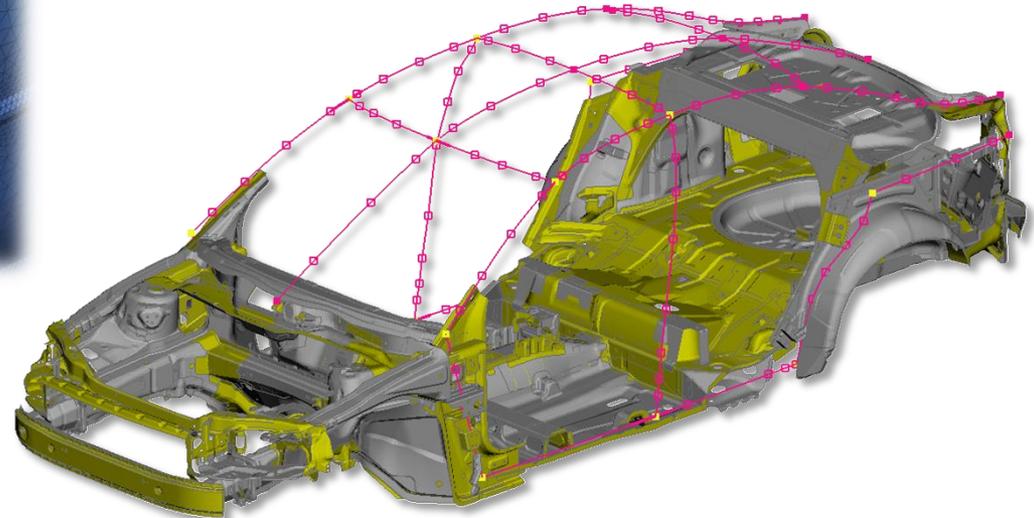
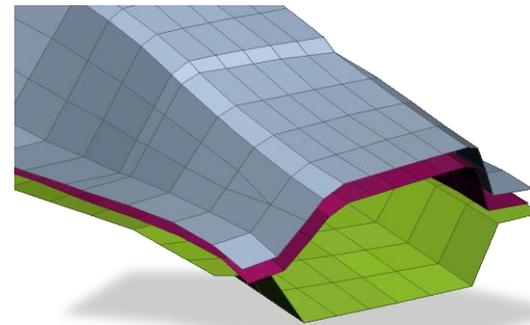
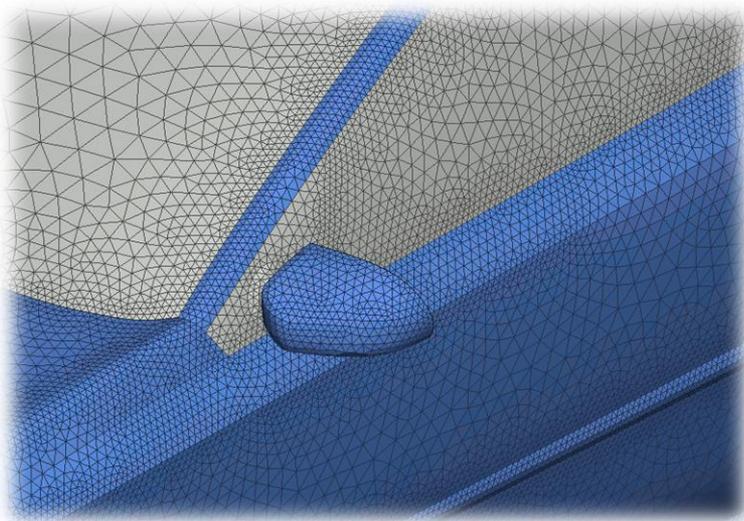


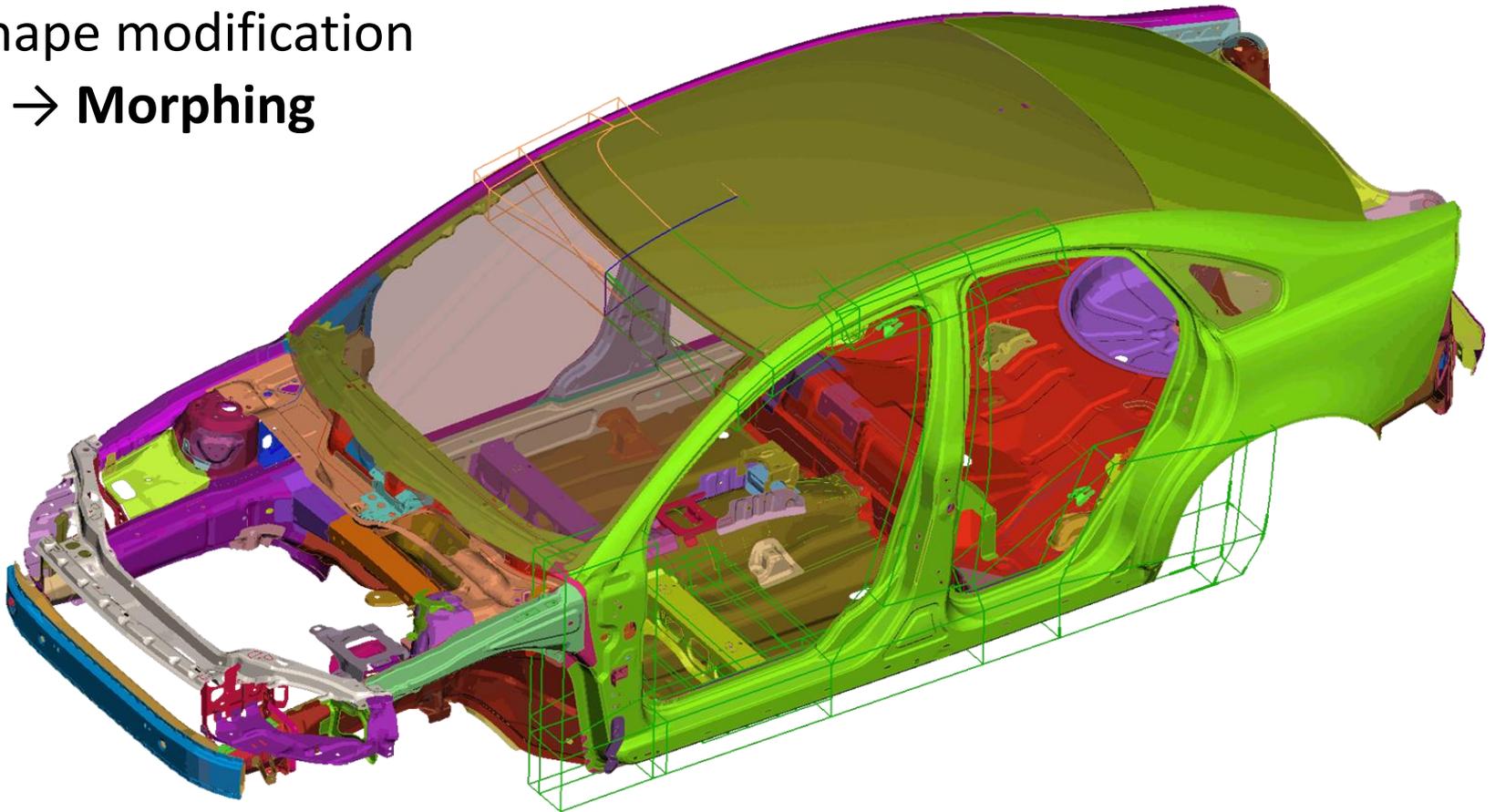
Model Parameterization in ANSA



Dirk Dreißig
Mail: ansa@lasso.de

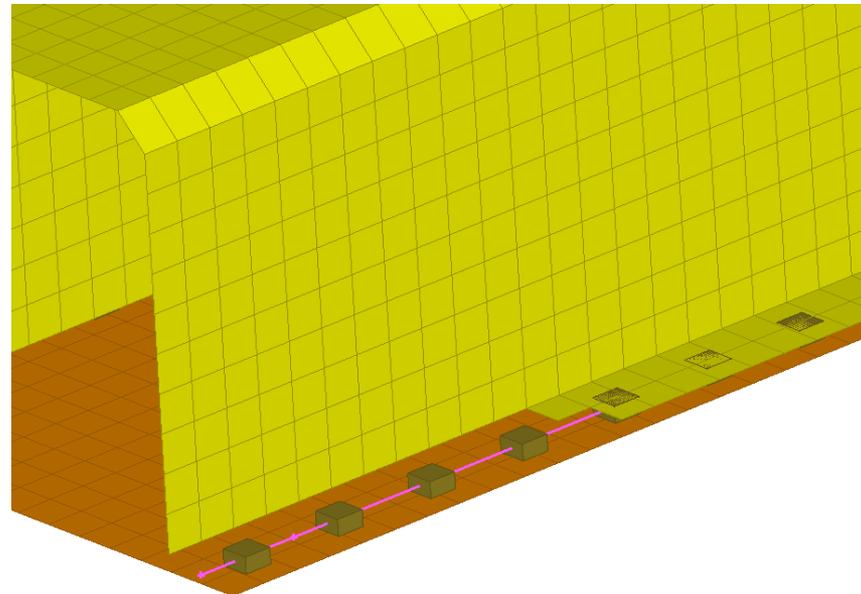
Types of Parameterization

- Shape modification
→ **Morphing**



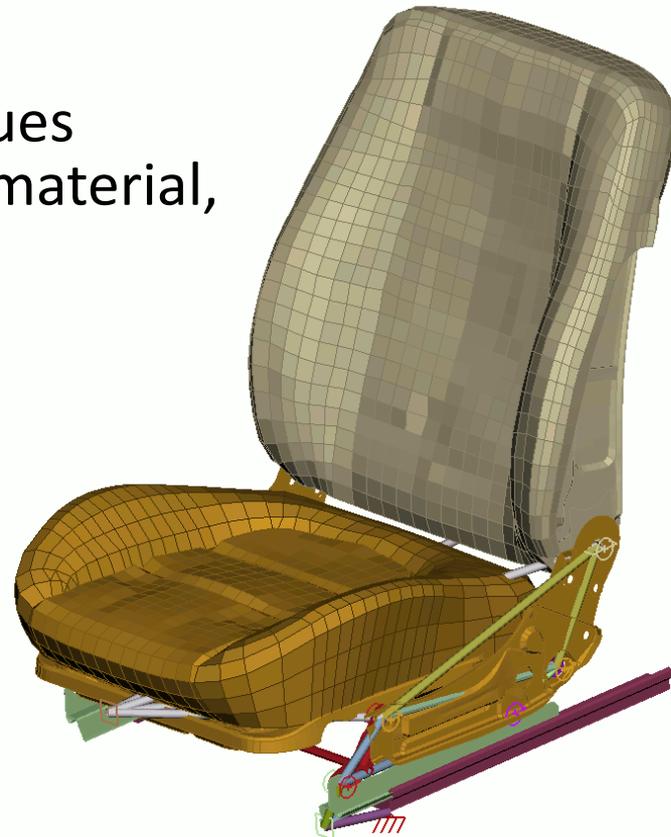
Types of Parameterization

- Shape modification
 - **Morphing**
- Modification of entity card values (e.g. property thickness, used material, connection properties)
 - **ANSA Parameter**



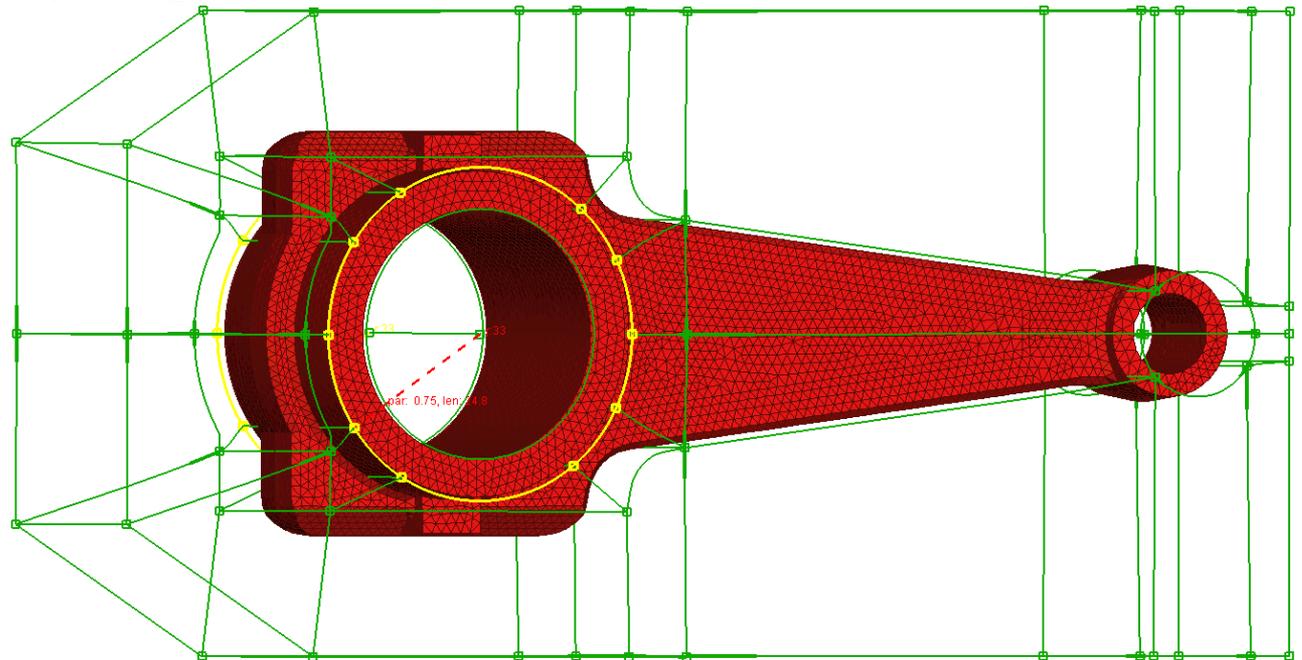
Types of Parameterization

- Shape modification
 - **Morphing**
- Modification of entity card values (e.g. property thickness, used material, connection properties)
 - **ANSA Parameter**
- Anything else (e.g. Mesh Studies, Kinetics)
 - **Scripting**



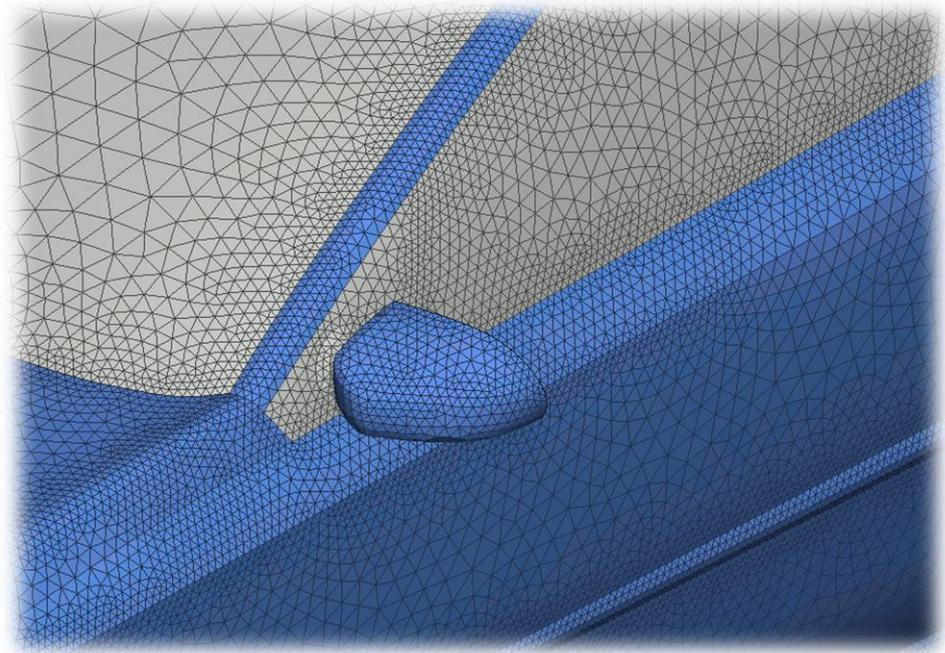
Morphing

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



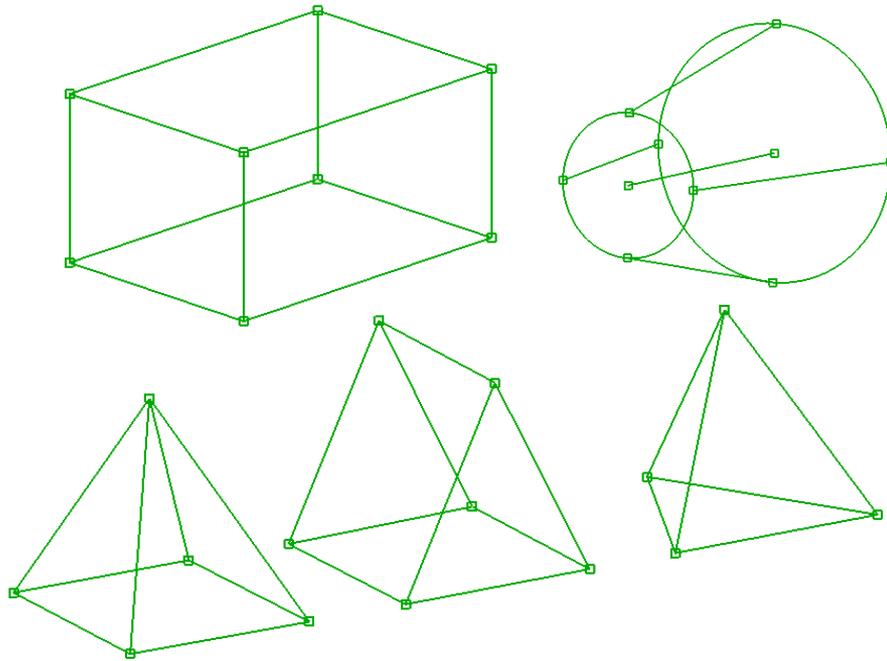
Morphing

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



Box Morphing

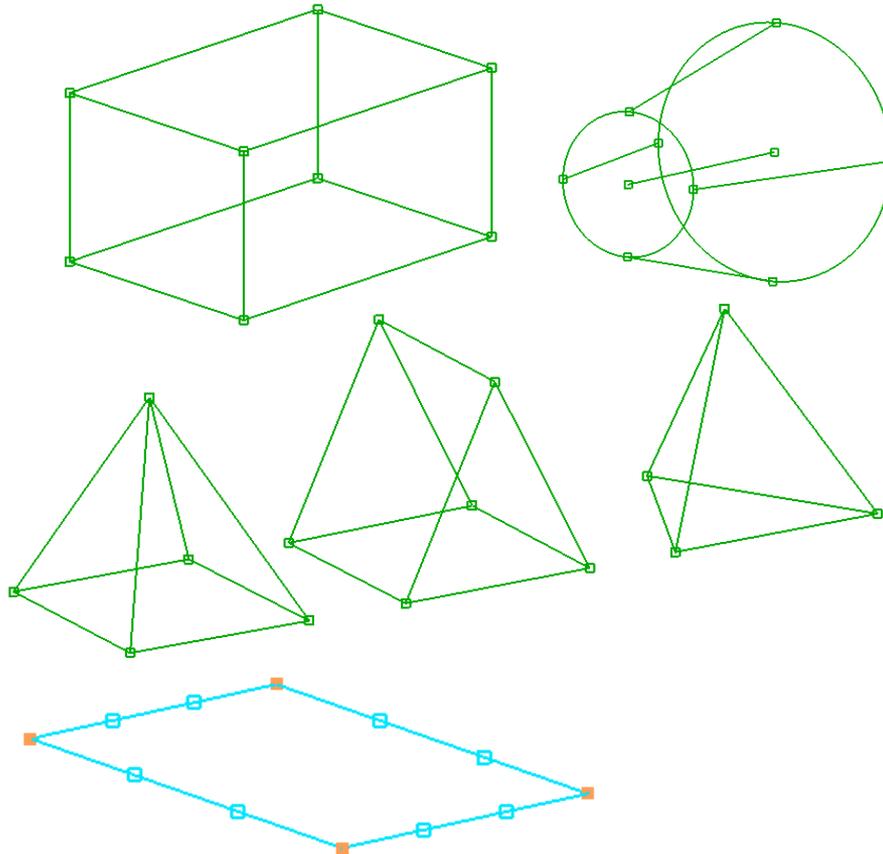
Types of boxes



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

Box Morphing

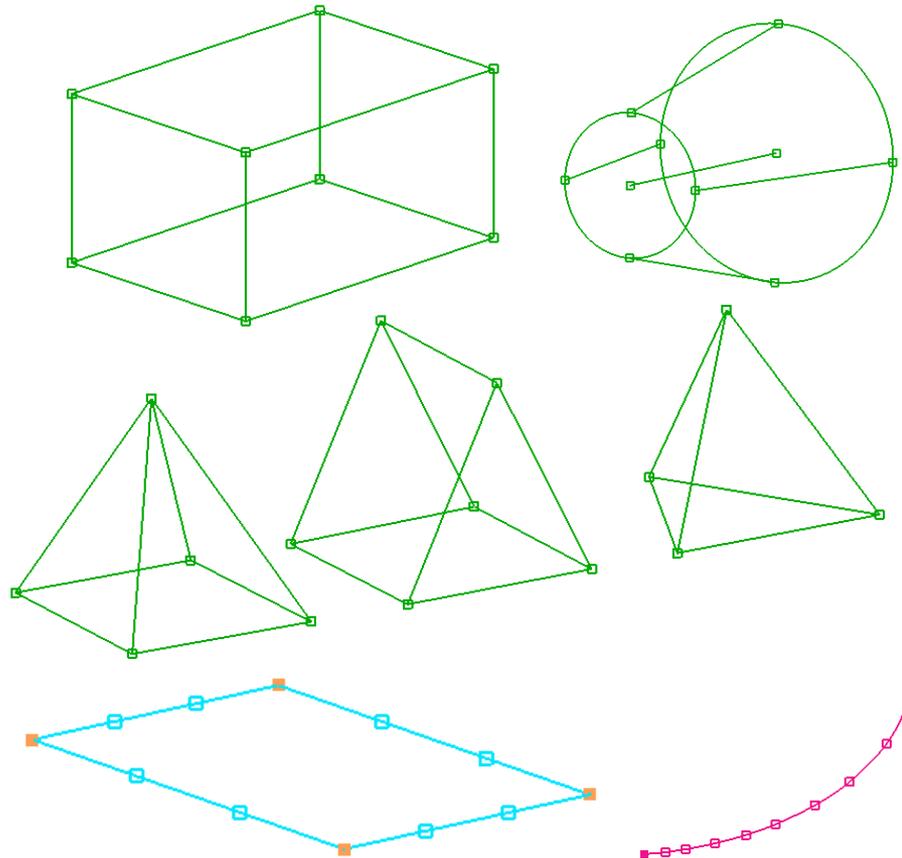
Types of boxes



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

Box Morphing

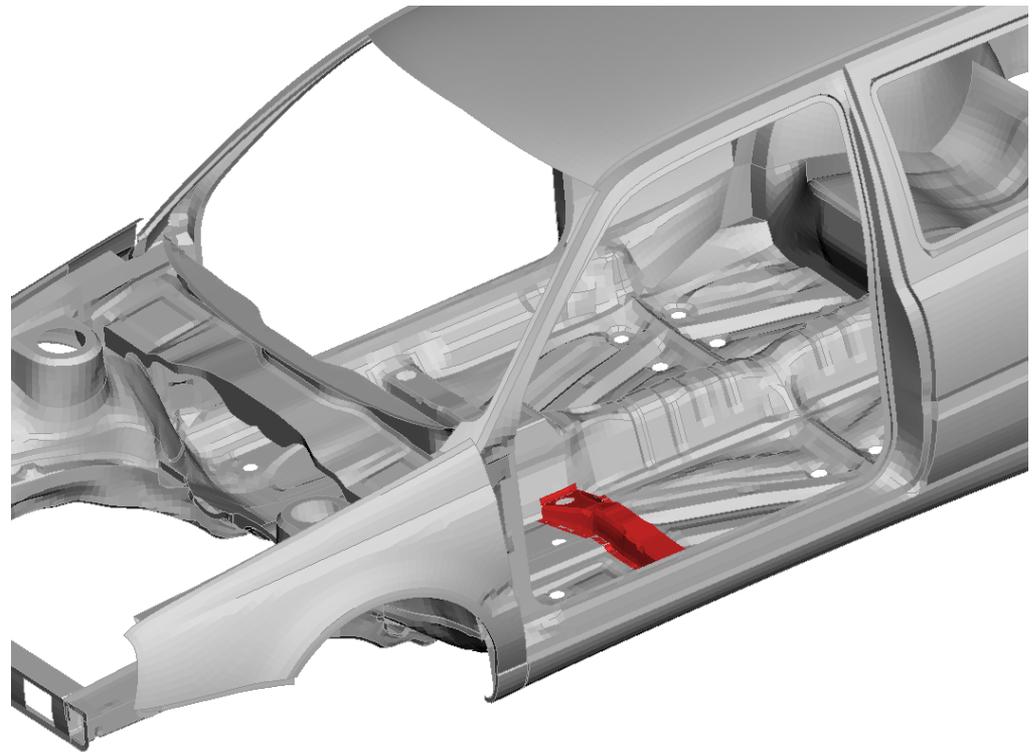
Types of boxes



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

Box Morphing

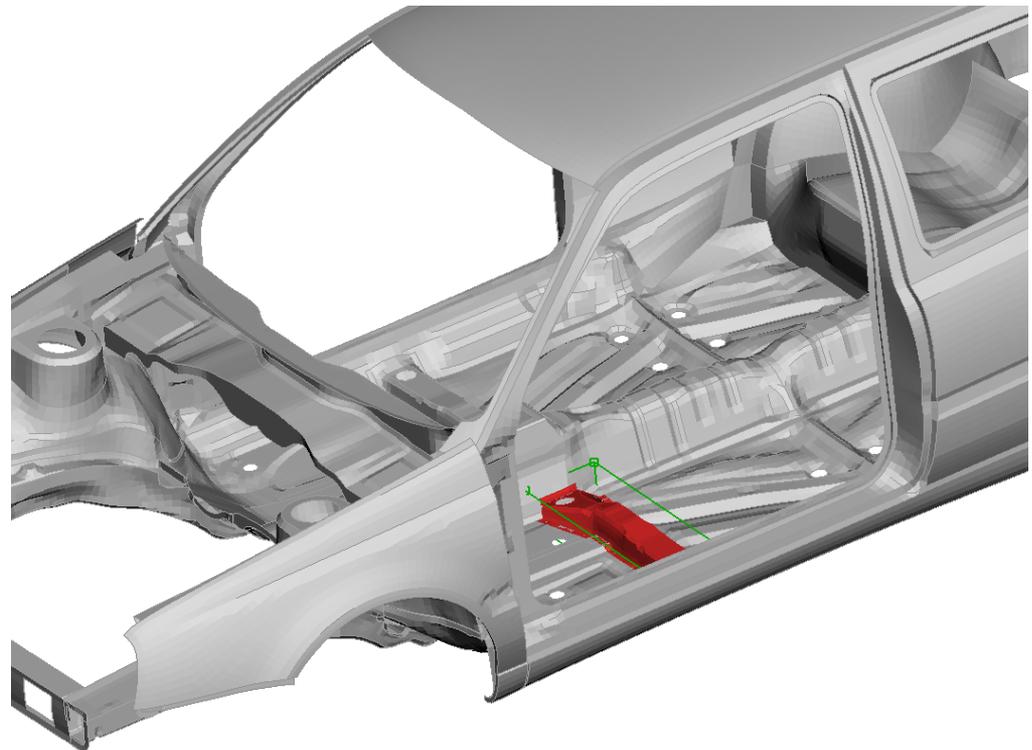
Creation of Boxes



Box Morphing

Creation of Boxes

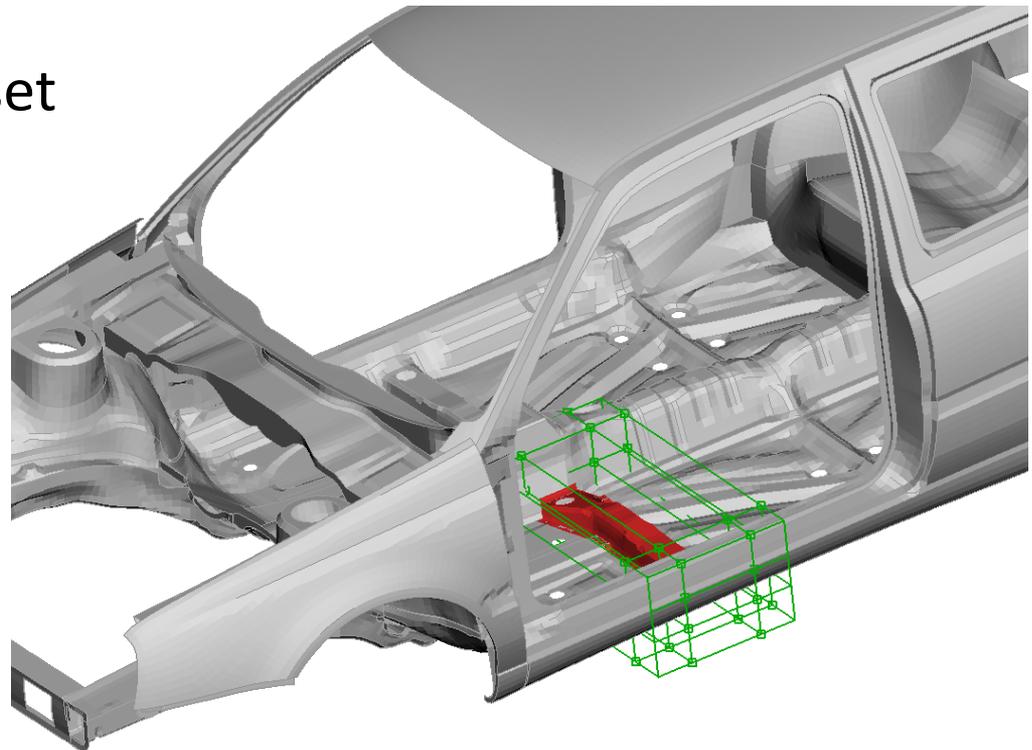
- Around Entities



Box Morphing

Creation of Boxes

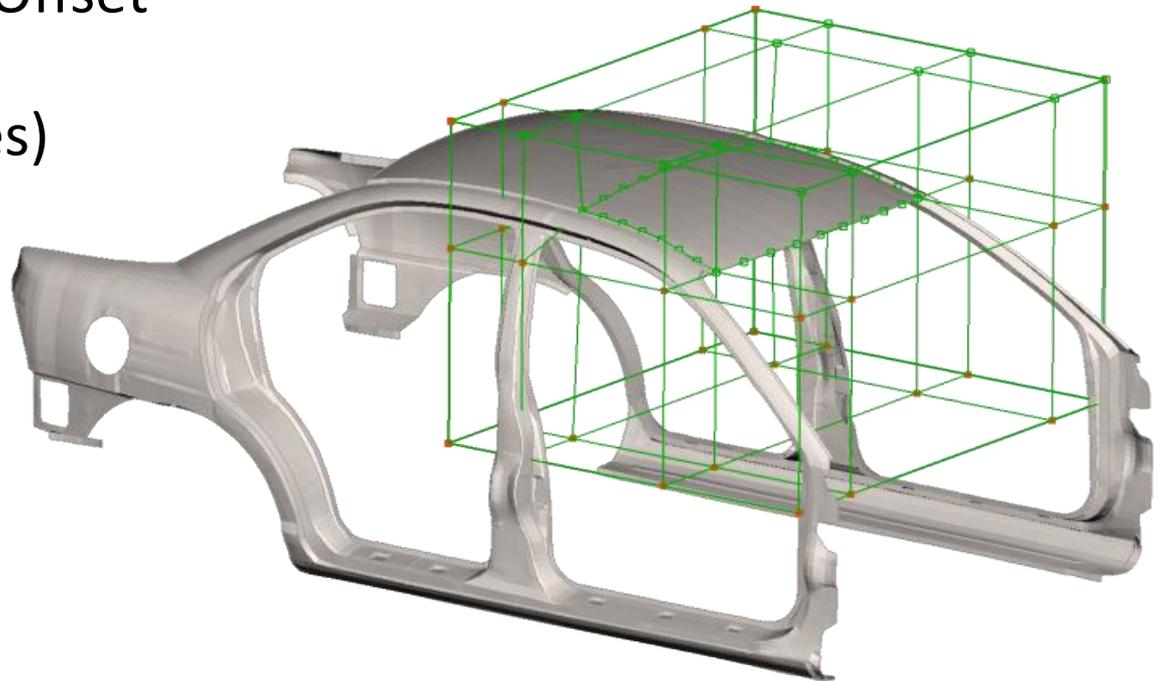
- Around Entities
- Buffer Zones via Offset



Box Morphing

Creation of Boxes

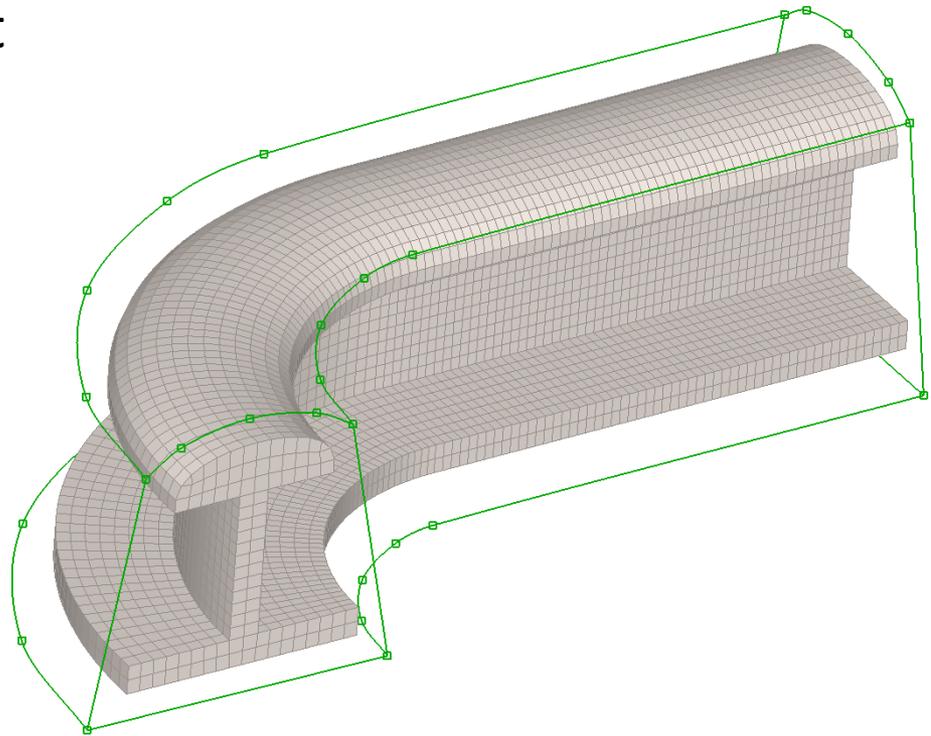
- Around Entities
- Buffer Zones via Offset
- Split + Fit
(edges or surfaces)



Box Morphing

Creation of Boxes

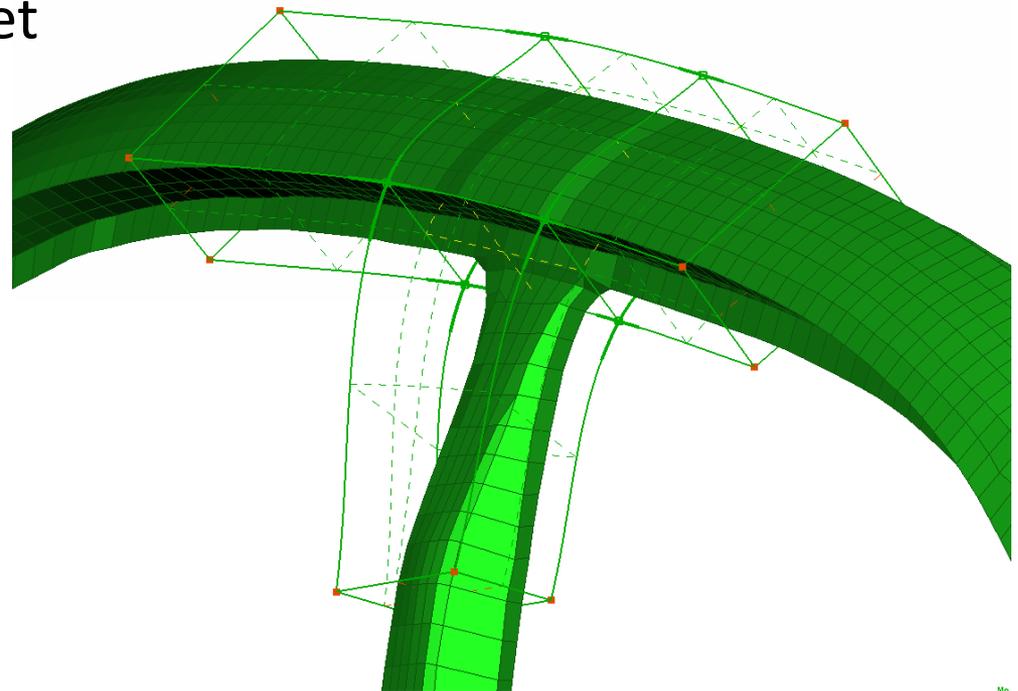
- Around Entities
- Buffer Zones via Offset
- Split + Fit
(edges or surfaces)
- Sweep / Glide



Box Morphing

Creation of Boxes

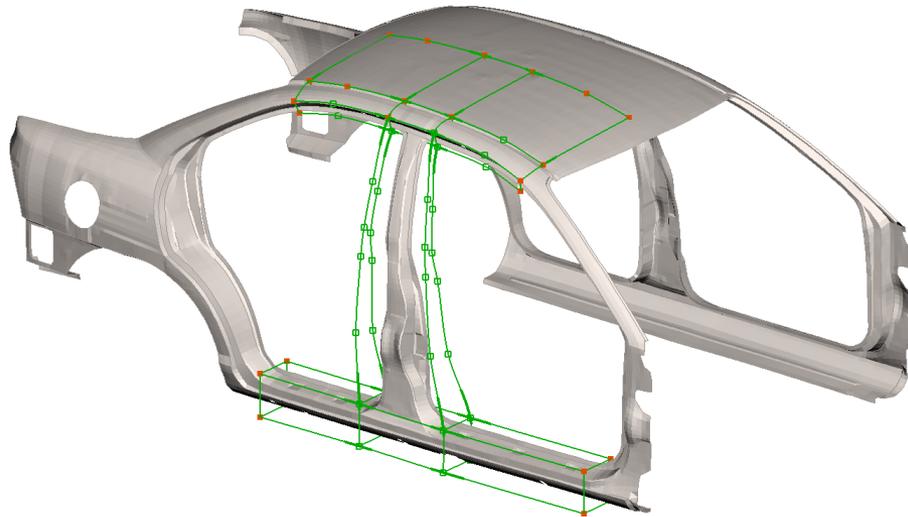
- Around Entities
- Buffer Zones via Offset
- Split + Fit
(edges or surfaces)
- Sweep / Glide
- Wrap
- ...



Box Morphing

Linked Morphing Boxes

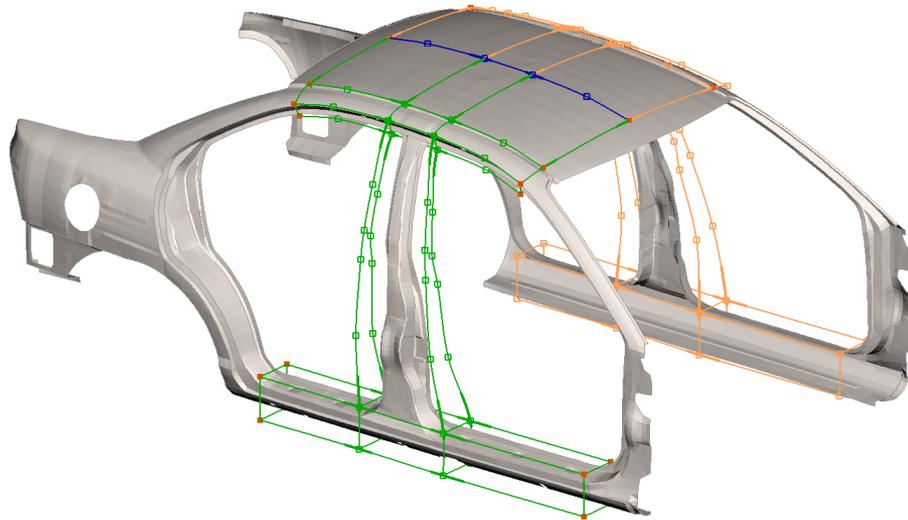
- Taking advantage of model symmetry
- Link according symmetry-/mirror plane, translation vector or rotation axis



Box Morphing

Linked Morphing Boxes

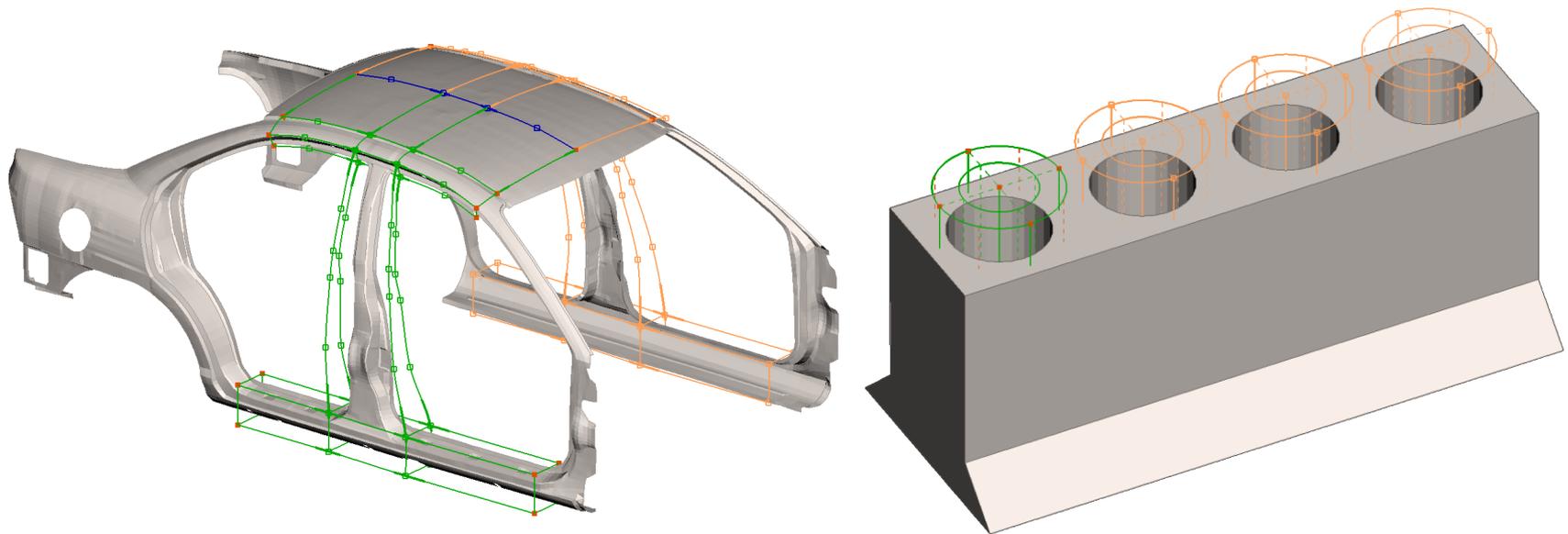
- Taking advantage of model symmetry
- Link according symmetry-/mirror plane, translation vector or rotation axis



Box Morphing

Linked Morphing Boxes

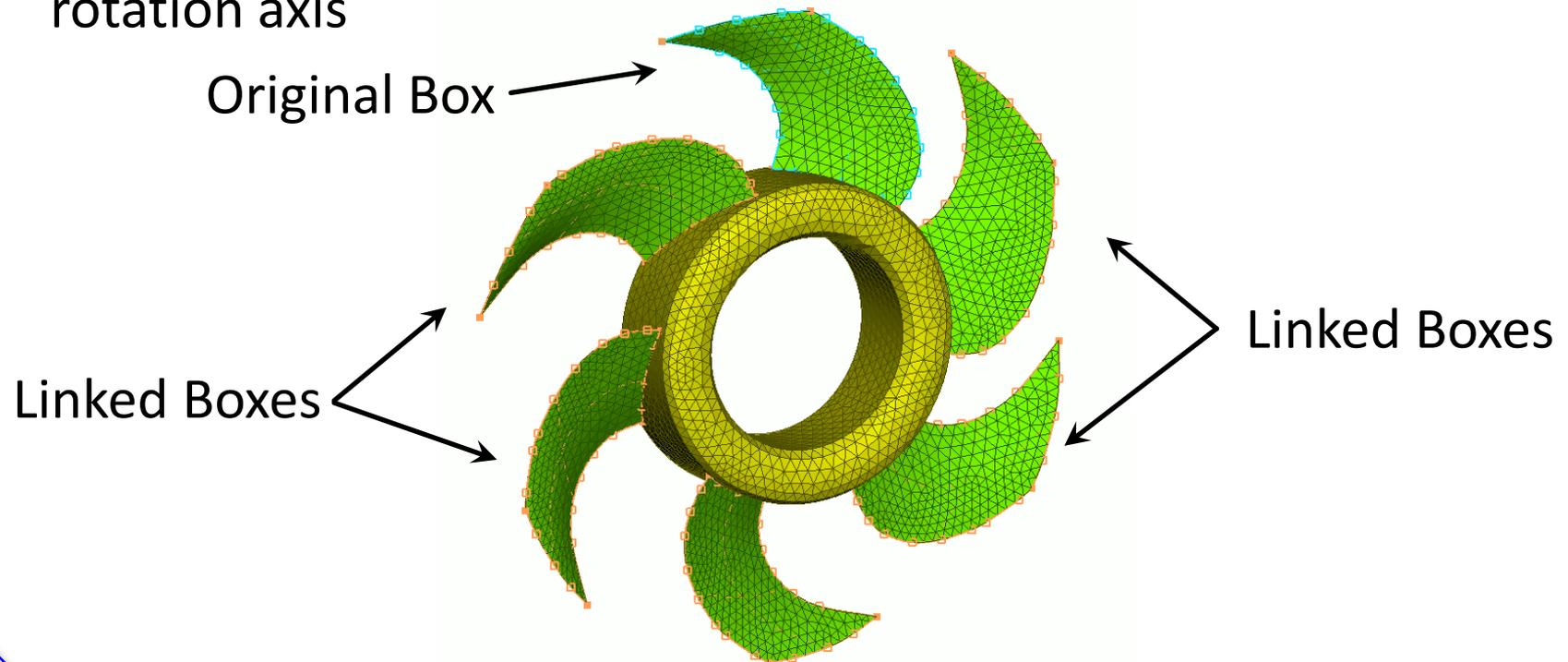
- Taking advantage of model symmetry
- Link according symmetry-/mirror plane, translation vector or rotation axis



Box Morphing

Linked Morphing Boxes

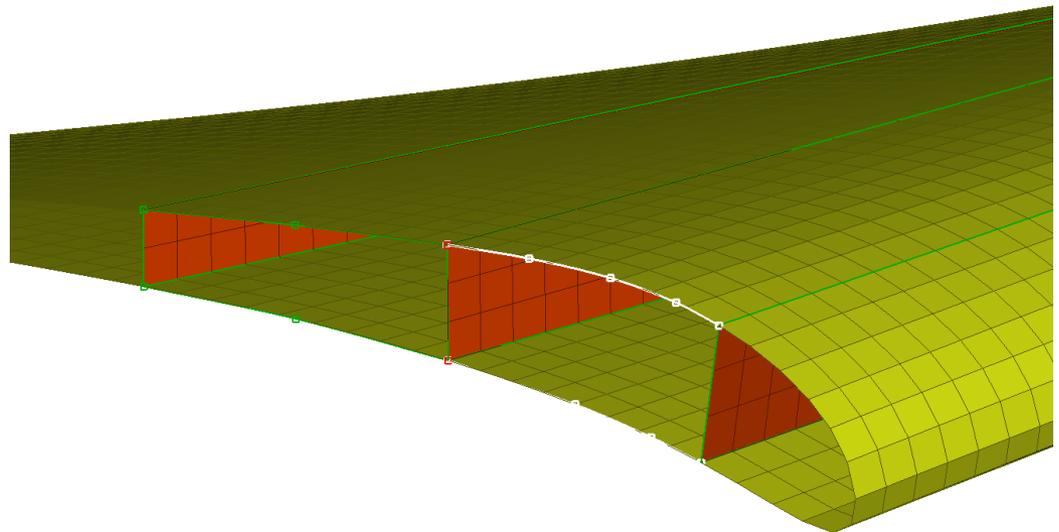
- Taking advantage of model symmetry
- Link according symmetry-/mirror plane, translation vector or rotation axis



Box Morphing

Modification of Boxes

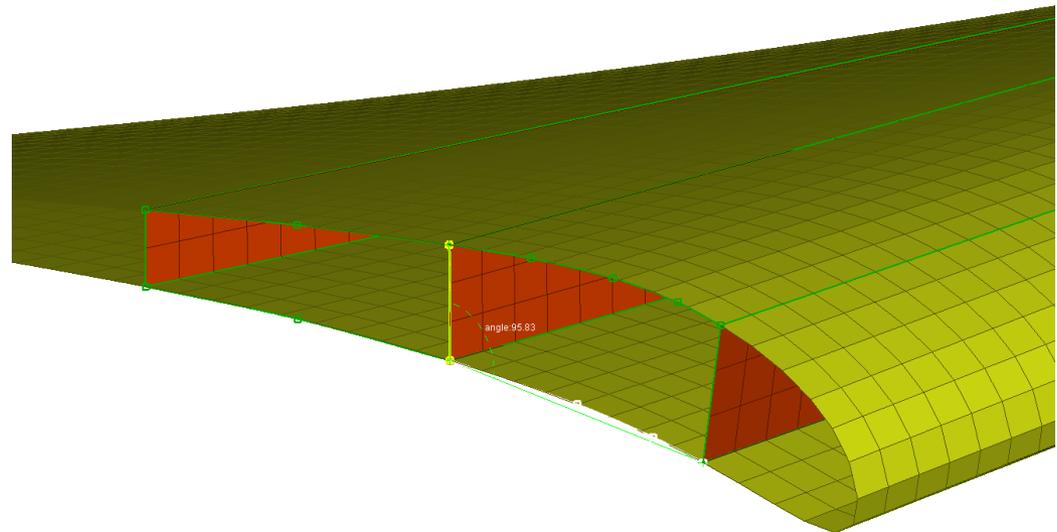
- Move (Translate, Rotate)
- Slide / Extend



Box Morphing

Modification of Boxes

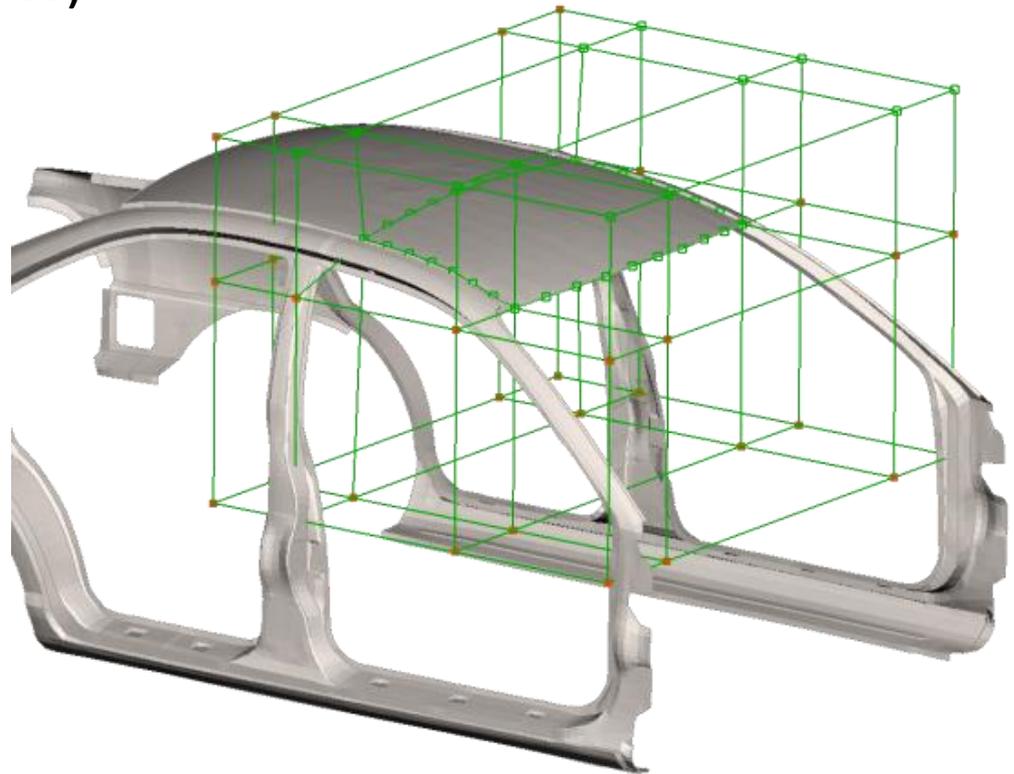
- Move (Translate, Rotate)
- Slide / Extend
- Angle



Box Morphing

Modification of Boxes

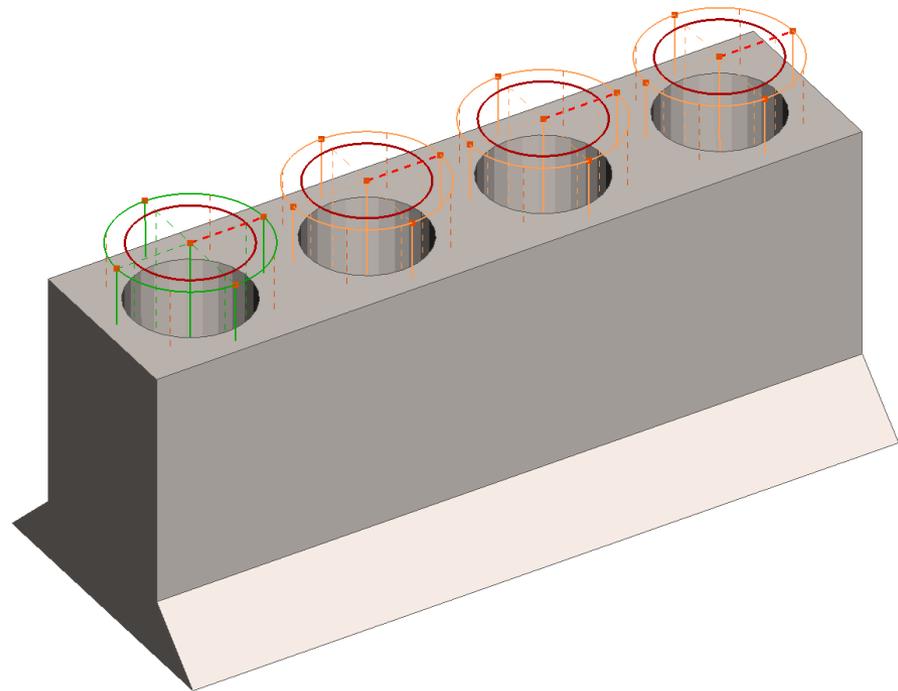
- Move (Translate, Rotate)
- Slide / Extend
- Angle
- Fit (edges, surfaces)



Box Morphing

Modification of Boxes

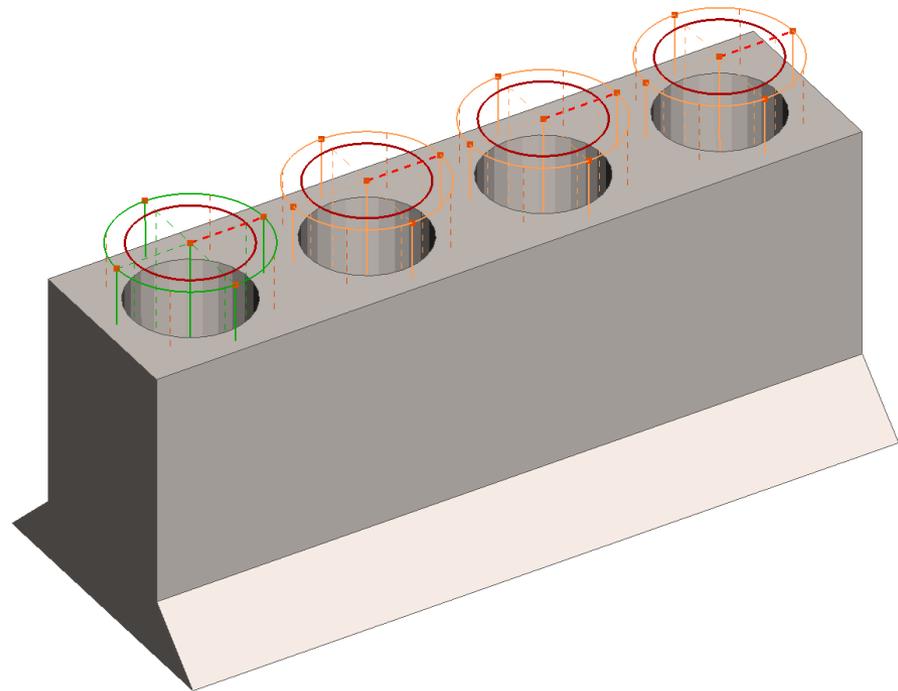
- Move (Translate, Rotate)
- Slide / Extend
- Angle
- Fit (edges, surfaces)
- Radius



Box Morphing

Modification of Boxes

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



Box Morphing

Box in Box

- Separate groups of boxes handle different features
- Global and local modifications without excessive splits of boxes

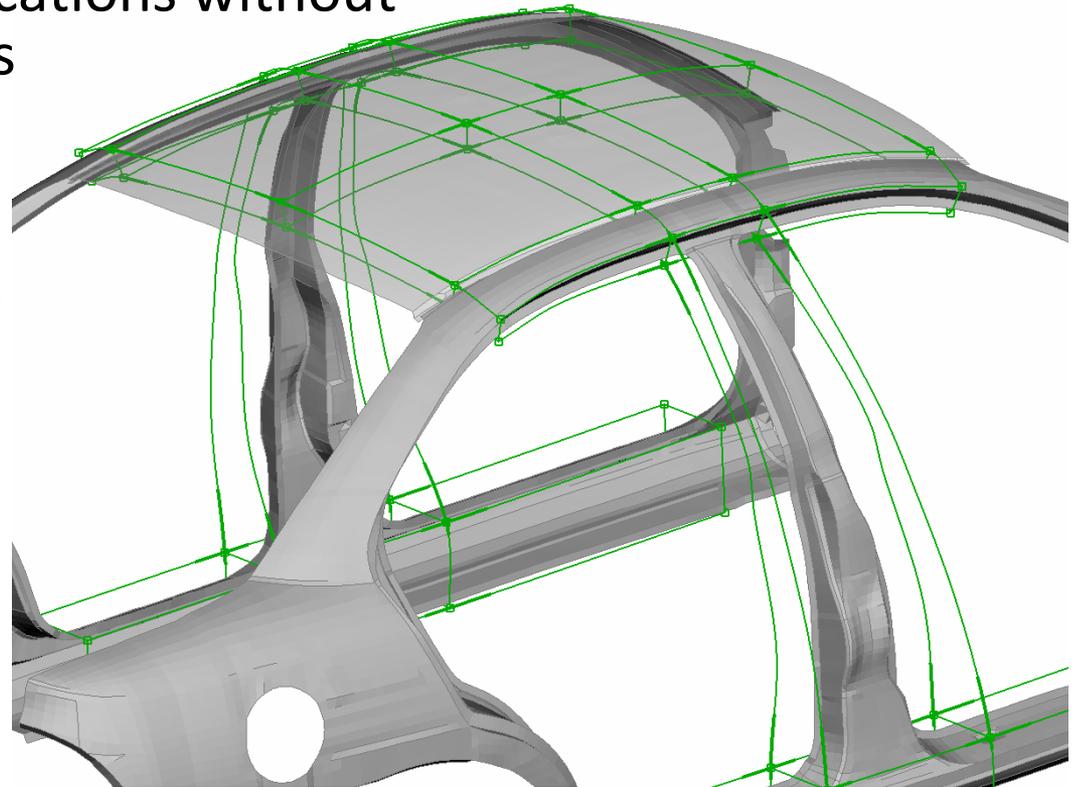


Box Morphing

Box in Box

- Separate groups of boxes handle different features
- Global and local modifications without excessive splits of boxes

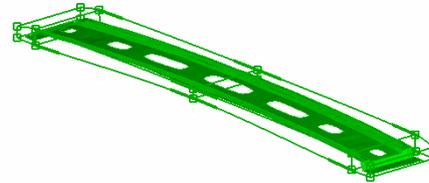
- Global: B-pillar position



Box Morphing

Box in Box

- Separate groups of boxes handle different features
- Global and local modifications without excessive splits of boxes



- Global: B-pillar position
- Local: cross member width

Box Morphing

Box in Box

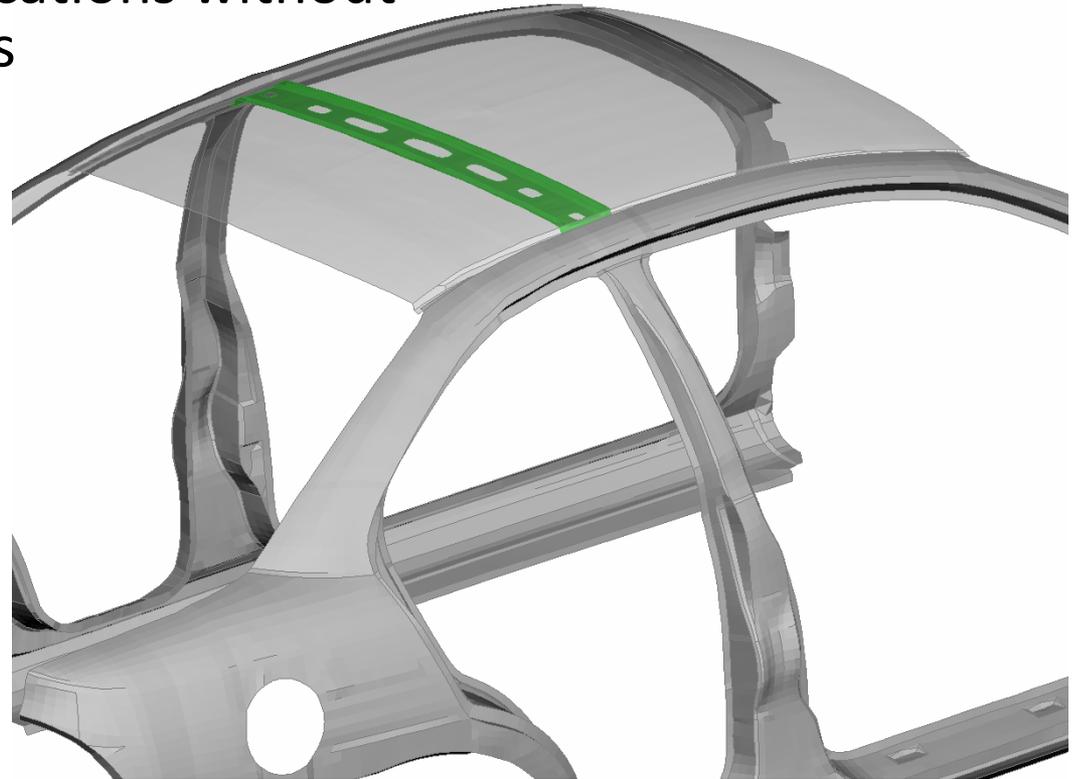
- Separate groups of boxes handle different features
- Global and local modifications without excessive splits of boxes



Box Morphing

Box in Box

- Separate groups of boxes handle different features
- Global and local modifications without excessive splits of boxes
- Global morphing



Box Morphing

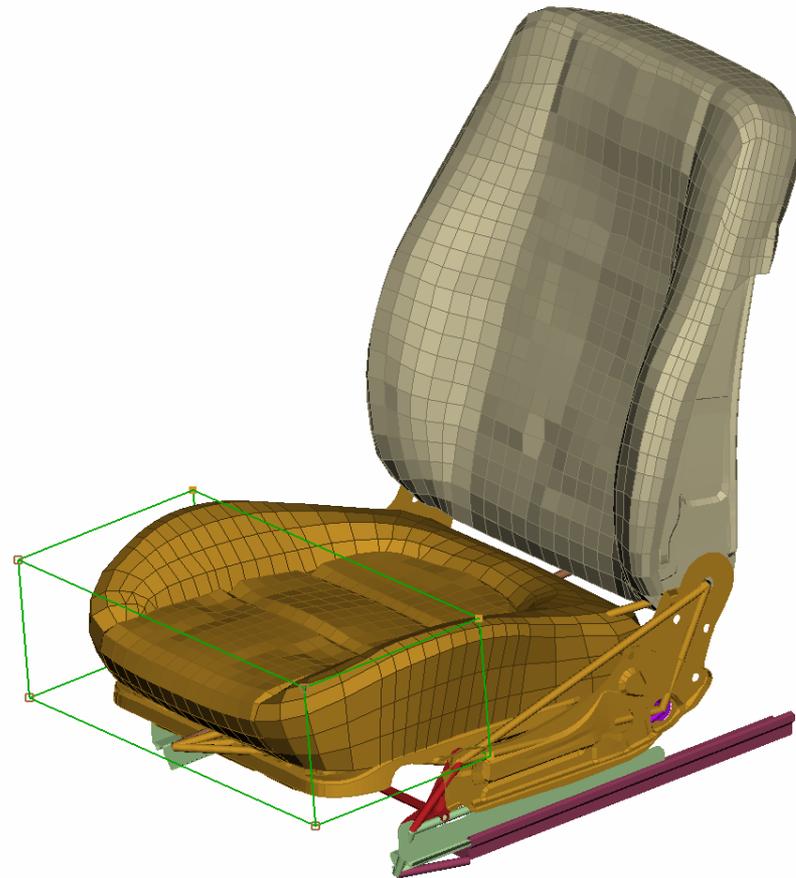
Box in Box

- Separate groups of boxes handle different features
- Global and local modifications without excessive splits of boxes

- Global morphing
- Local morphing



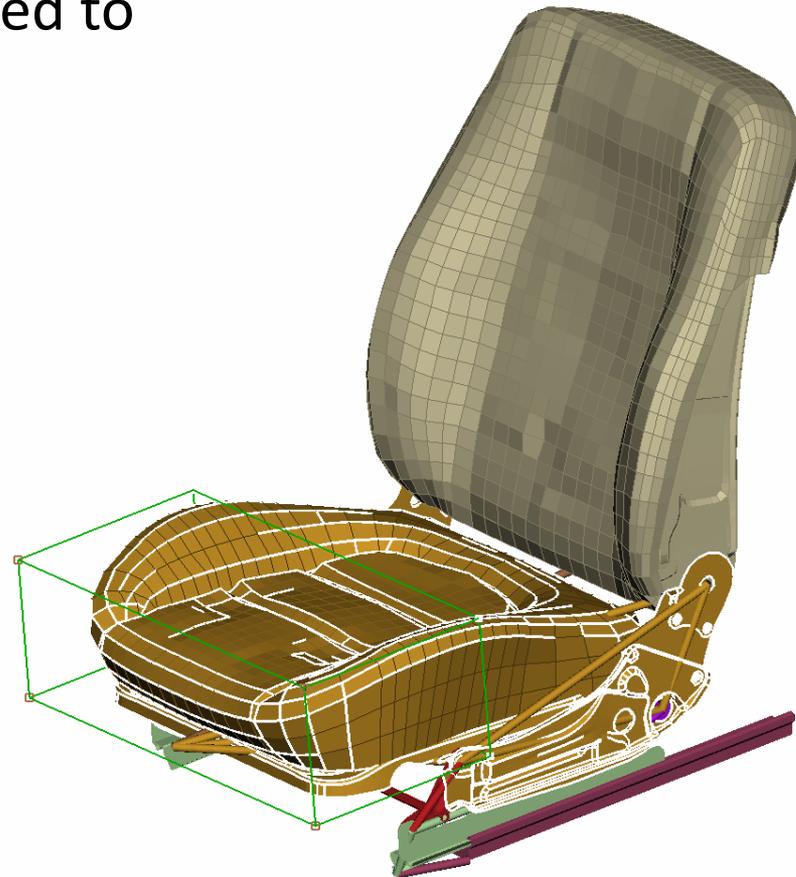
Box Morphing Coupled with Kinetics



Box Morphing

Coupled with Kinetics

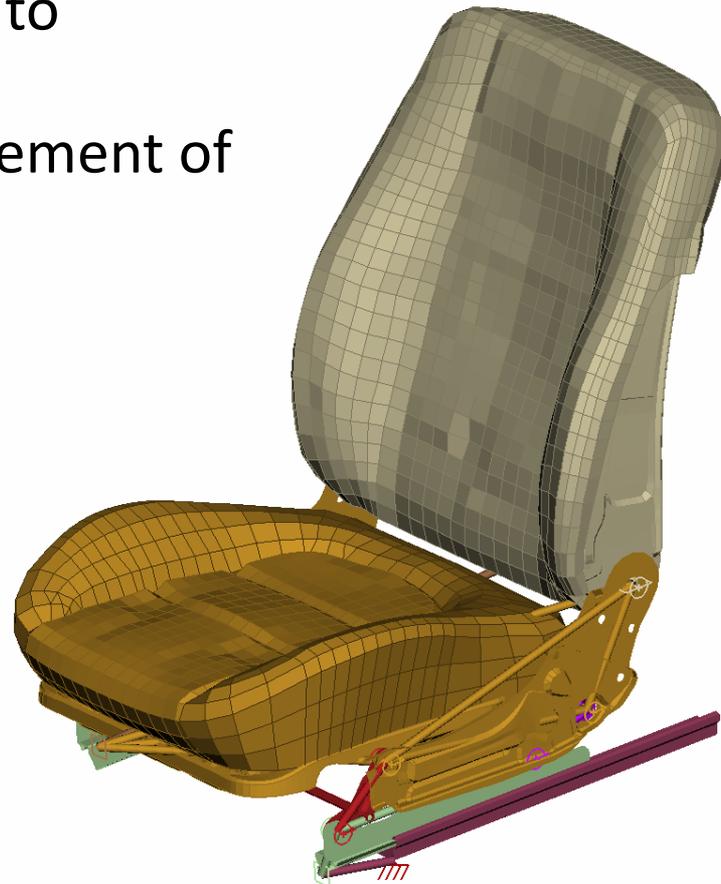
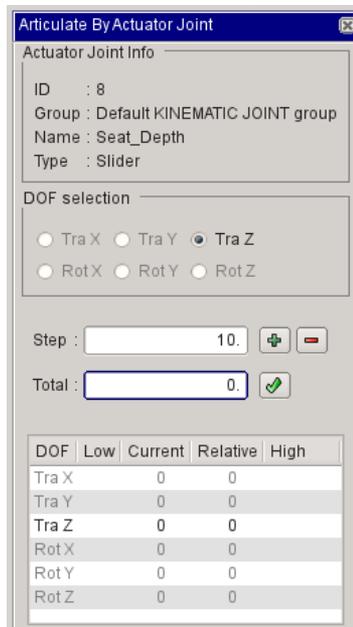
- Morph Control Points added to Kinetic Rigid Bodies



Box Morphing

Coupled with Kinetics

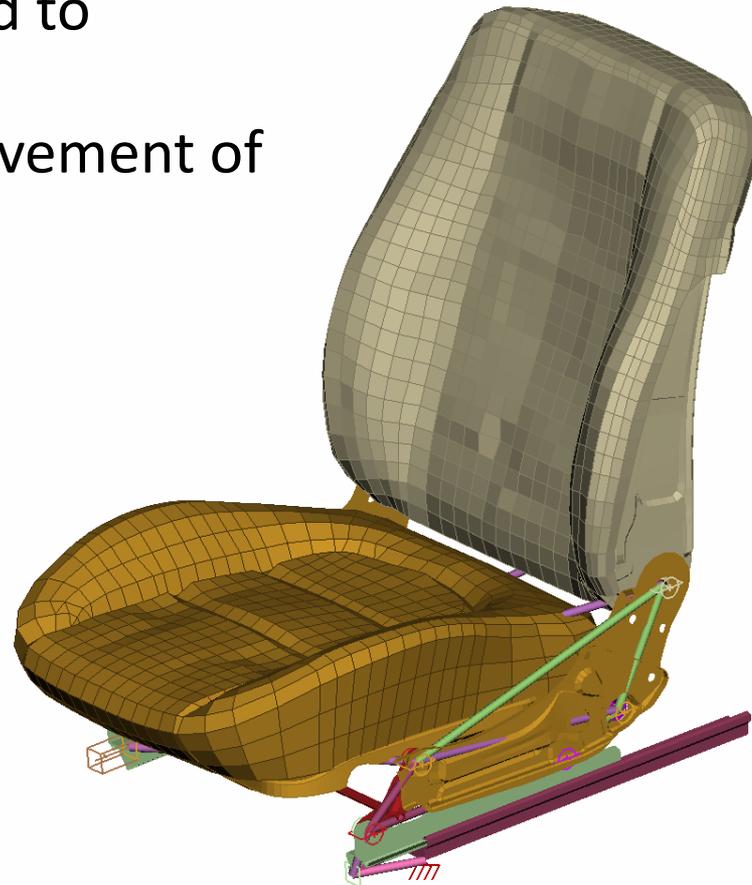
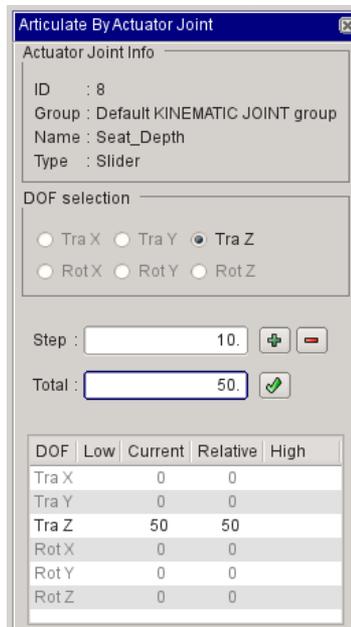
- Morph Control Points added to Kinetic Rigid Bodies
- Morphing controlled by movement of Rigid Bodies



Box Morphing

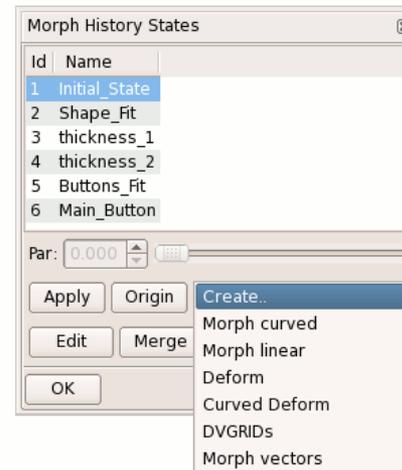
Coupled with Kinetics

- Morph Control Points added to Kinetic Rigid Bodies
- Morphing controlled by movement of Rigid Bodies



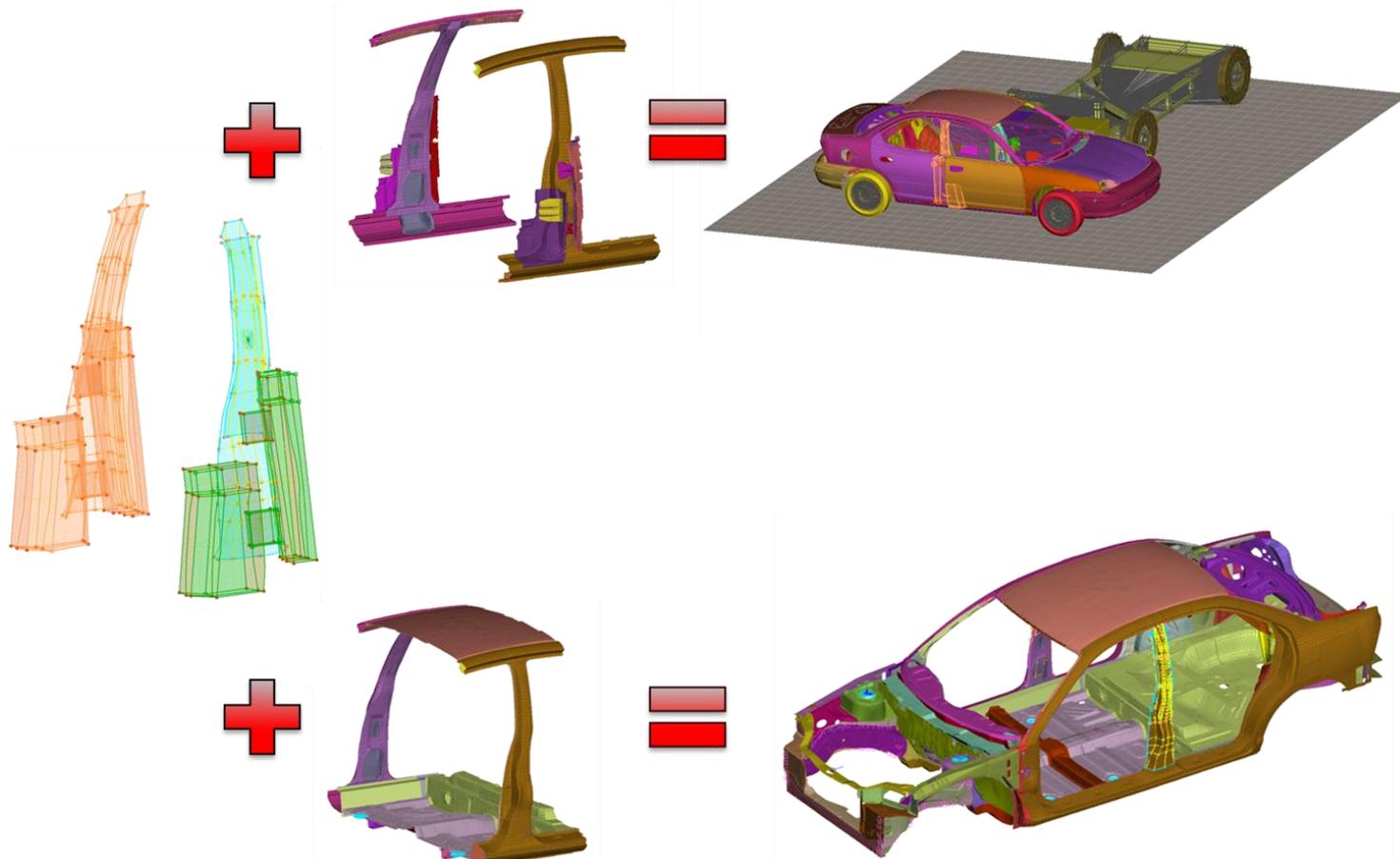
Box Morphing

Recording History



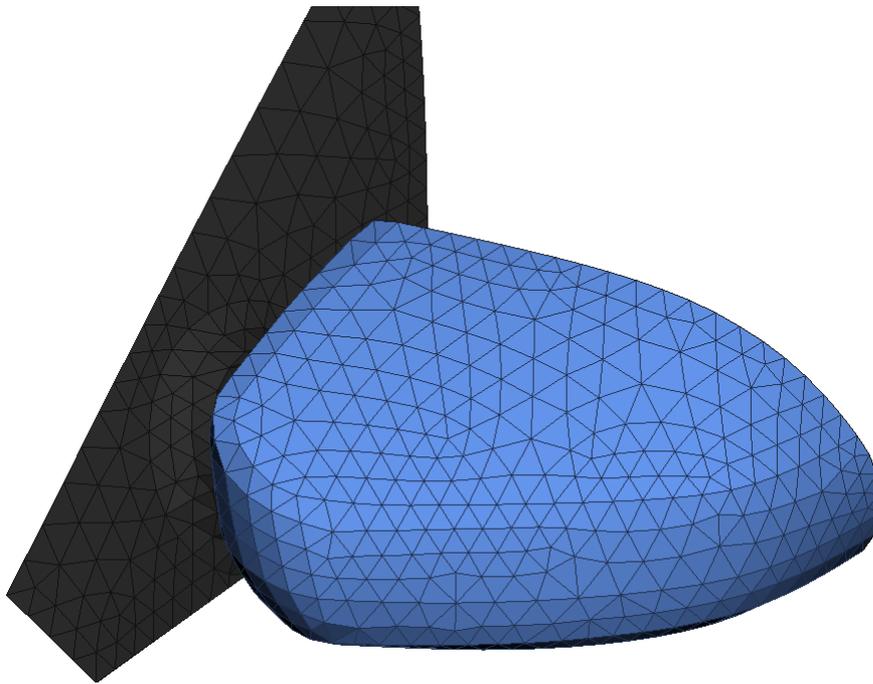
Box Morphing

Re-use of boxes and parameters for multiple models



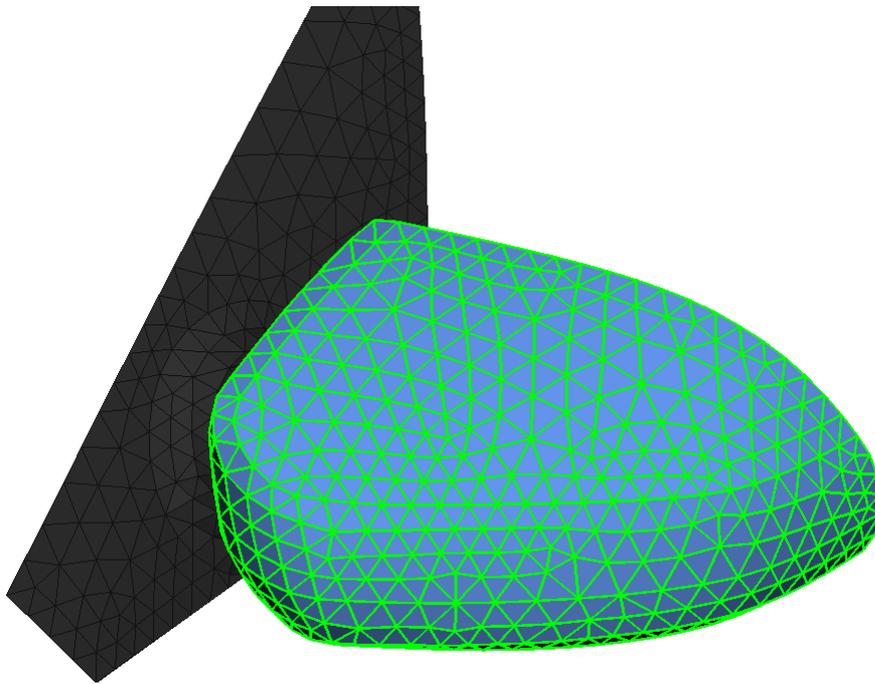
Direct Morphing

Translate, rotate or scale FE-mesh or Geometry entities



Direct Morphing

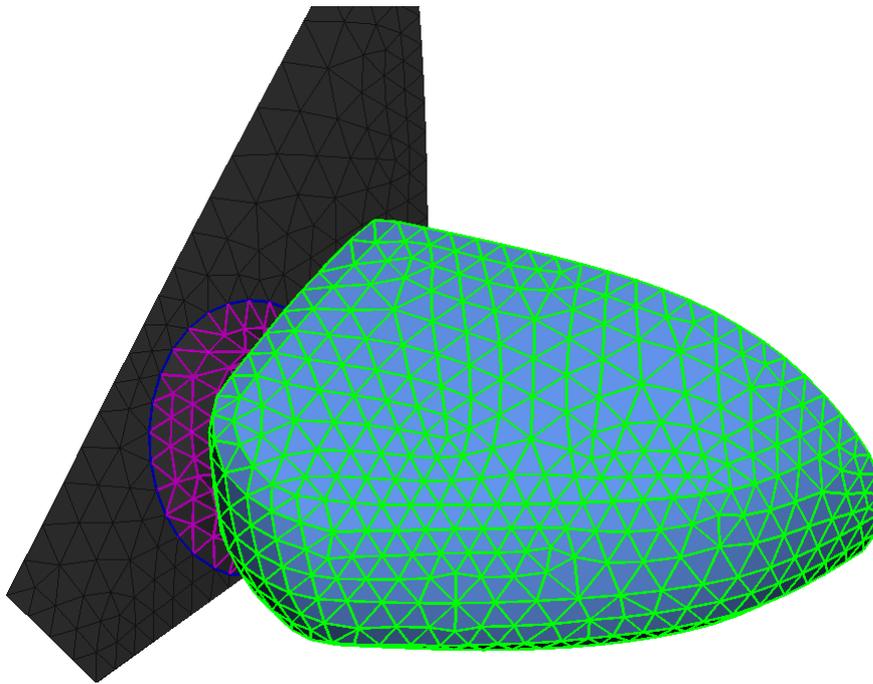
Translate, rotate or scale FE-mesh or Geometry entities



- Control Entities

Direct Morphing

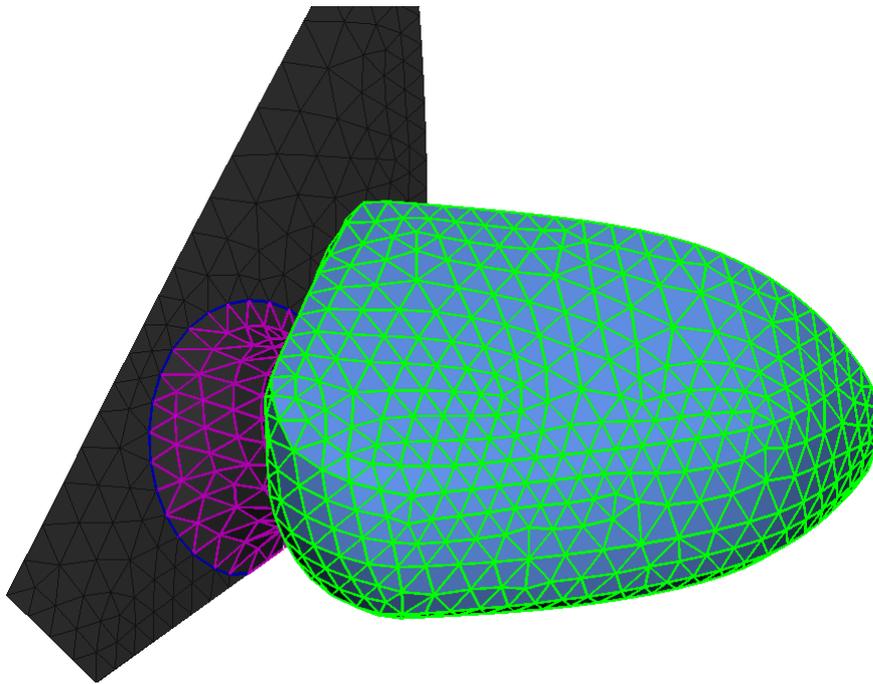
Translate, rotate or scale FE-mesh or Geometry entities



- Control Entities
- Morphed Entities
- Boundary

Direct Morphing

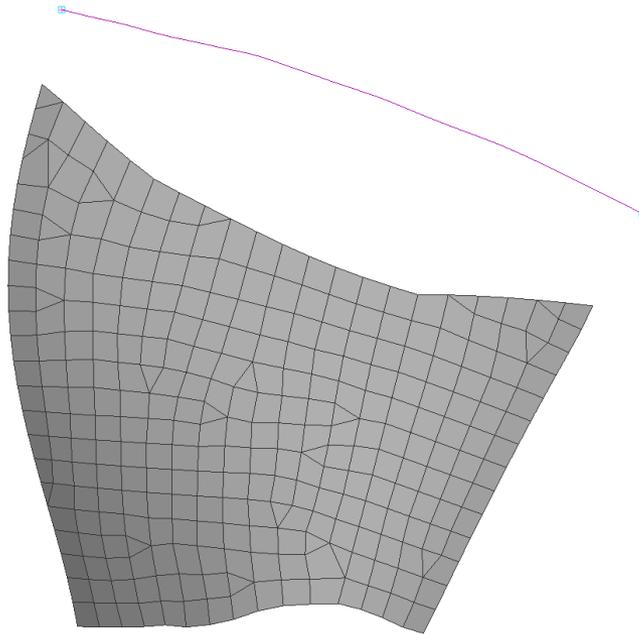
Translate, rotate or scale FE-mesh or Geometry entities



- Control Entities
- Morphed Entities
- Boundary
- Morphing

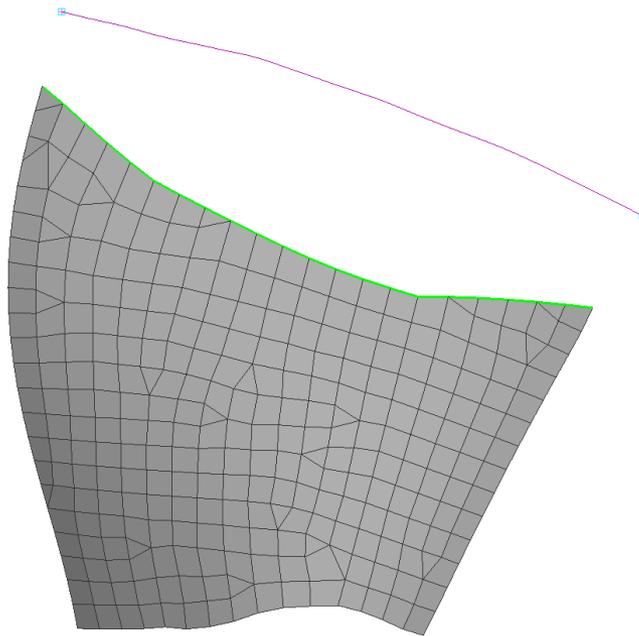
Direct Morphing

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



Direct Morphing

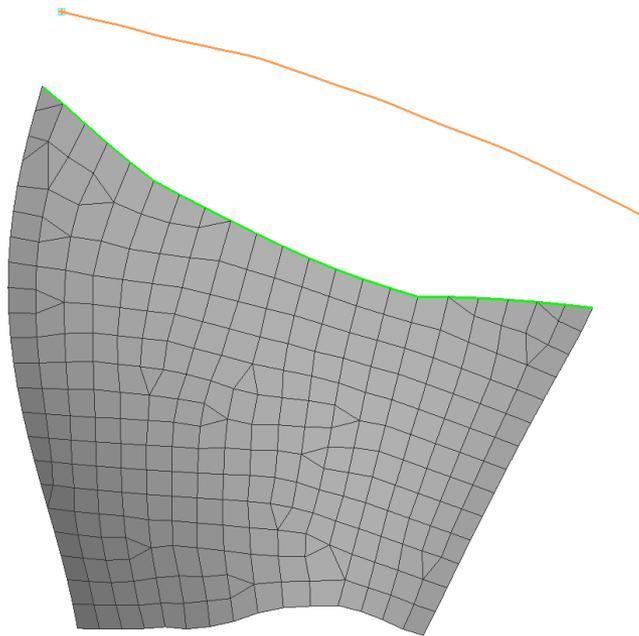
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin

Direct Morphing

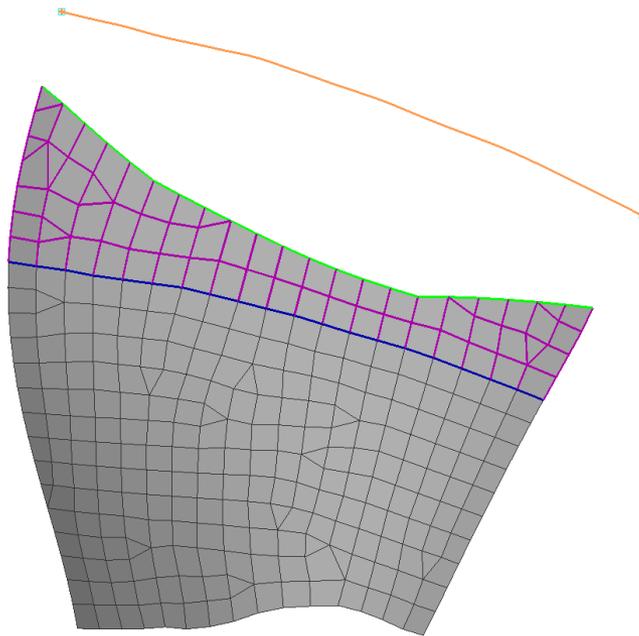
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target

Direct Morphing

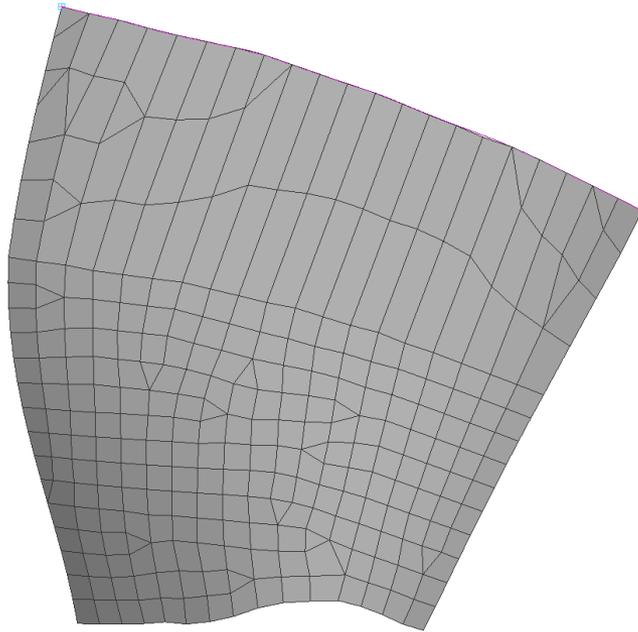
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target
- Morphed Entities
- Boundary

Direct Morphing

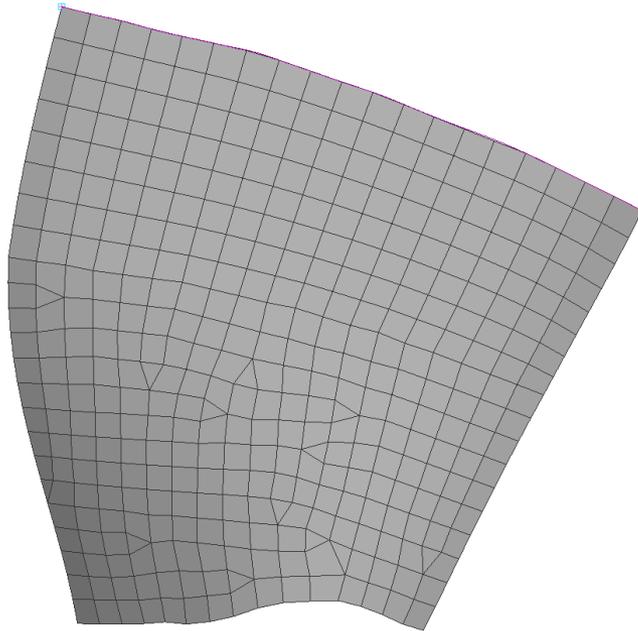
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target
- Morphed Entities
- Boundary
- Morphing

Direct Morphing

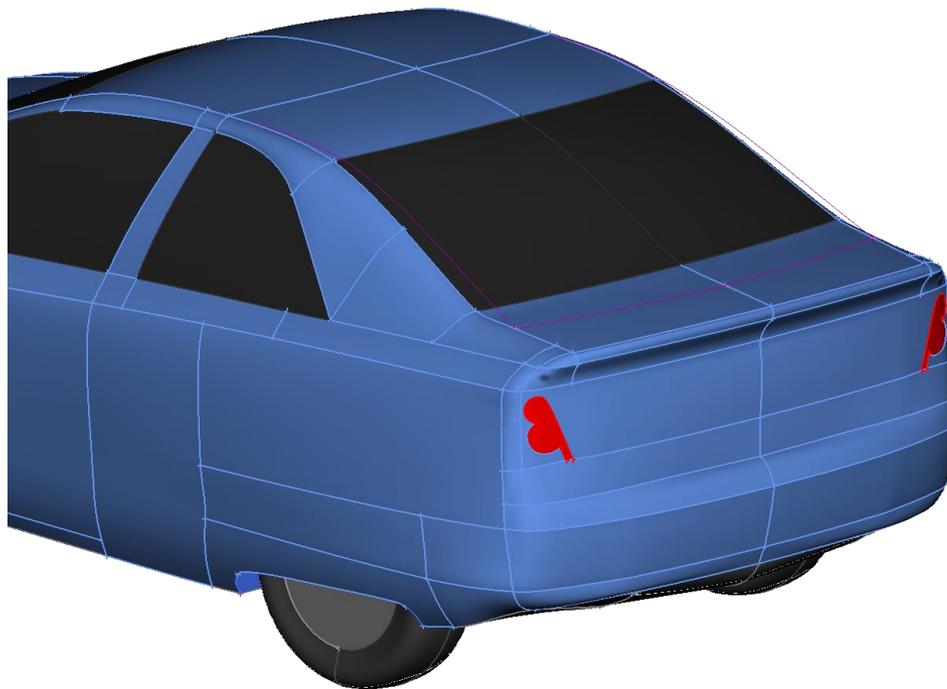
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target
- Morphed Entities
- Boundary
- Morphing
- Reconstruct of morphed area

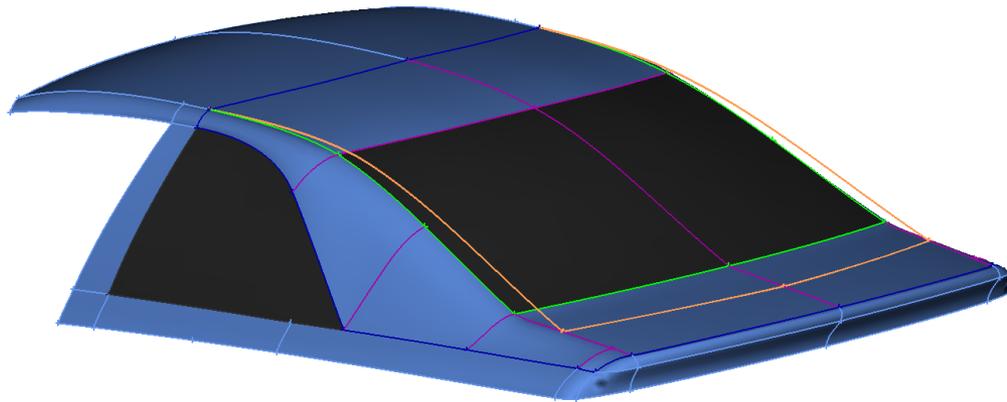
Direct Morphing

Snap FE or geometry edges to single or multiple target curves



Direct Morphing

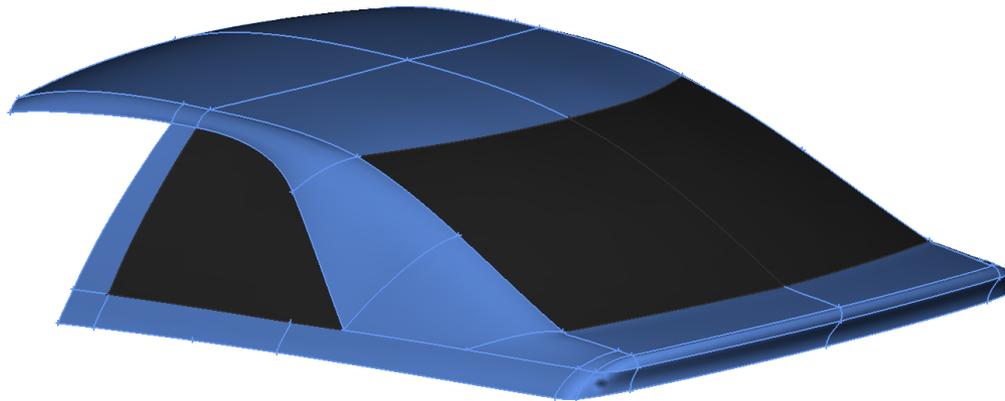
Snap FE or **geometry** edges to single or **multiple** target curves



- Origin
- Target
- Morphed Entities
- Boundary

Direct Morphing

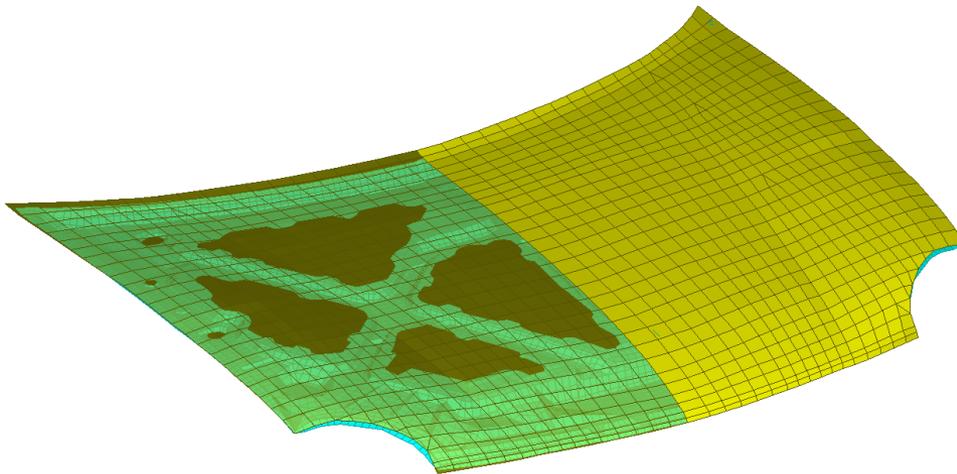
Snap FE or **geometry** edges to single or **multiple** target curves



- Origin
- Target
- Morphed Entities
- Boundary
- Morphing

Direct Morphing

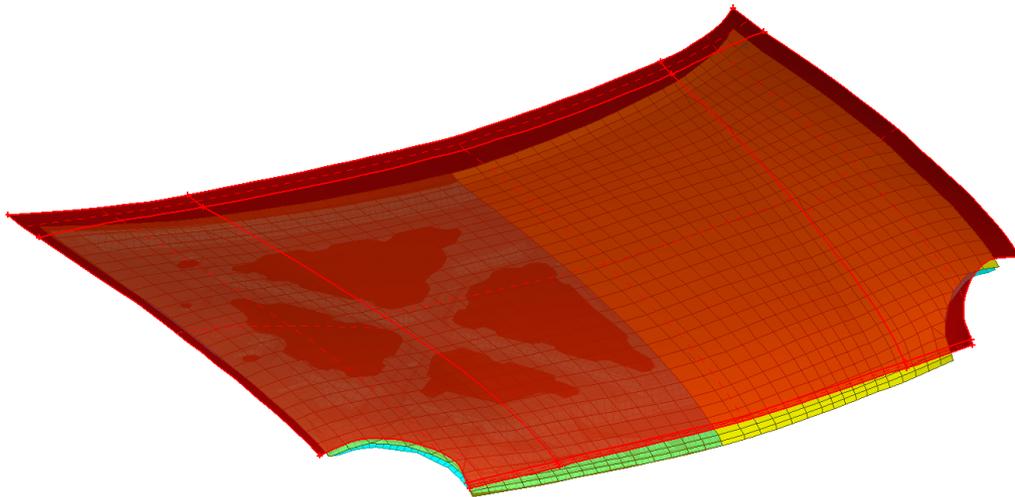
Fit surfaces – e.g. fit existing FE-mesh onto new CAD-geometry



- Original FE-surface (with additional underlying parts)

Direct Morphing

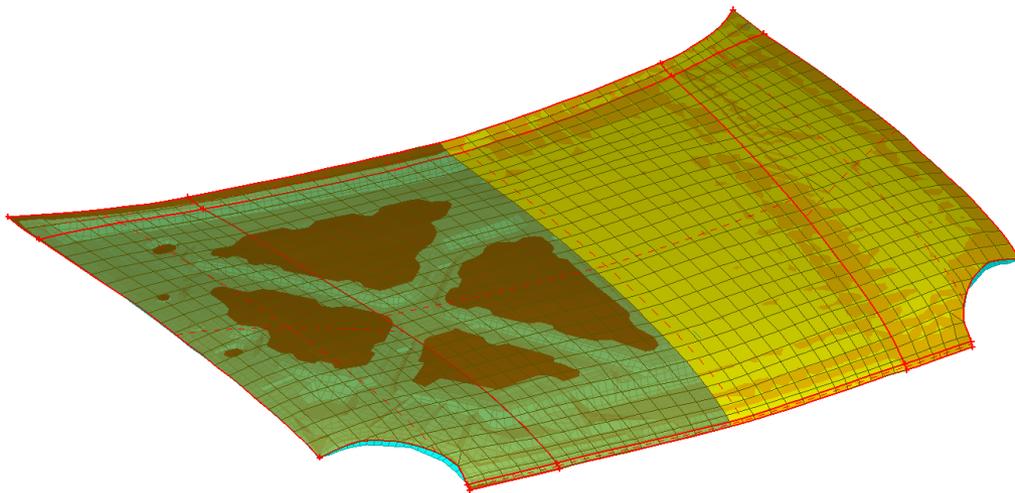
Fit surfaces – e.g. fit existing FE-mesh onto new CAD-geometry



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

Direct Morphing

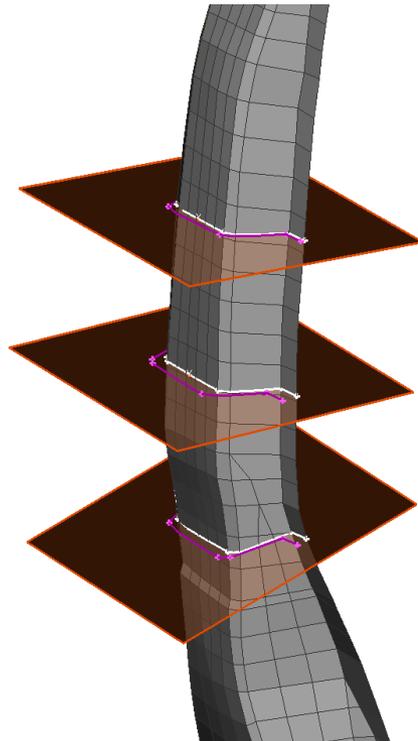
Fit surfaces – e.g. fit existing FE-mesh onto new CAD-geometry



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

Direct Morphing

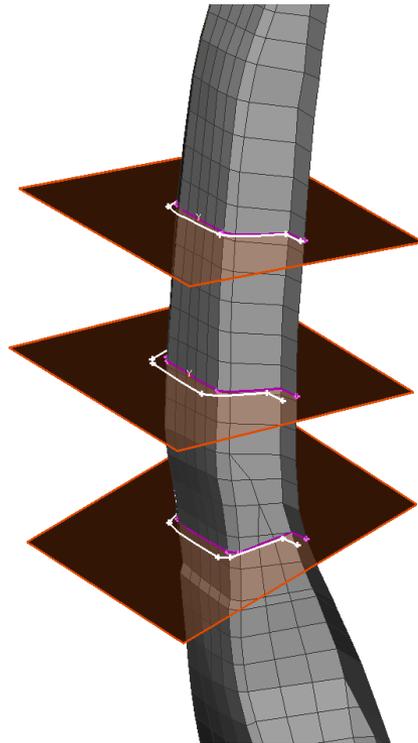
Fit cross sections (applicable on FE-mesh and geometry)



- Original cross section

Direct Morphing

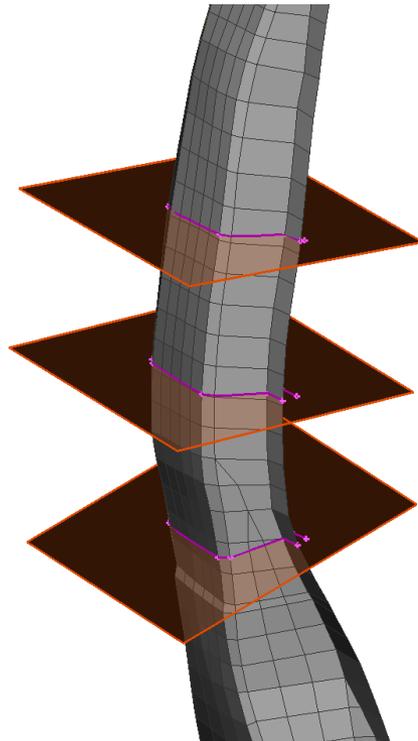
Fit cross sections (applicable on FE-mesh and geometry)



- Original cross section
- Target cross section

Direct Morphing

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

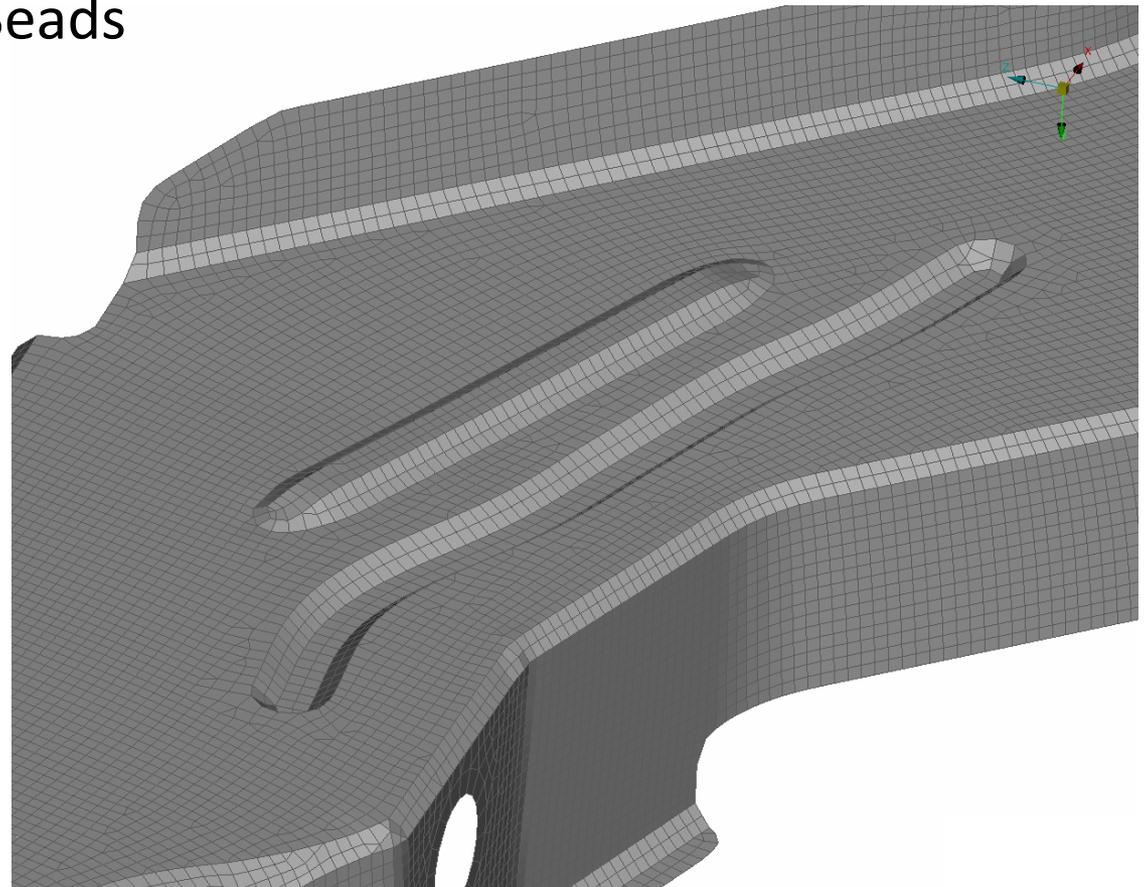
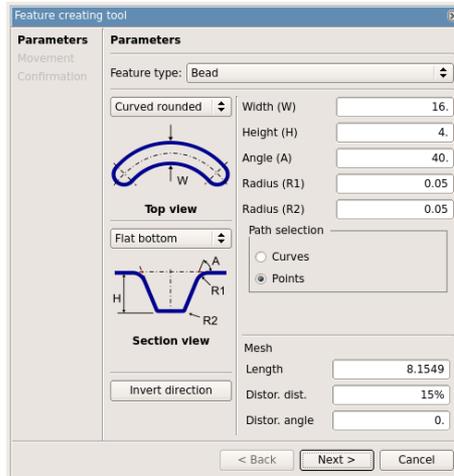


- Original cross section
- Target cross section
- Morphing

Direct Morphing

Generation & modification of beads and embosses

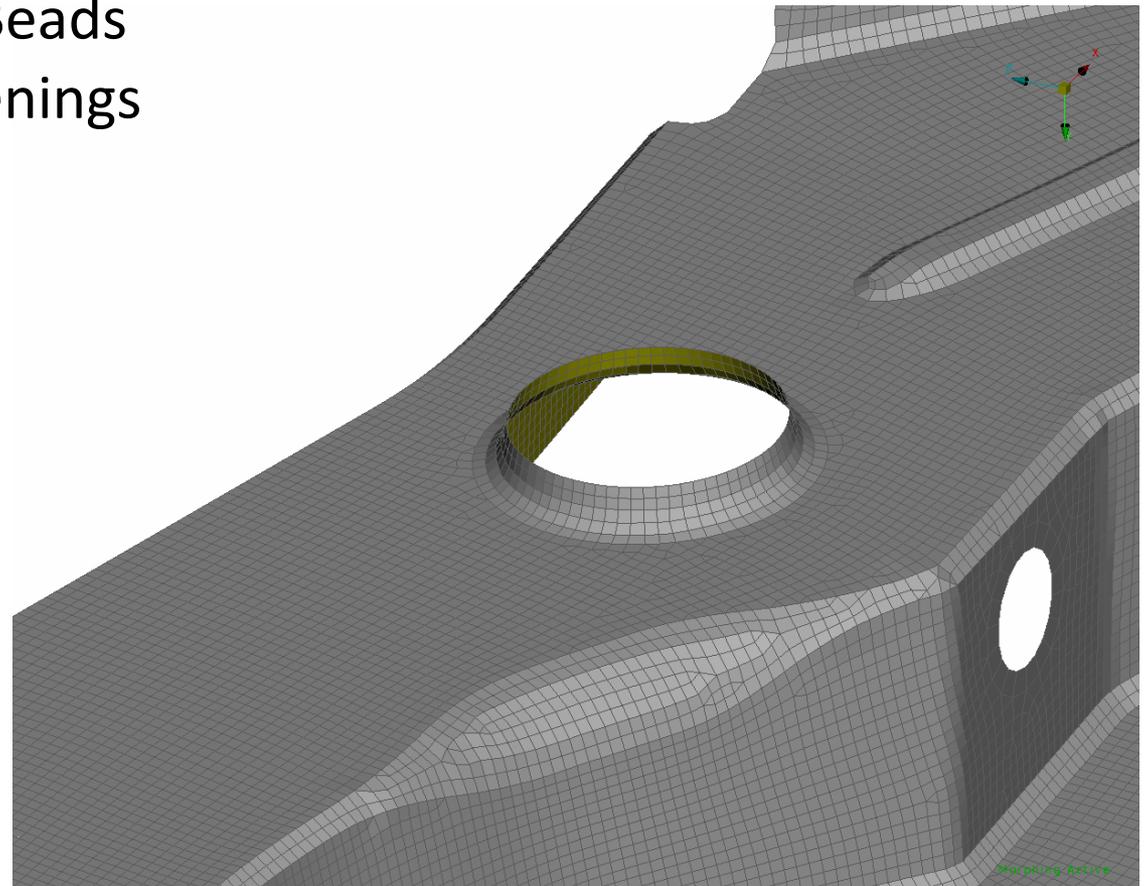
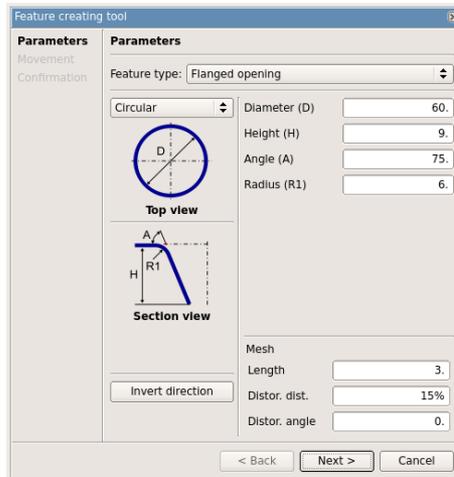
- Curved & Rounded Beads



Direct Morphing

Generation & modification of beads and embosses

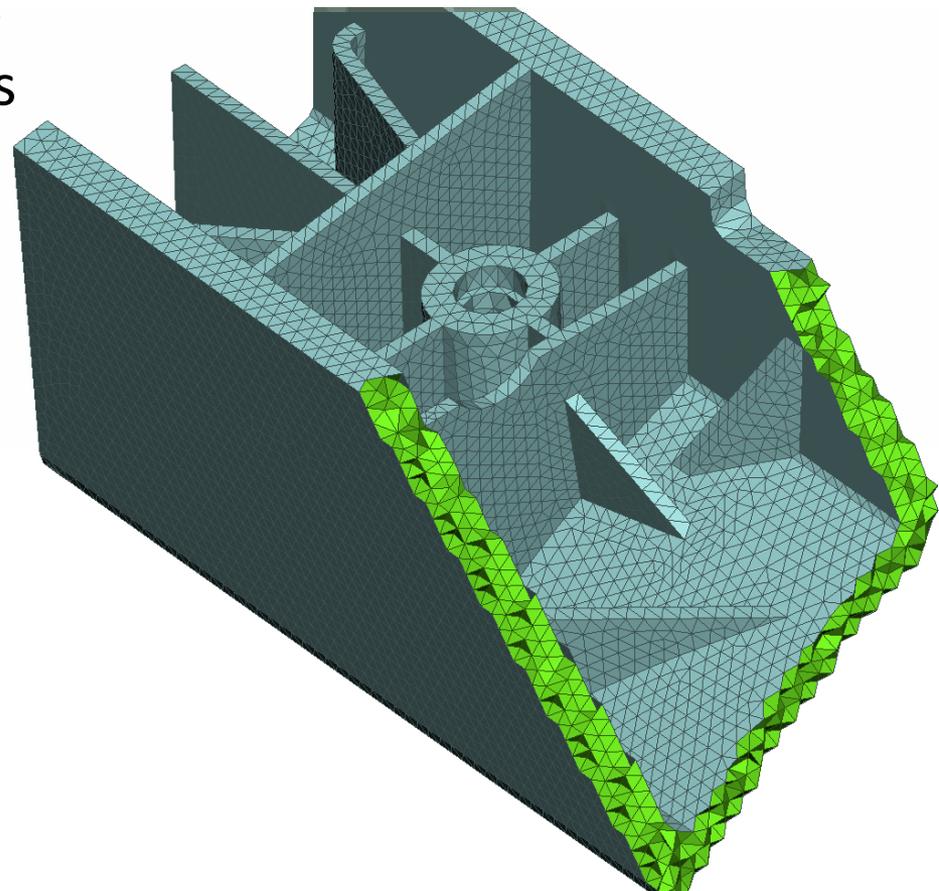
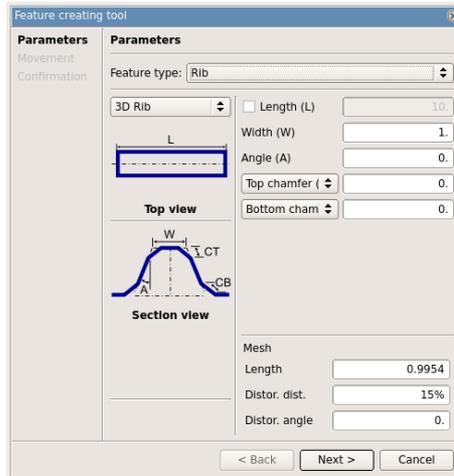
- Curved & Rounded Beads
- Circular Flanged Openings



Direct Morphing

Generation & modification of beads and embosses

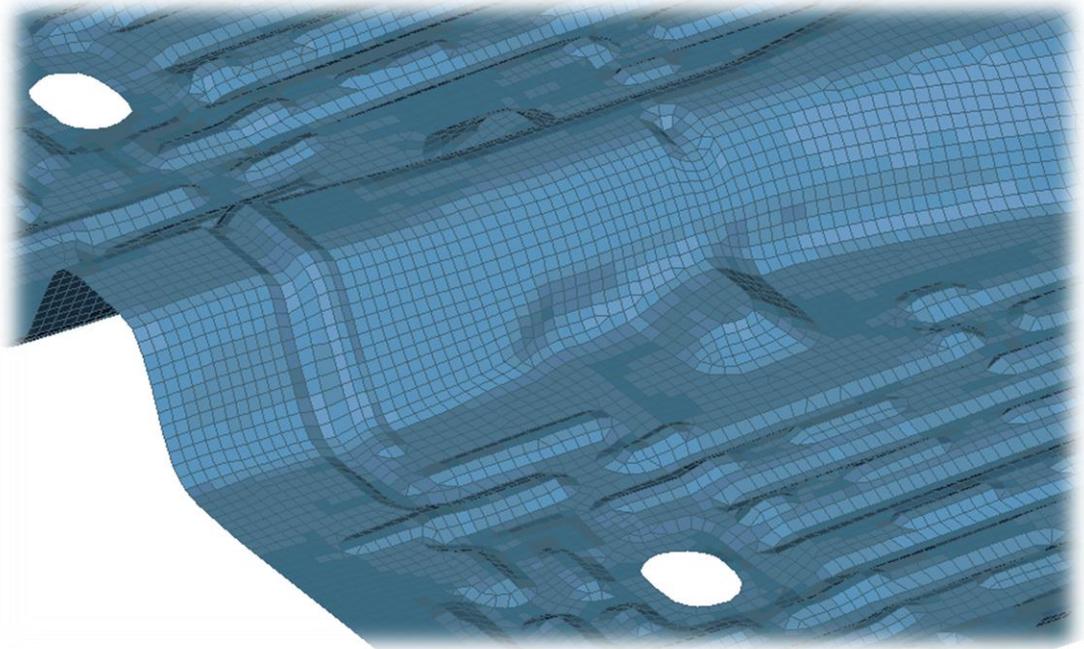
- Curved & Rounded Beads
- Circular Flanged Openings
- Shell or Solid Ribs



Direct Morphing

Slide Feature

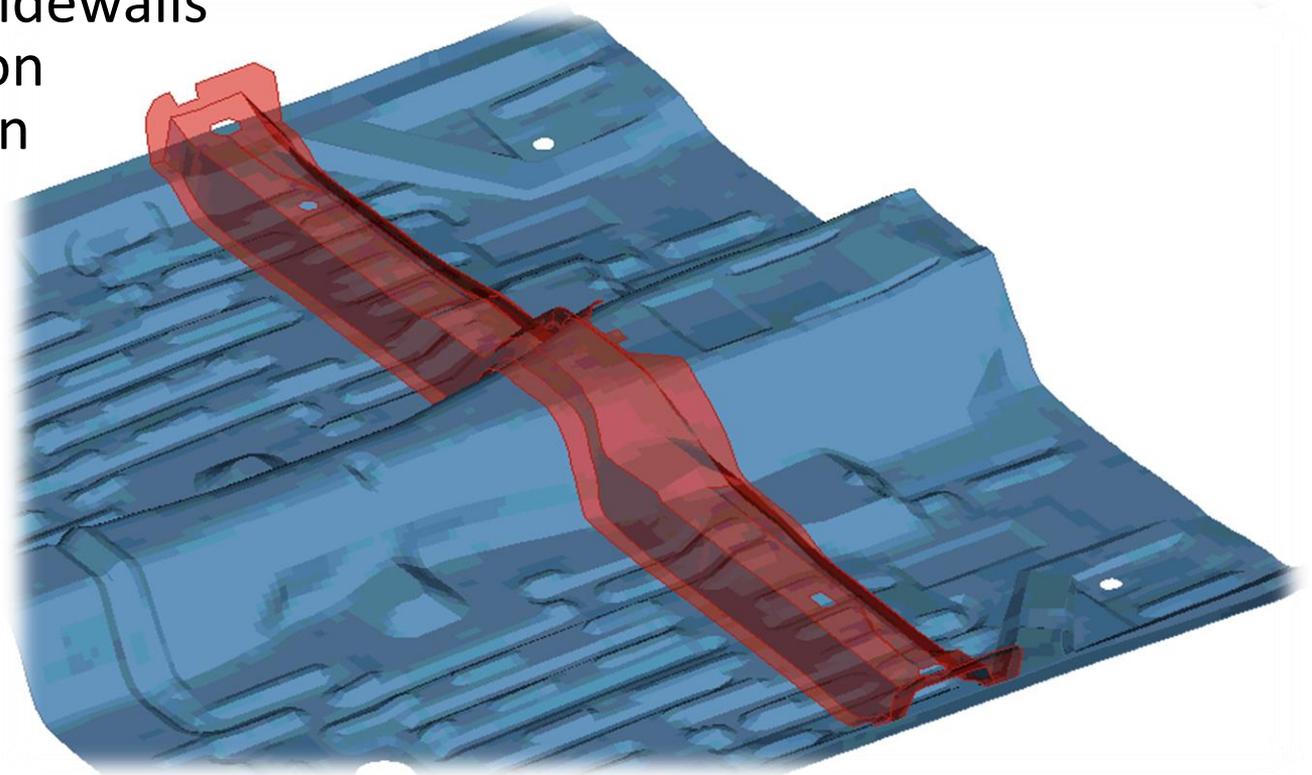
- Features of any shape (e.g. holes, beads, ribs) slide on underlying surface
- Mesh of origin and target areas is reconstructed
- Features are moved or copied



Direct Morphing

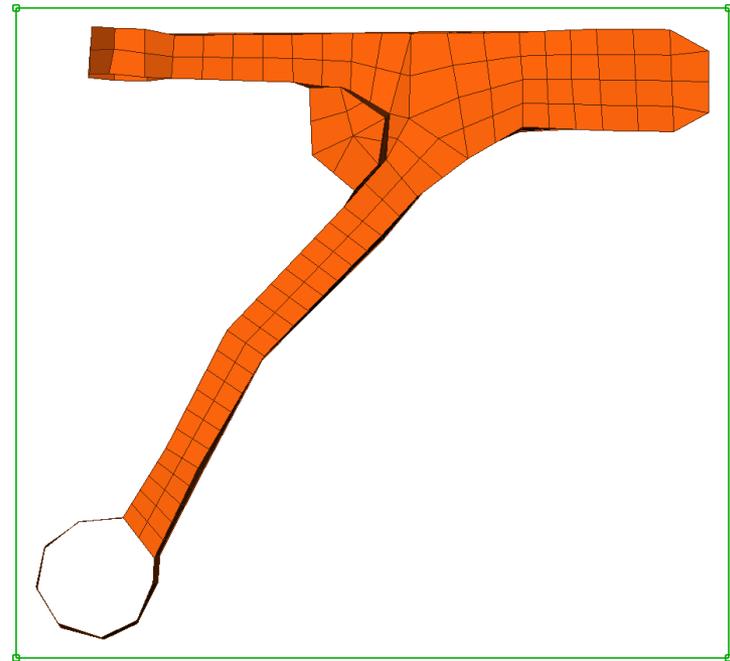
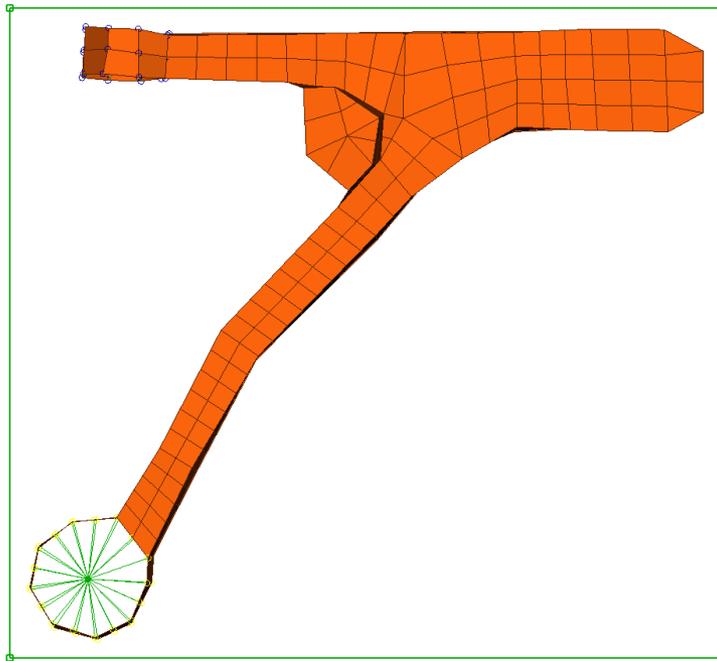
Slide Member

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



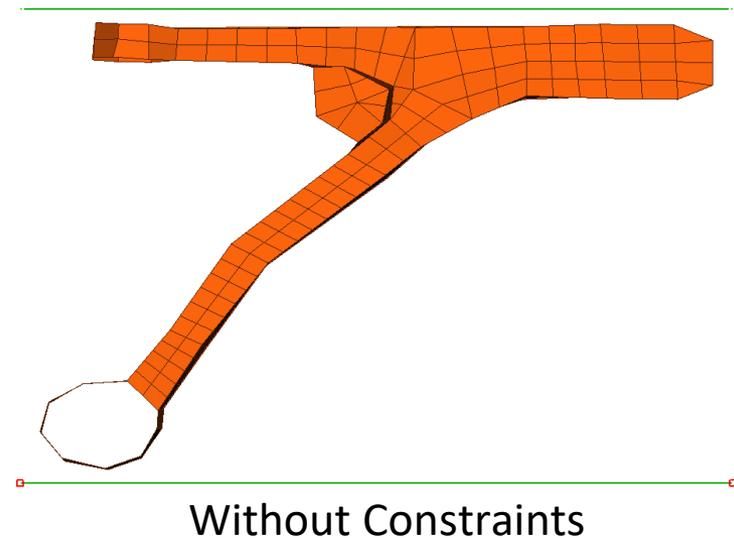
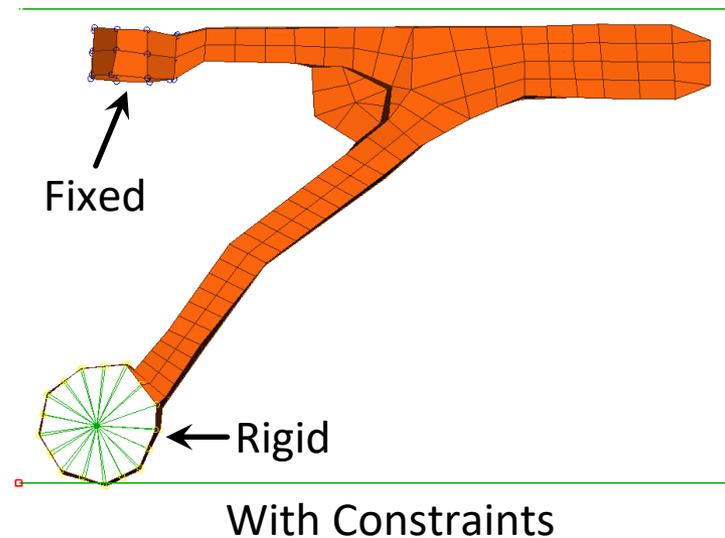
Morphing Constraints

- Nested Elements for Box and Direct Morphing
- Additional Constraints (e.g. Planar, Rigid, Path Follower) for DFM
- Freeze, rigidize, constrain feature-movement during morphing



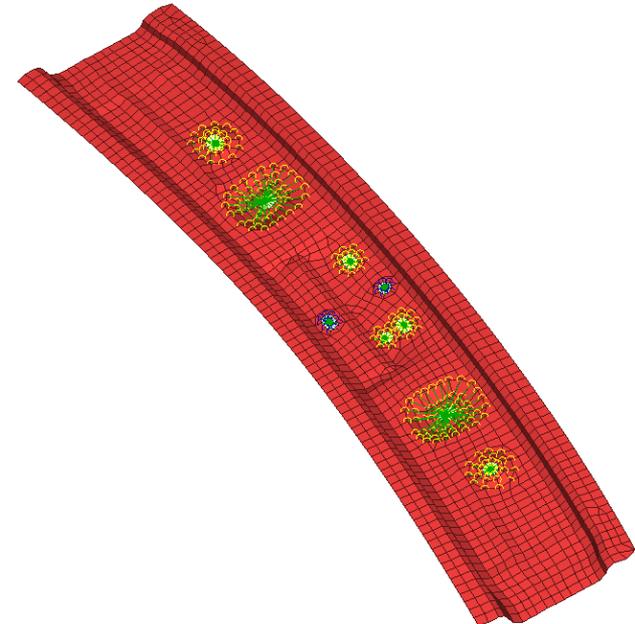
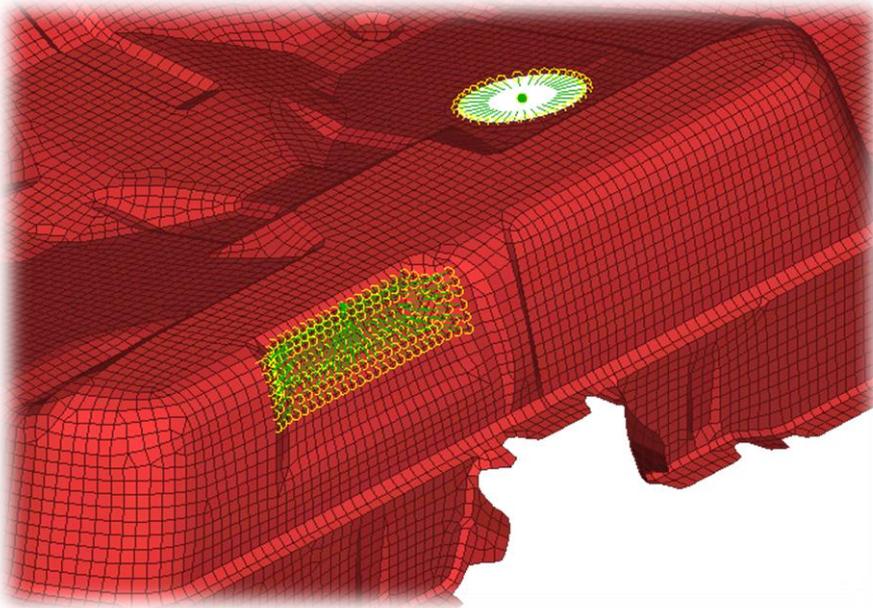
Morphing Constraints

- Nested Elements for Box and Direct Morphing
- Additional Constraints (e.g. Planar, Rigid, Path Follower) for DFM
- Freeze, rigidize, constrain feature-movement during morphing



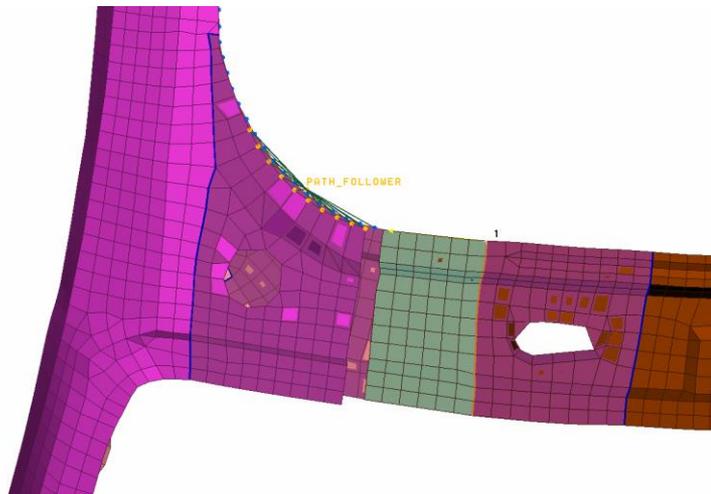
Morphing Constraints

- Nested Elements for Box and Direct Morphing
- Additional Constraints (e.g. Planar, Rigid, Path Follower) for DFM
- Freeze, rigidize, constrain feature-movement during morphing

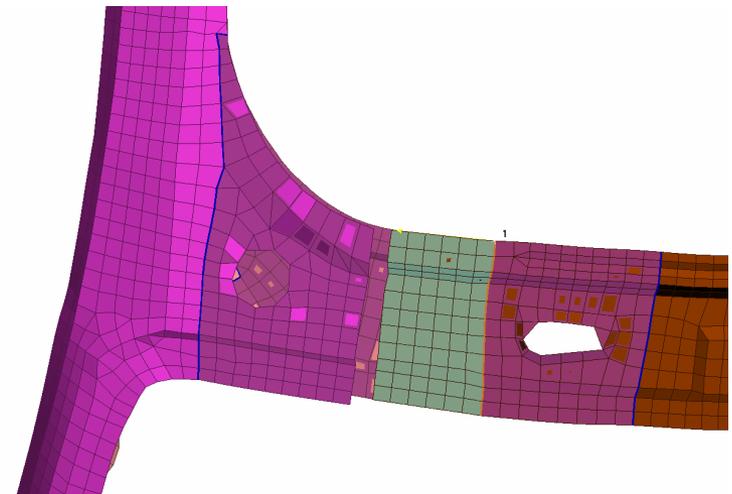


Morphing Constraints

- Nested Elements for Box and Direct Morphing
- Additional Constraints (e.g. Planar, Rigid, Path Follower) for DFM
- Freeze, rigidize, constrain feature-movement during morphing



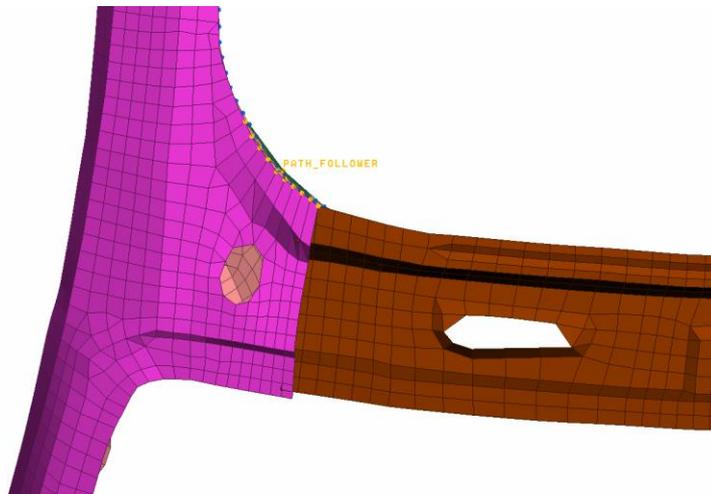
With Path Follower



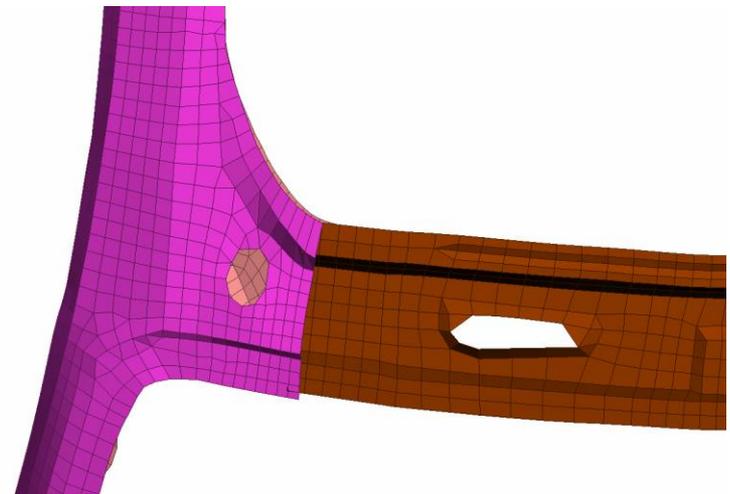
Without Constraint

Morphing Constraints

- Nested Elements for Box and Direct Morphing
- Additional Constraints (e.g. Planar, Rigid, Path Follower) for DFM
- Freeze, rigidize, constrain feature-movement during morphing



With Path Follower

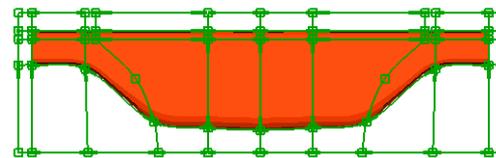


Without Constraint

Record Morphing Actions

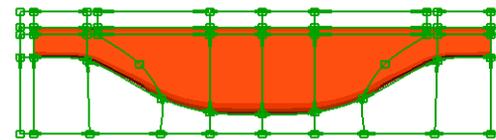
Deformation Parameter

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

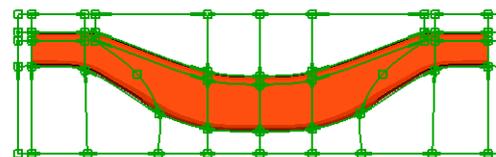


Initial shape – start recording

Edge Fit



Move Free

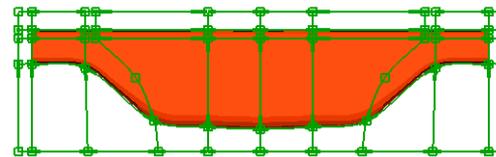


Deformed shape – stop recording

Record Morphing Actions

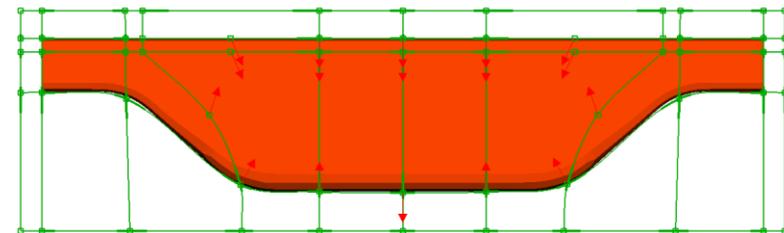
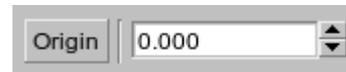
Deformation Parameter

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

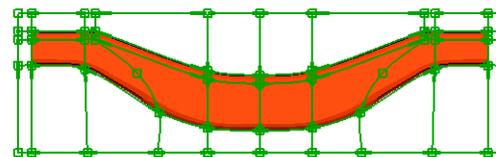


Initial shape – start recording

**Deformation
Parameter**



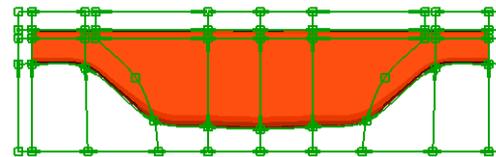
Deformed shape – stop recording



Record Morphing Actions

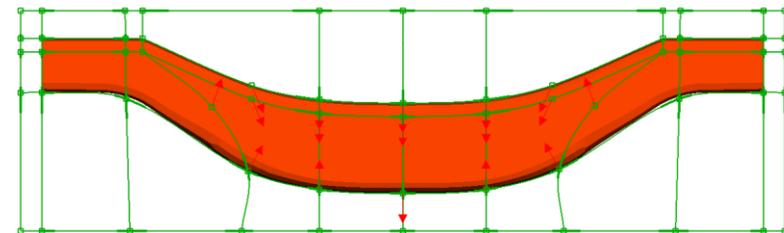
Deformation Parameter

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

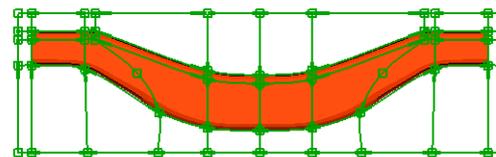


Initial shape – start recording

**Deformation
Parameter**

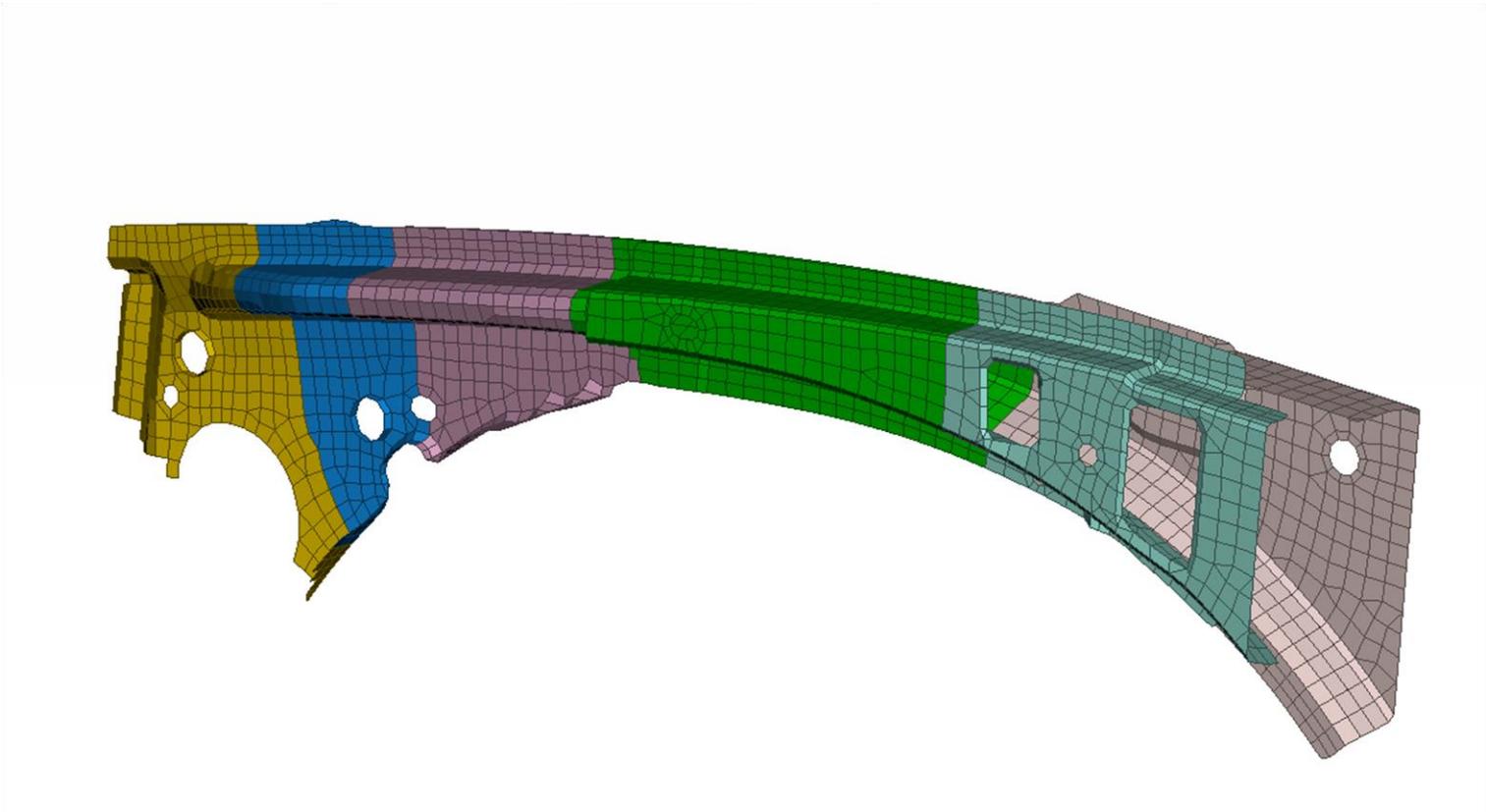


Deformed shape – stop recording



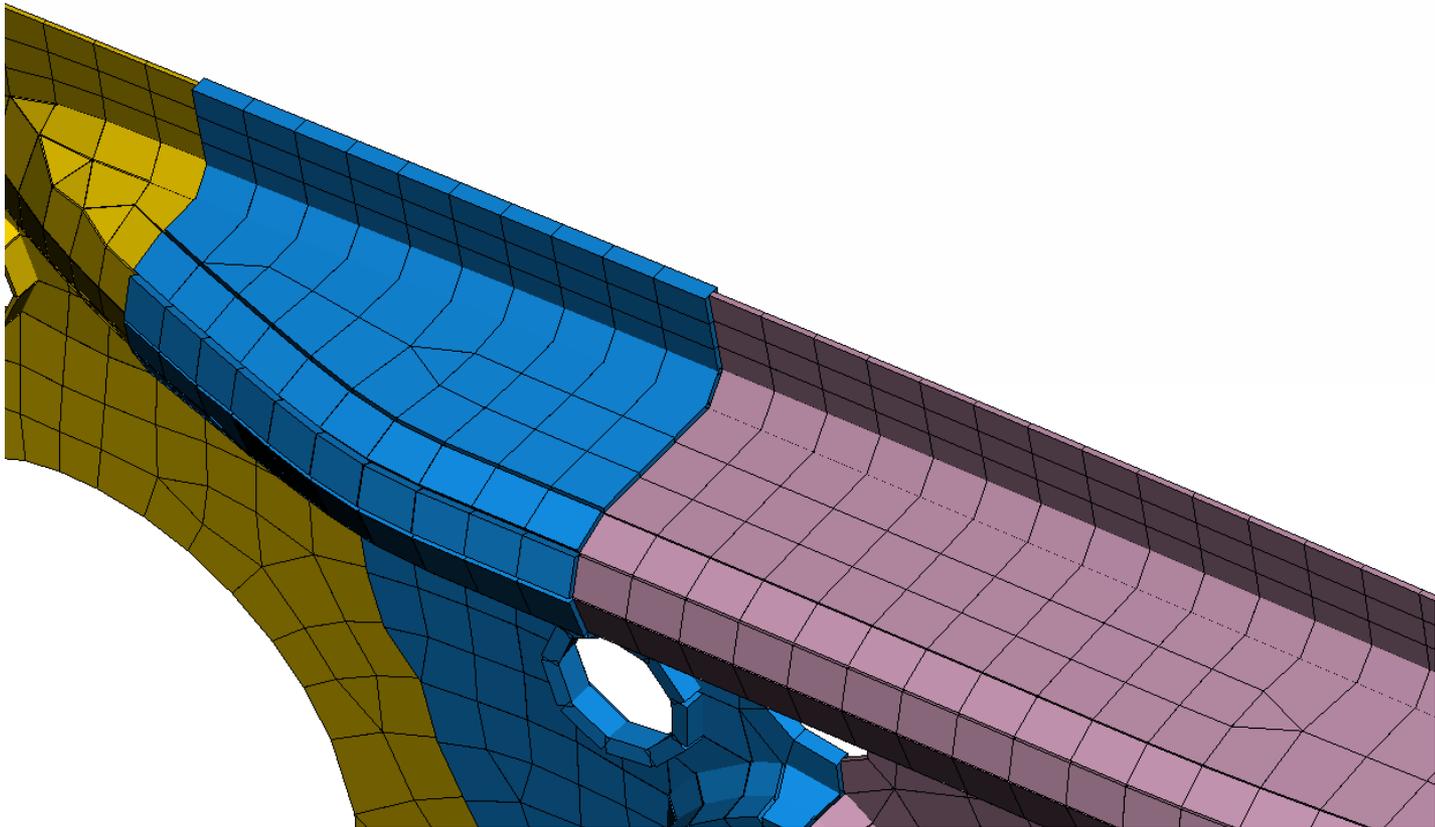
Taylor Welded Blanks Parameter

Parameterization and Optimization of Taylor Blanks



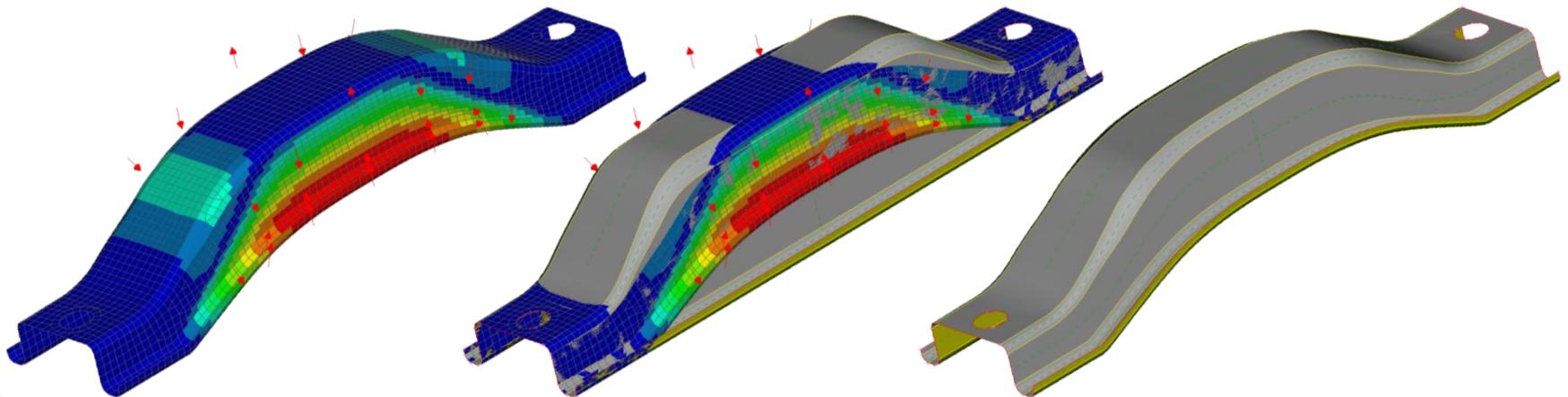
Taylor Welded Blanks Parameter

Parameterization and Optimization of Taylor Blanks



Mapping of Deformations

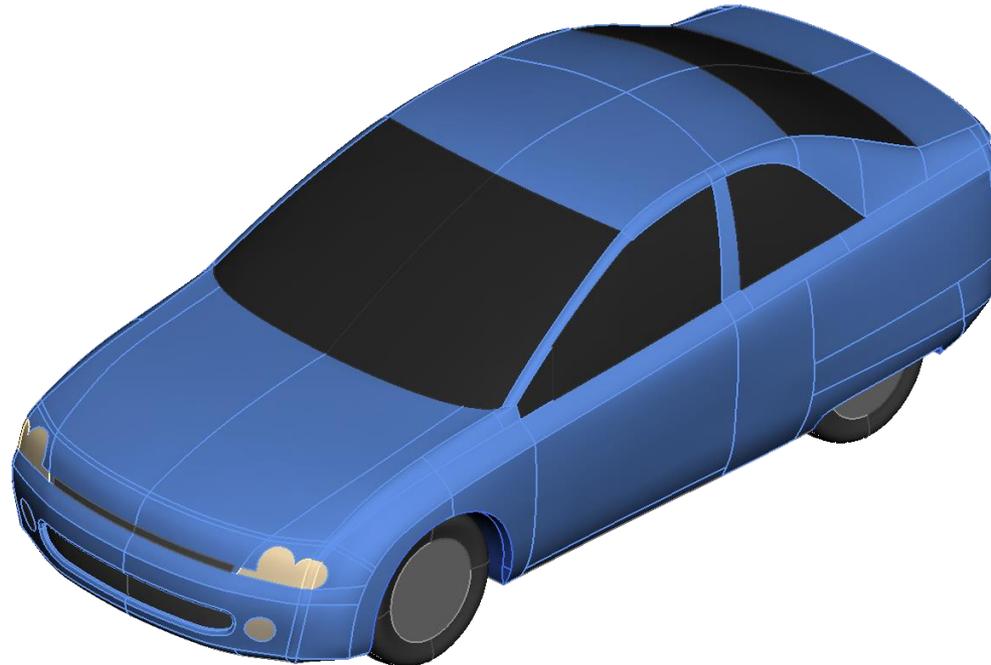
- Morph according existing deformation field:
 - Deformation Parameter
 - History States
 - DESVAR of Nastran SOL 200
 - Text file
- E.g. Modify geometry according optimized FE-model



Functionalities assisting Morphing

3D Points and Curves

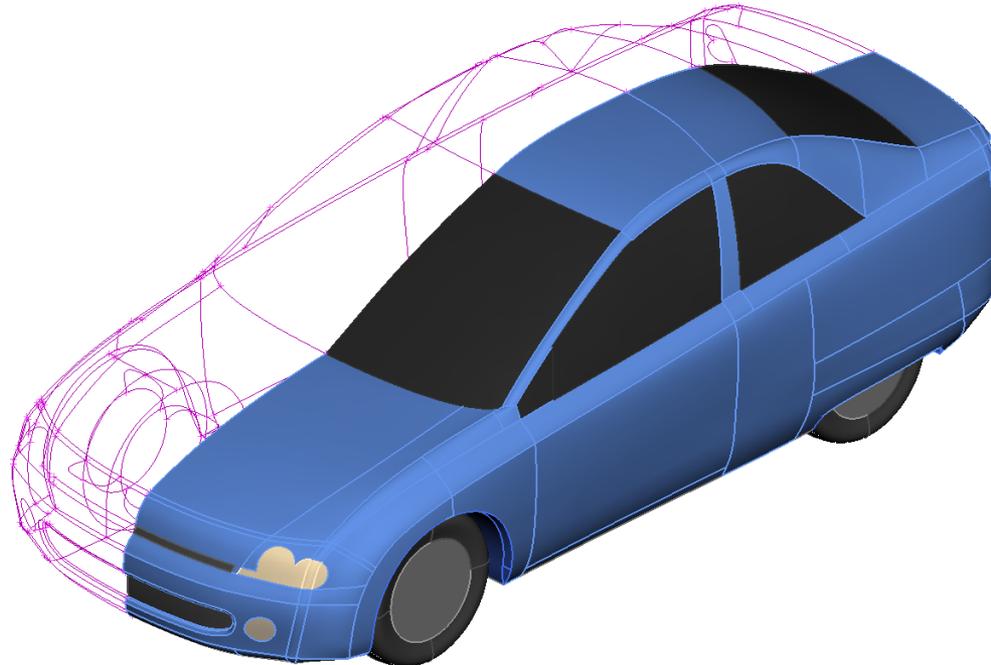
- Act as initial or target positions for fittings
- Suitable for Box and Direct Morphing
- Obtained from FE mesh or CAD geometry



Functionalities assisting Morphing

3D Points and Curves

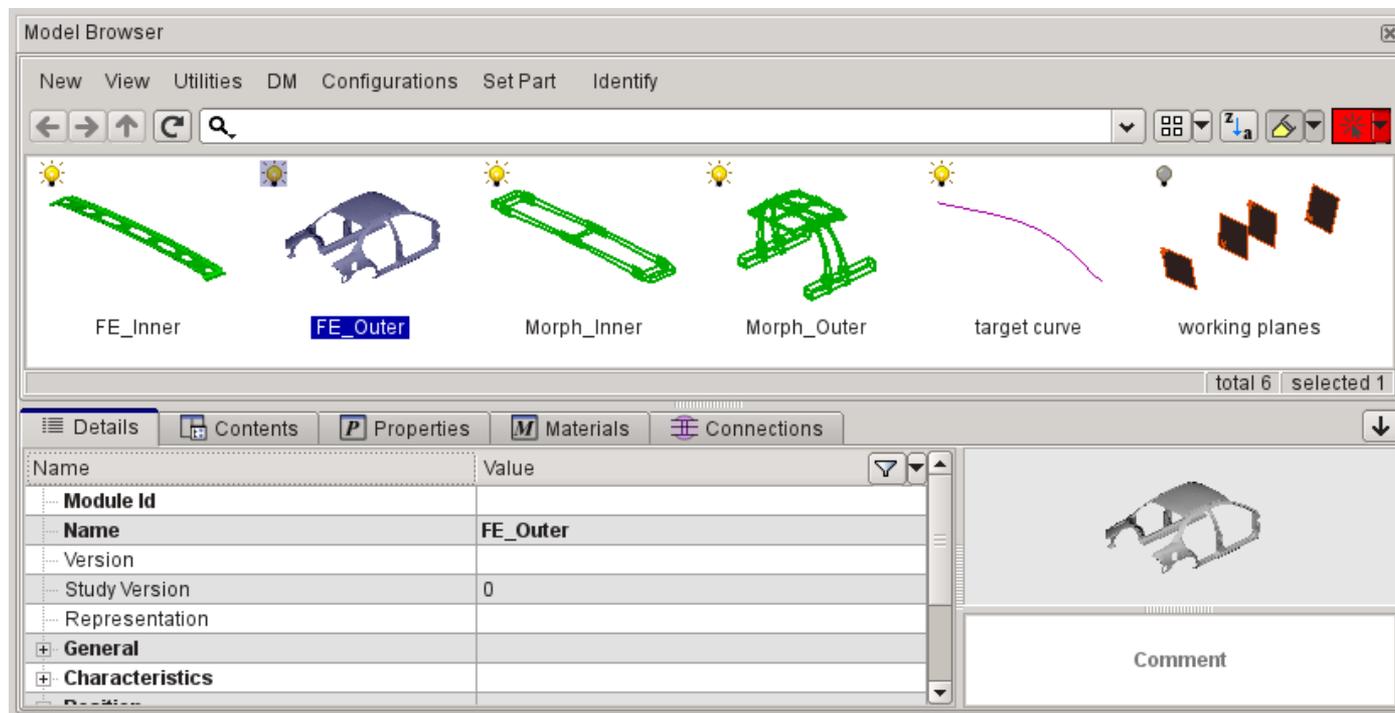
- Act as initial or target positions for fittings
- Suitable for Box and Direct Morphing
- Obtained from FE mesh or CAD geometry



Functionalities assisting Morphing

Model Browser

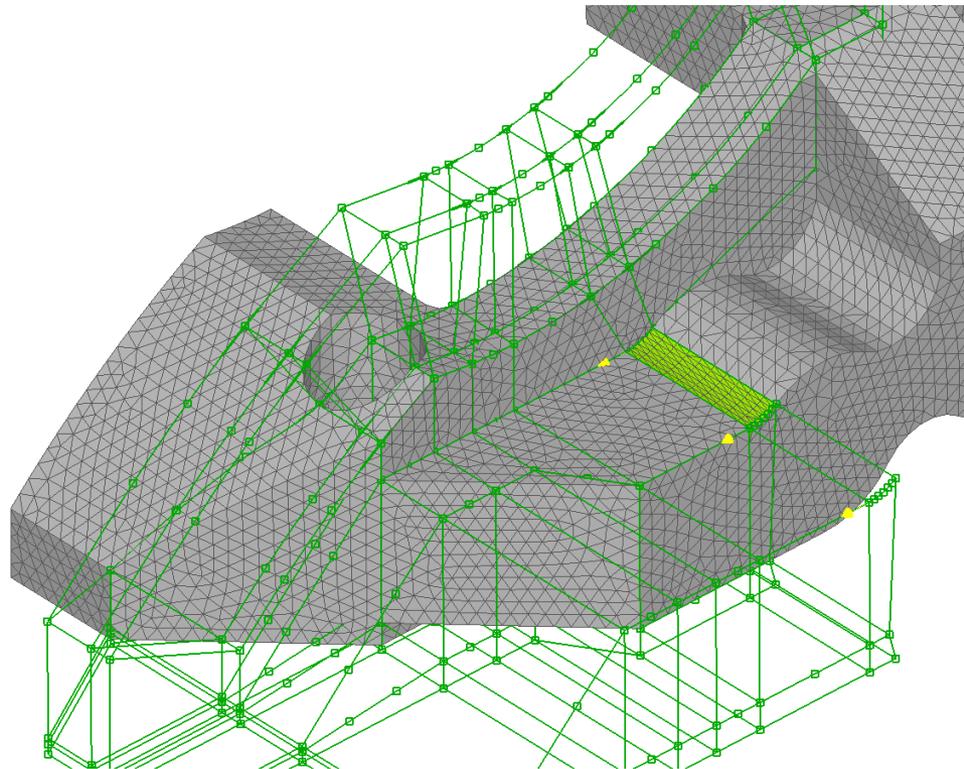
- Useful for Box Morphing (esp. complex configurations)
- To organize morph contents



Functionalities assisting Morphing

Reconstruct / Smooth morphed mesh

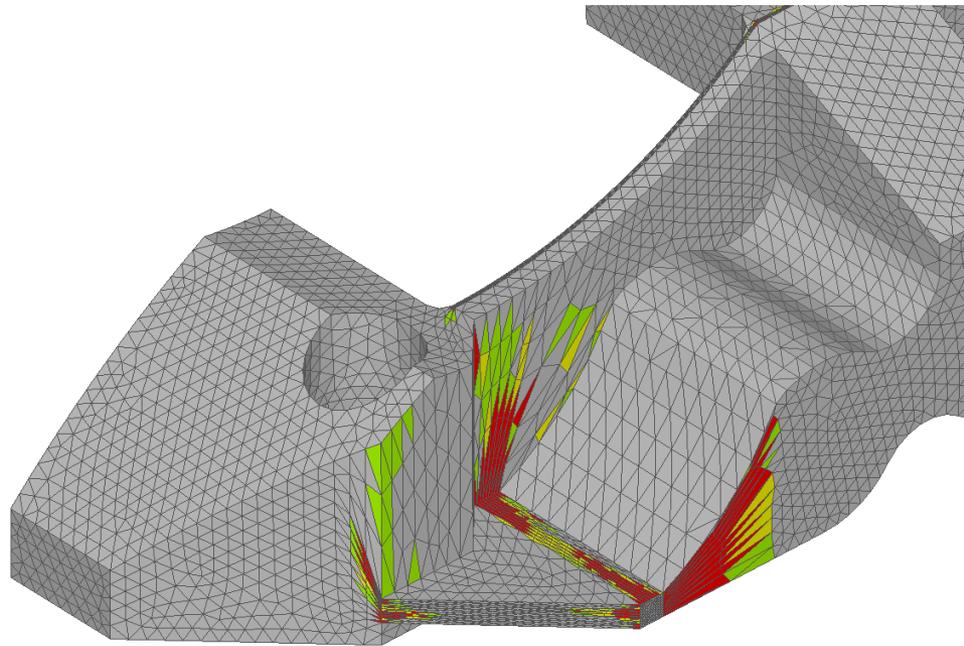
- Suitable for Box and Direct Morphing
- Improve mesh after morphing with large deformations



Functionalities assisting Morphing

Reconstruct / Smooth morphed mesh

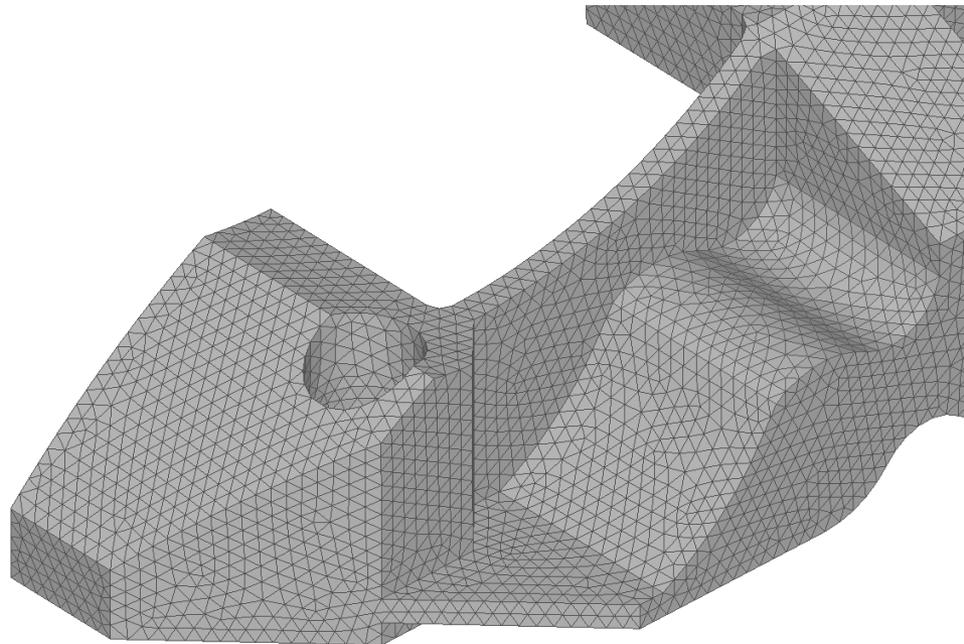
- Suitable for Box and Direct Morphing
- Improve mesh after morphing with large deformations



Functionalities assisting Morphing

Reconstruct / Smooth morphed mesh

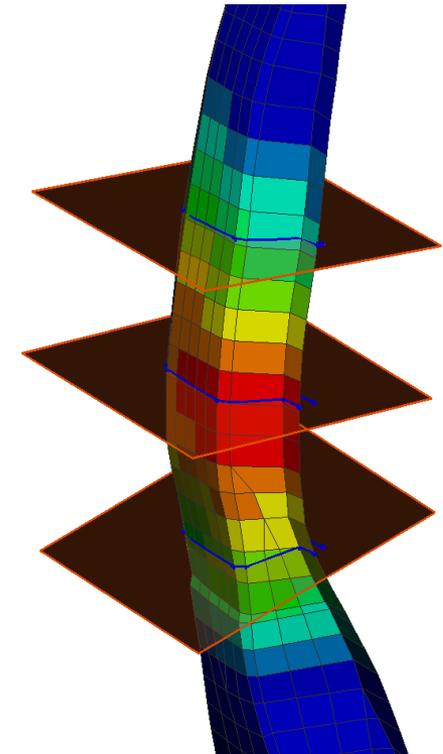
- Suitable for Box and Direct Morphing
- Improve mesh after morphing with large deformations



Functionalities assisting Morphing

Visualize Morphing Deviations

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



ANSA Parameter

- For parameterization of solver card entries

*DLOAD [DLOAD]

Name

FROZEN_DELETE

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

by ELSET LOAD TYPE magn(EID)

Comment

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"/>	<input type="text"/>
by ELSET LOAD TYPE magn(EID)			
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>

```

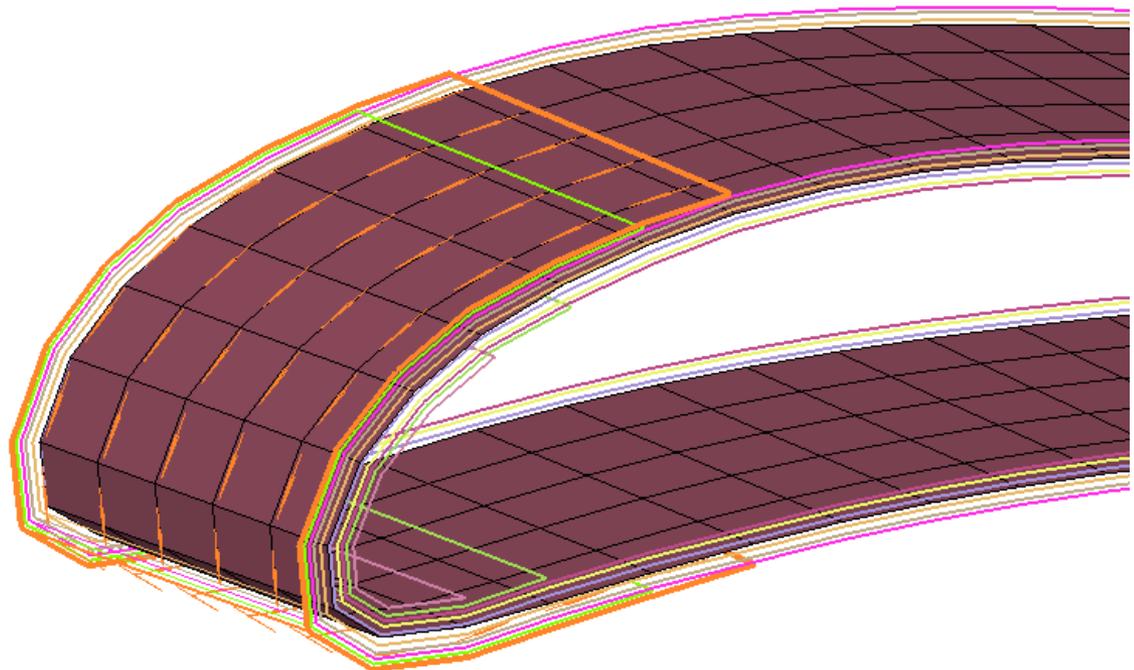
ANSA Parameter

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

Layers

PID	Z0	NSM	S
1			

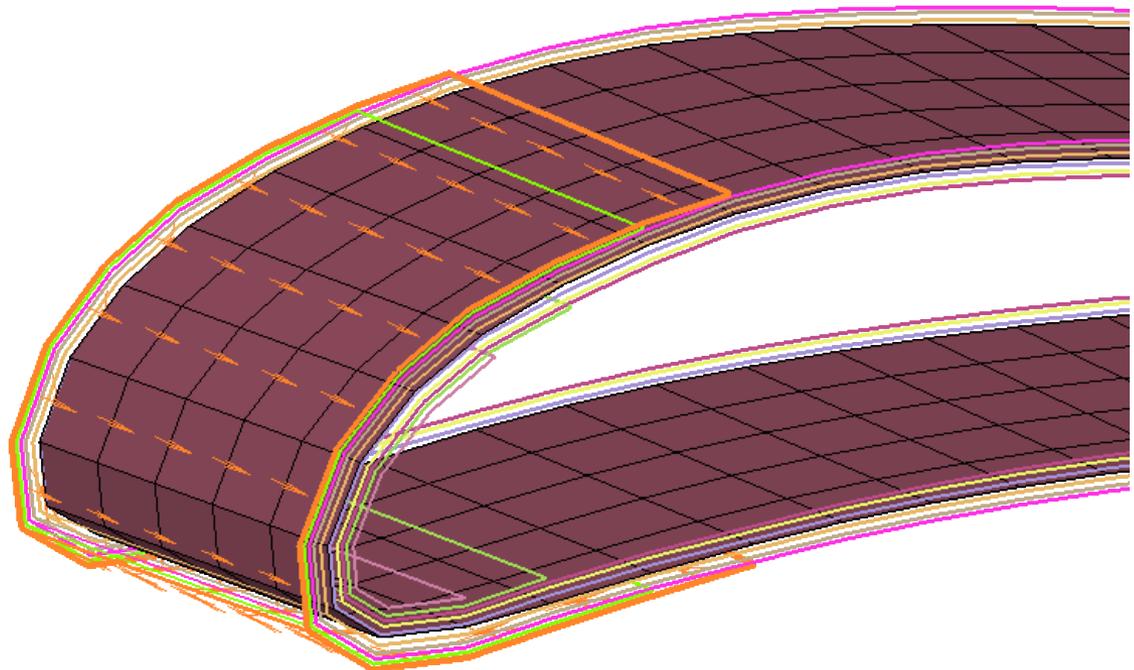
AVA	Type	T	THETA	m:
1	Sequence			
1	Layer	0.2	90.	
2	Layer	0.1	-45.	
3	Layer	0.1	45.	
4	Layer	0.2	0.	
5	Layer	0.2	0.	
6	Layer	0.1	45.	
7	Layer	0.1	-45.	
8	Layer	0.2	90.	



ANSA Parameter

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

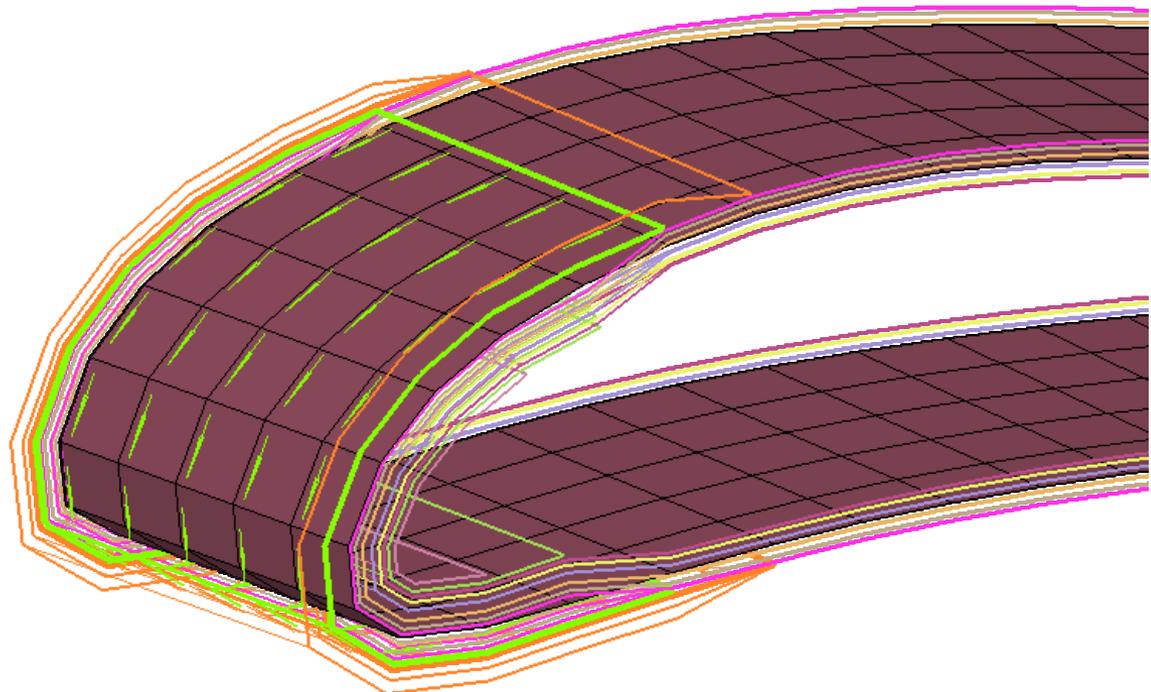
Layers				
PID	Z0	NSM	S	
1				
AVA	Type	T	THETA	m:
1	Sequence			
1	Layer	0.2	90.	
2	Layer	0.1	-45.	
3	Layer	0.1	45.	
4	Layer	0.2	0.	
5	Layer	0.2	0.	
6	Layer	0.1	45.	
7	Layer	0.1	-45.	
8	Layer	0.2	90.	



ANSA Parameter

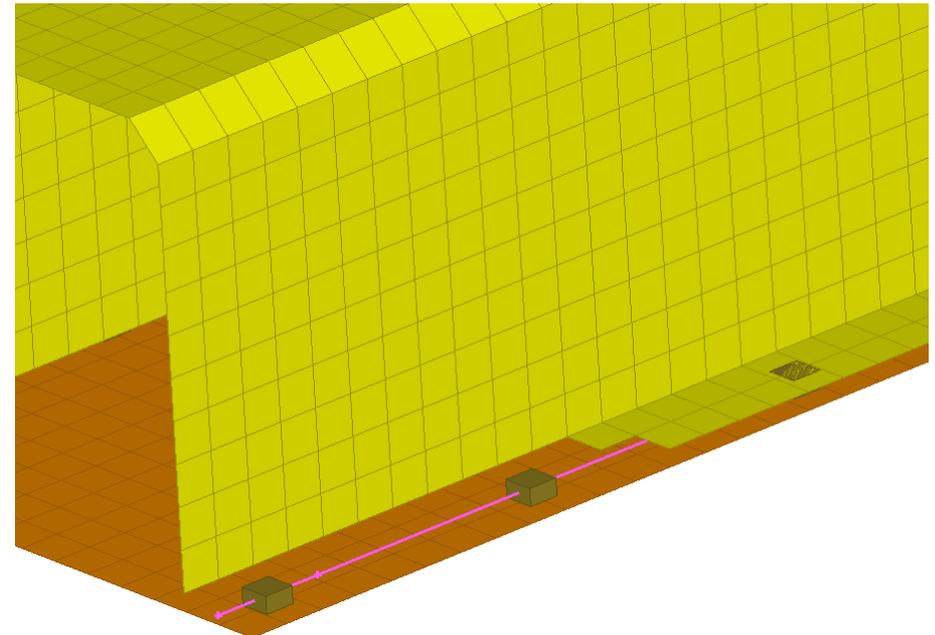
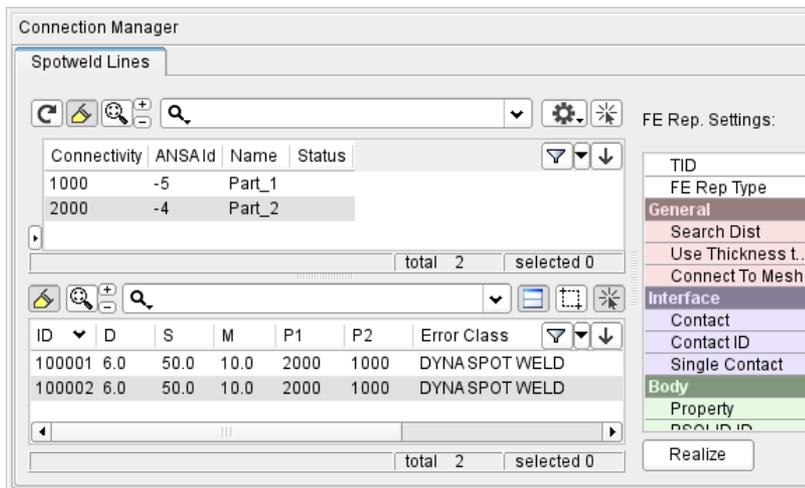
- For parameterization of composite properties, e.g.:
 - fabric orientation
 - layer thickness

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.	



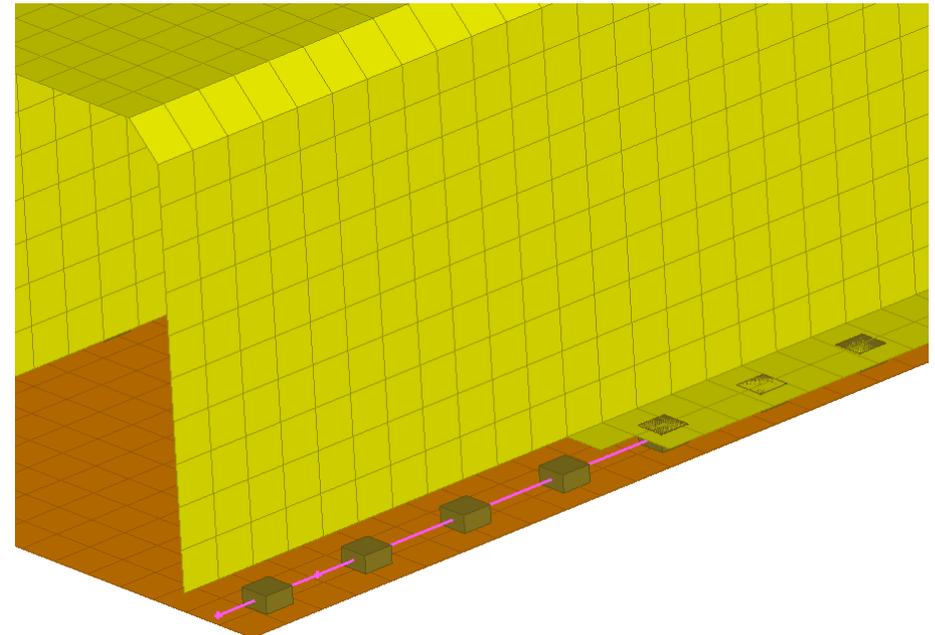
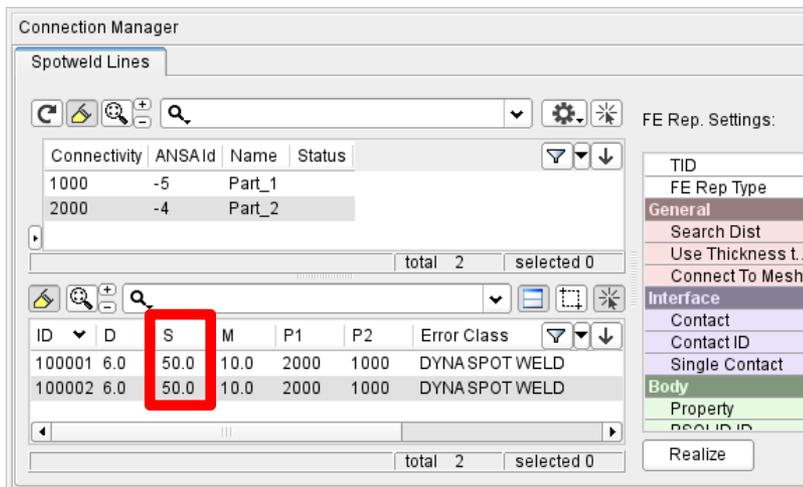
ANSA Parameter

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



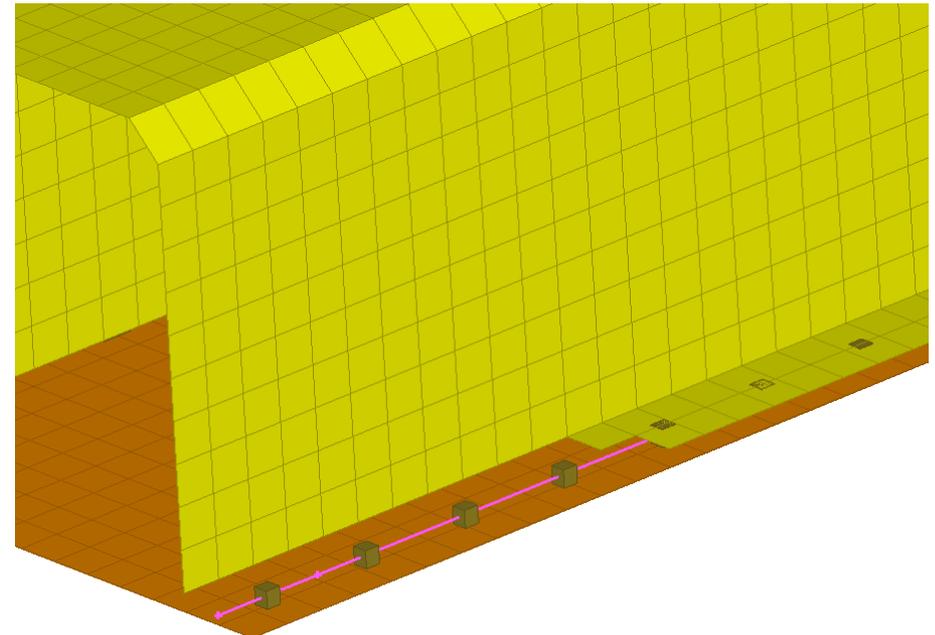
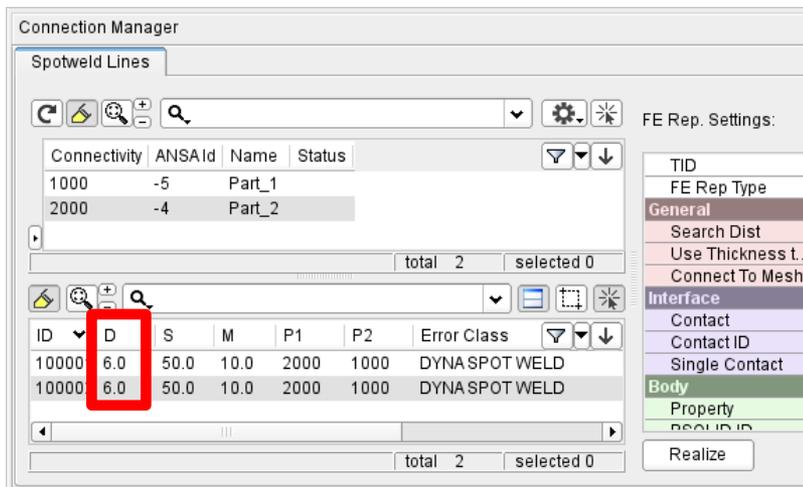
ANSA Parameter

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

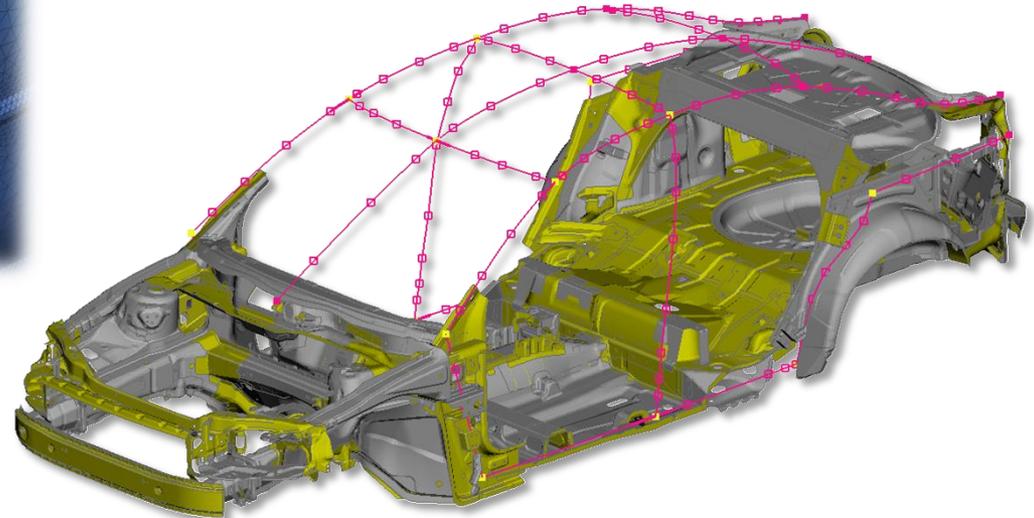
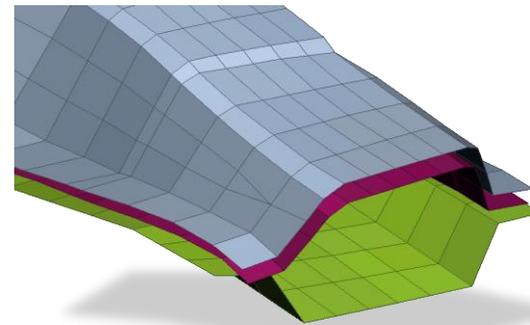
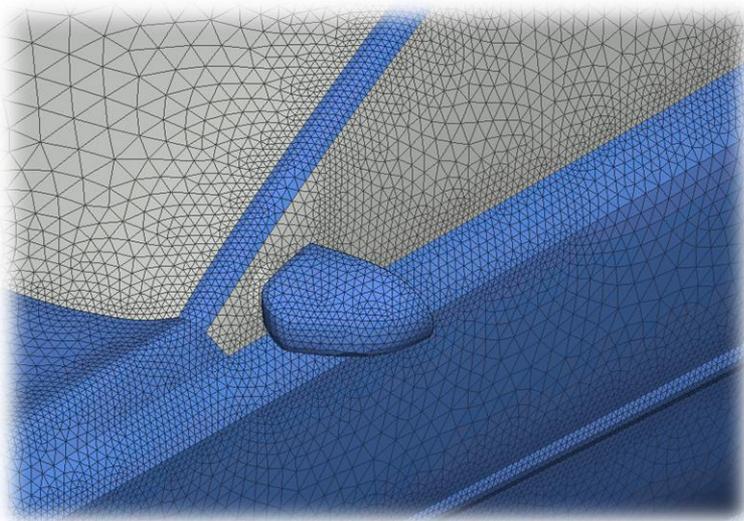


ANSA Parameter

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



Ευχαριστώ πολύ



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