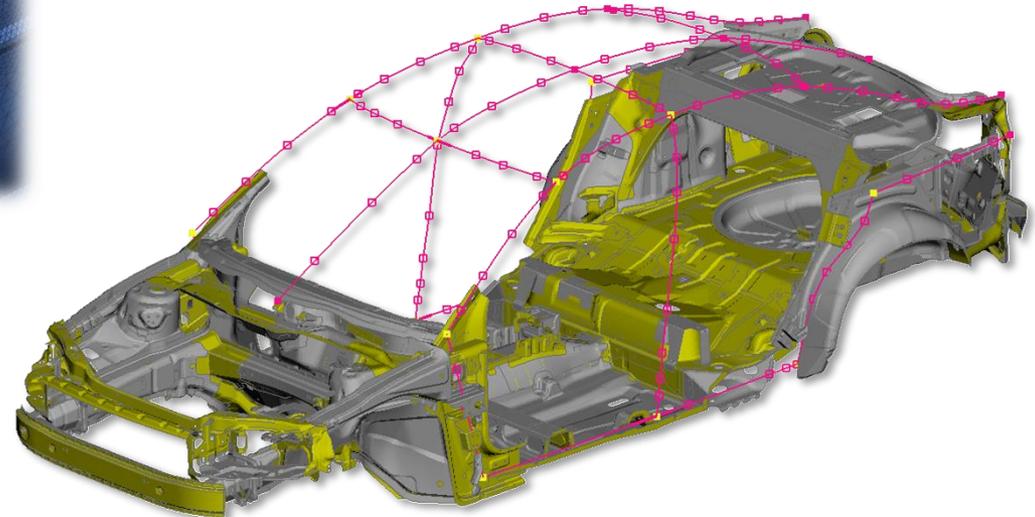
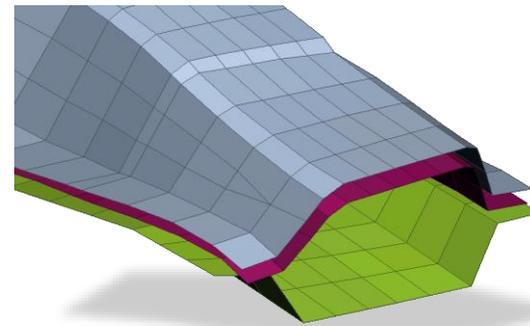
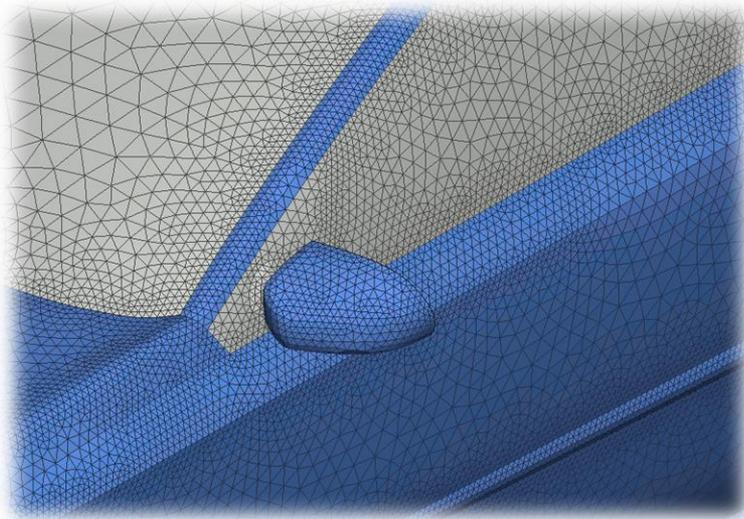


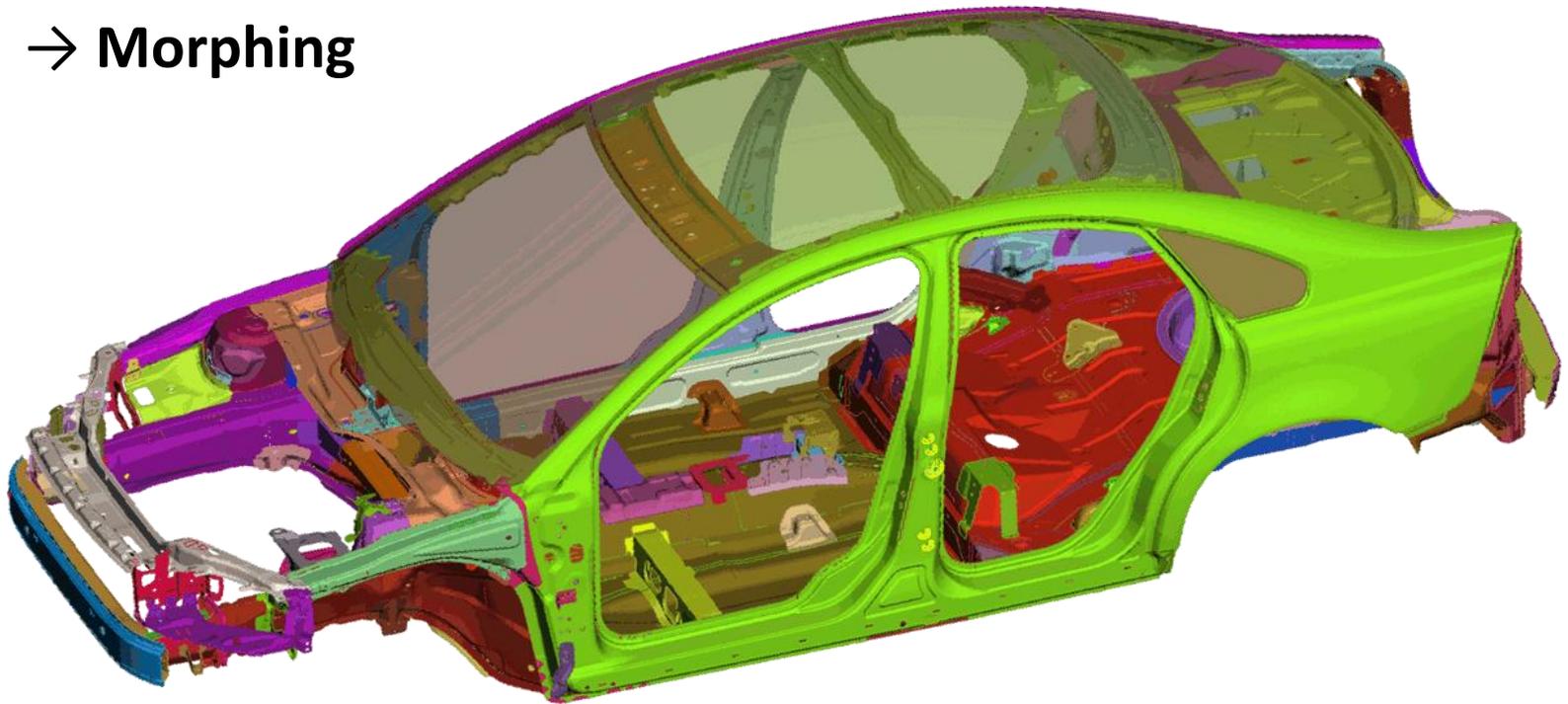
Model Parameterization in ANSA



Dirk Dreißig
Mail: ansa@lasso.de

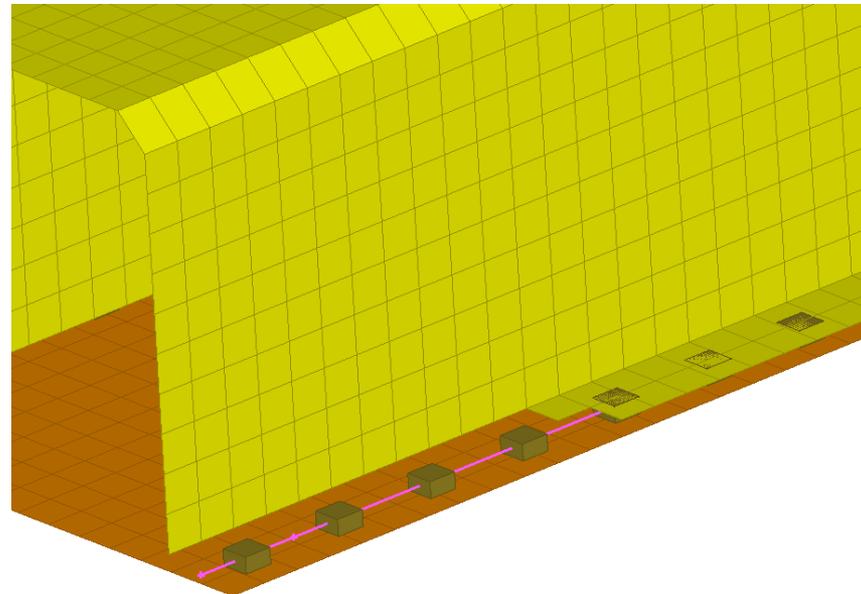
Types of Parameterization

- Shape modification
→ **Morphing**



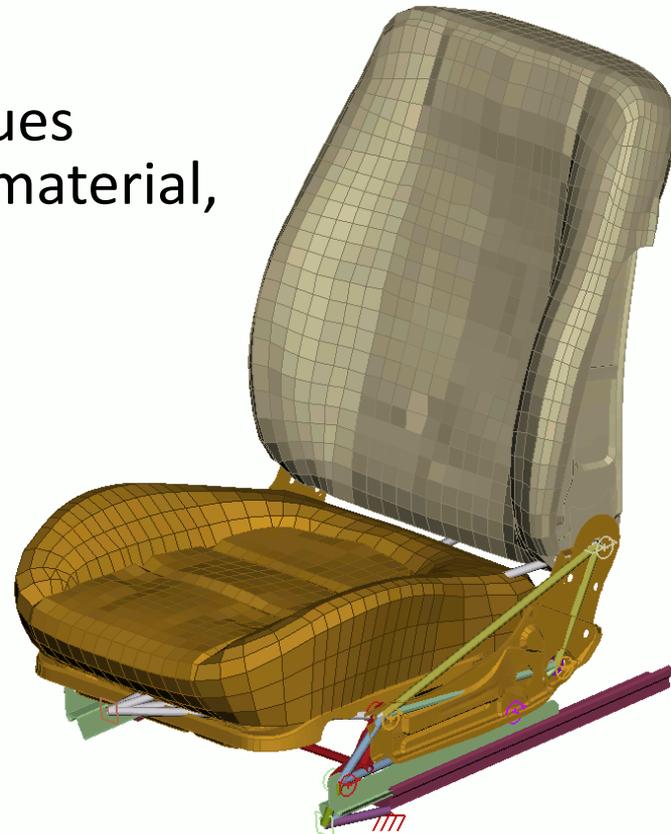
Types of Parameterization

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



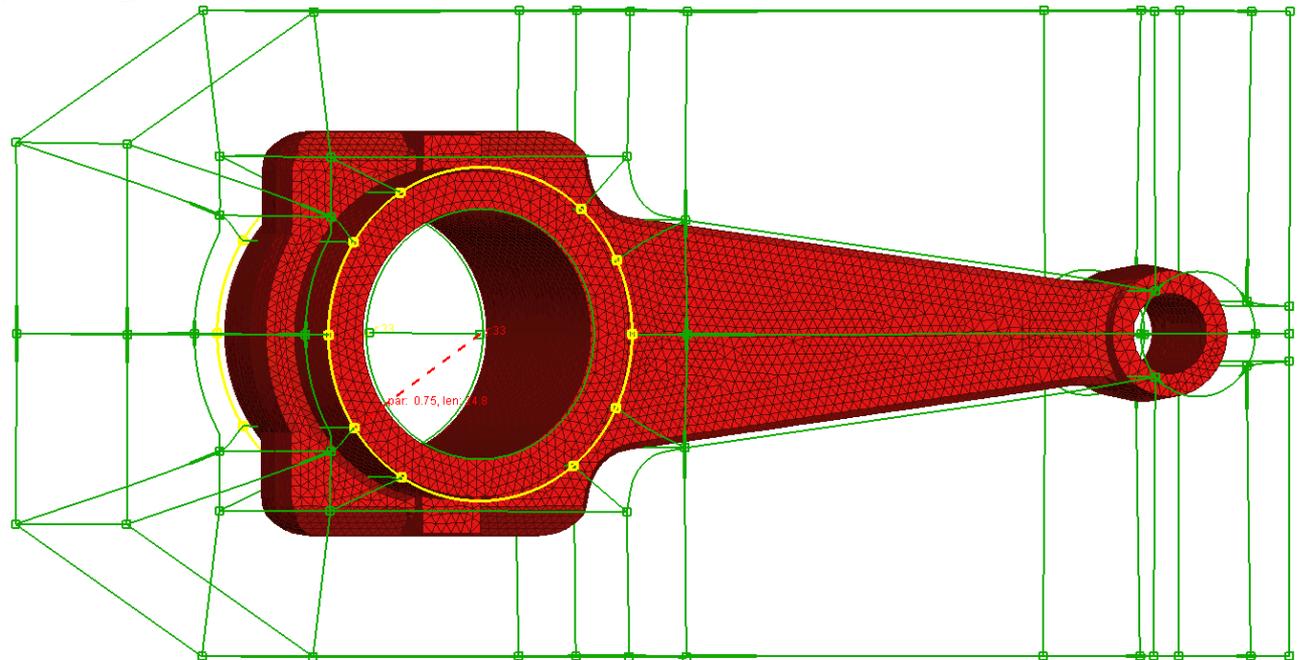
Types of Parameterization

- 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**



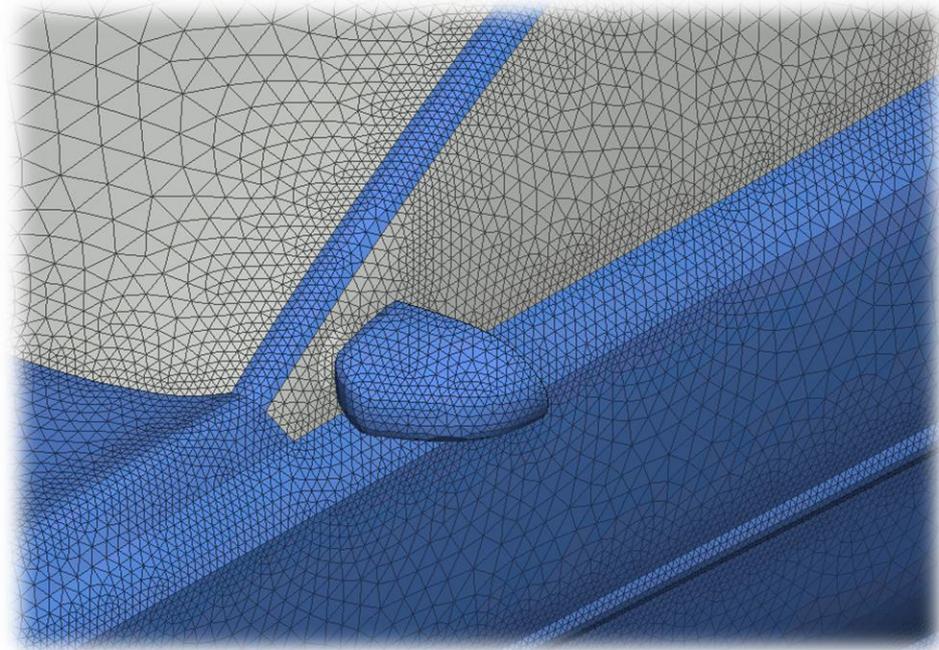
Morphing

- Applicable on FE- and Geometry
- Two main methods:
 - Box Morphing



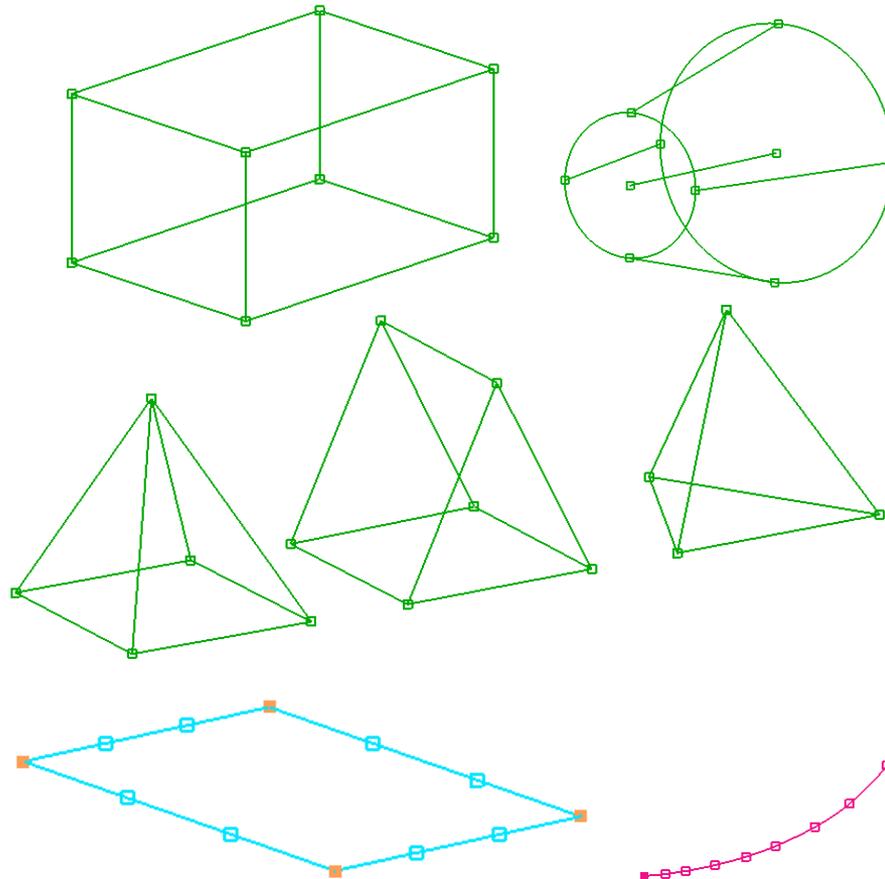
Morphing

- Applicable on FE- and Geometry
- Two main methods:
 - Box Morphing
 - Direct Morphing



Box Morphing

Types of boxes

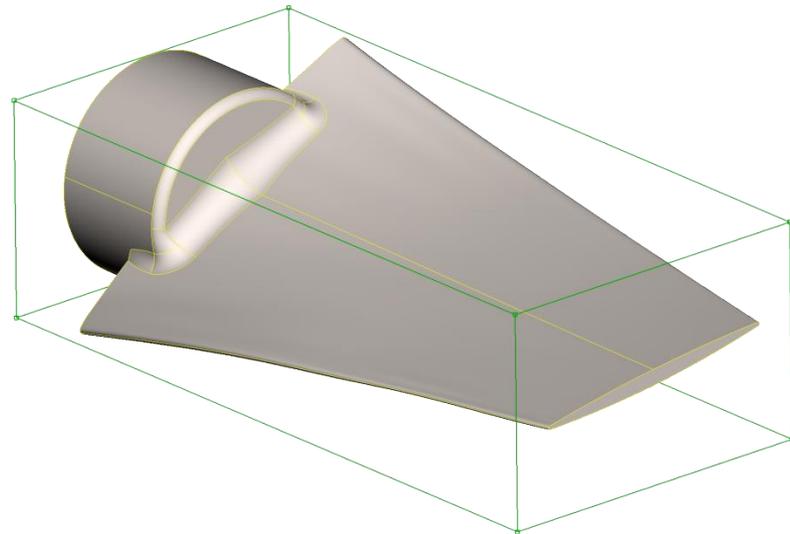


- 3D
 - Hexa
 - Penta
 - Tetra
 - Pyramid
 - Cylindrical
- 2D (specific thickness)
- 1D (specific diameter)

Box Morphing

How to create?

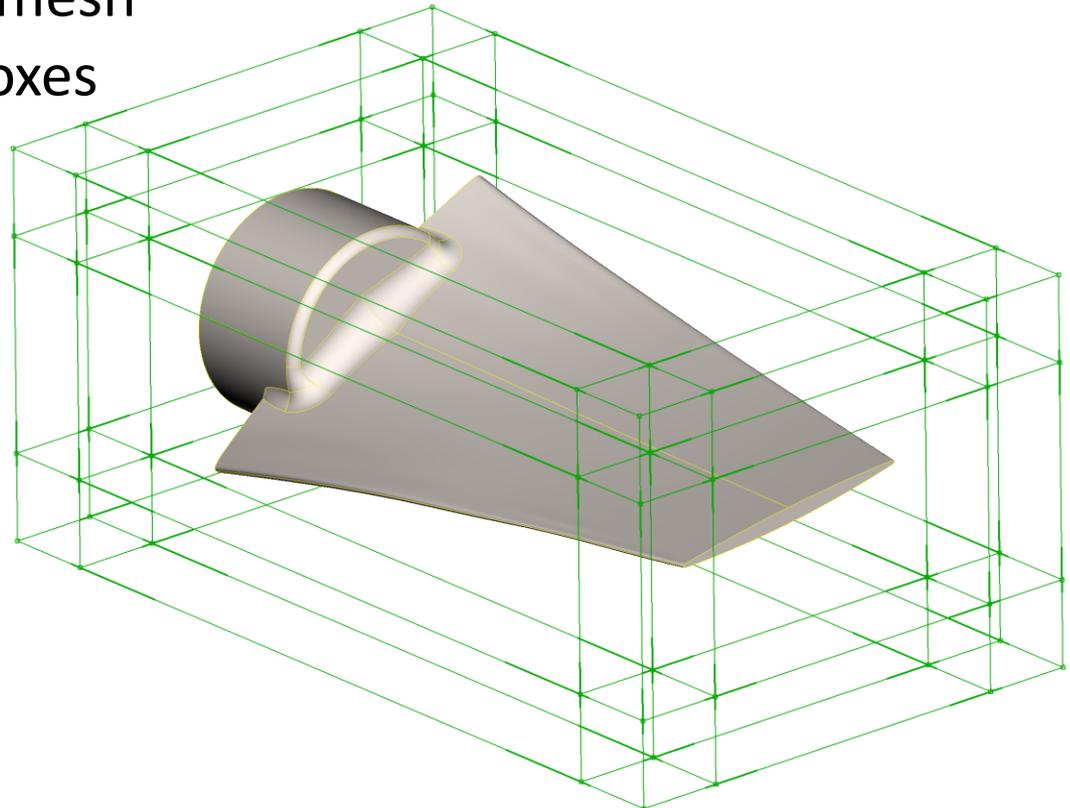
- Around geometry / mesh



Box Morphing

How to create?

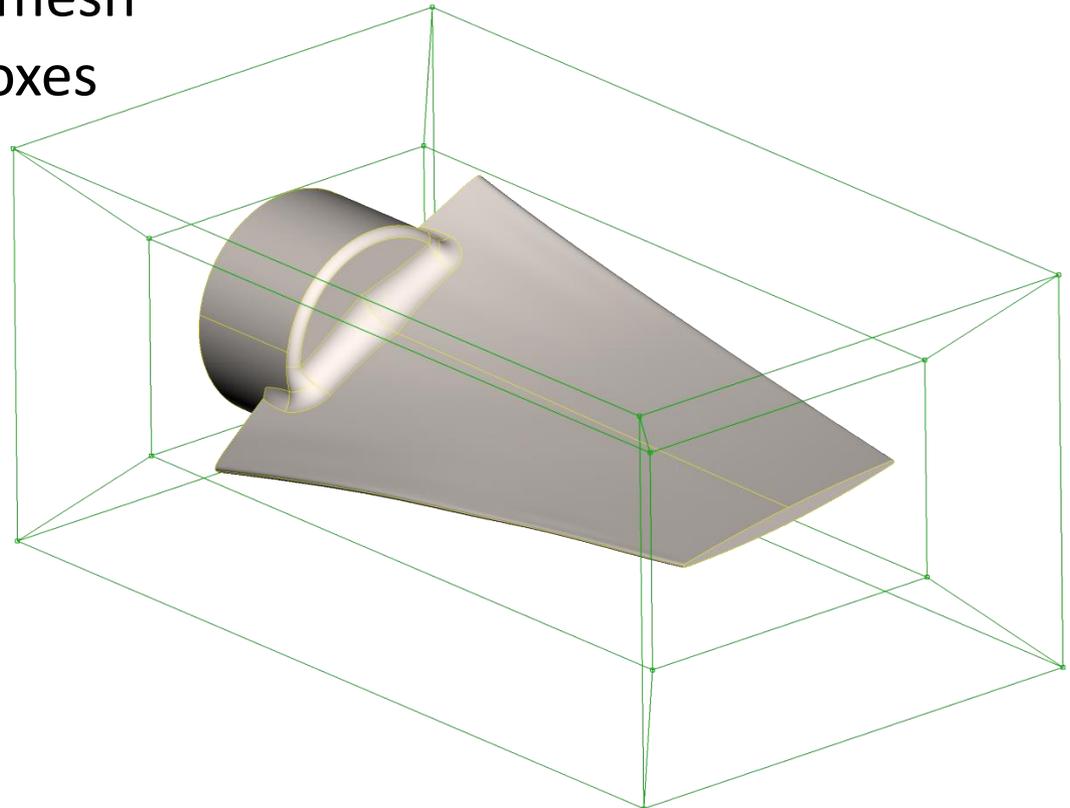
- Around geometry / mesh
- Offset on existing boxes



Box Morphing

How to create?

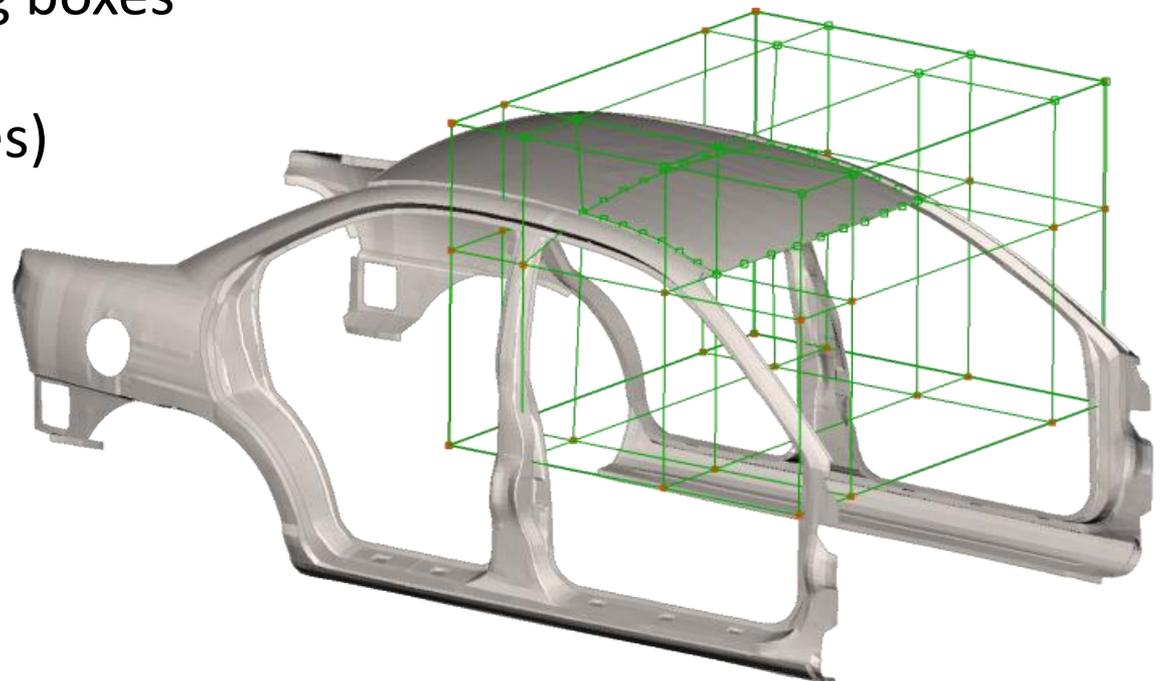
- Around geometry / mesh
- Offset on existing boxes



Box Morphing

How to create?

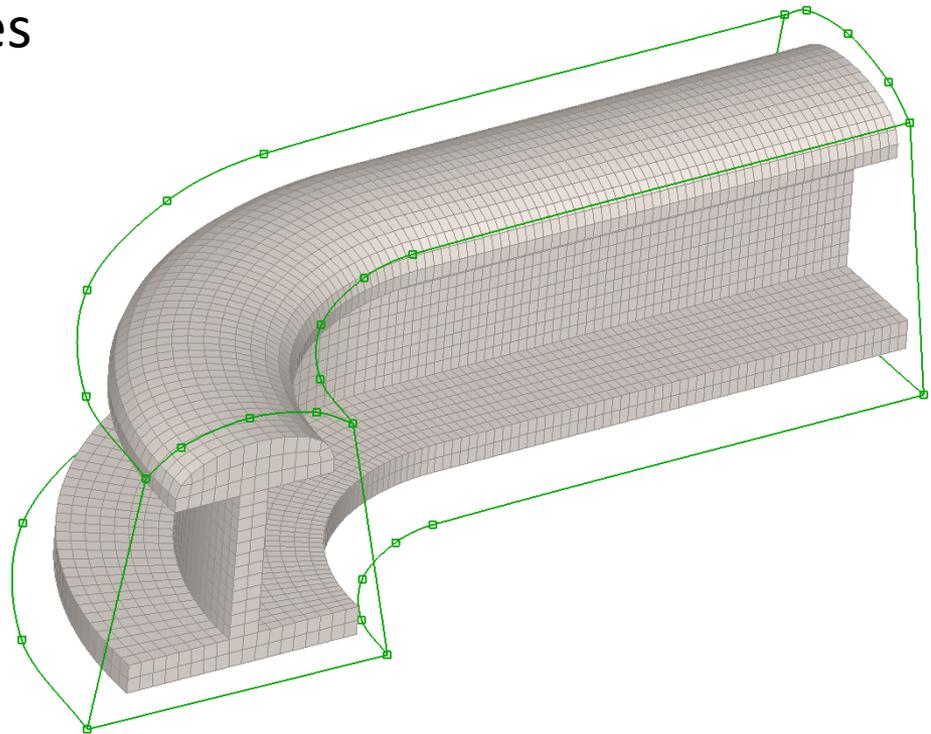
- Around geometry / mesh
- Offset on existing boxes
- Split + Fit
(edges or surfaces)



Box Morphing

How to create?

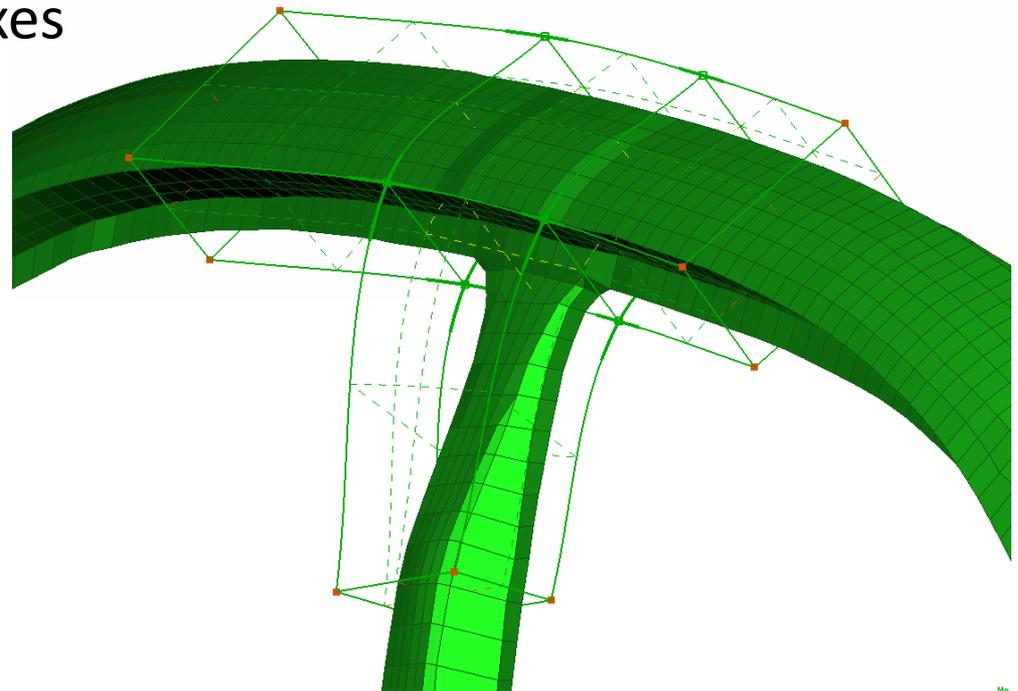
- Around geometry / mesh
- Offset on existing boxes
- Split + Fit
(edges or surfaces)
- Sweep / Glide



Box Morphing

How to create?

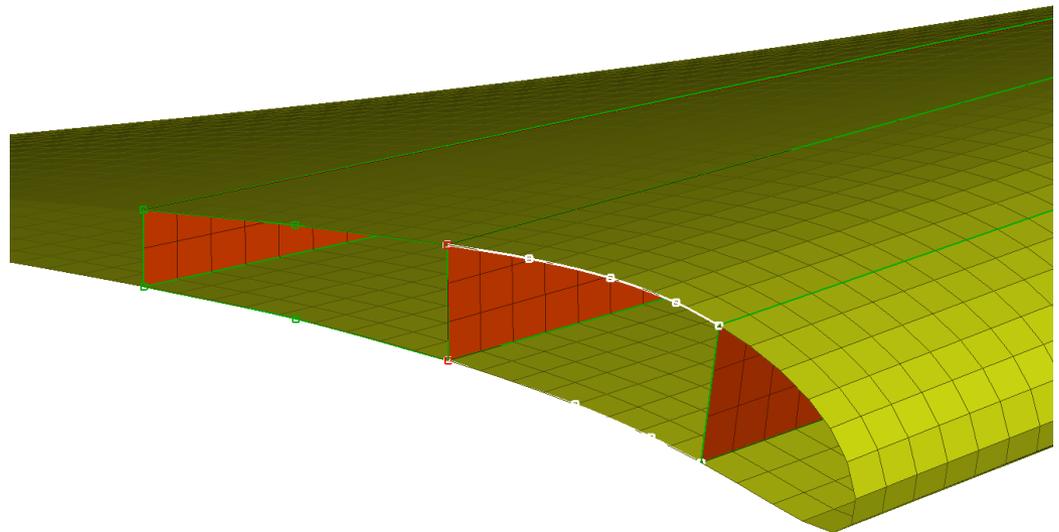
- Around geometry / mesh
- Offset on existing boxes
- Split + Fit
(edges or surfaces)
- Sweep / Glide
- Wrap
- ...



Box Morphing

How to modify?

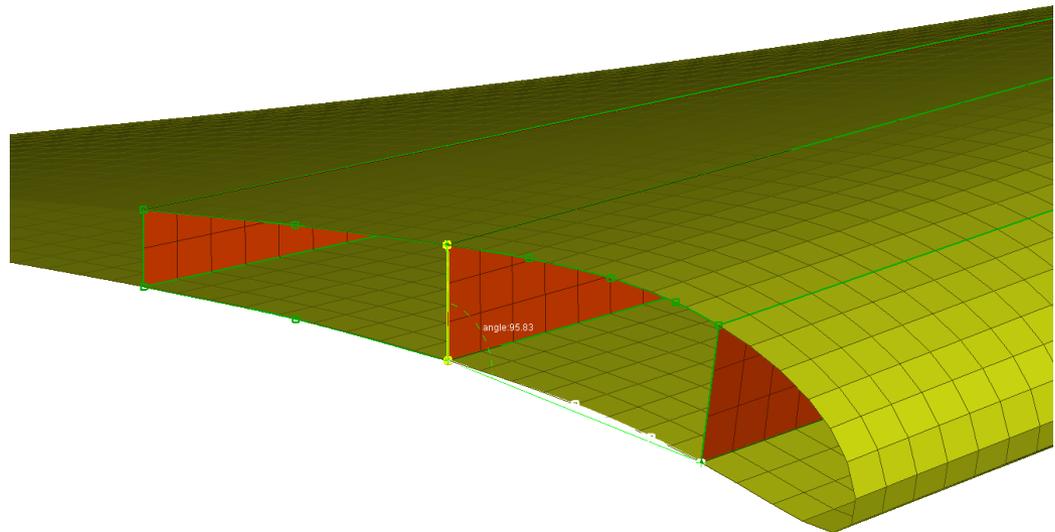
- Move (Translate, Rotate)
- Slide / Extend



Box Morphing

How to modify?

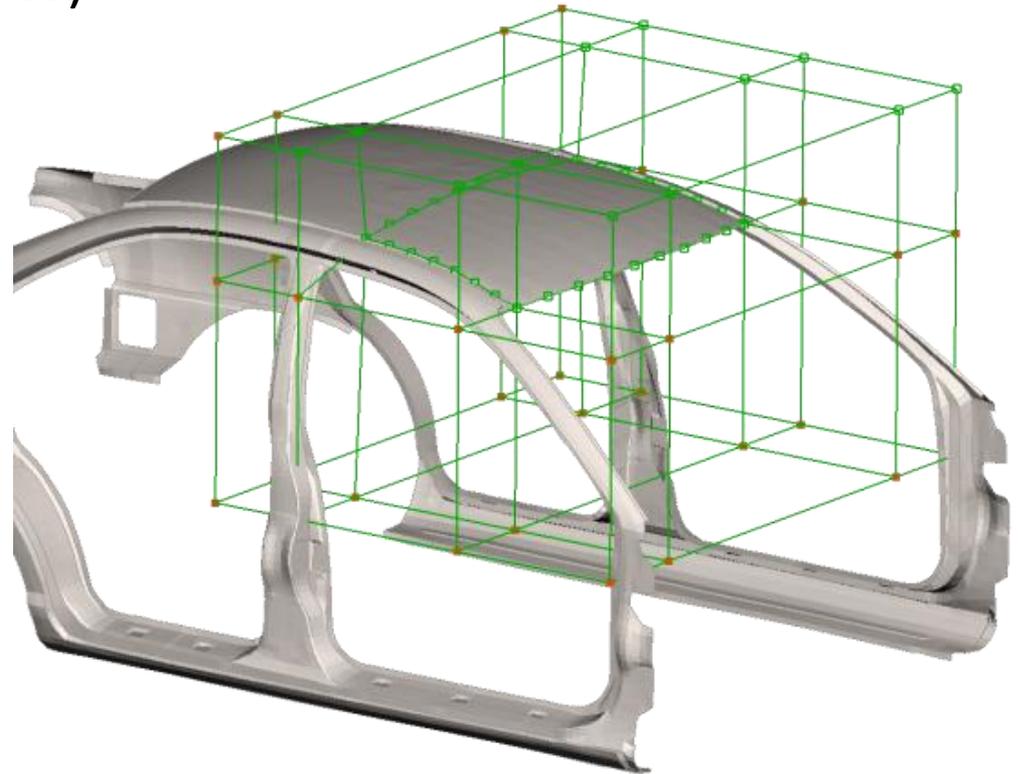
- Move (Translate, Rotate)
- Slide / Extend
- Angle



Box Morphing

How to modify?

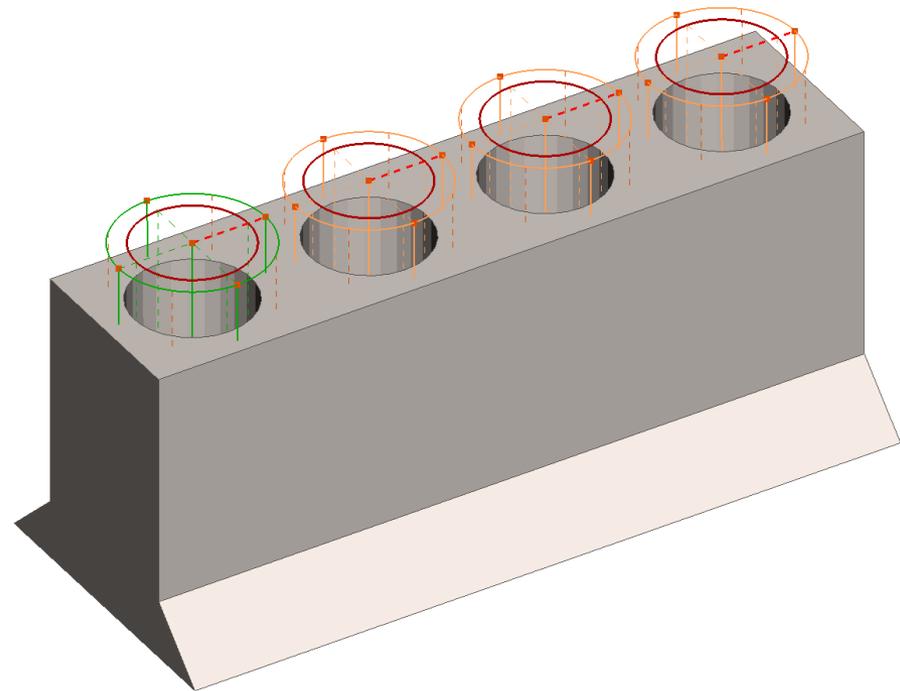
- Move (Translate, Rotate)
- Slide / Extend
- Angle
- Fit (edges, surfaces)



Box Morphing

How to modify?

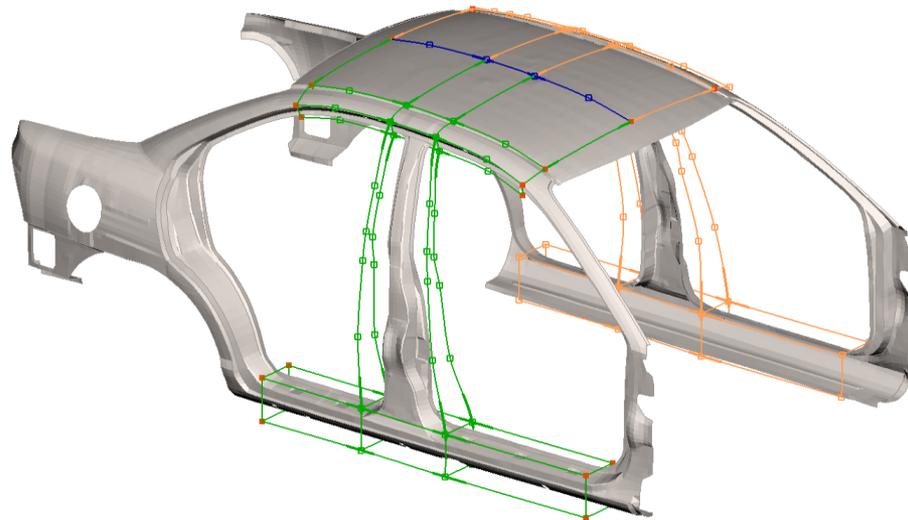
- Move (Translate, Rotate)
- Slide / Extend
- Angle
- Fit (edges, surfaces)
- Radius
- ...



Box Morphing

Linked Morphing Boxes

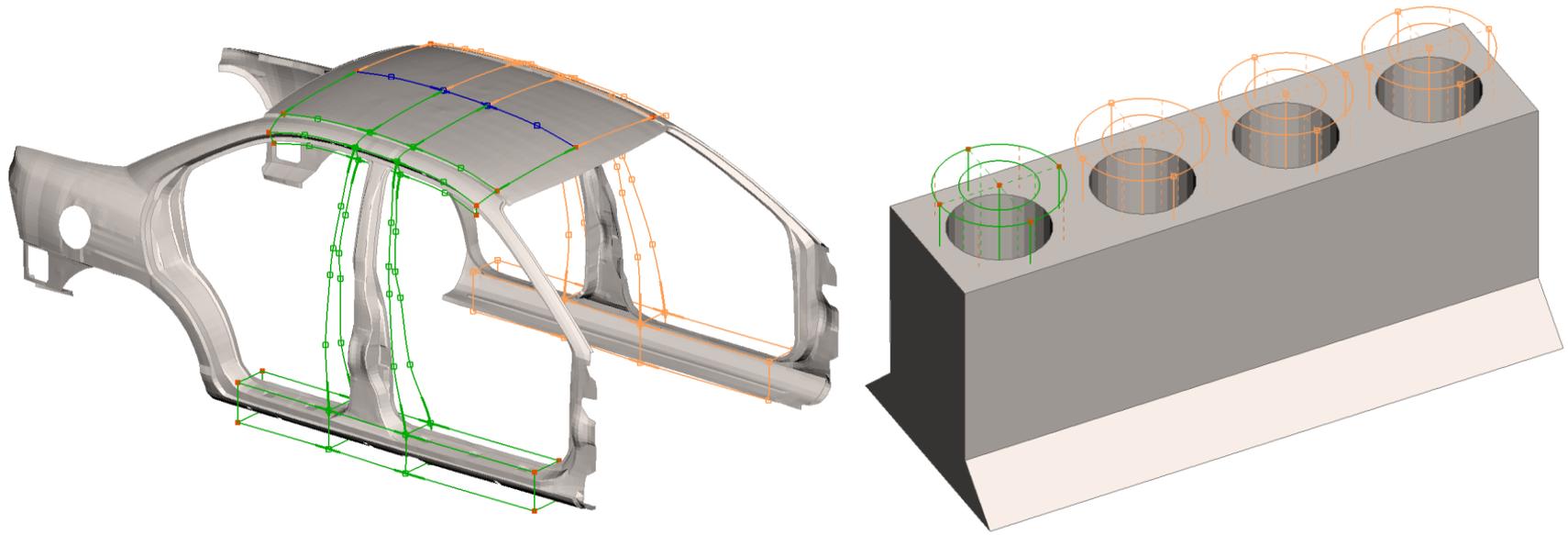
- Utilize model symmetry
- Link according symmetry-/mirror plane



Box Morphing

Linked Morphing Boxes

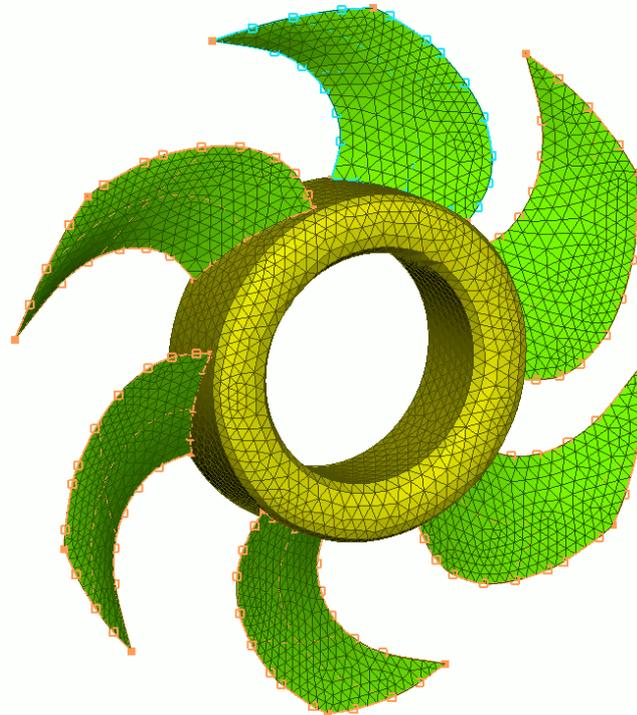
- Utilize model symmetry
- Link according symmetry-/mirror plane, translation vector



Box Morphing

Linked Morphing Boxes

- Utilize model symmetry
- Link according symmetry-/mirror plane, translation vector or rotation axis



Box Morphing

Box in Box

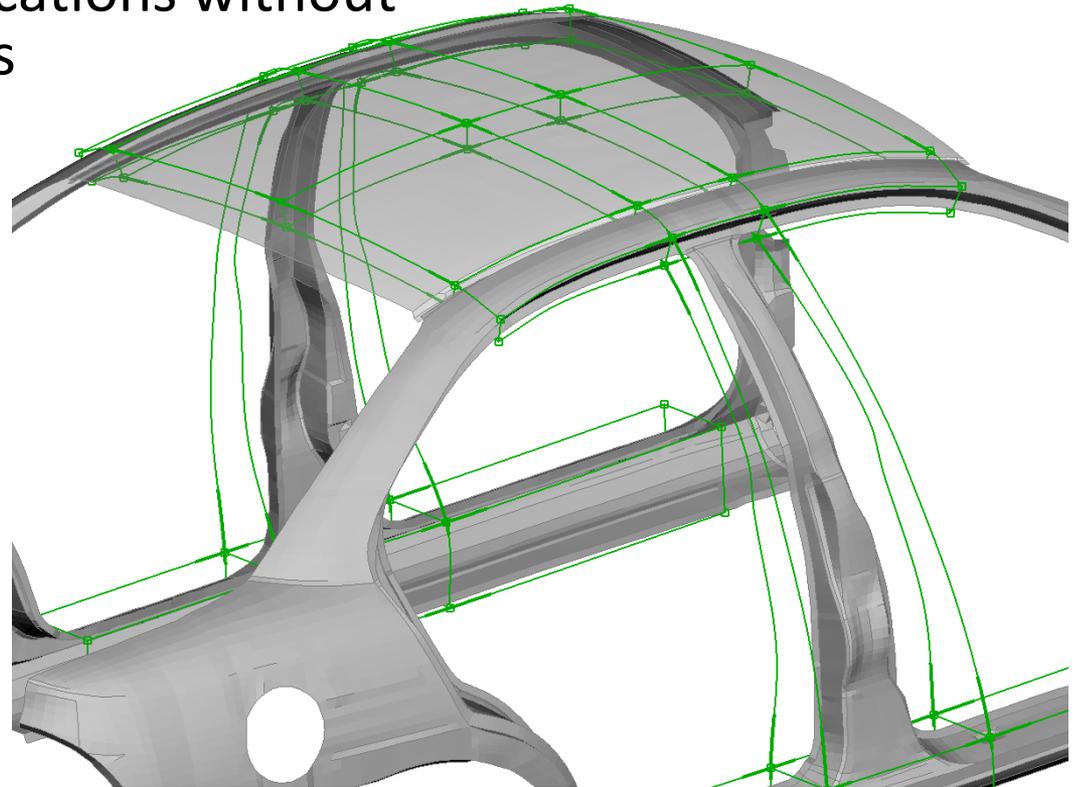
- Separate groups of boxes handle different features
- Global and local modifications without excessive splits of boxes



Box Morphing

Box in Box

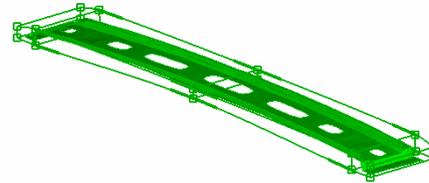
- Separate groups of boxes handle different features
- Global and local modifications without excessive splits of boxes
- Global: B-pillar position



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

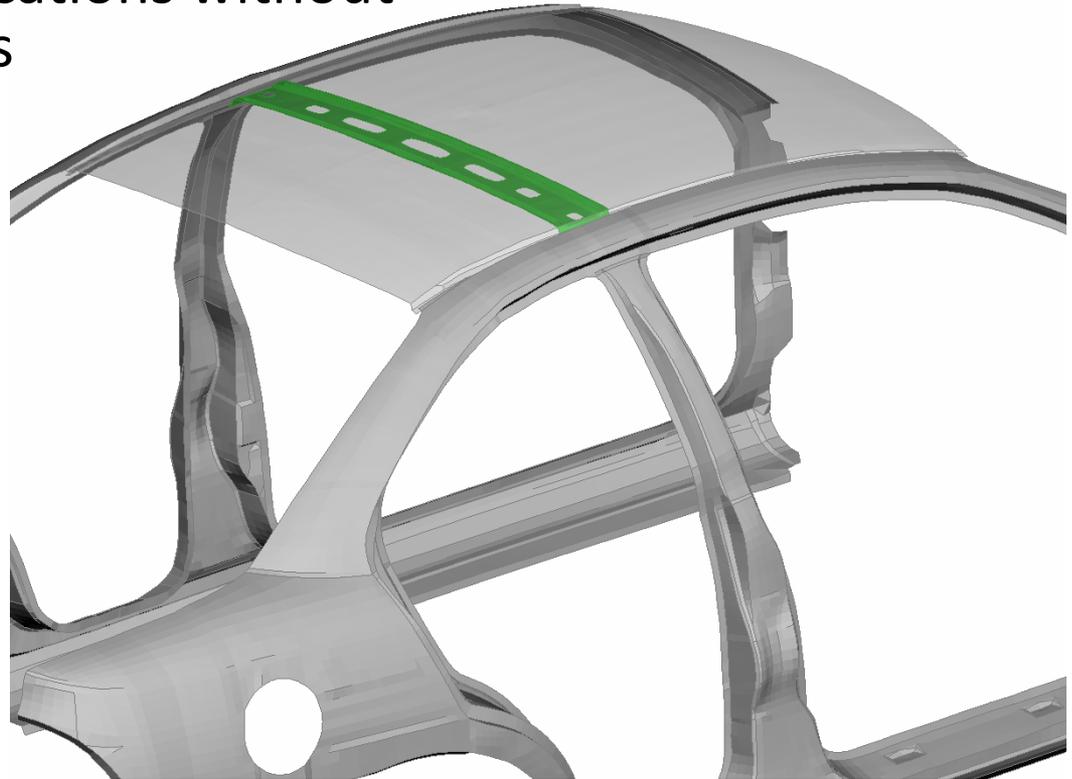


Box Morphing

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

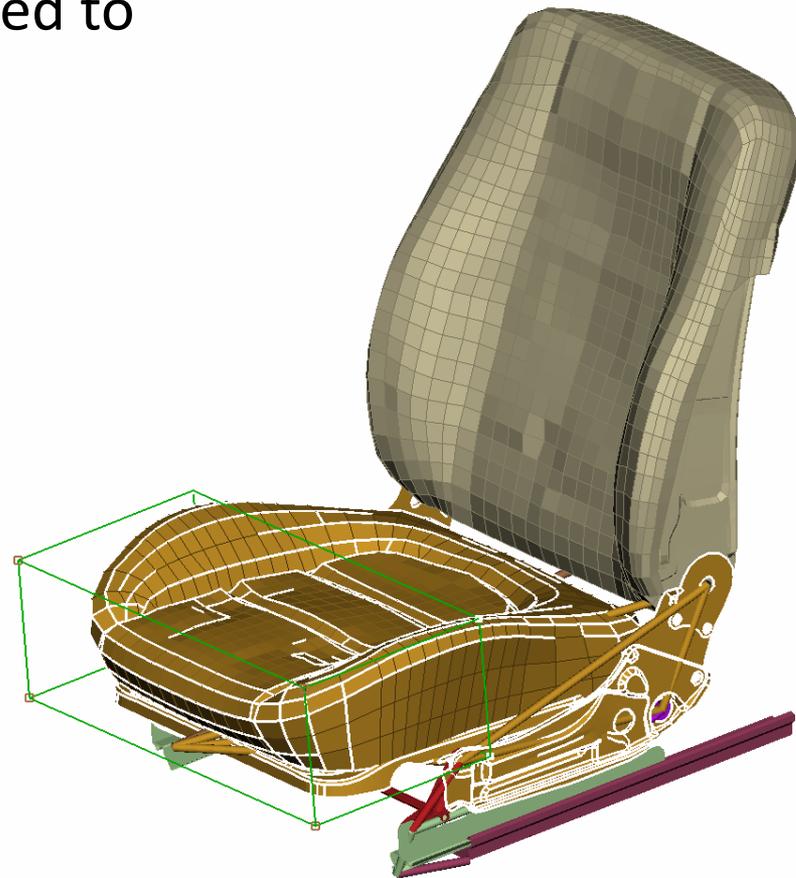
- Global morphing
- Local morphing



Box Morphing

Coupled with Kinetics

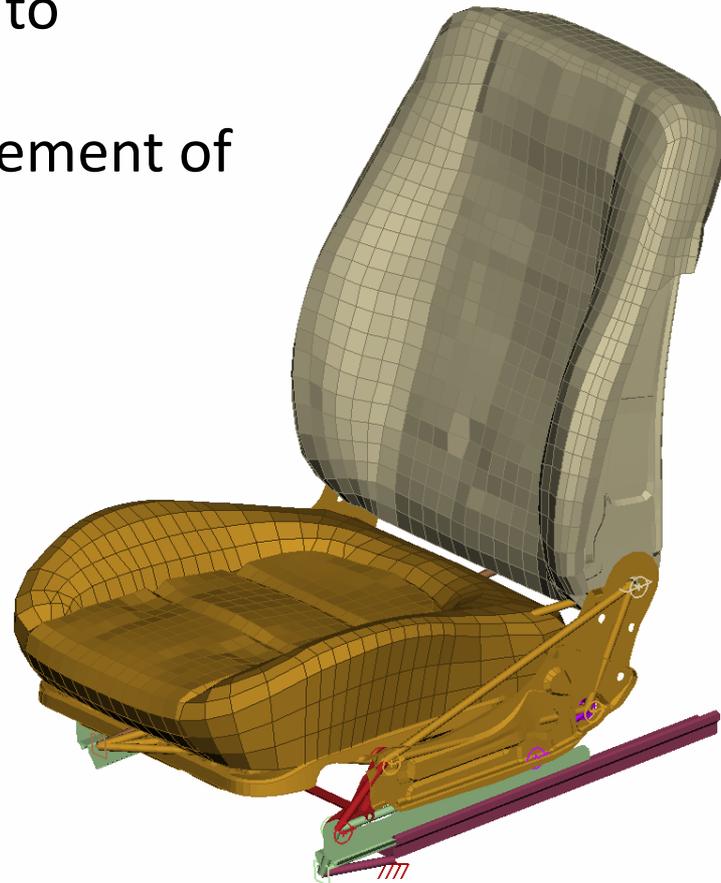
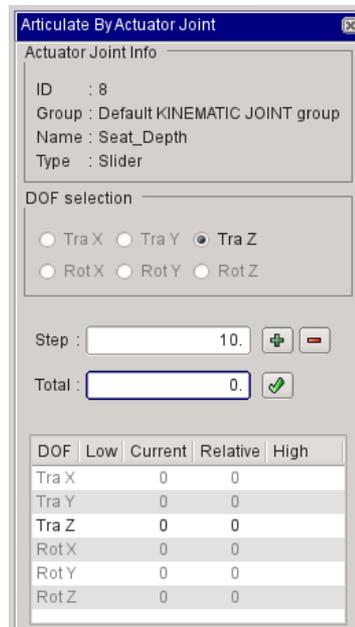
- Morph Control Points added to Kinetic Rigid Bodies



Box Morphing

Coupled with Kinetics

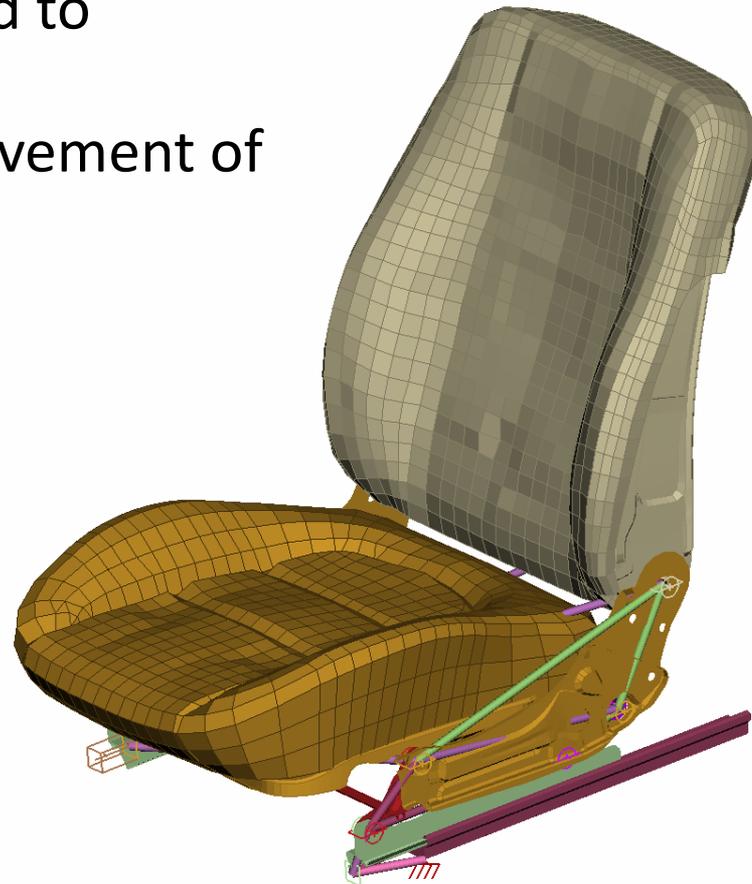
- Morph Control Points added to Kinetic Rigid Bodies
- Morphing controlled by movement of Rigid Bodies



Box Morphing

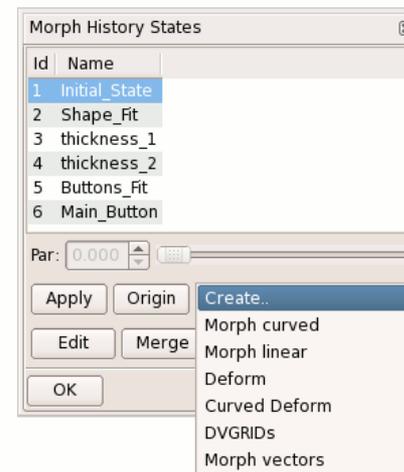
Coupled with Kinetics

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



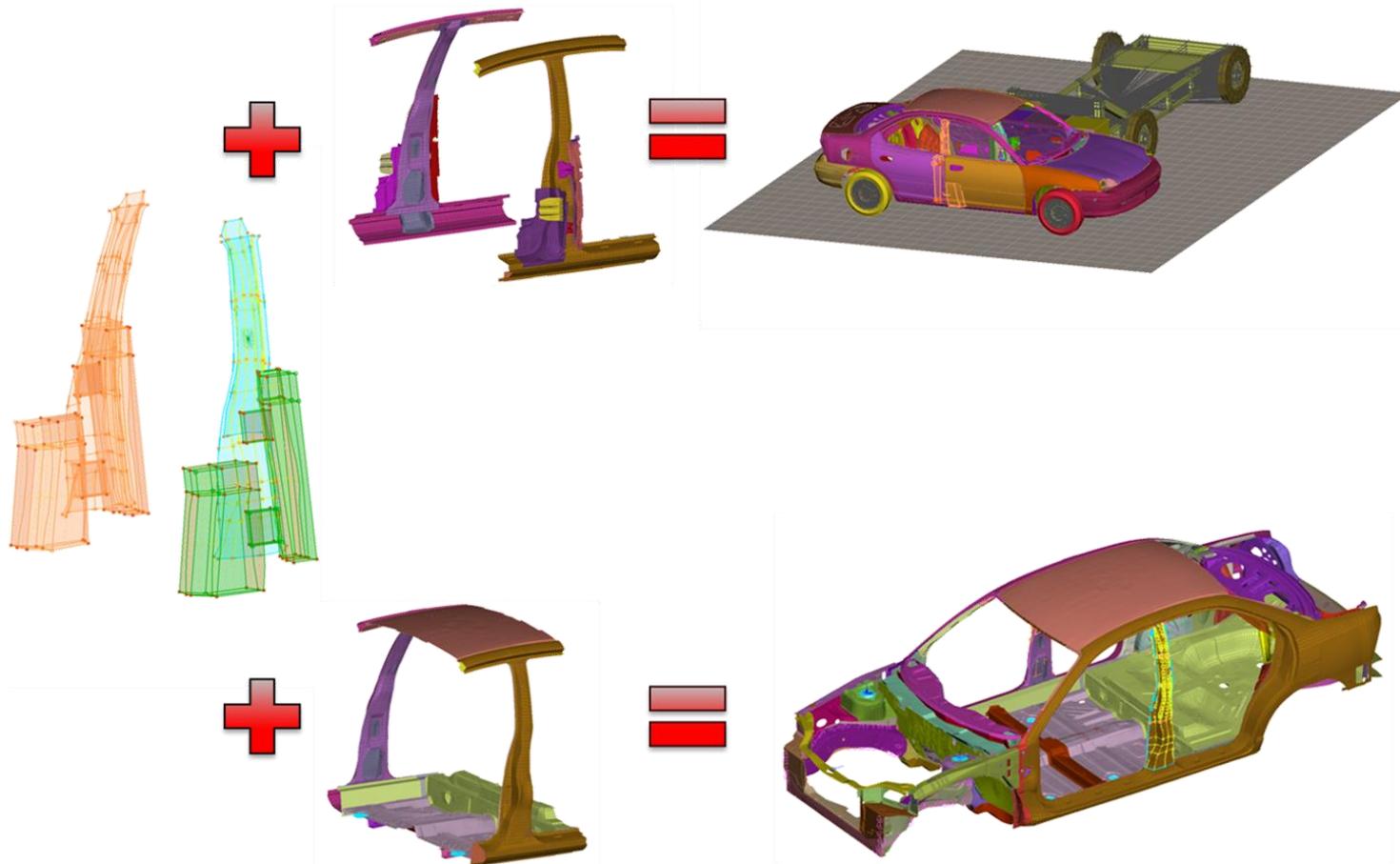
Box Morphing

Recording History



Box Morphing

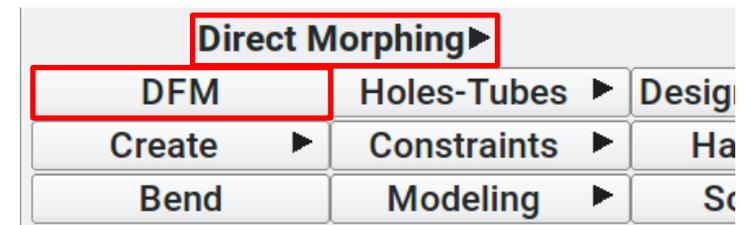
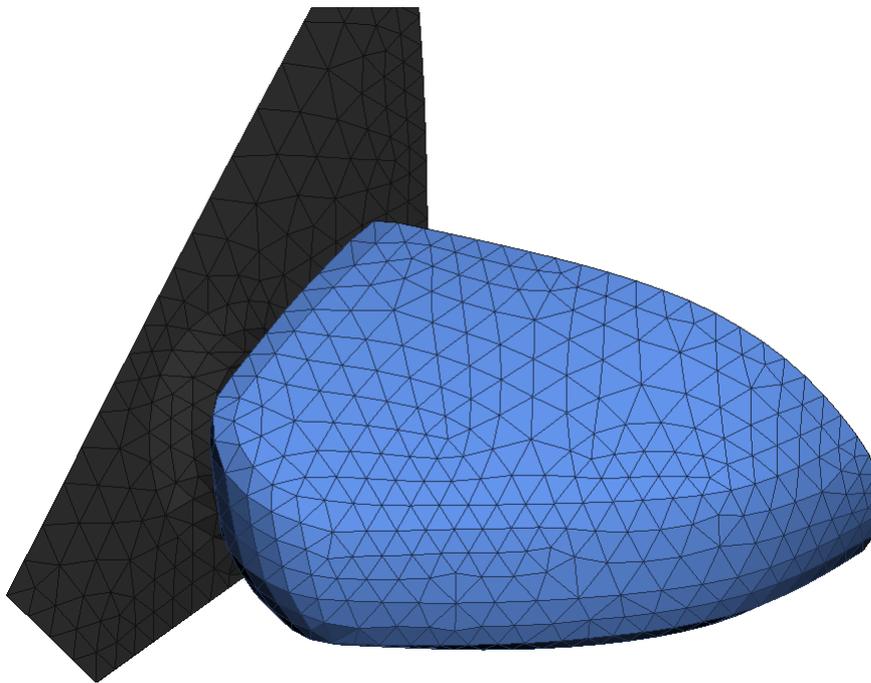
Re-use of boxes and parameters for multiple similar models



Direct Morphing

DFM

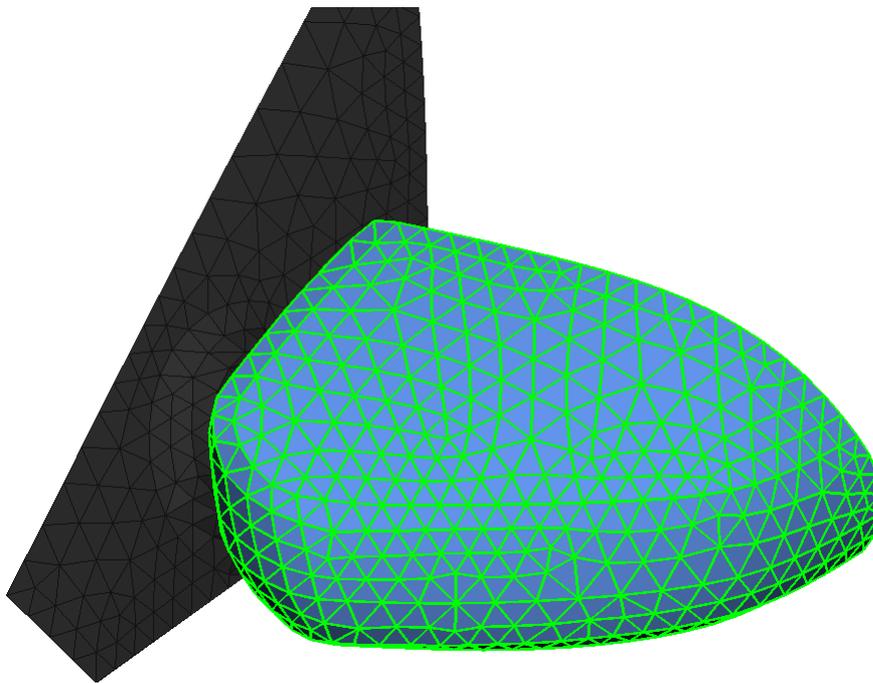
Translate, rotate or scale FE-mesh or Geometry entities



Direct Morphing

DFM

Translate, rotate or scale FE-mesh or Geometry entities

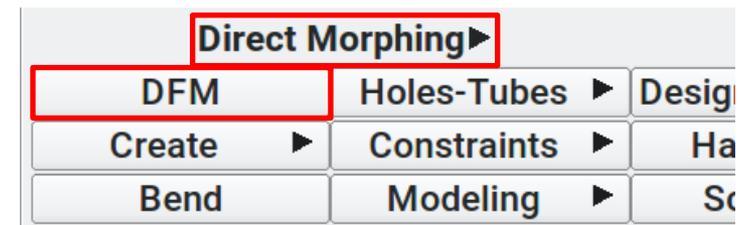
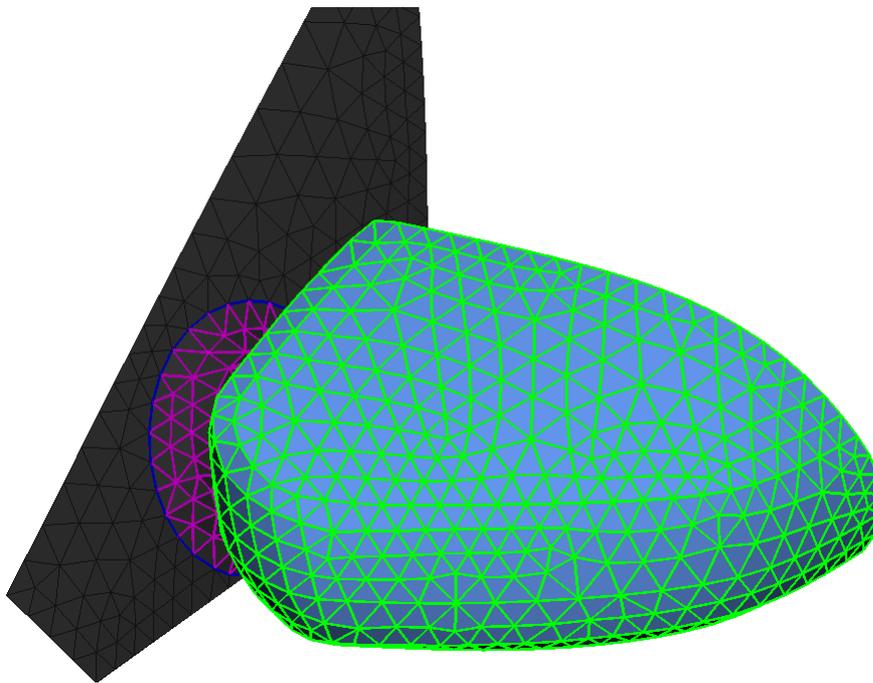


- Control Entities

Direct Morphing

DFM

Translate, rotate or scale FE-mesh or Geometry entities

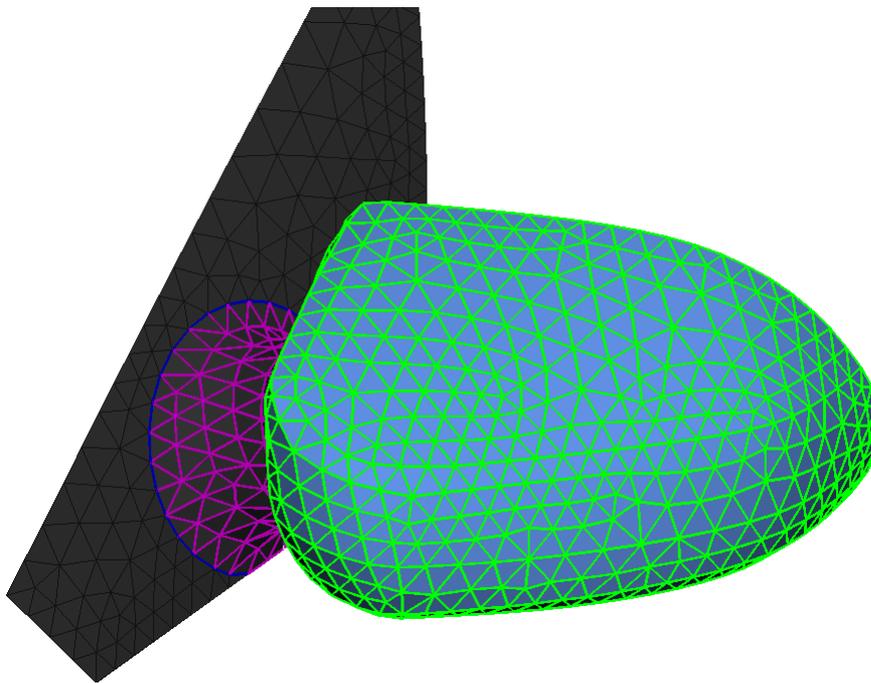


- Control Entities
- Morphed Entities
- Boundary

Direct Morphing

DFM

Translate, rotate or scale FE-mesh or Geometry entities

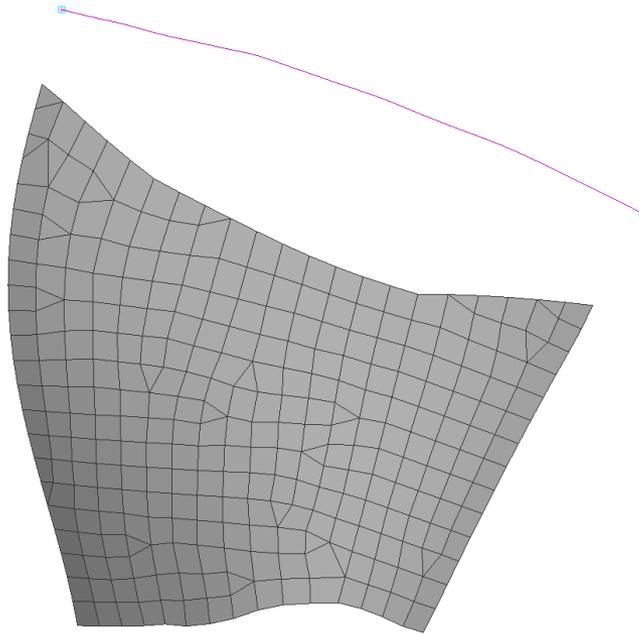


- Control Entities
- Morphed Entities
- Boundary
- Morphing

Direct Morphing

DFM

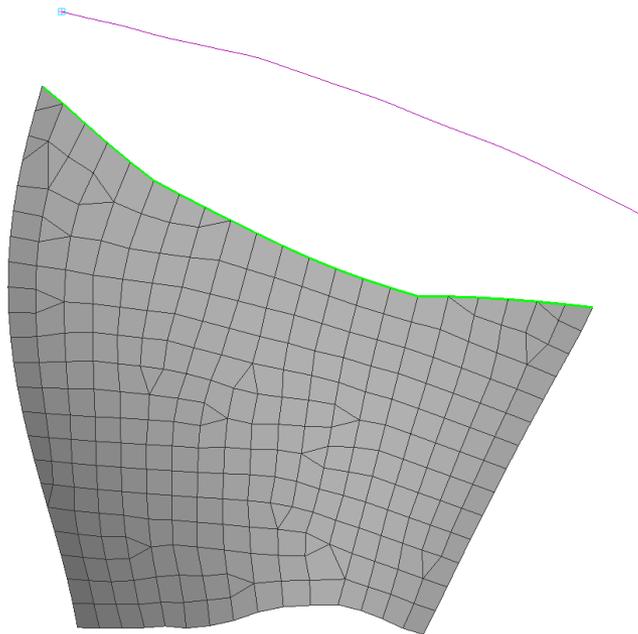
Snap **FE** or geometry edges to **single** or multiple target curves



Direct Morphing

DFM

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

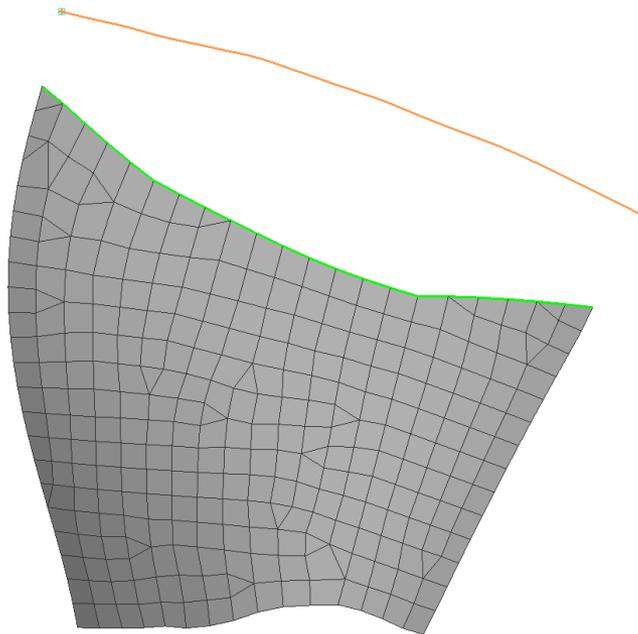


- Origin

Direct Morphing

DFM

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

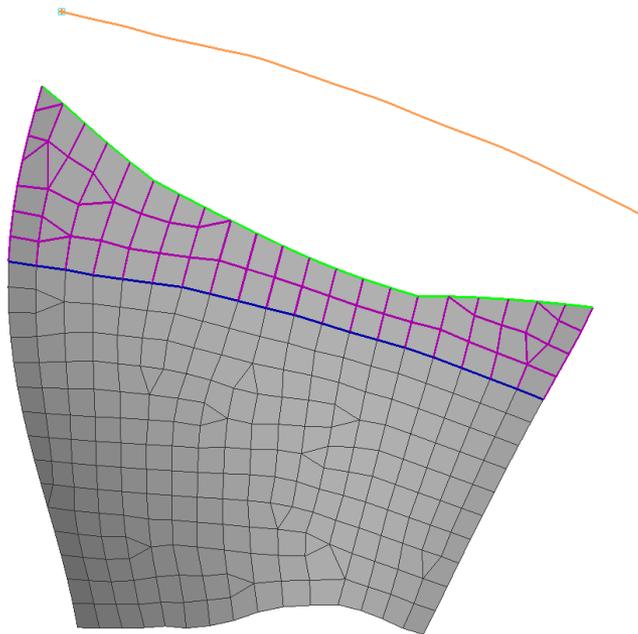


- Origin
- Target

Direct Morphing

DFM

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

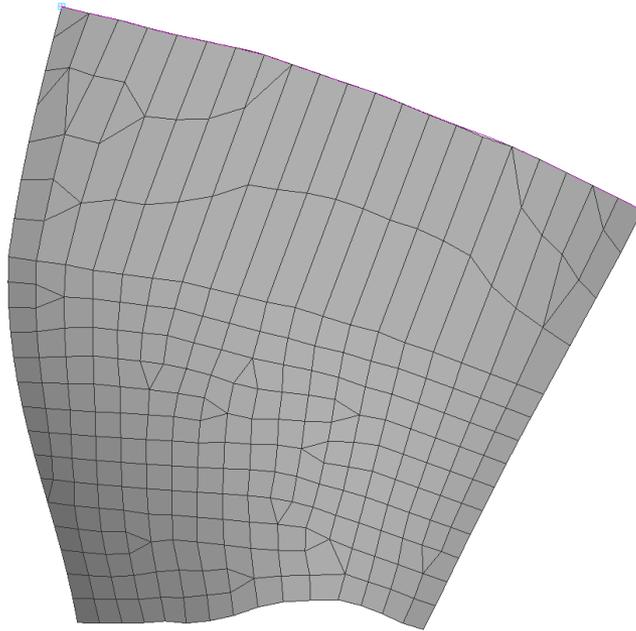


- Origin
- Target
- Morphed Entities
- Boundary

Direct Morphing

DFM

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

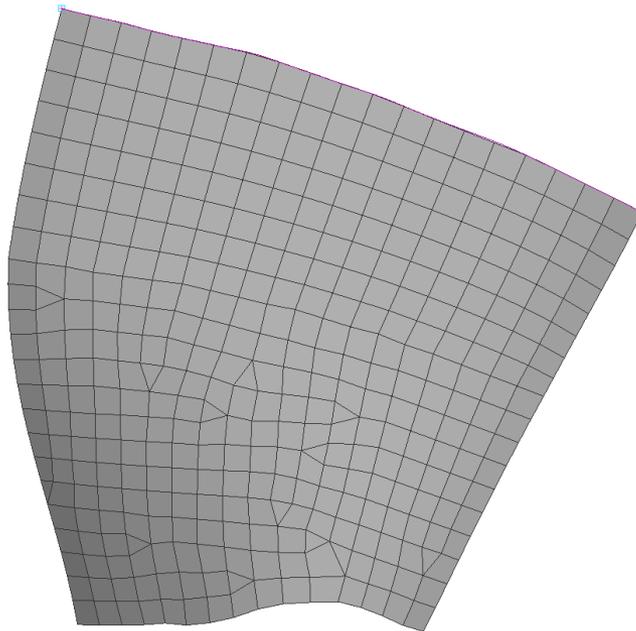


- Origin
- Target
- Morphed Entities
- Boundary
- Morphing

Direct Morphing

DFM

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

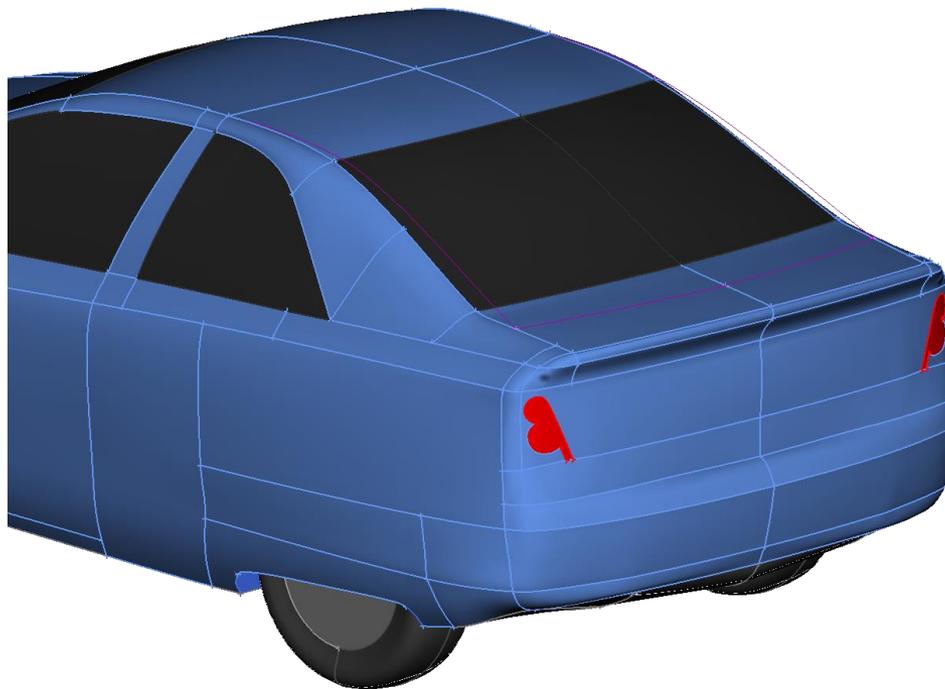


- Origin
- Target
- Morphed Entities
- Boundary
- Morphing
- Reconstruct of morphed area

Direct Morphing

DFM

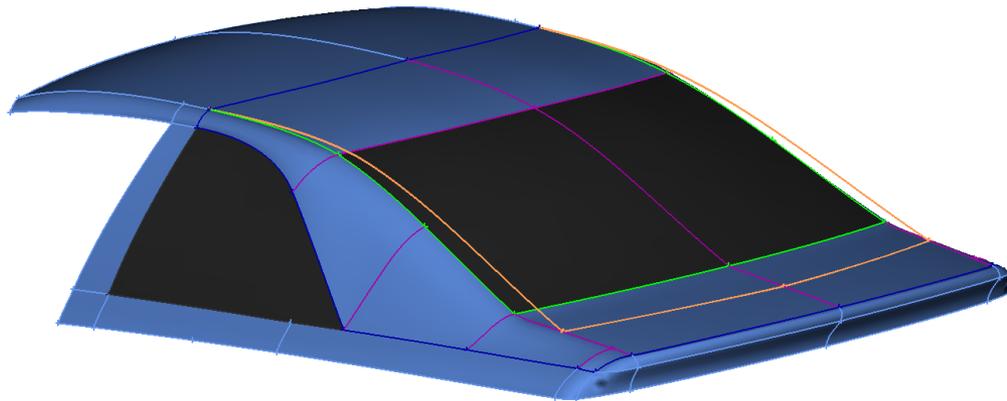
Snap FE or **geometry** edges to single or **multiple** target curves



Direct Morphing

DFM

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

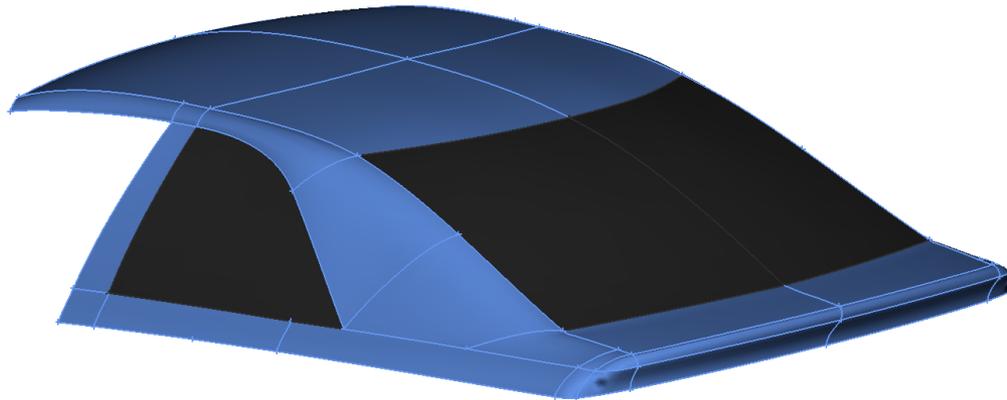


- Origin
- Target
- Morphed Entities
- Boundary

Direct Morphing

DFM

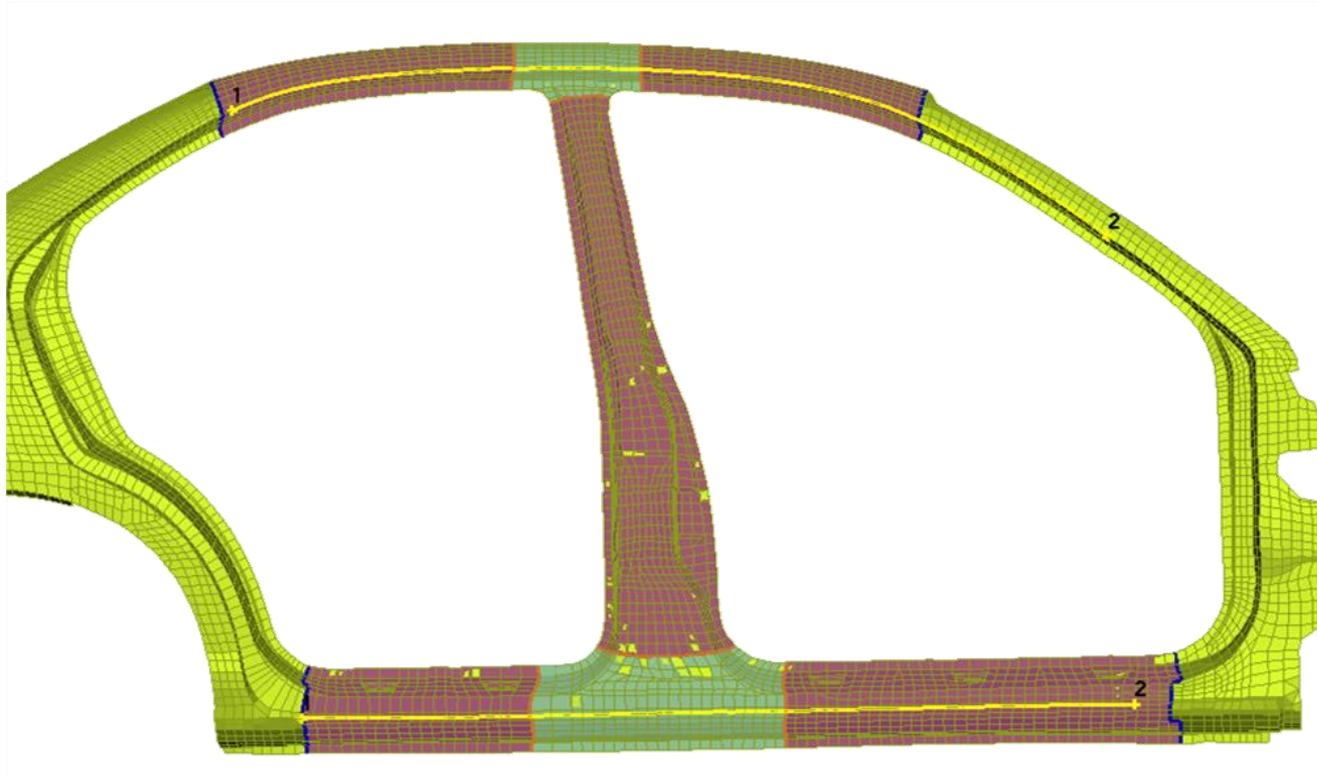
Snap FE or **geometry** edges to single or **multiple** target curves



- Origin
- Target
- Morphed Entities
- Boundary
- Morphing

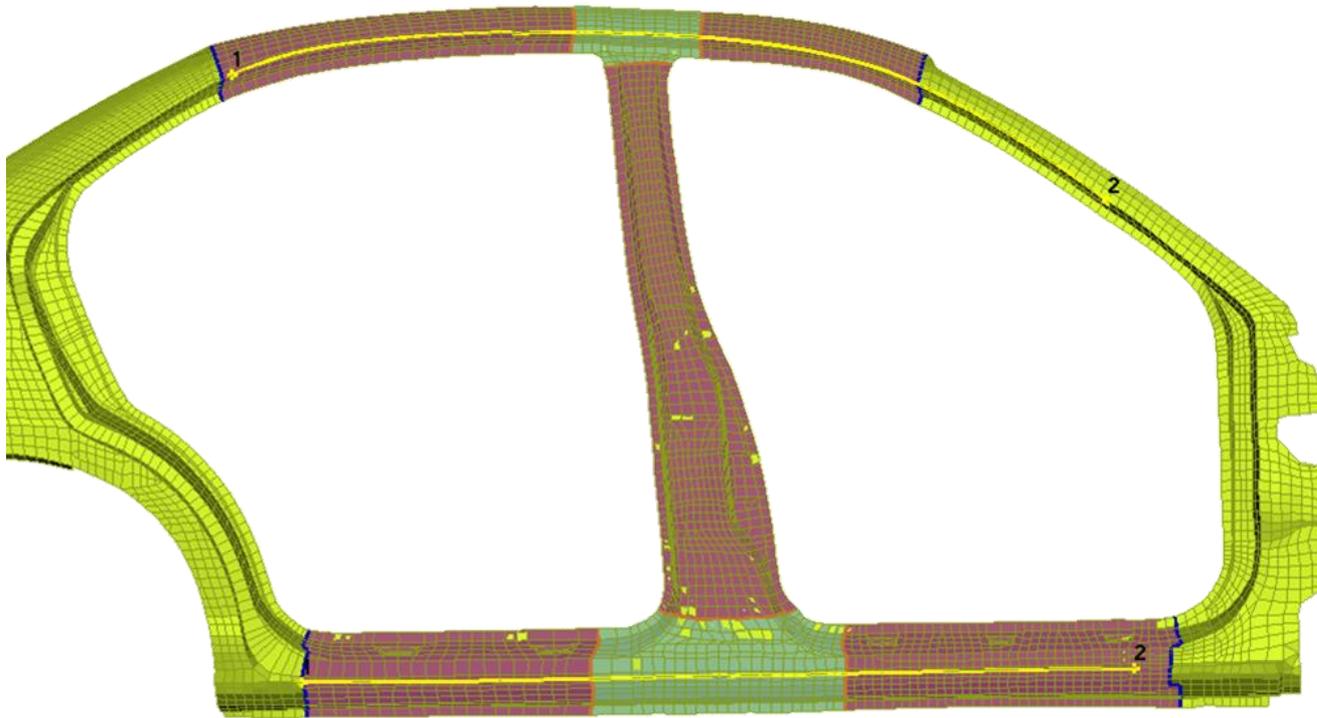
Direct Morphing DFM

Sweep / Glide along pre-defined curves



Direct Morphing DFM

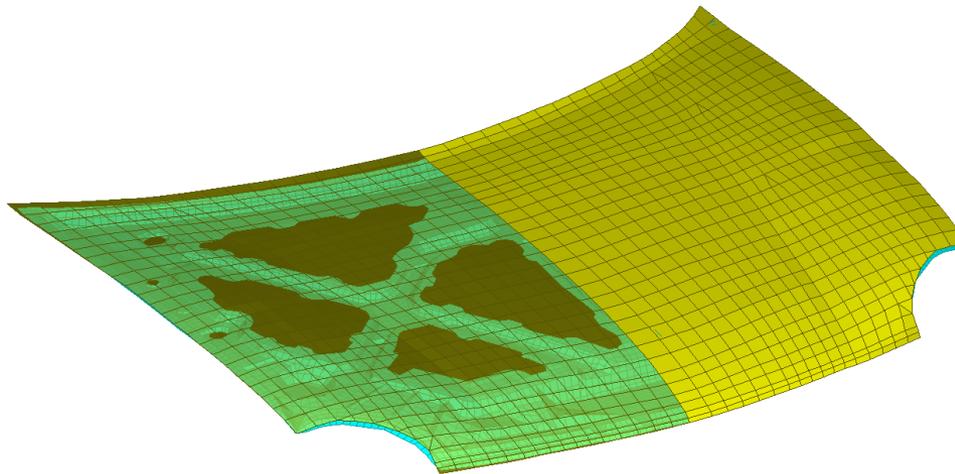
Sweep / Glide along pre-defined curves



Direct Morphing

DFM

Surface Fit of initial FE or geometry onto target FE or geometry

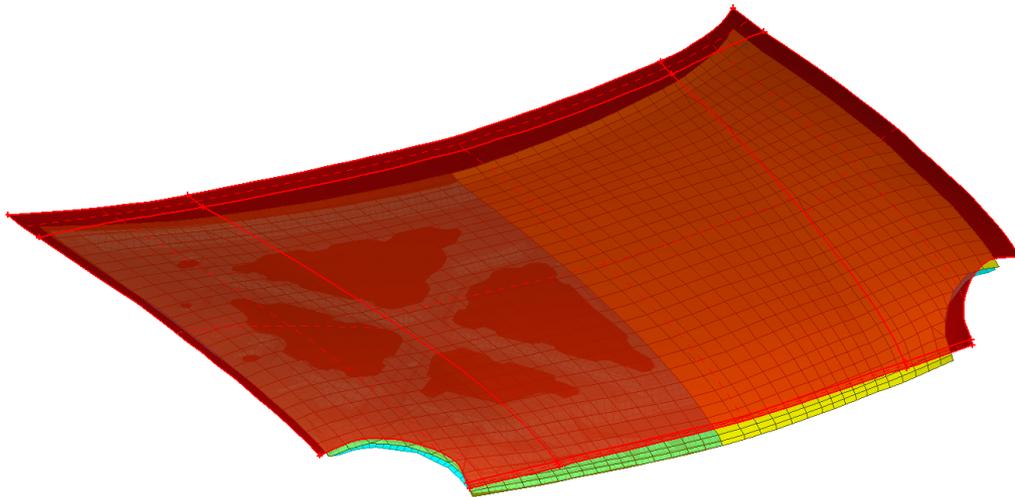


- Initial FE-surface (with additional underlying parts)

Direct Morphing

DFM

Surface Fit of initial FE or geometry onto target FE or geometry

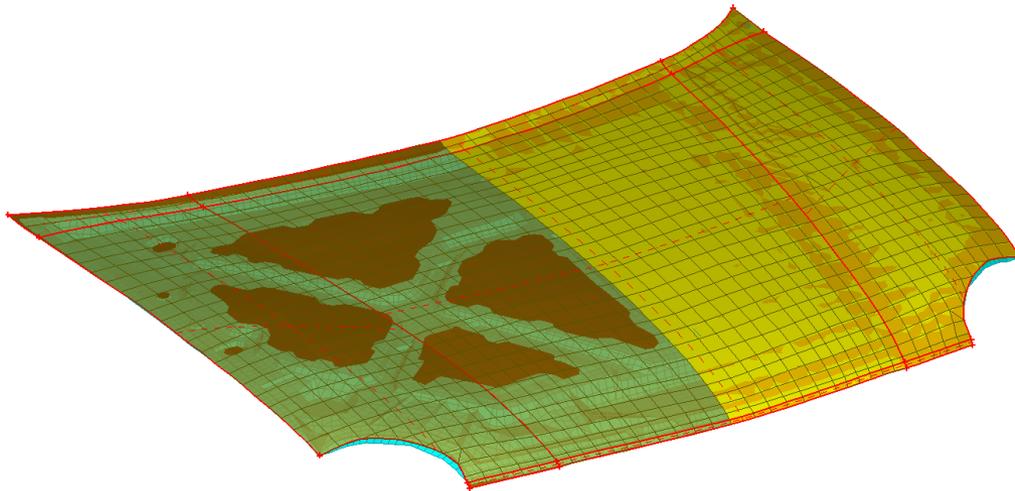


- Initial FE-surface (with additional underlying parts)
- Target CAD-surface

Direct Morphing

DFM

Surface Fit of initial FE or geometry onto target FE or geometry

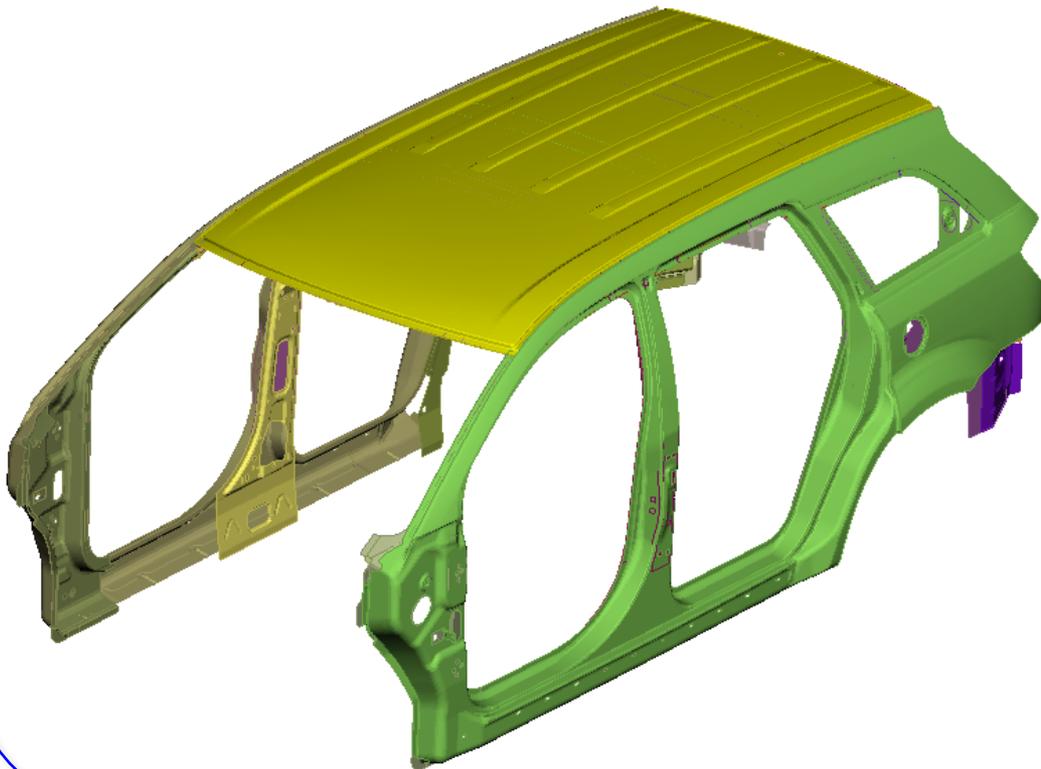


- Initial FE-surface (with additional underlying parts)
- Target CAD-surface
- Morphing

Direct Morphing

DFM

Surface Fit of initial FE or geometry onto target FE or geometry

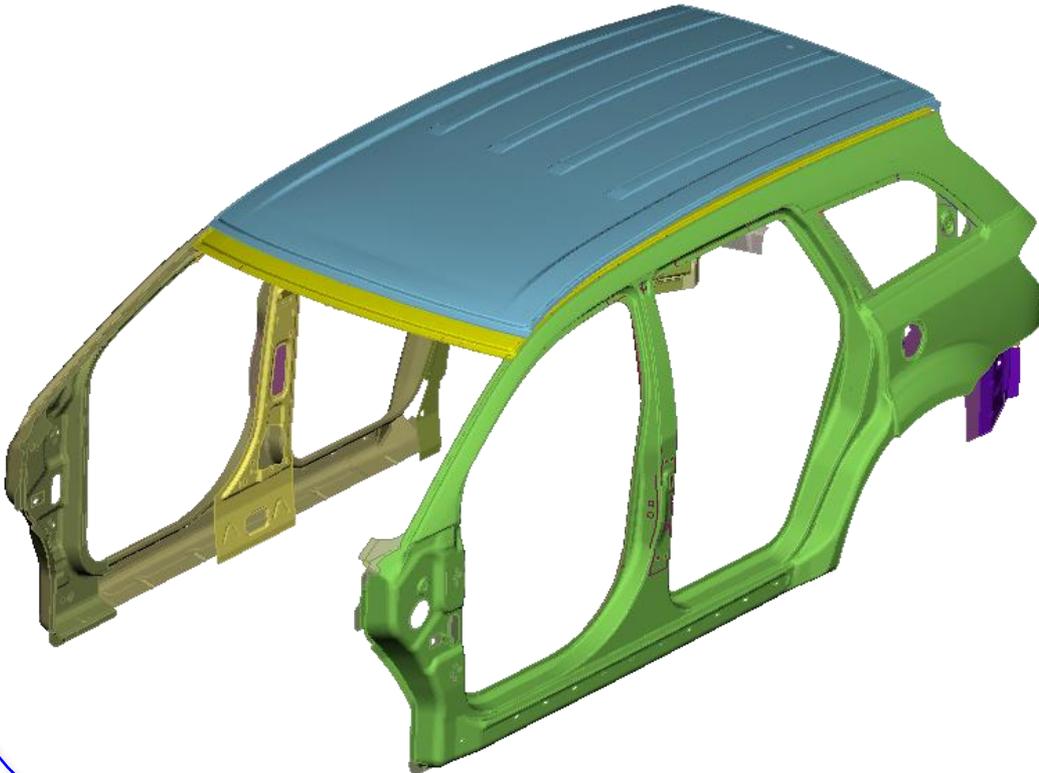


- Initial FE-surface

Direct Morphing

DFM

Surface Fit of **initial FE** or geometry onto **target FE** or geometry

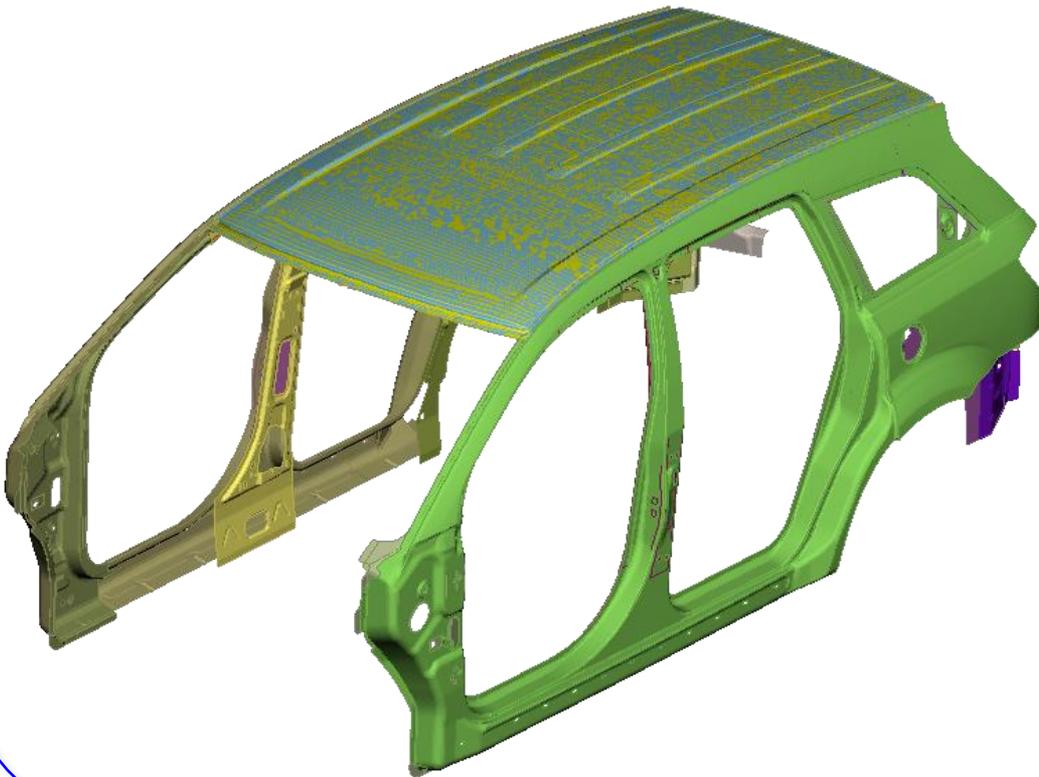


- Initial FE-surface
- Target FE-surface

Direct Morphing

DFM

Surface Fit of initial FE or geometry onto target FE or geometry

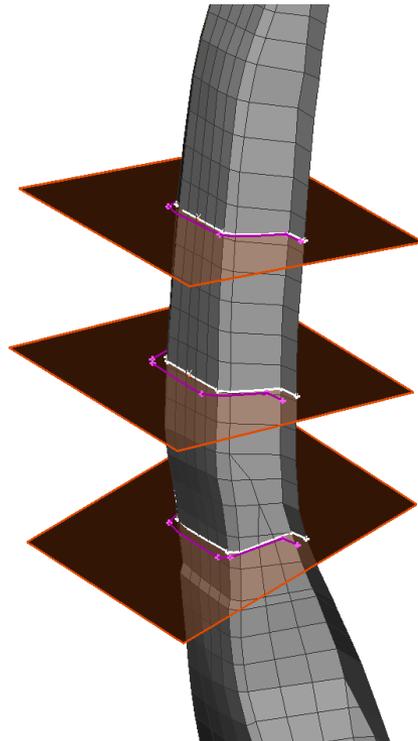


- Initial FE-surface
- Target FE-surface
- Morphing

Direct Morphing

Cross Sections

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

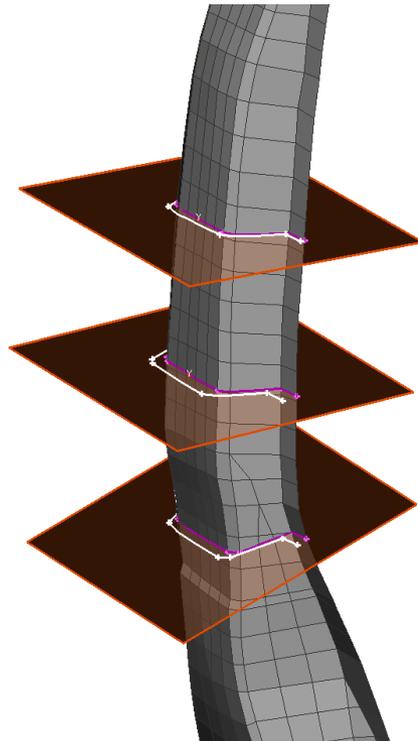


- Original cross section

Direct Morphing

Cross Sections

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

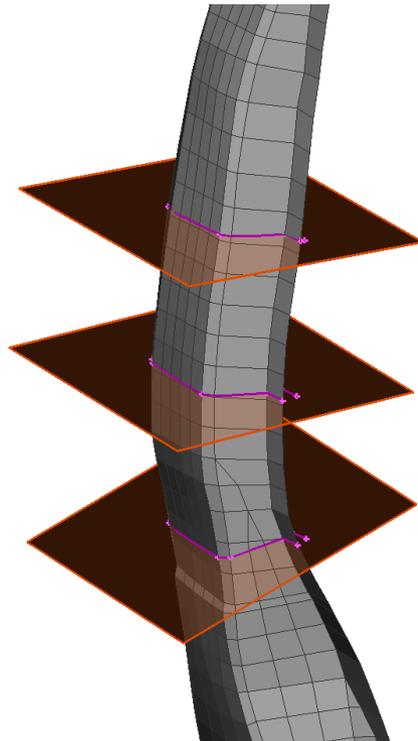


- Original cross section
- Target cross section

Direct Morphing

Cross Sections

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

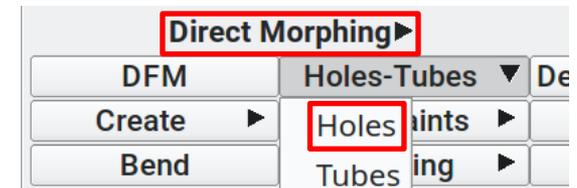
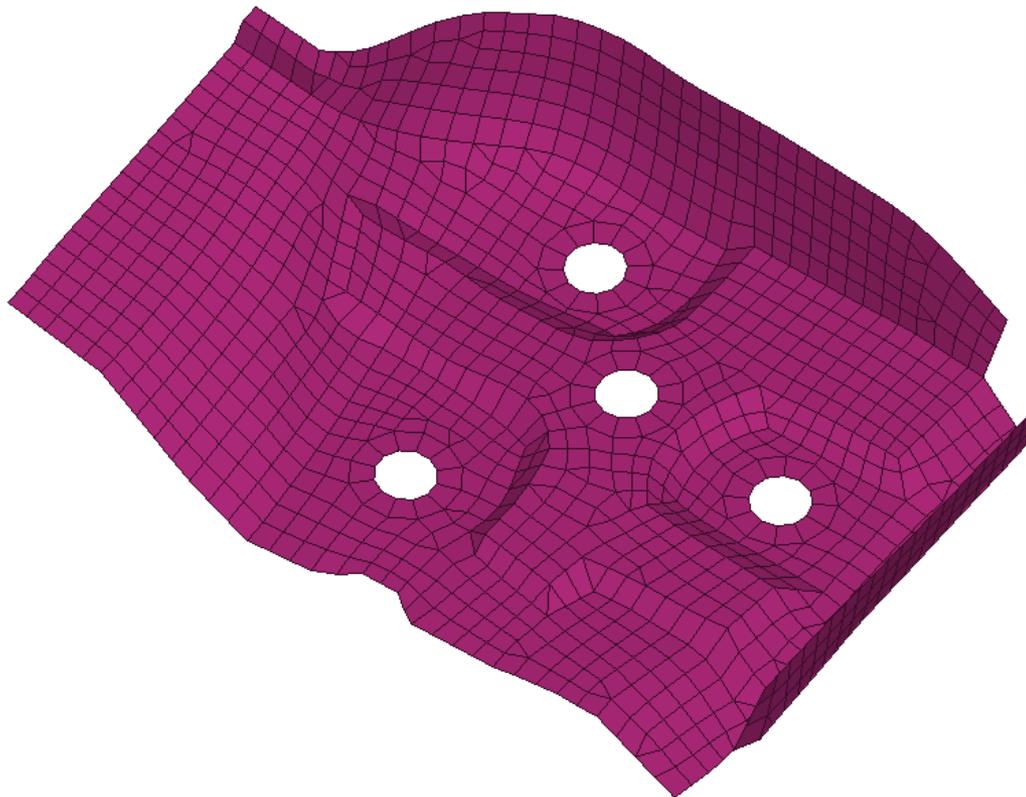


- Original cross section
- Target cross section
- Morphing

Direct Morphing

2D & 3D Holes

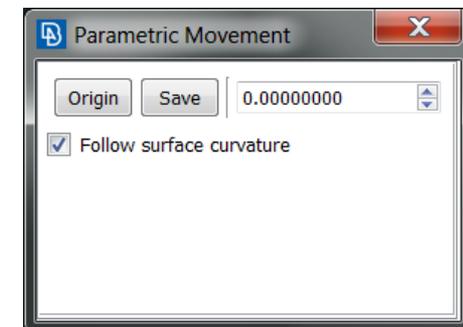
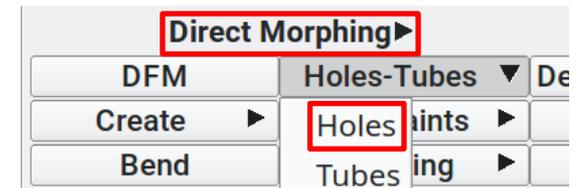
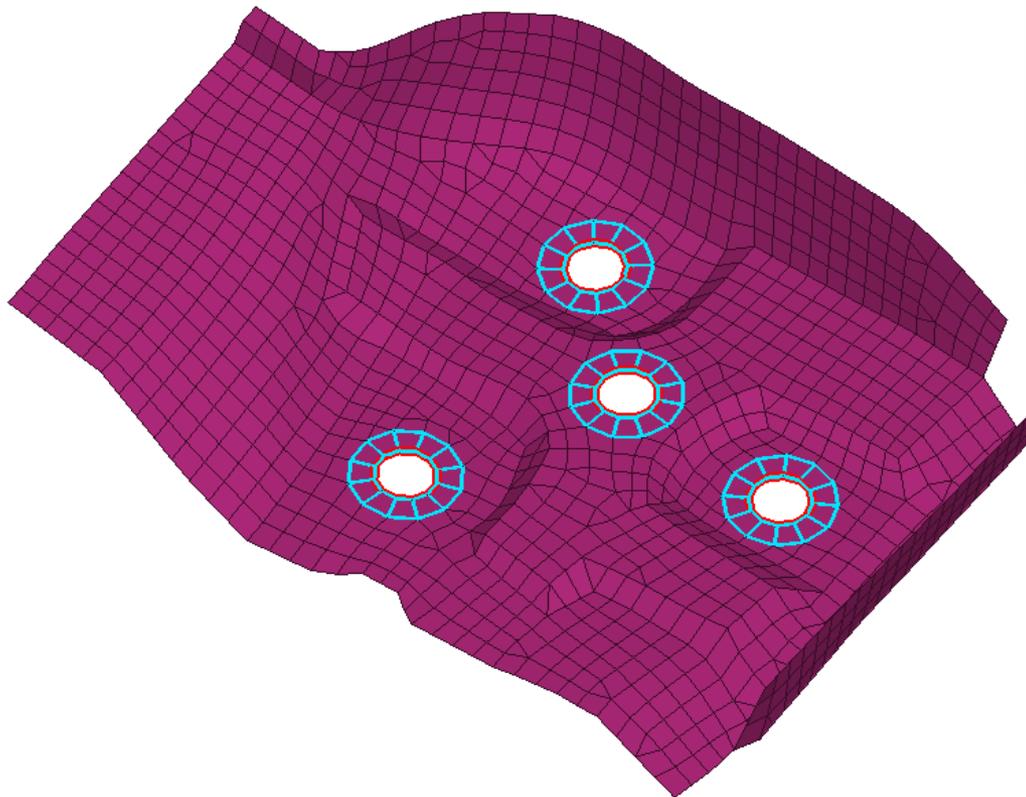
Manipulate diameter of **2D Holes**



Direct Morphing

2D & 3D Holes

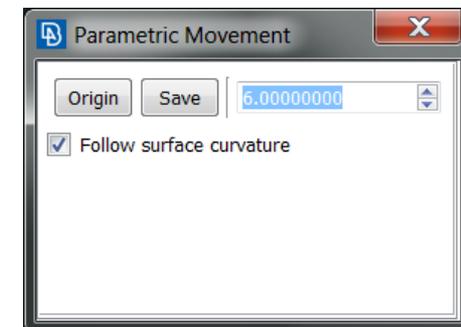
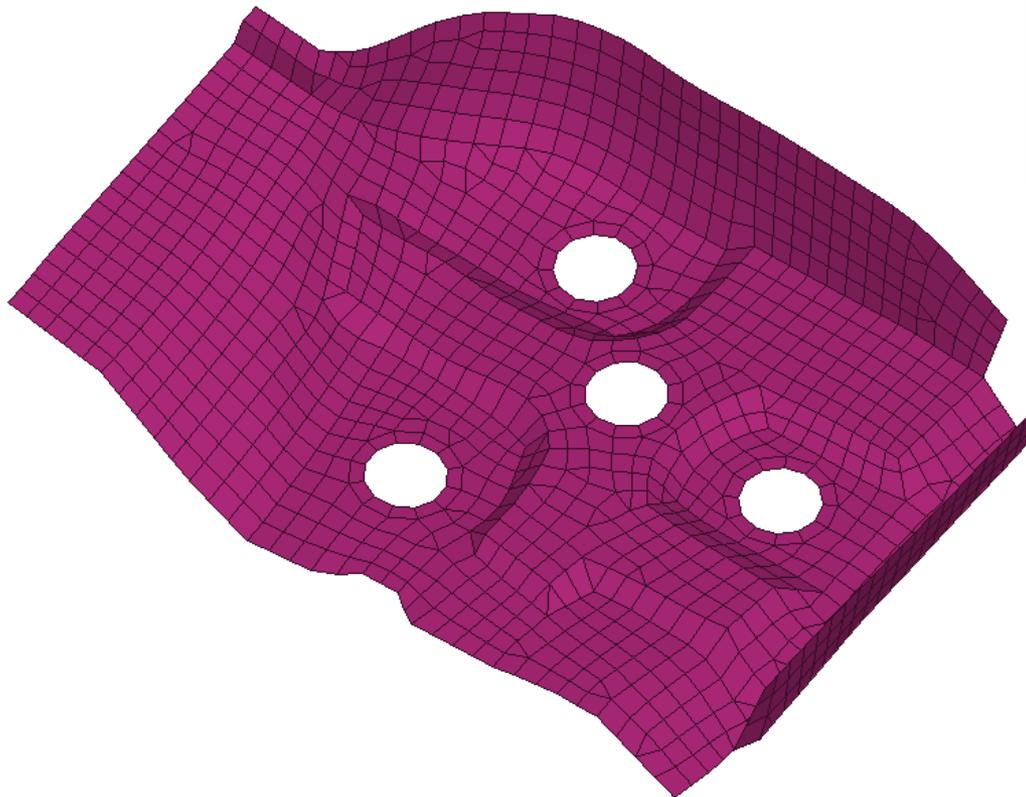
Manipulate diameter of **2D Holes**



Direct Morphing

2D & 3D Holes

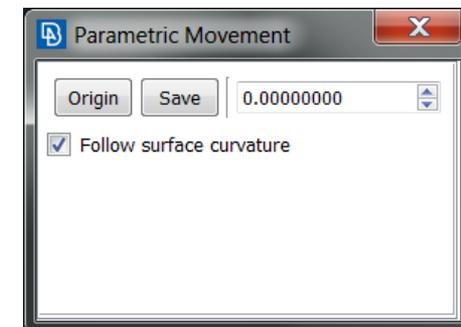
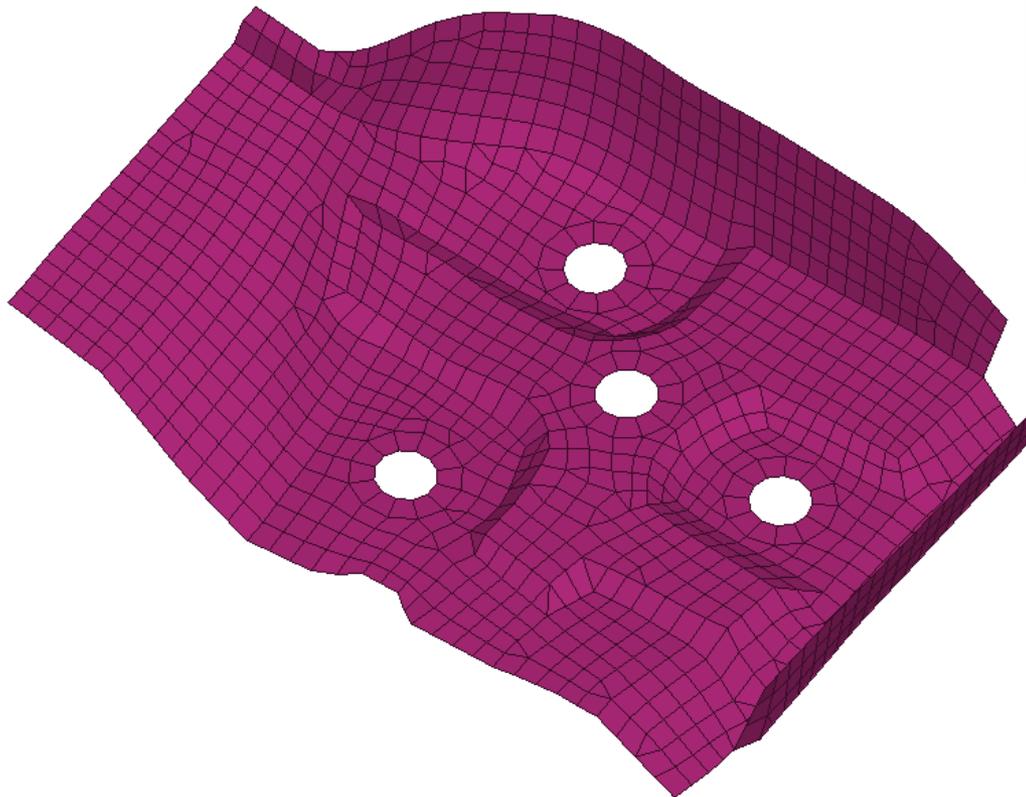
Manipulate diameter of **2D Holes**



Direct Morphing

2D & 3D Holes

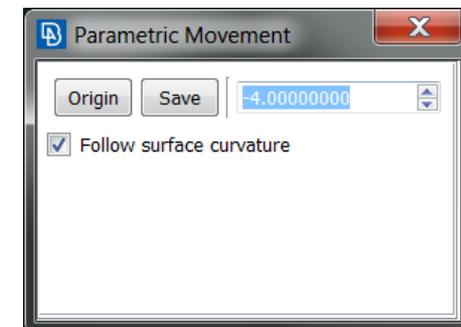
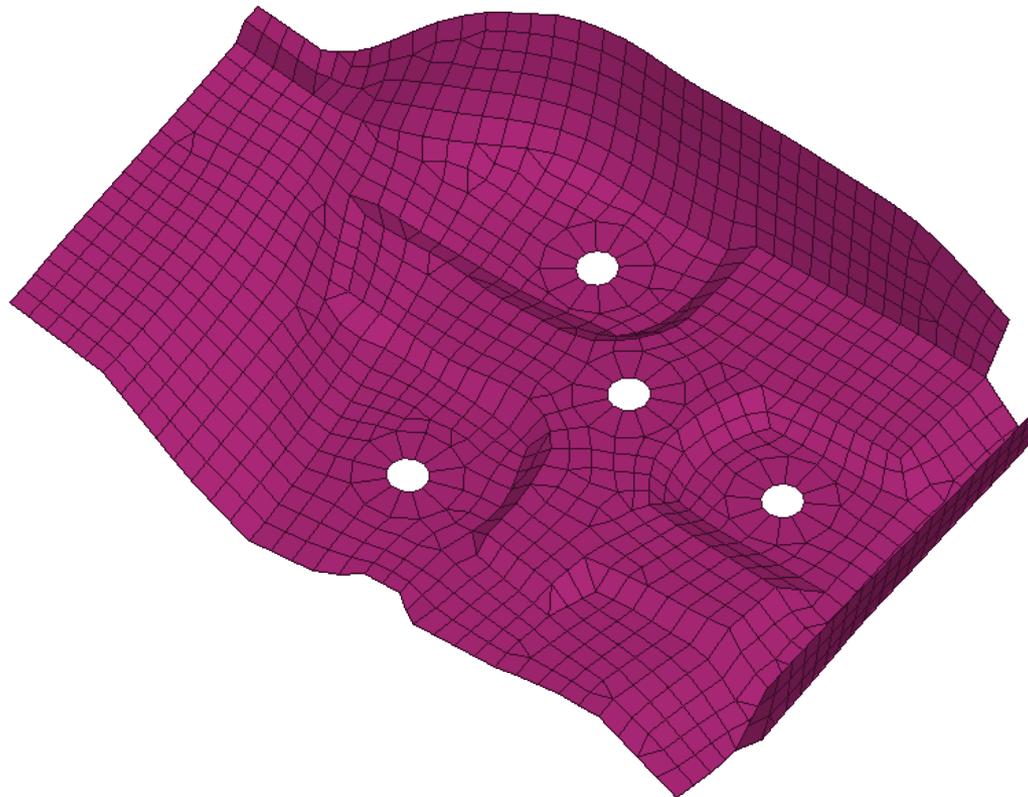
Manipulate diameter of **2D Holes**



Direct Morphing

2D & 3D Holes

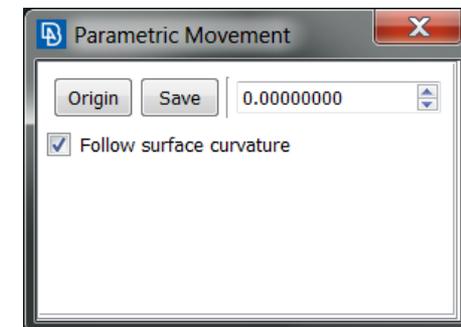
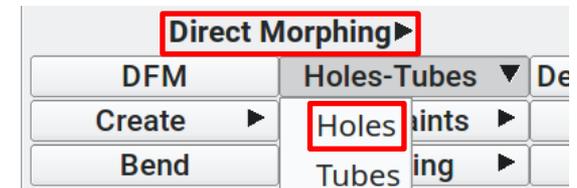
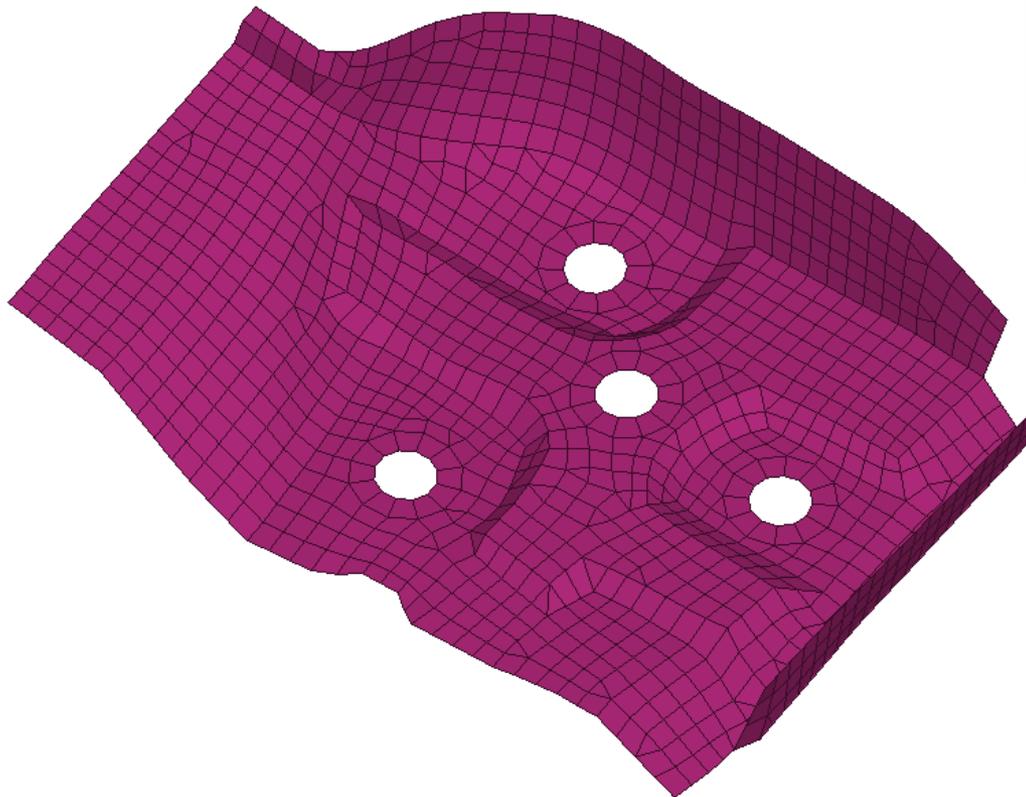
Manipulate diameter of **2D Holes**



Direct Morphing

2D & 3D Holes

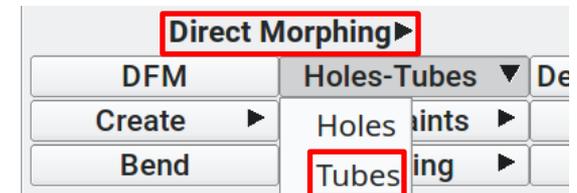
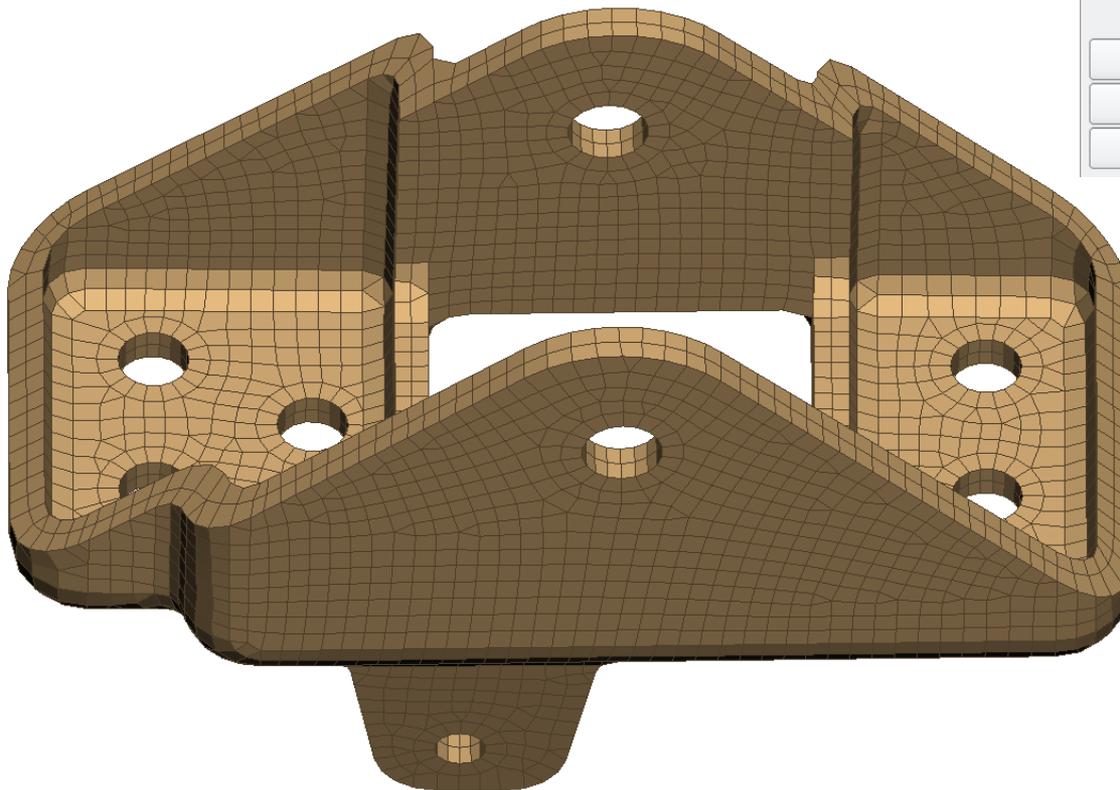
Manipulate diameter of **2D Holes**



Direct Morphing

2D & 3D Holes

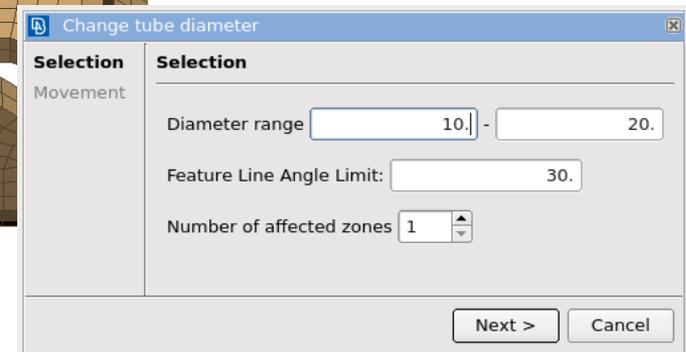
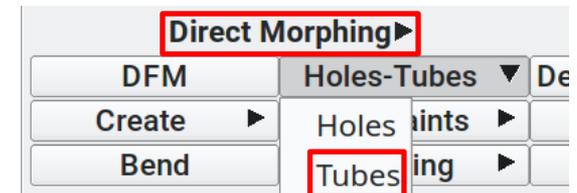
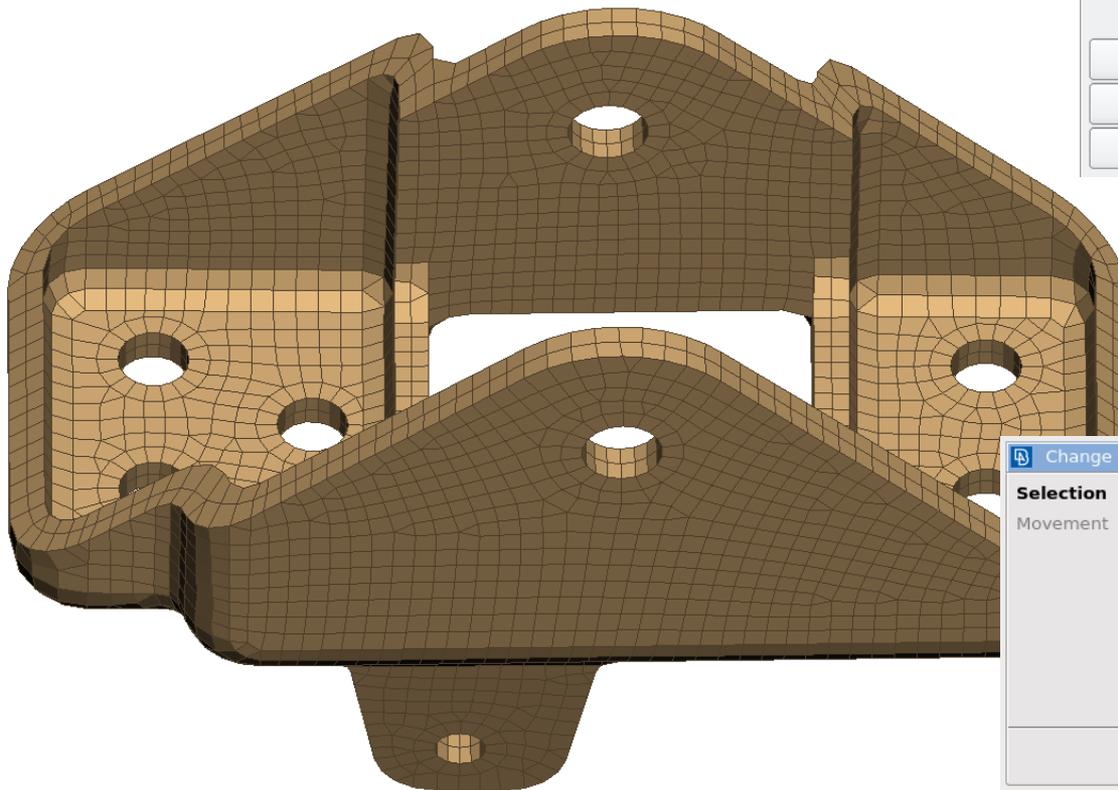
Manipulate diameter of **3D Holes**



Direct Morphing

2D & 3D Holes

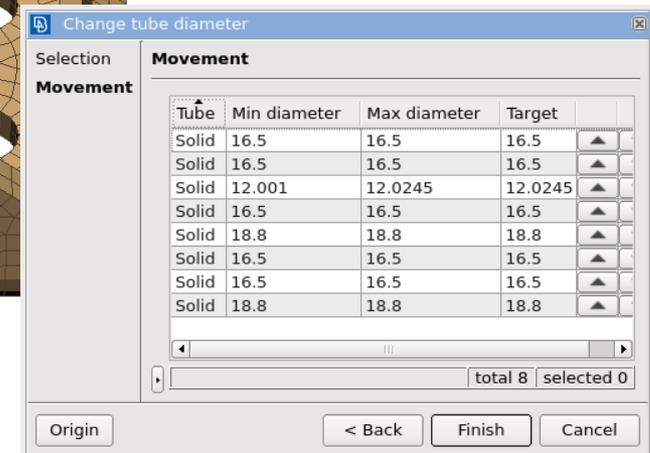
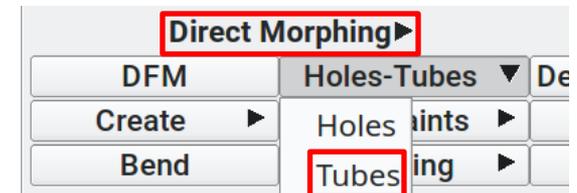
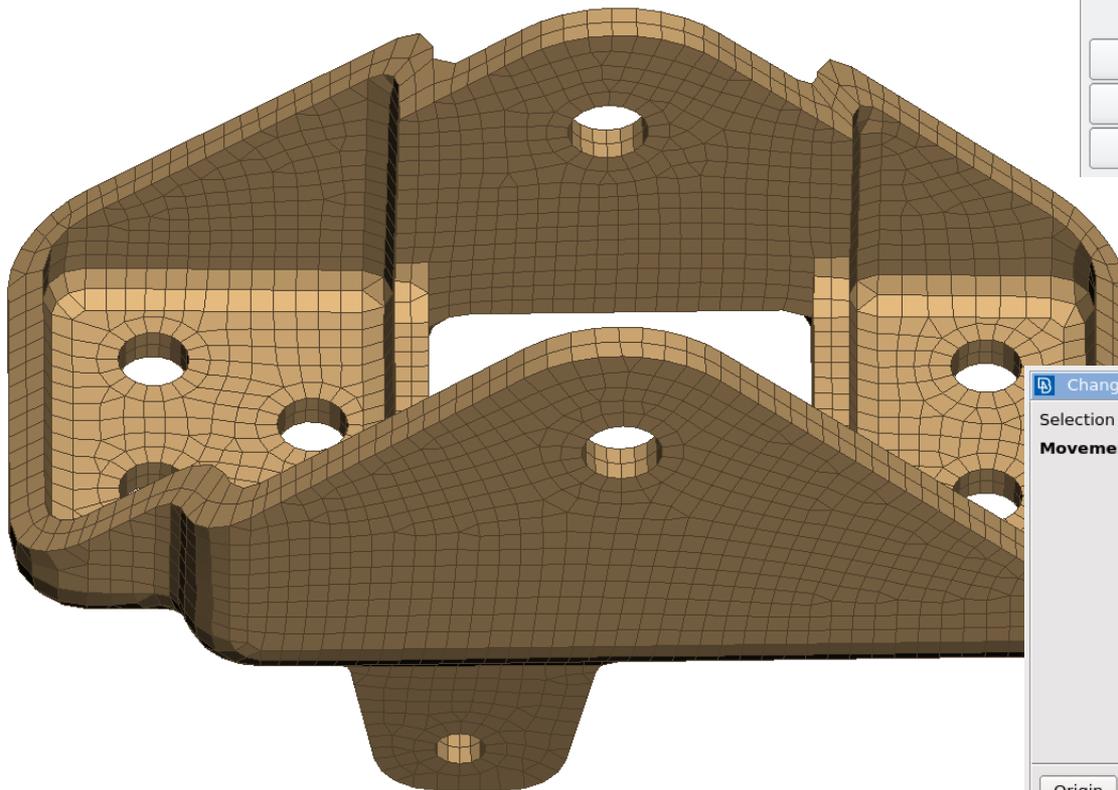
Manipulate diameter of **3D Holes**



Direct Morphing

2D & 3D Holes

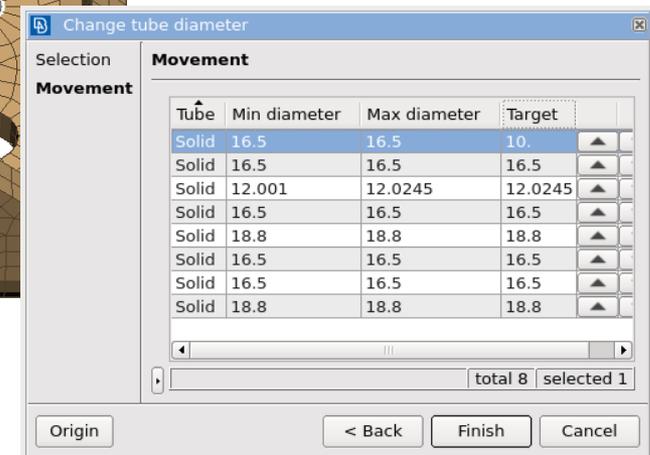
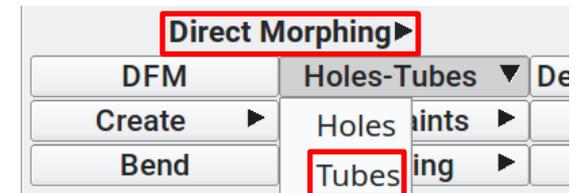
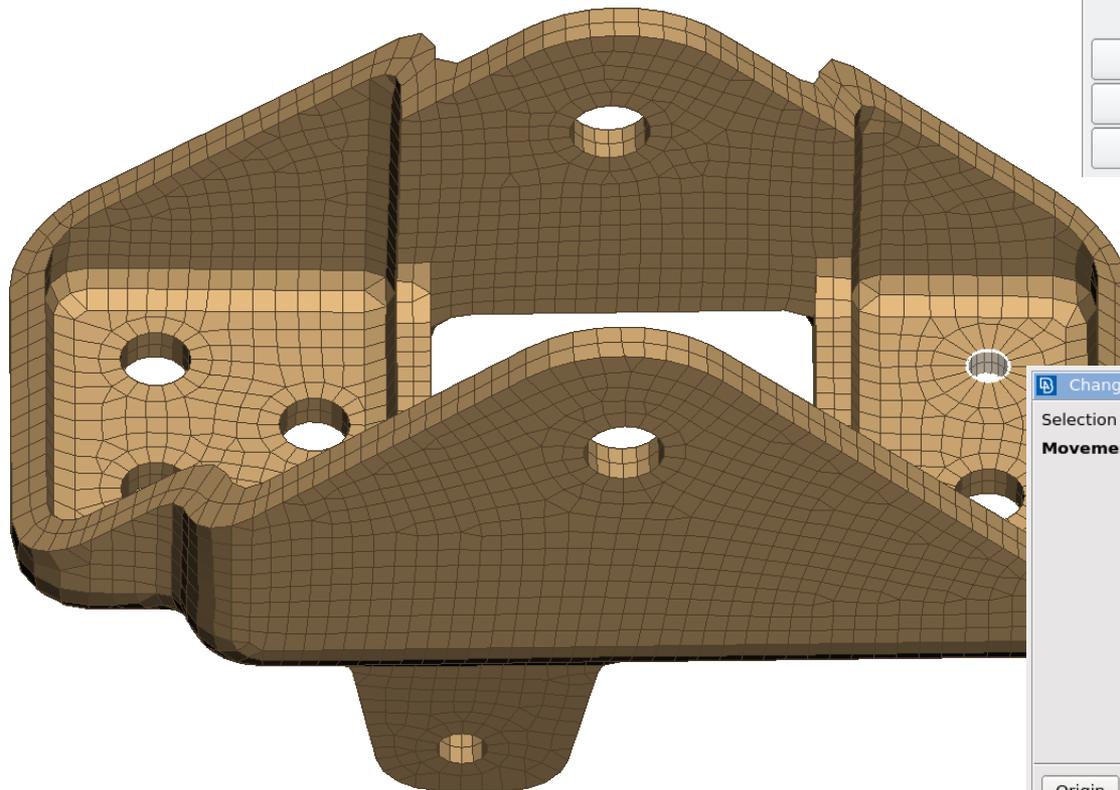
Manipulate diameter of **3D Holes**



Direct Morphing

2D & 3D Holes

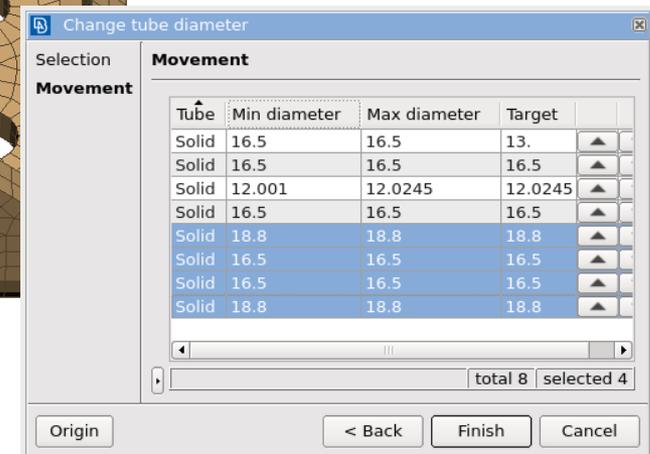
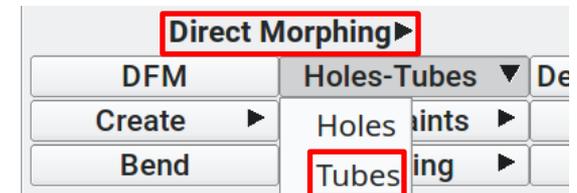
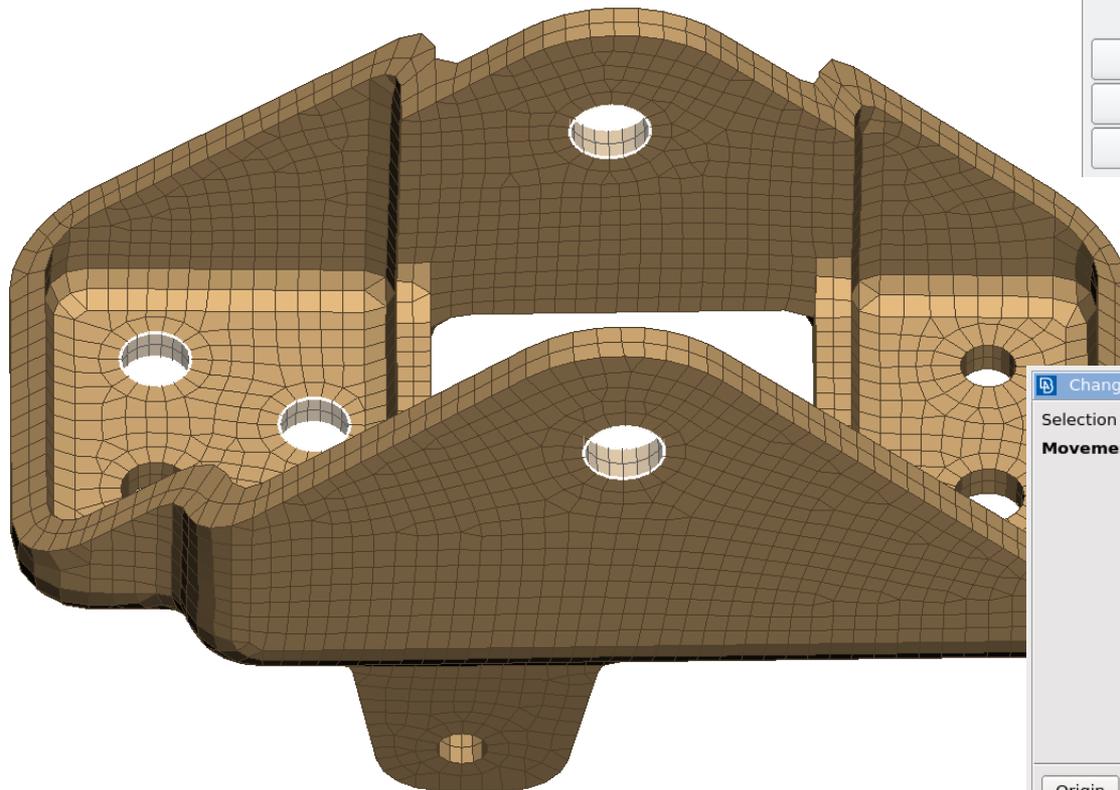
Manipulate diameter of 3D Holes



Direct Morphing

2D & 3D Holes

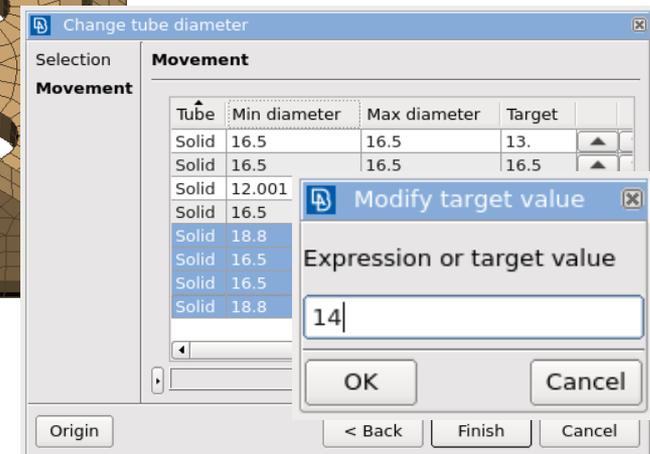
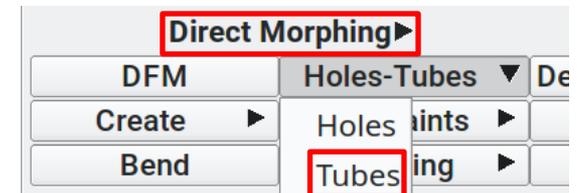
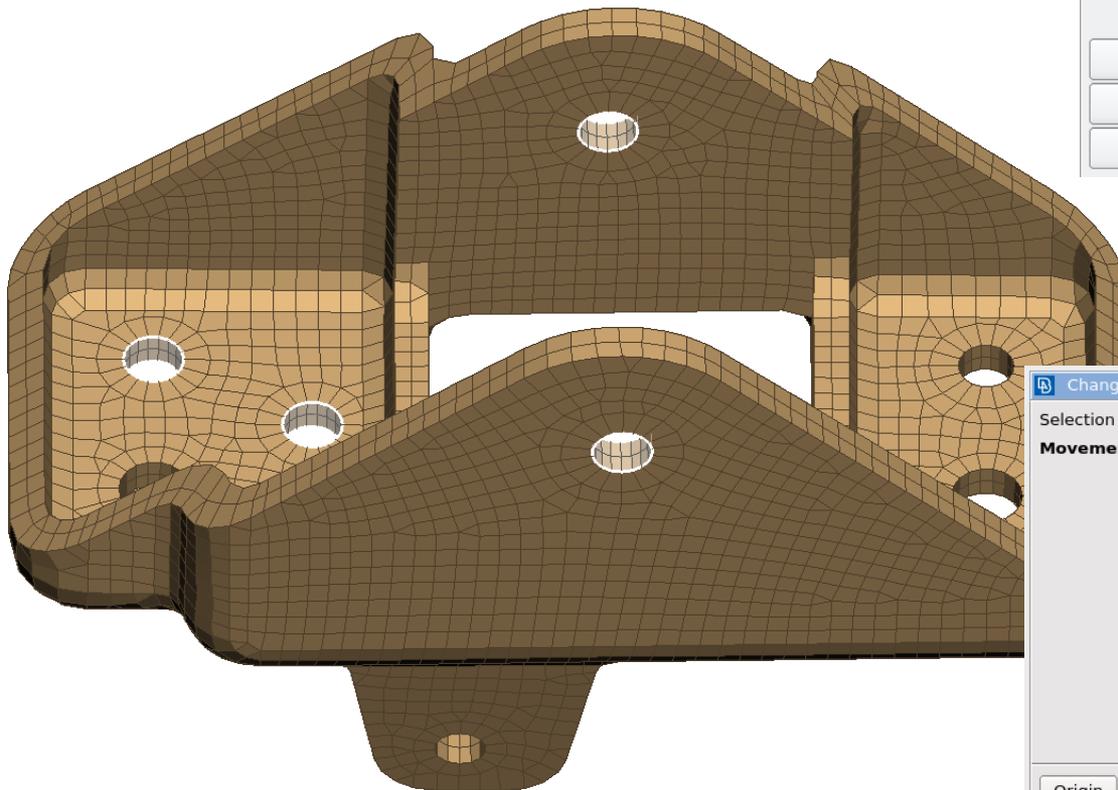
Manipulate diameter of **3D Holes**



Direct Morphing

2D & 3D Holes

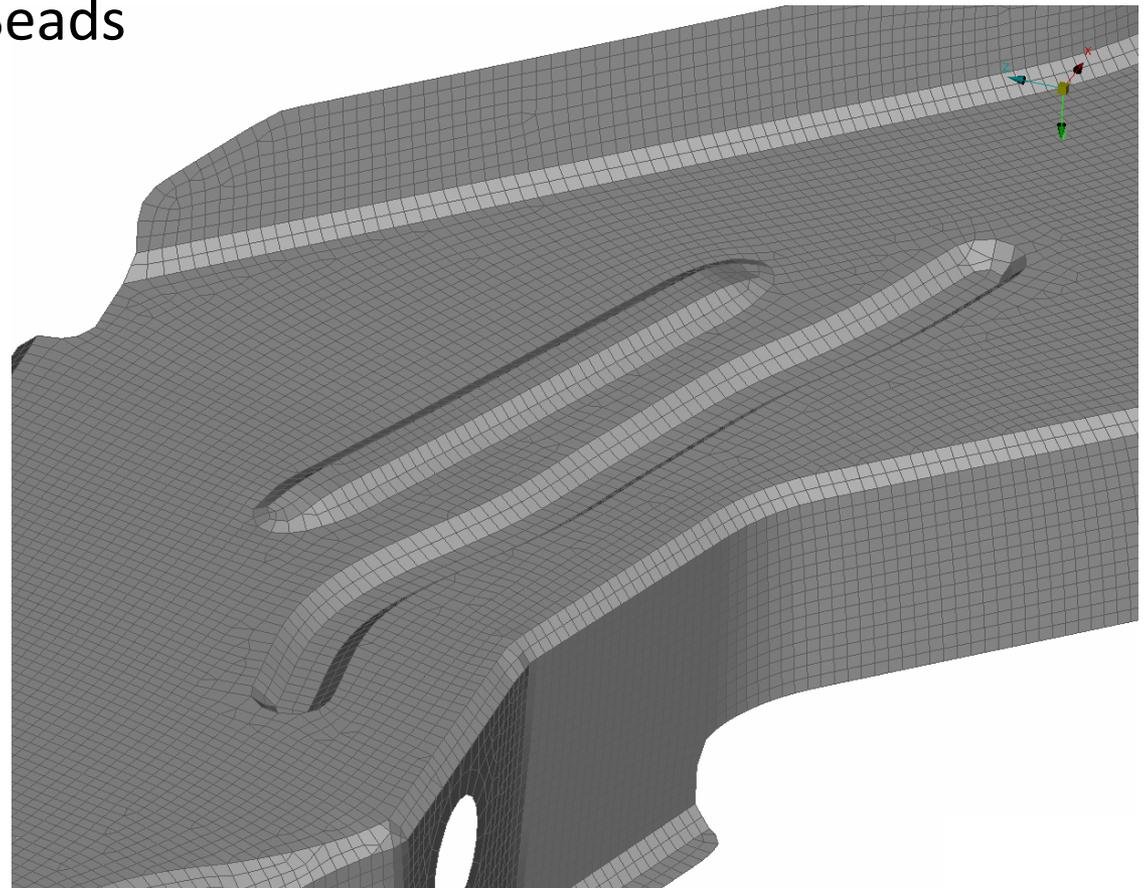
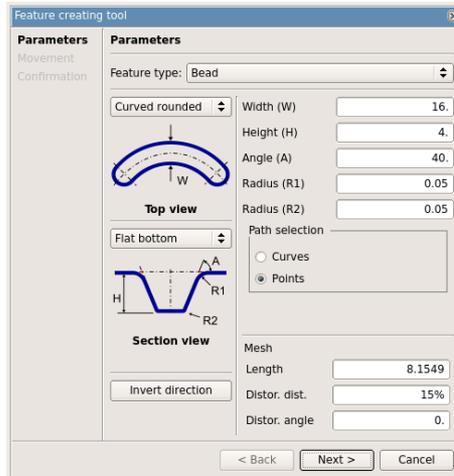
Manipulate diameter of 3D Holes



Direct Morphing

Generation & modification of beads and embosses

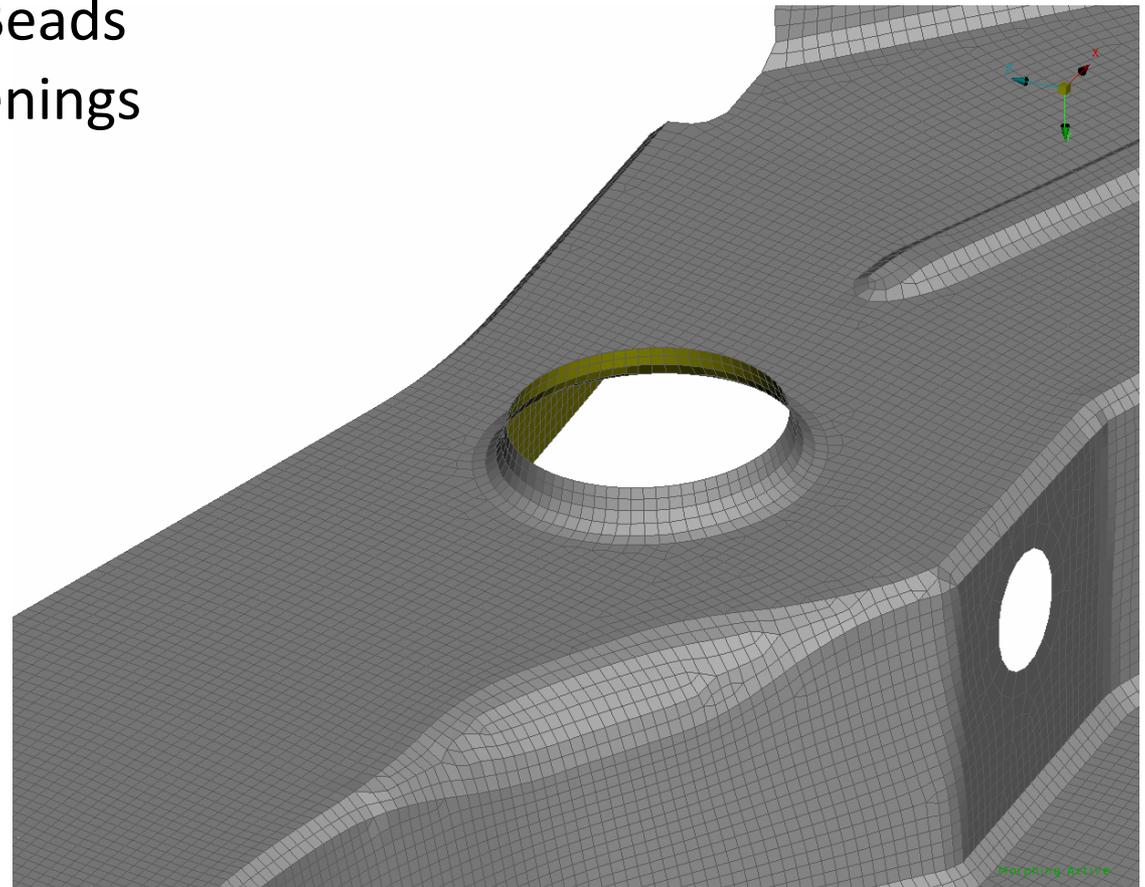
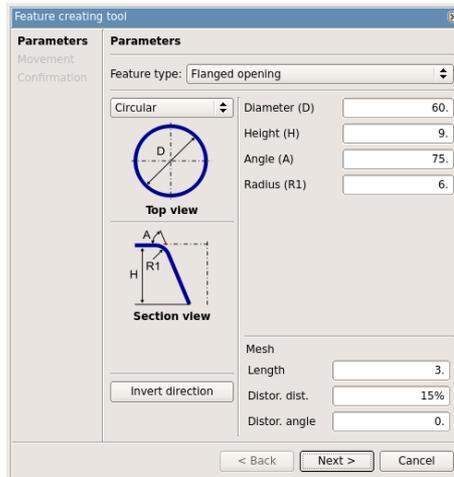
- Curved & Rounded Beads



Direct Morphing

Generation & modification of beads and embosses

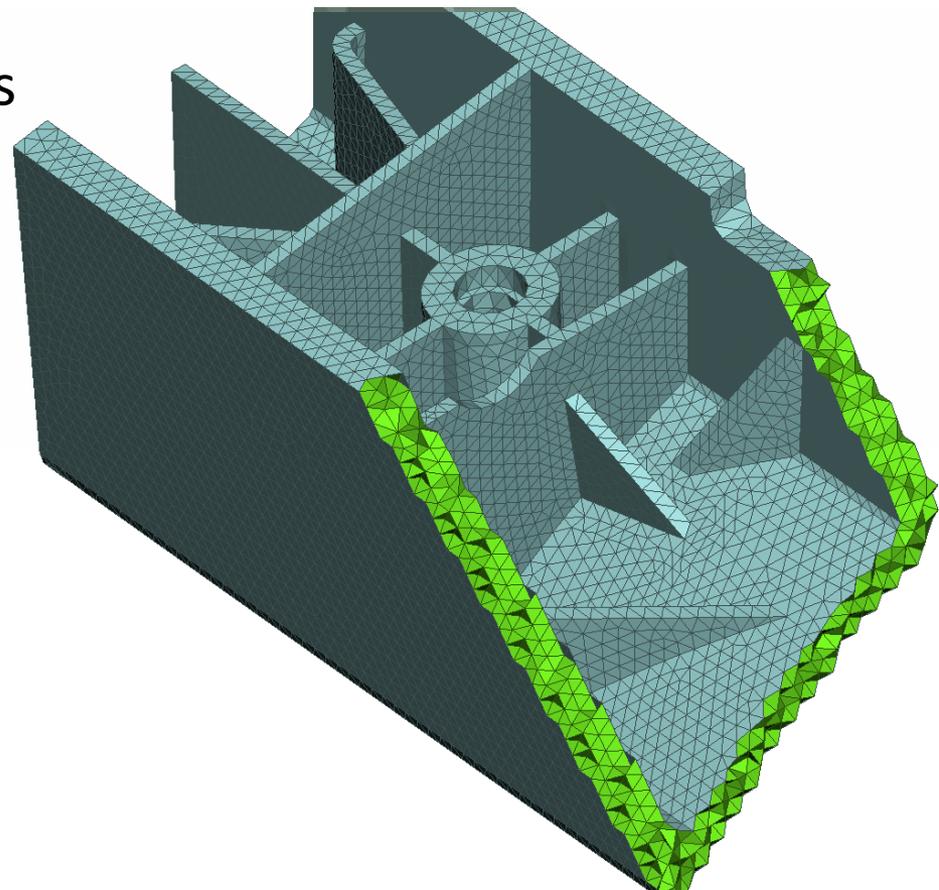
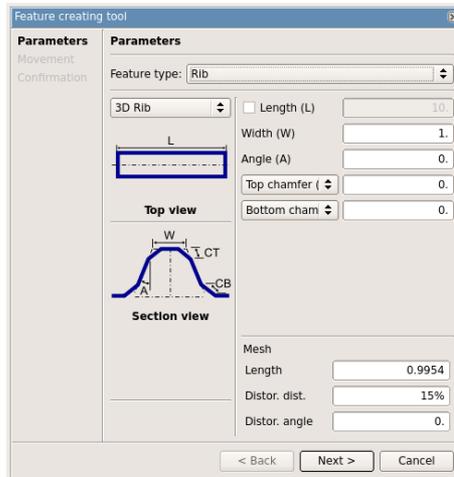
- Curved & Rounded Beads
- Circular Flanged Openings



Direct Morphing

Generation & modification of beads and embosses

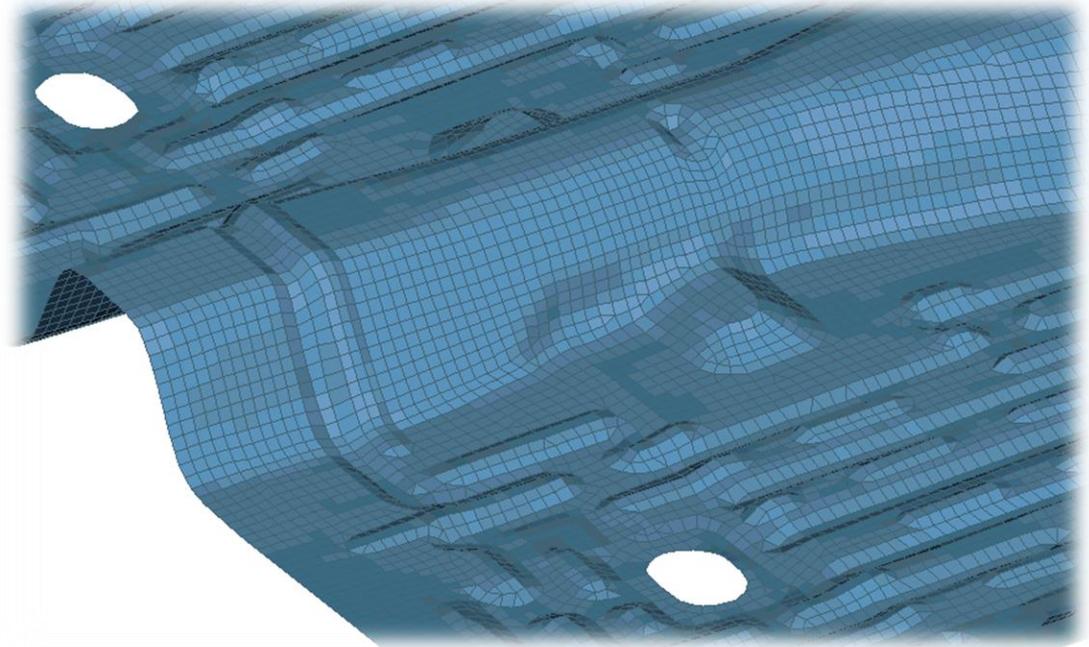
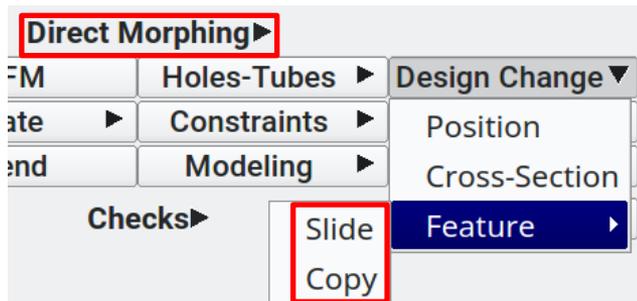
- Curved & Rounded Beads
- Circular Flanged Openings
- Shell or Solid Rib



Direct Morphing

Design Change: Feature Slide/Copy

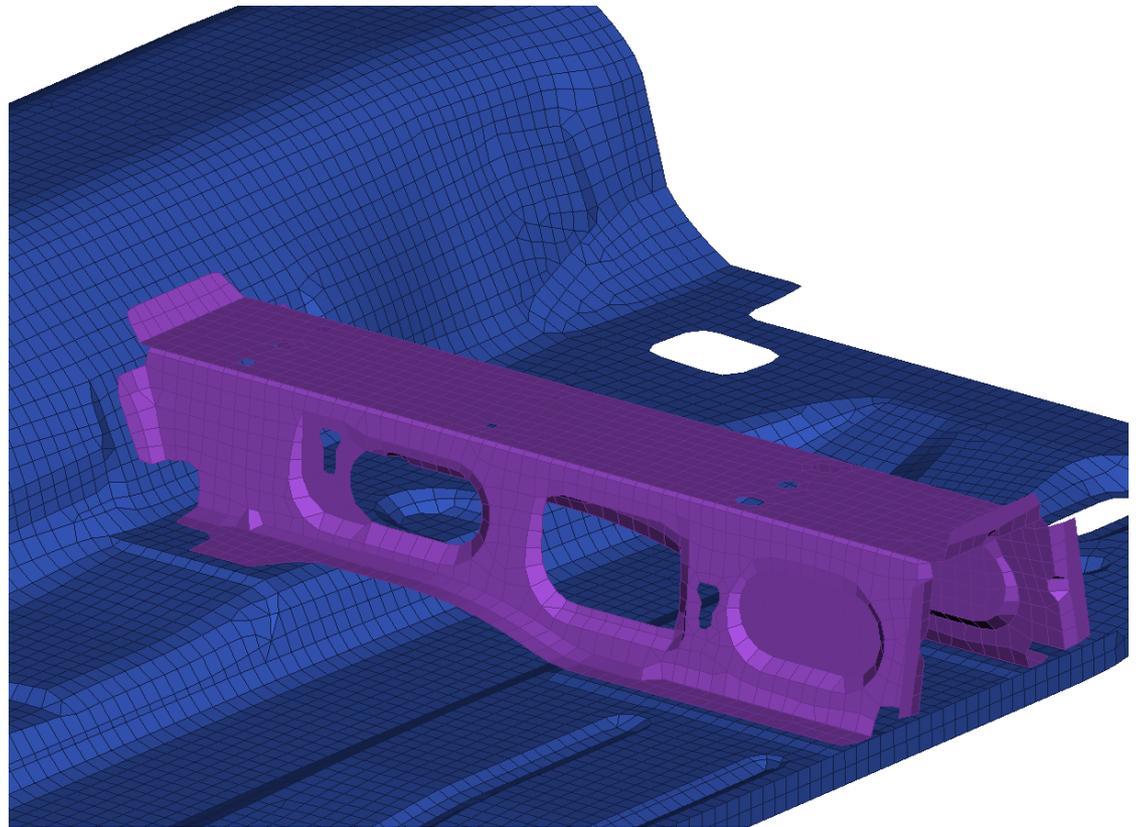
- Features of any shape (e.g. holes, beads, ribs) can be moved or copied on underlying surface
- Mesh of origin and target areas is reconstructed



Direct Morphing

Design Change: Position

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

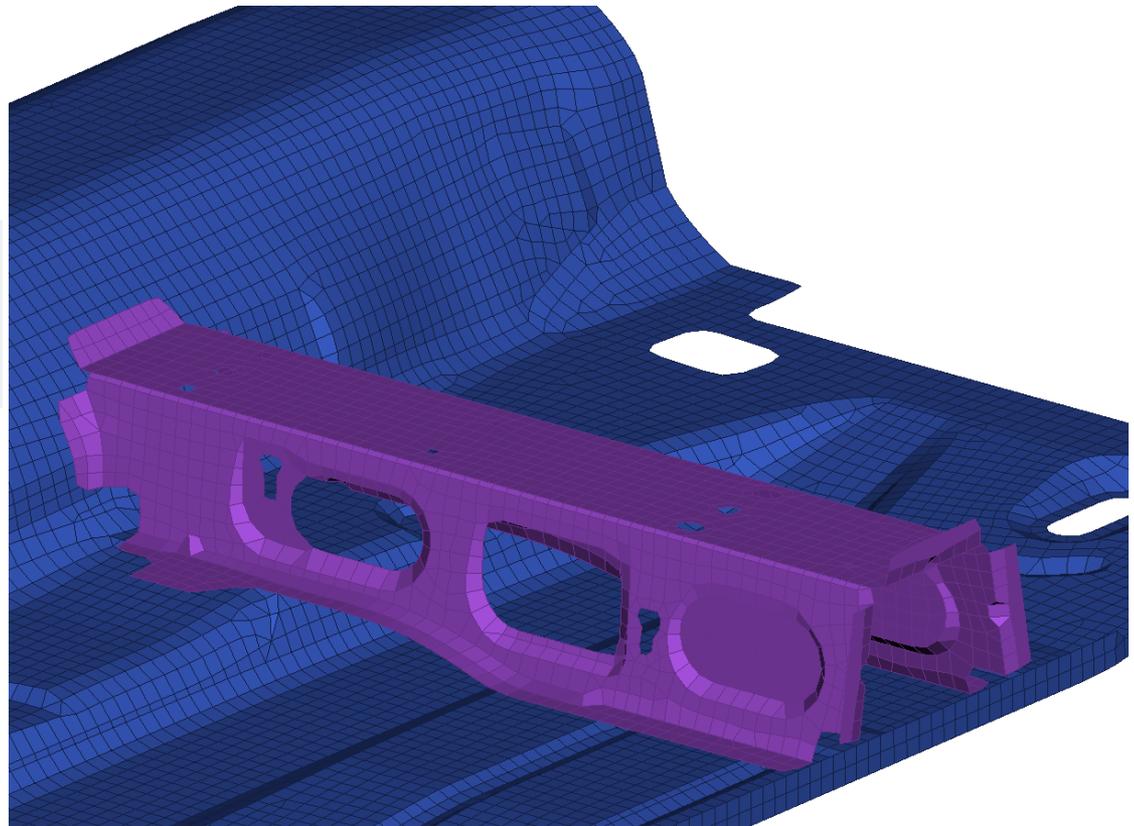


Direct Morphing

Design Change: Position

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

Direct Morphing ▶		
M	Holes-Tubes ▶	Design Change ▼
te	▶ Constraints ▶	Position
nd	Modeling ▶	Cross-Section

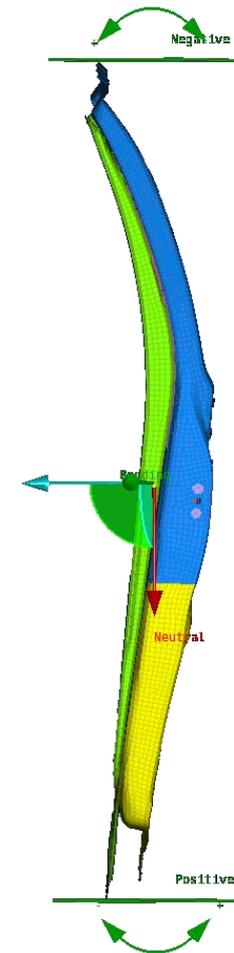
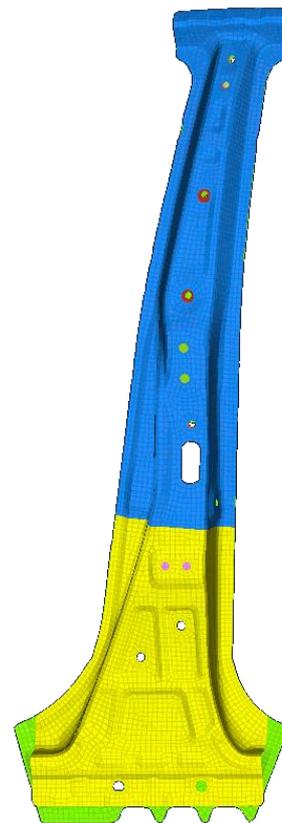


Direct Morphing

Bend

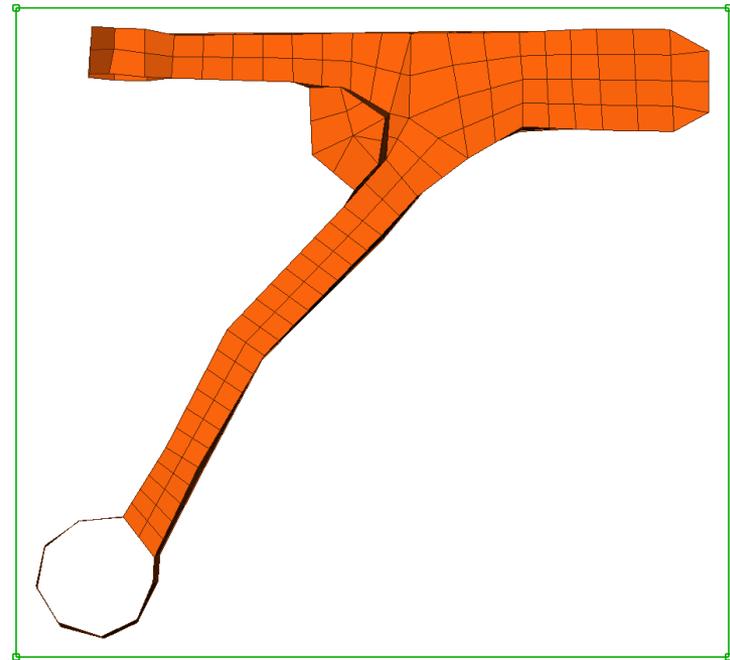
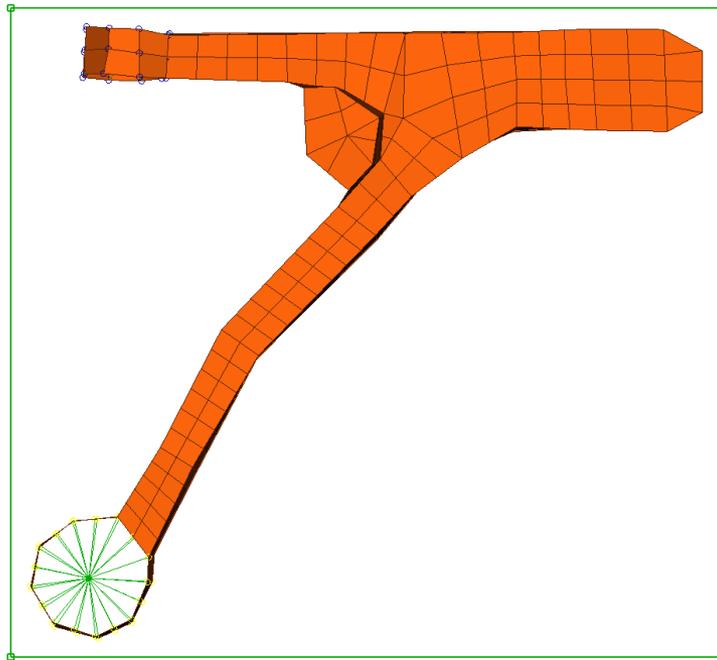
Bend parts by maintaining their cross-section

Direct Morphing ▶		
DFM	Holes-Tubes ▶	Design
Create ▶	Constraints ▶	Ha
Bend	Modeling ▶	Sc



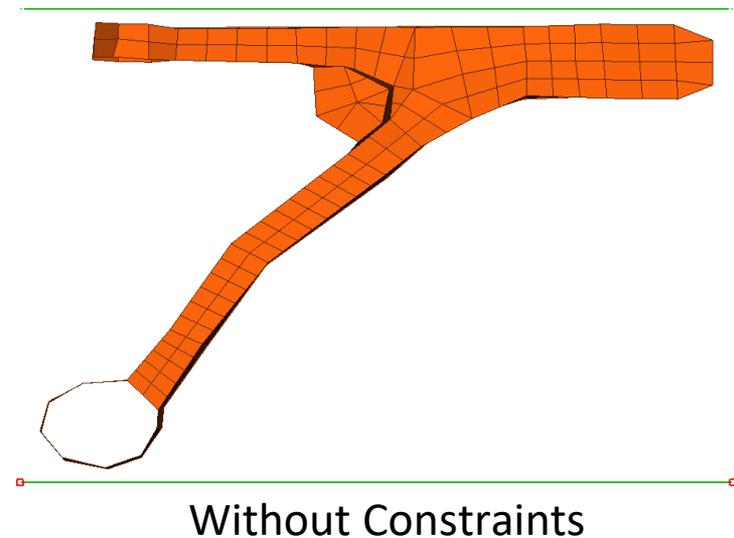
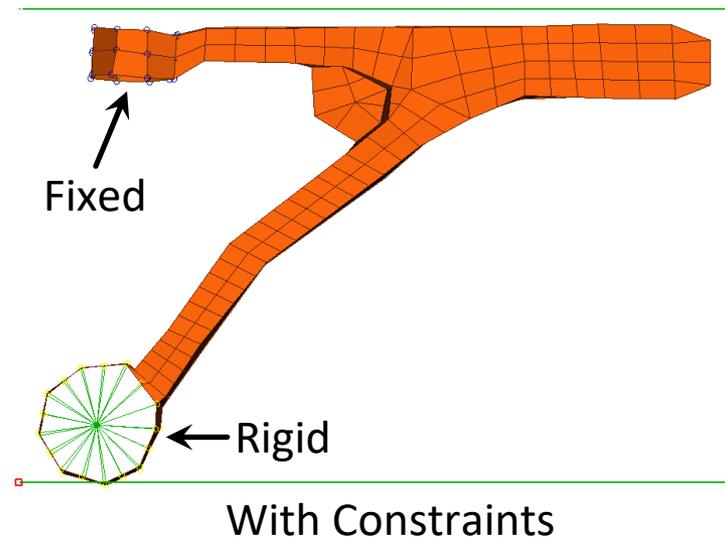
Morphing Constraints

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



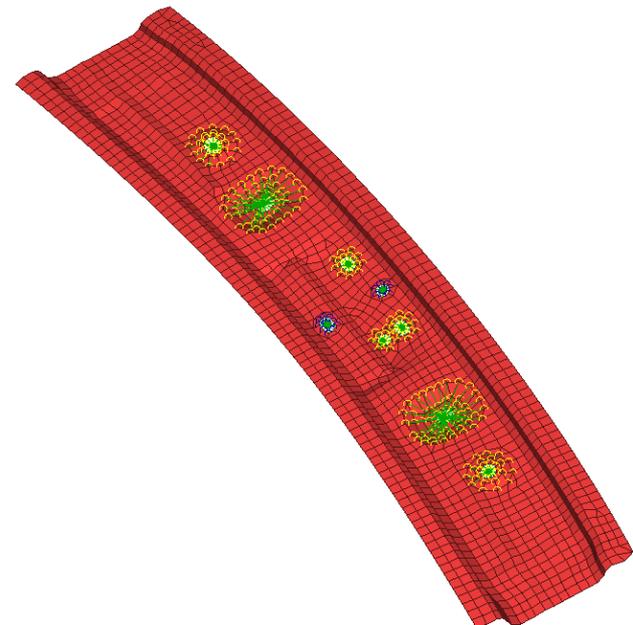
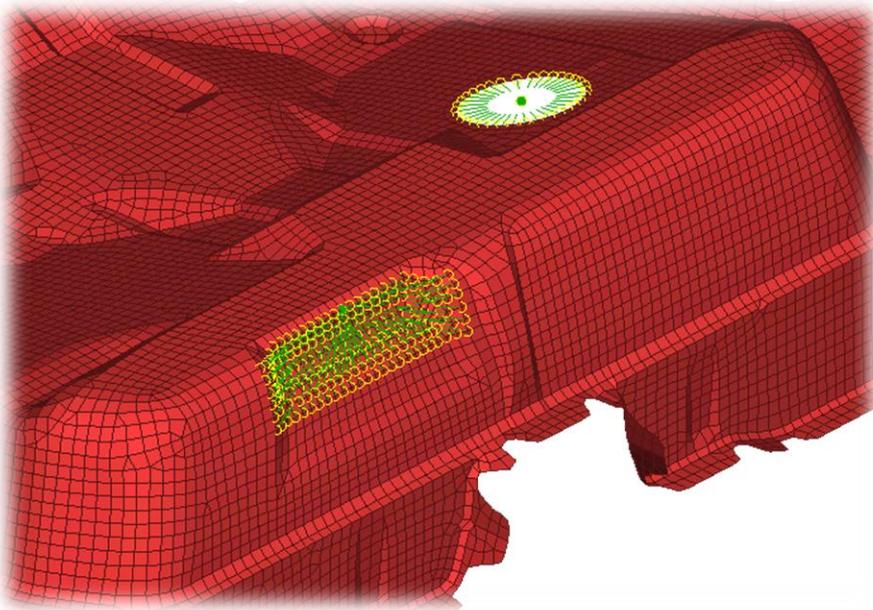
Morphing Constraints

- Nested Elements for Box and Direct Morphing
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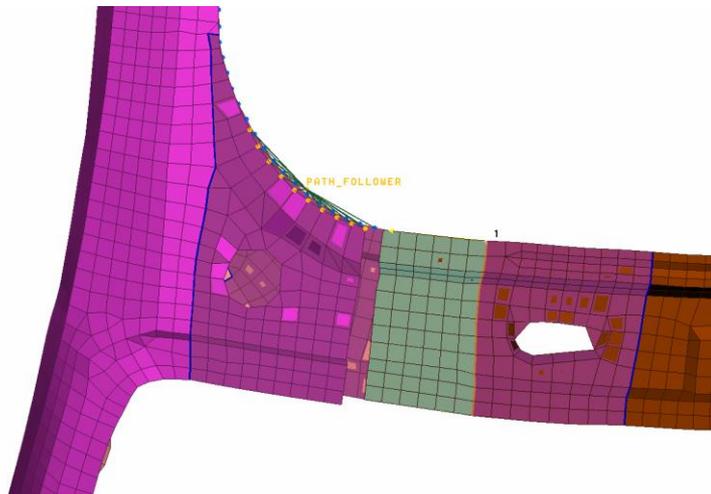
Morphing Constraints

- Nested Elements for Box and Direct Morphing
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- Freeze, rigidize, constrain feature-movement during morphing

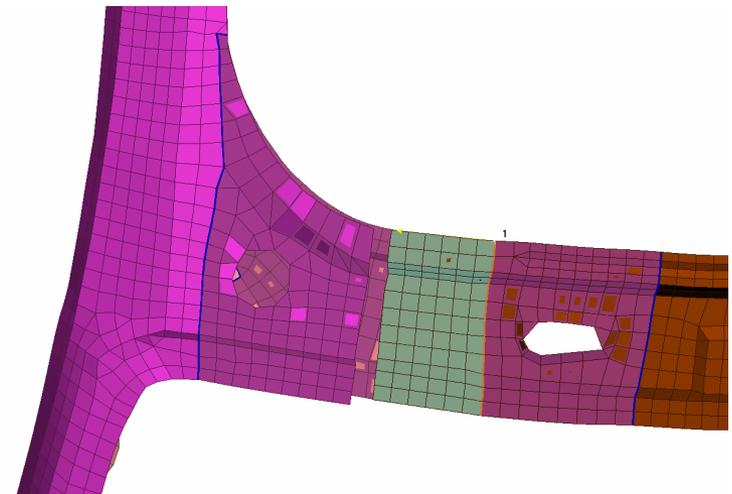


Morphing Constraints

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



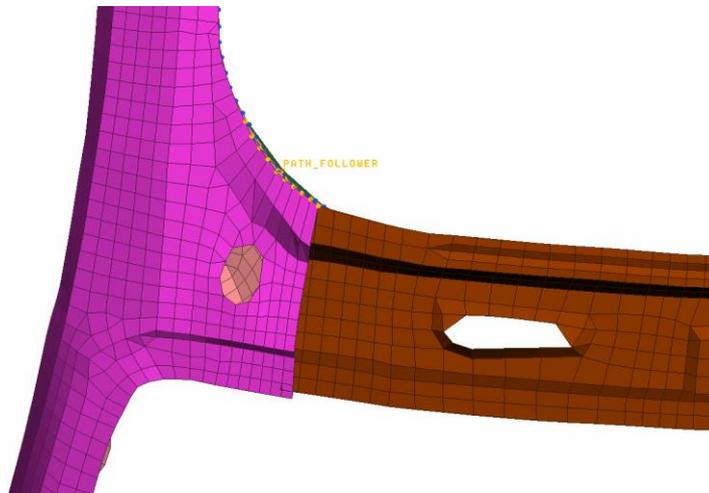
With Path Follower Constraint



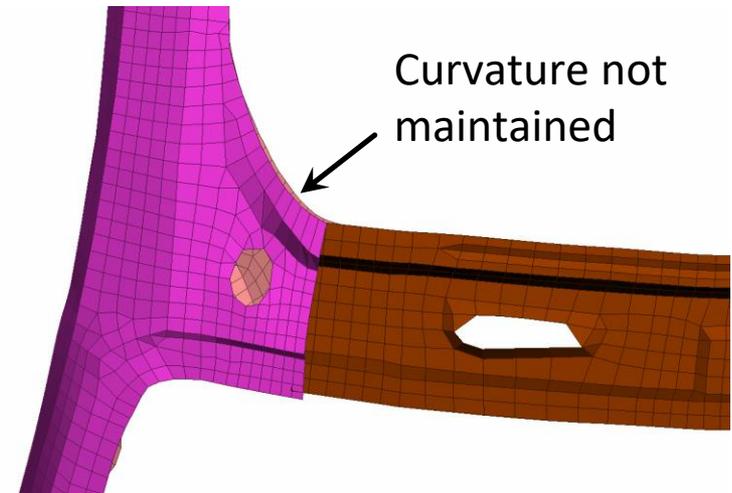
Without Constraint

Morphing Constraints

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



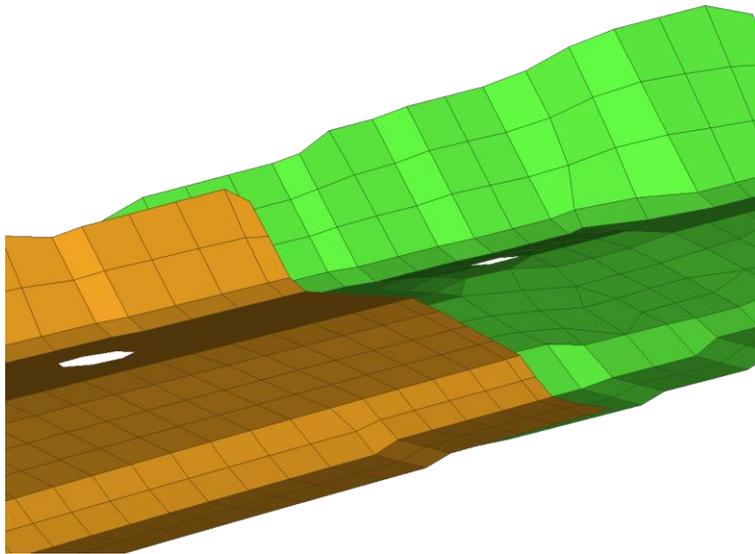
With Path Follower Constraint



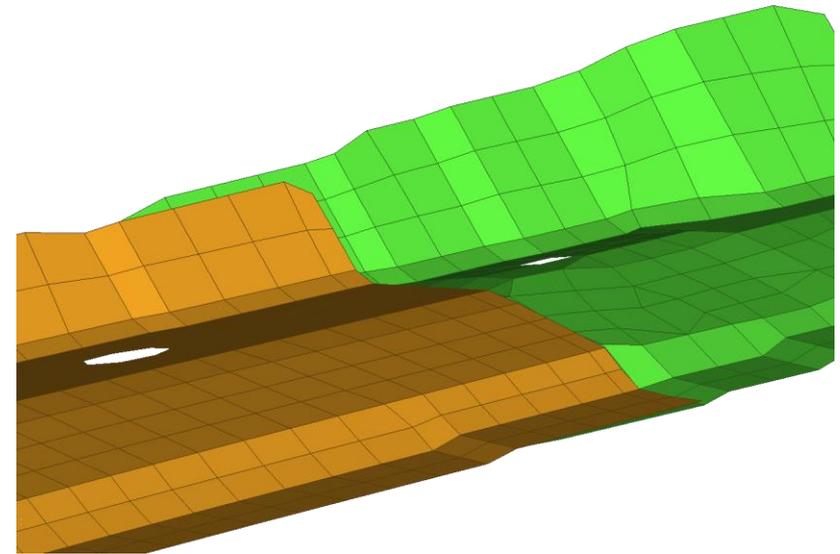
Without Constraint

Morphing Constraints

- Nested Elements for Box and Direct Morphing
- DFM Constraints (e.g. Planar, Rigid, Flange, Path Follower)
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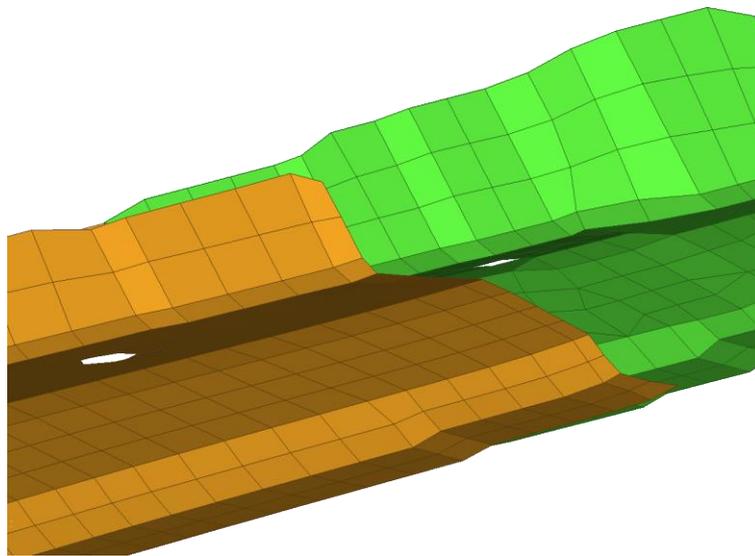
With Flange Constraint



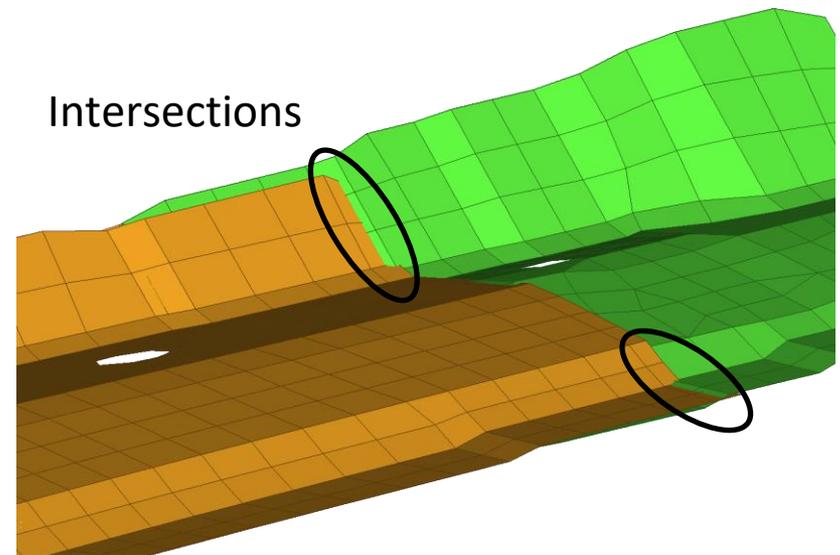
Without Constraint

Morphing Constraints

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



With Flange Constraint

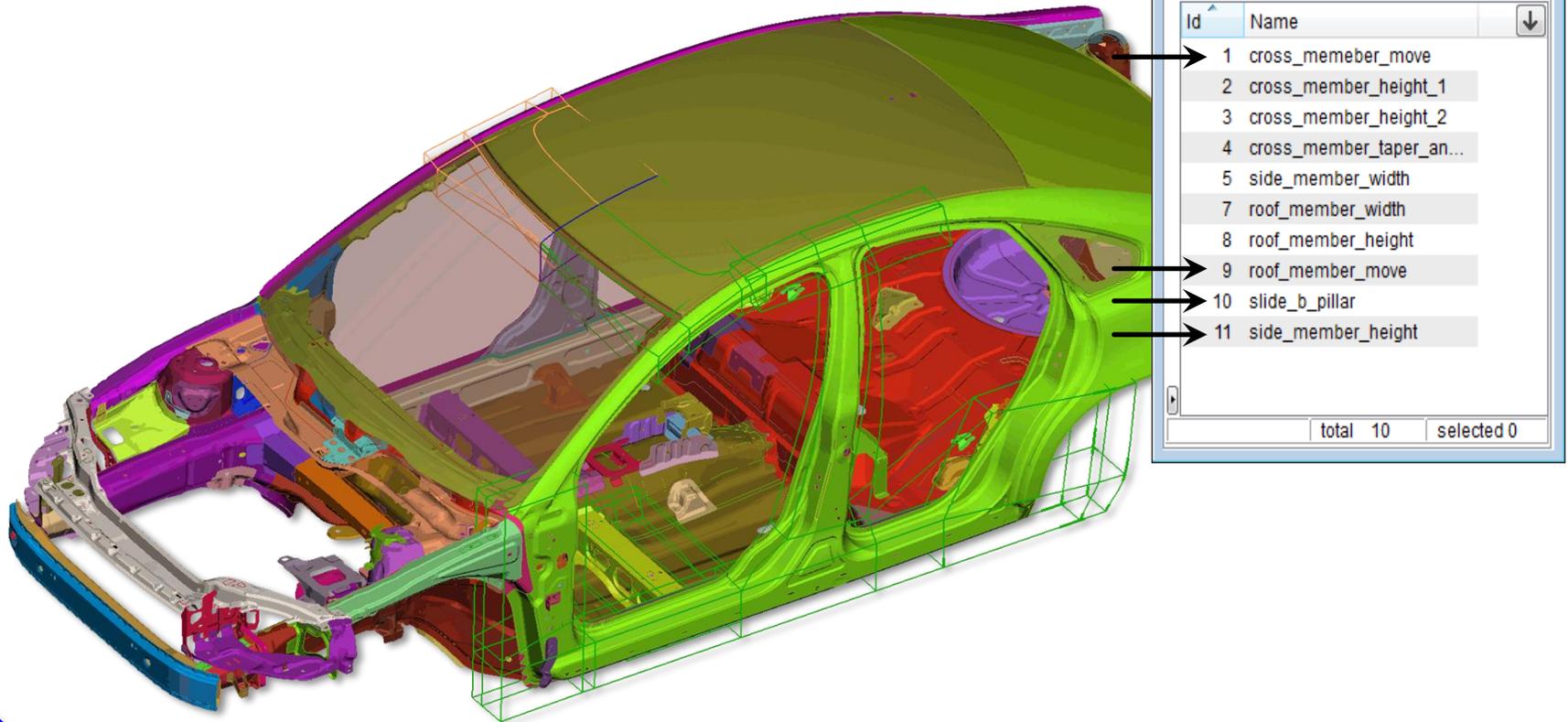


Intersections

Without Constraint

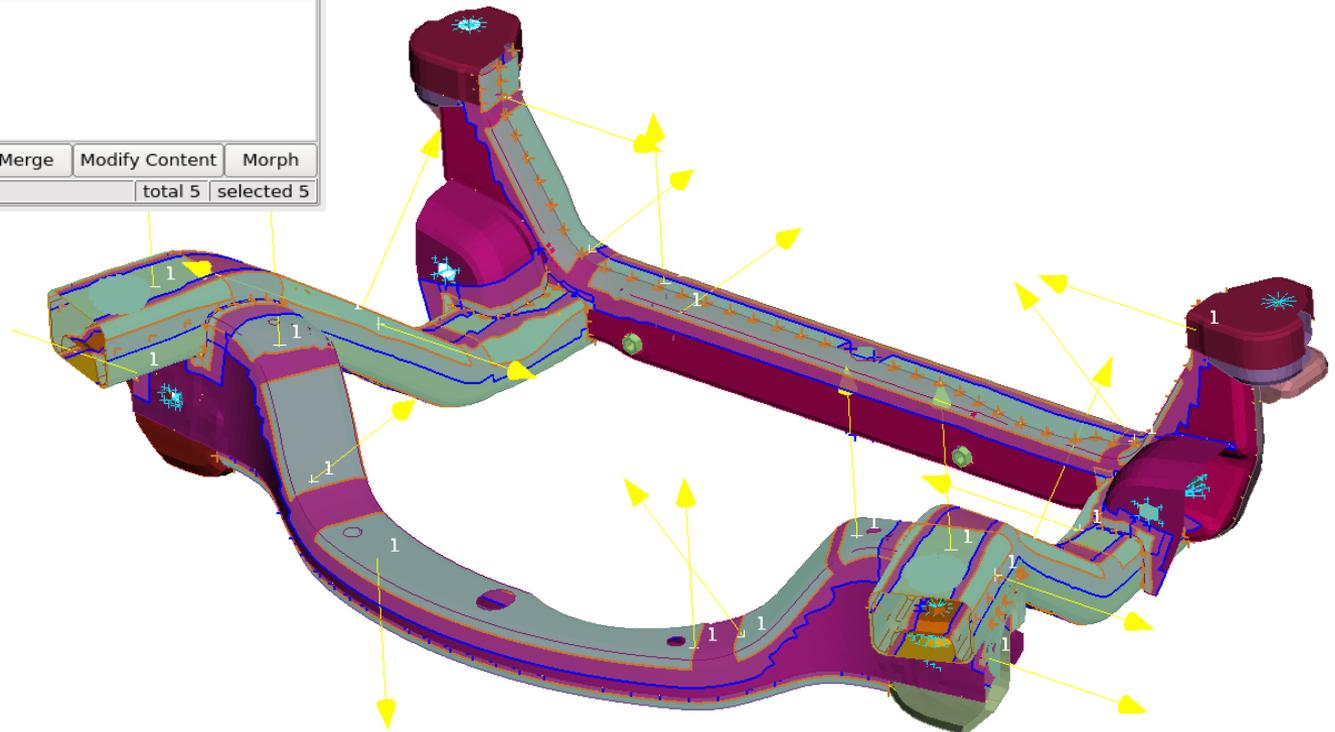
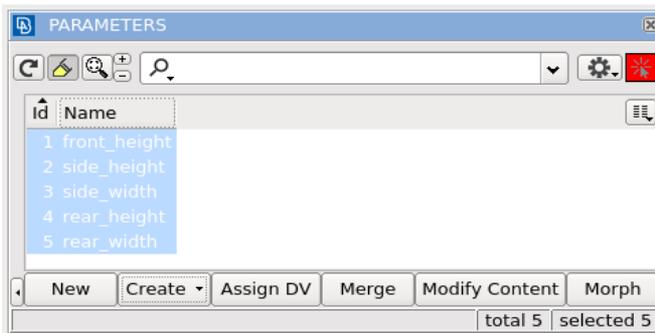
Morphing Parameters

- For Box and Direct Morphing



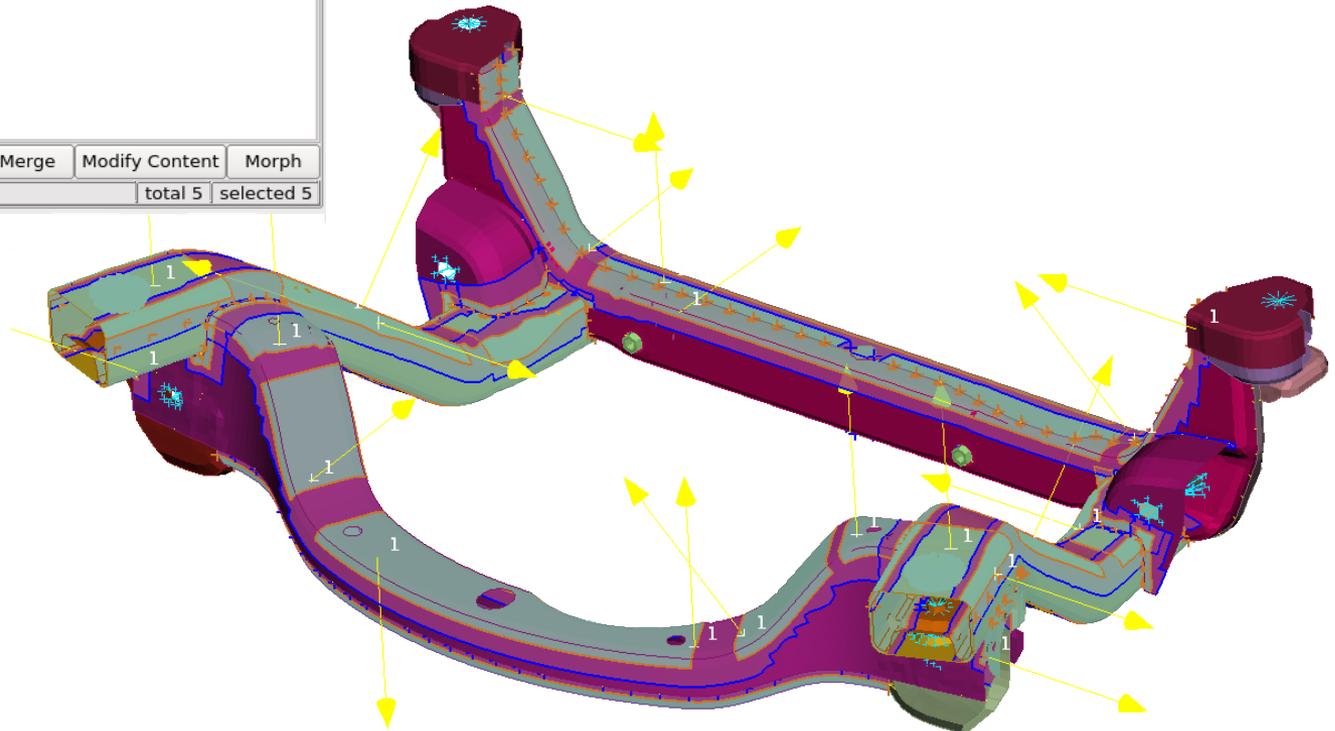
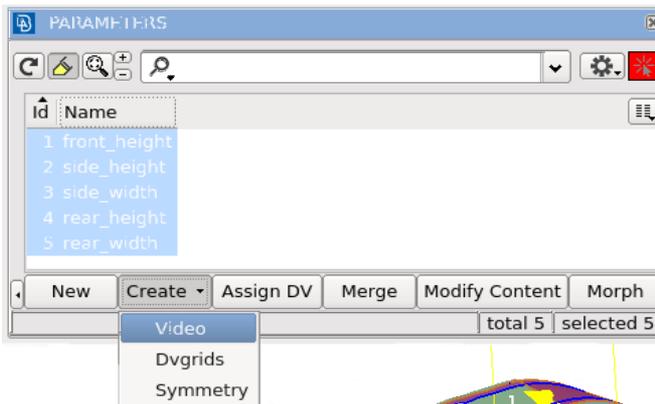
Morphing Parameters

Video Recording



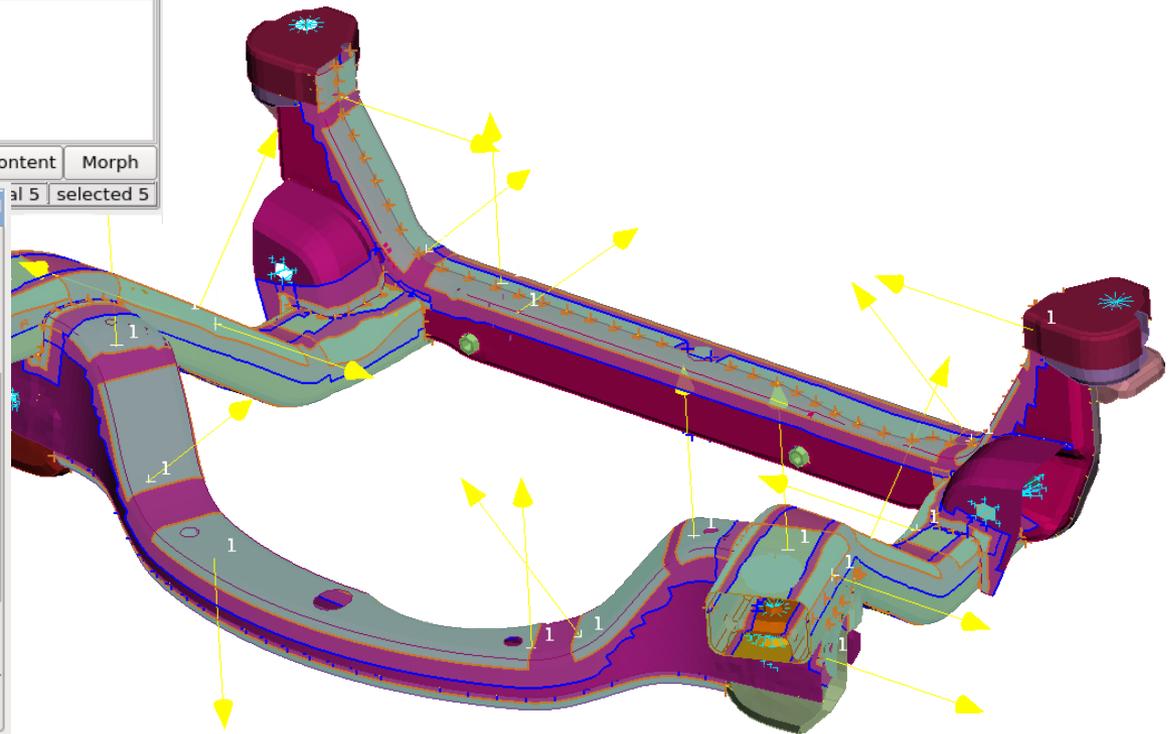
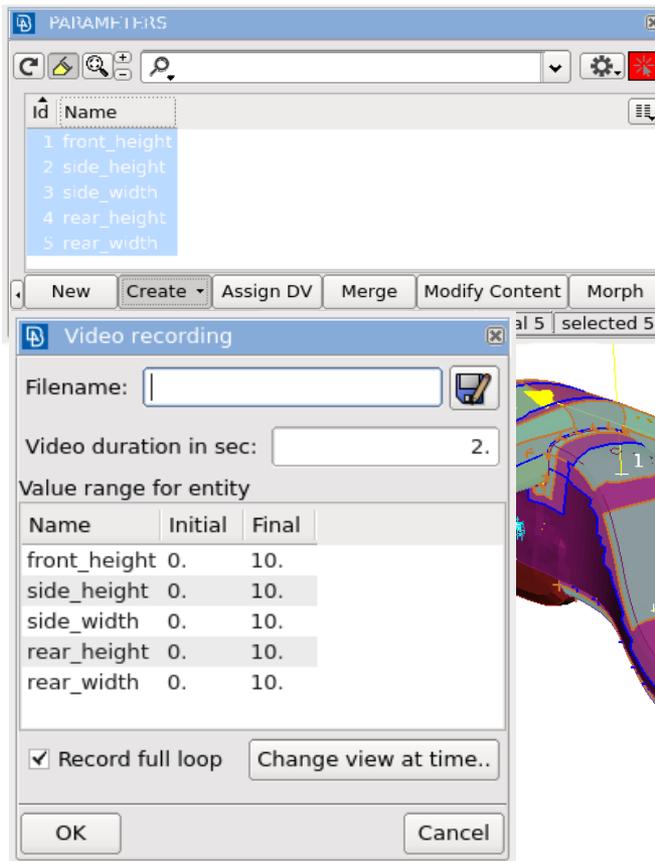
Morphing Parameters

Video Recording



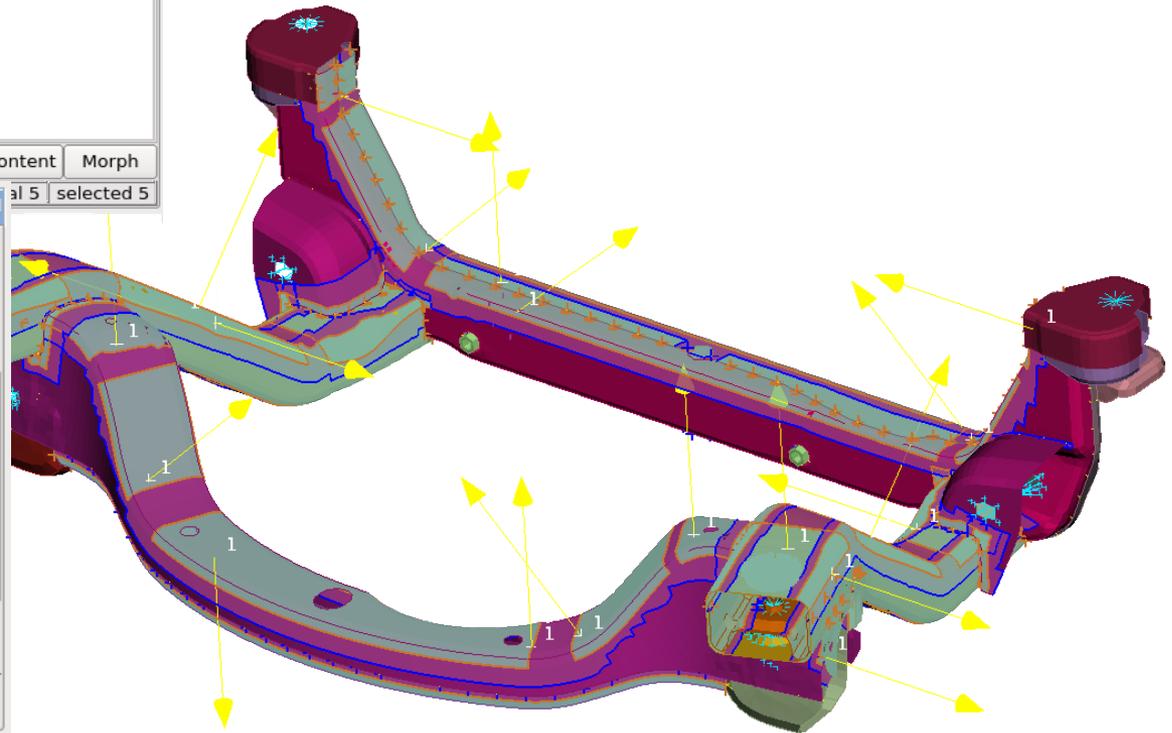
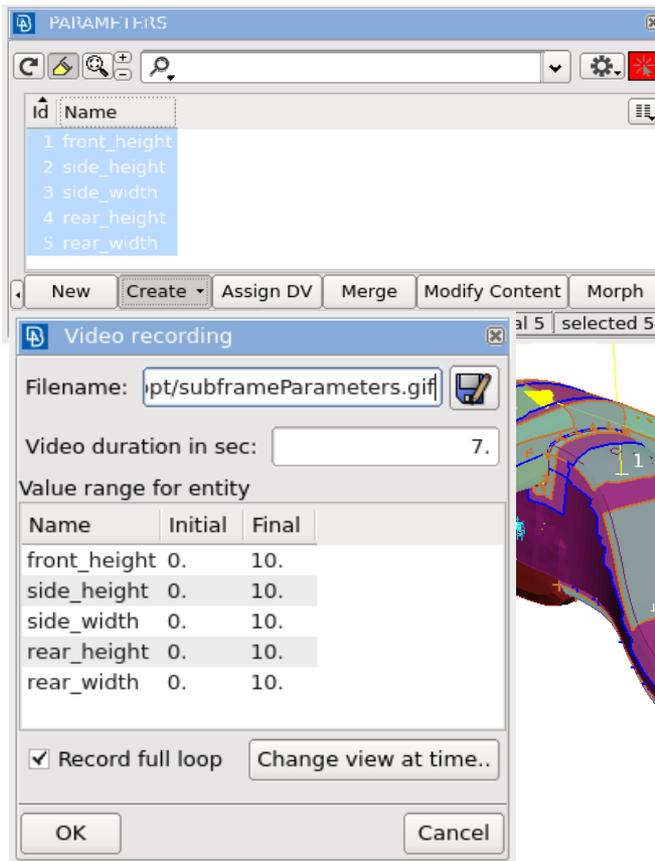
Morphing Parameters

Video Recording



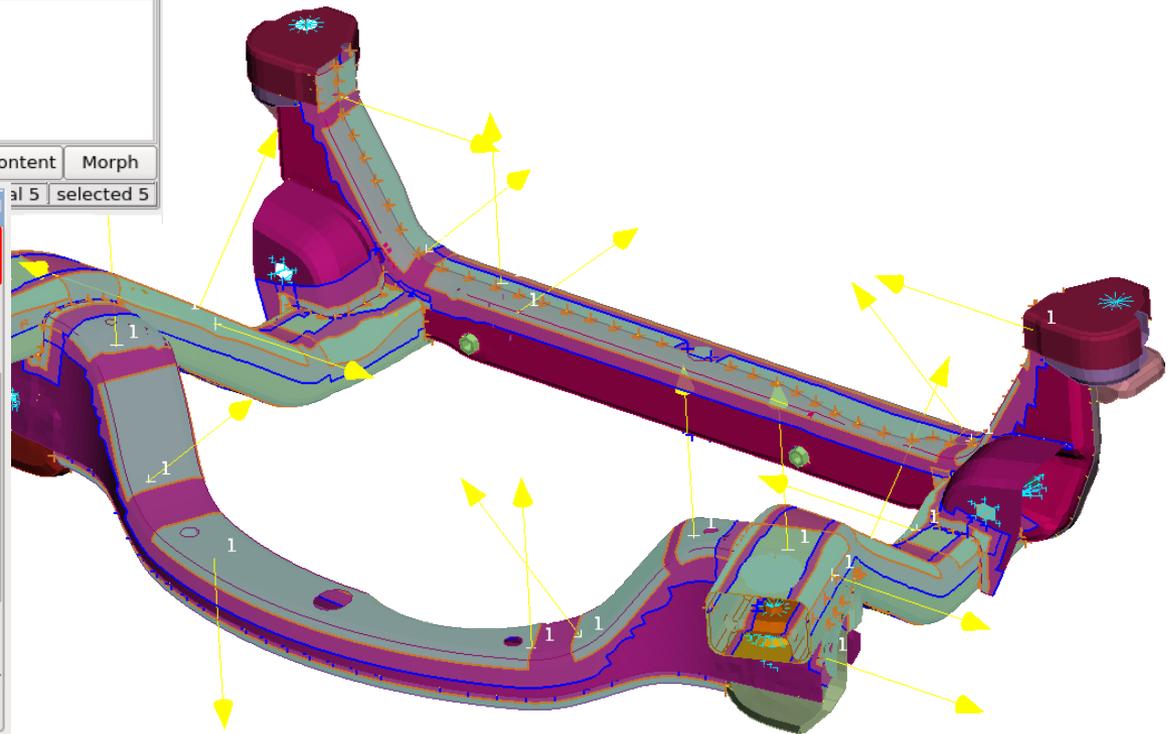
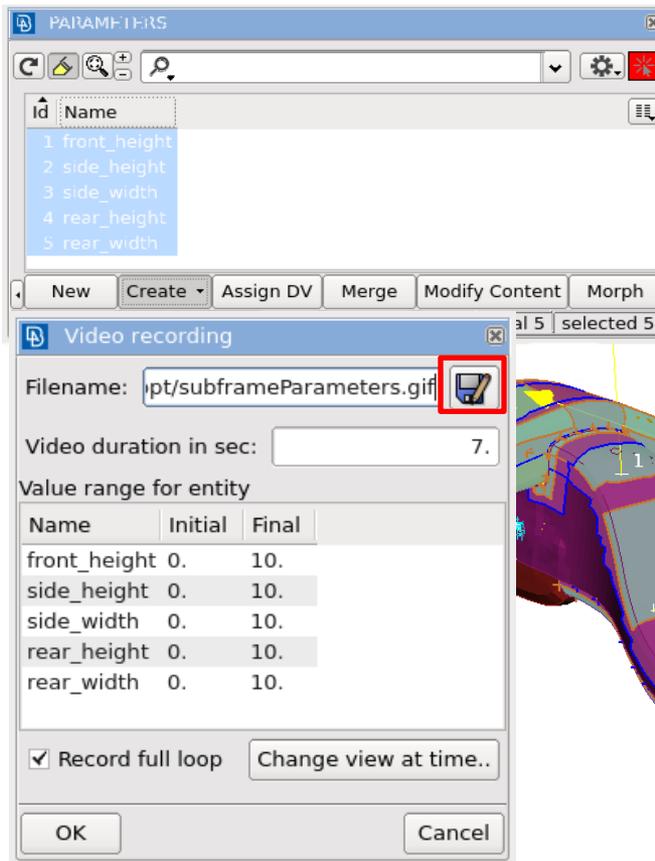
Morphing Parameters

Video Recording



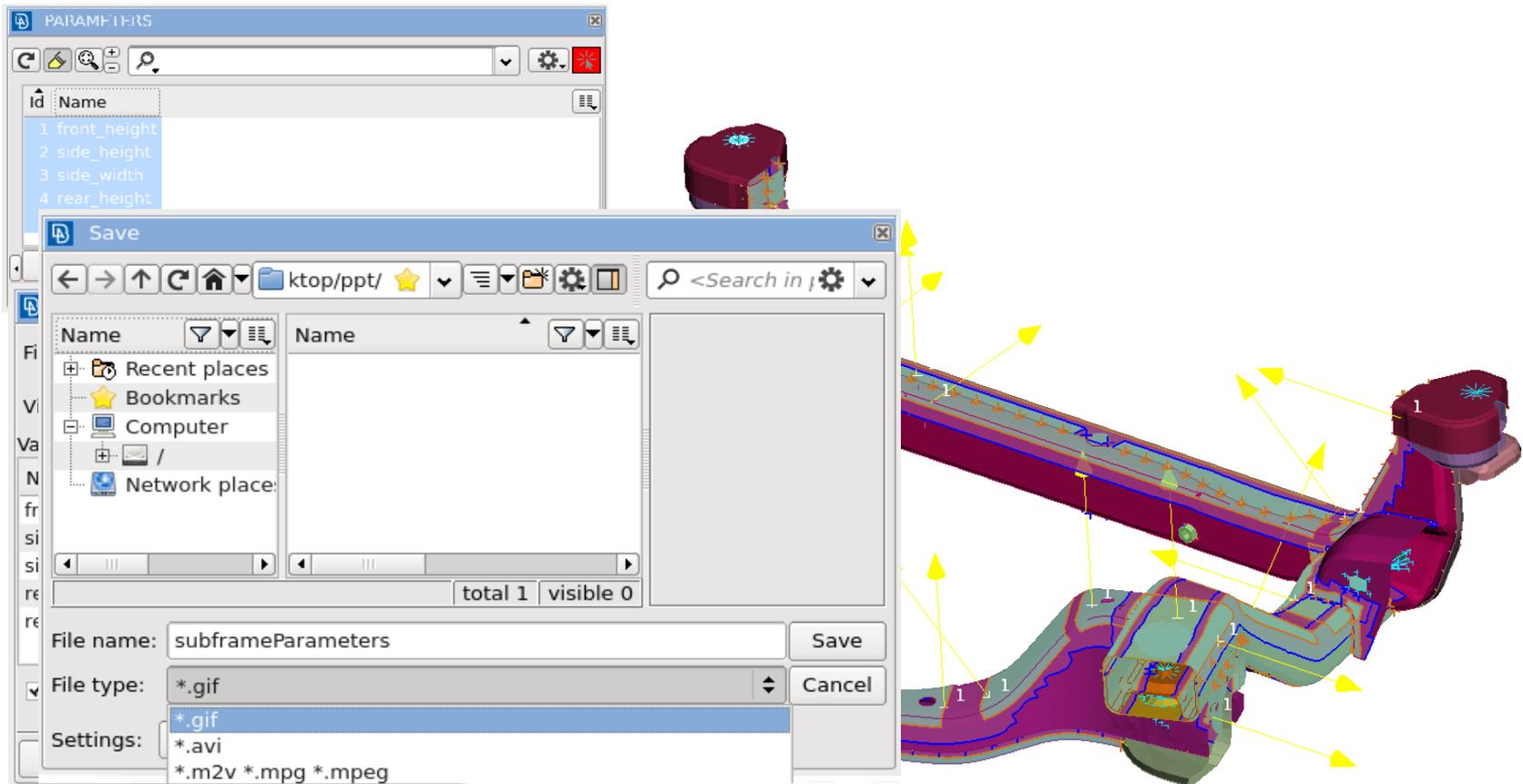
Morphing Parameters

Video Recording



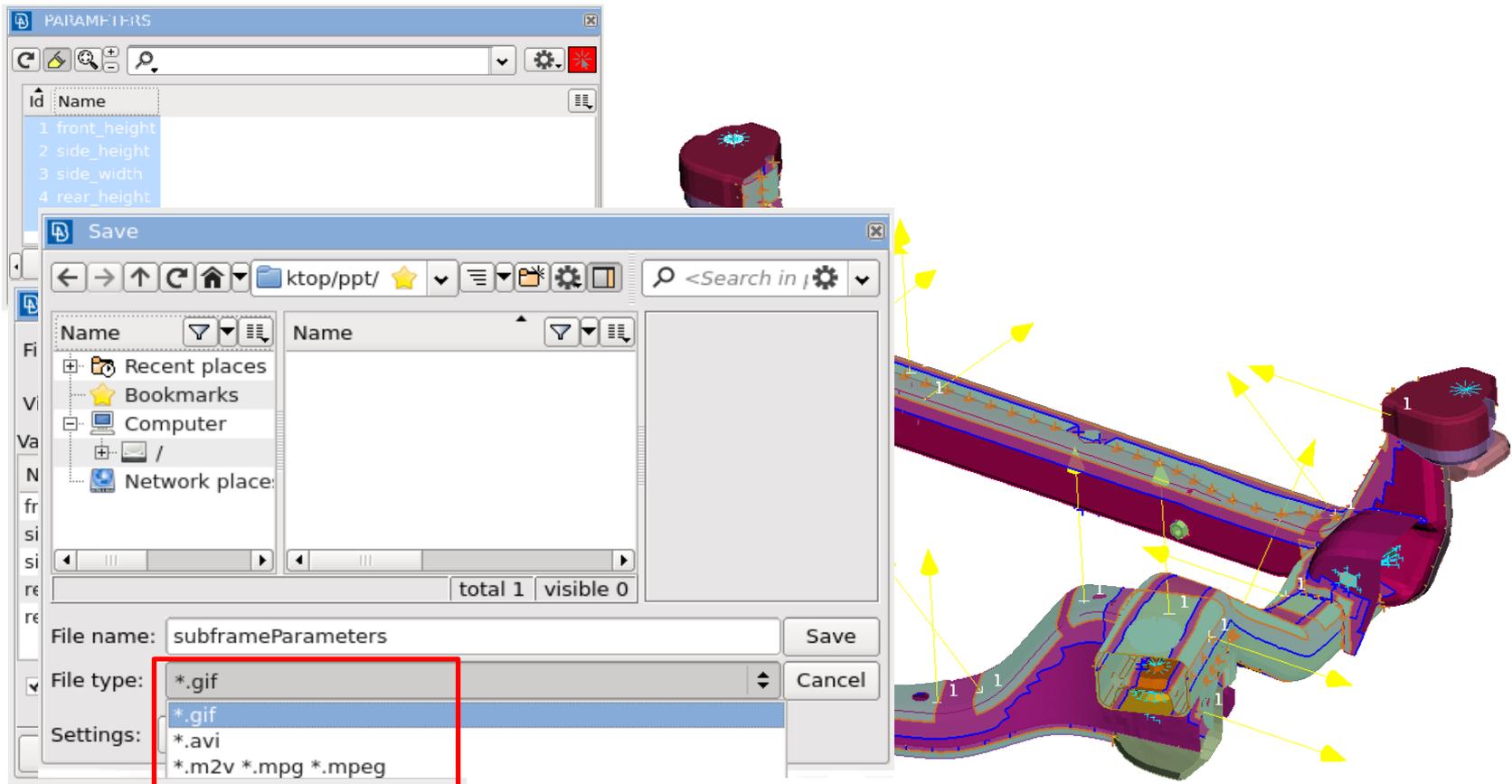
Morphing Parameters

Video Recording



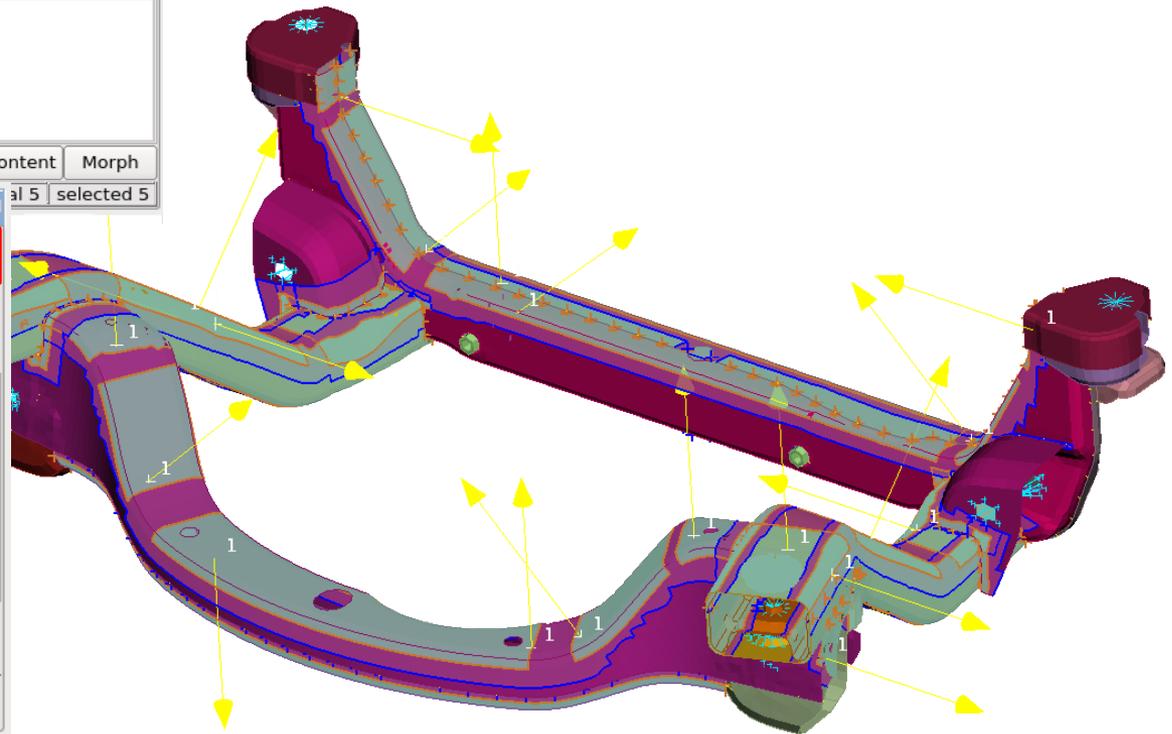
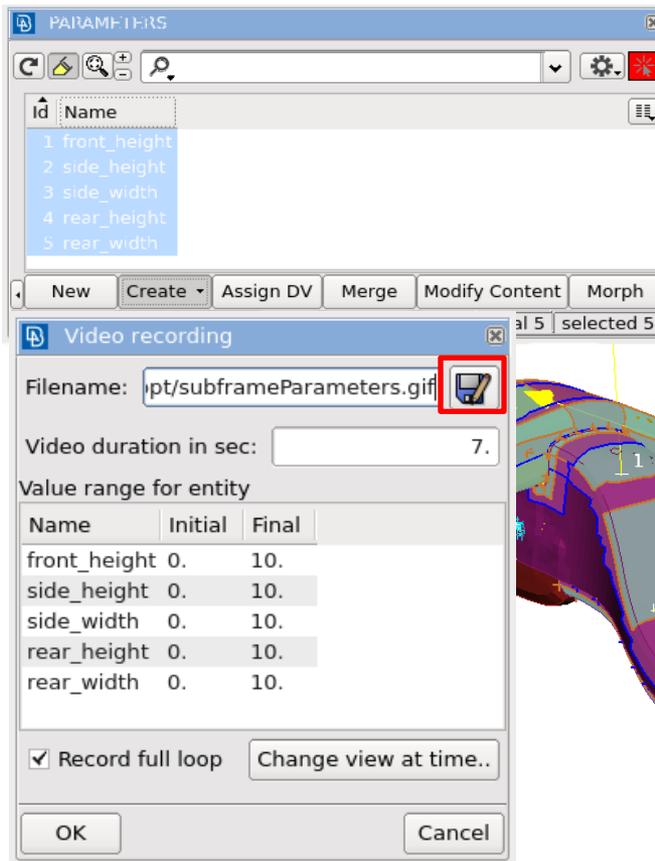
Morphing Parameters

Video Recording



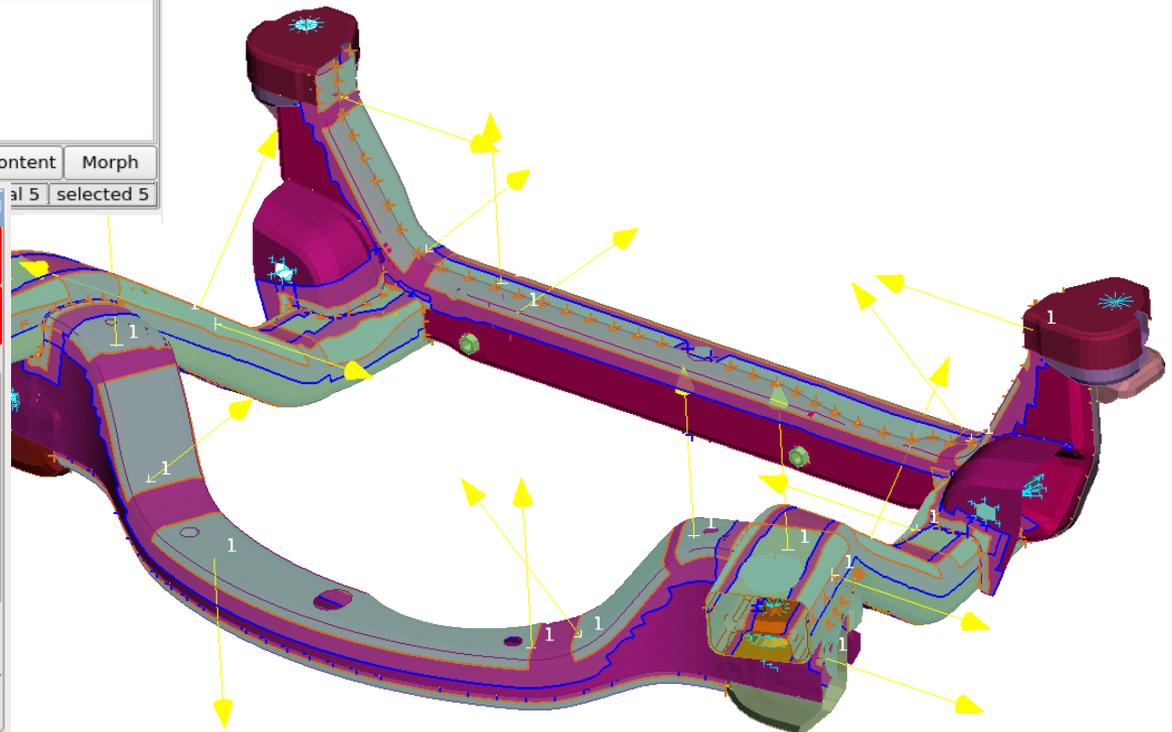
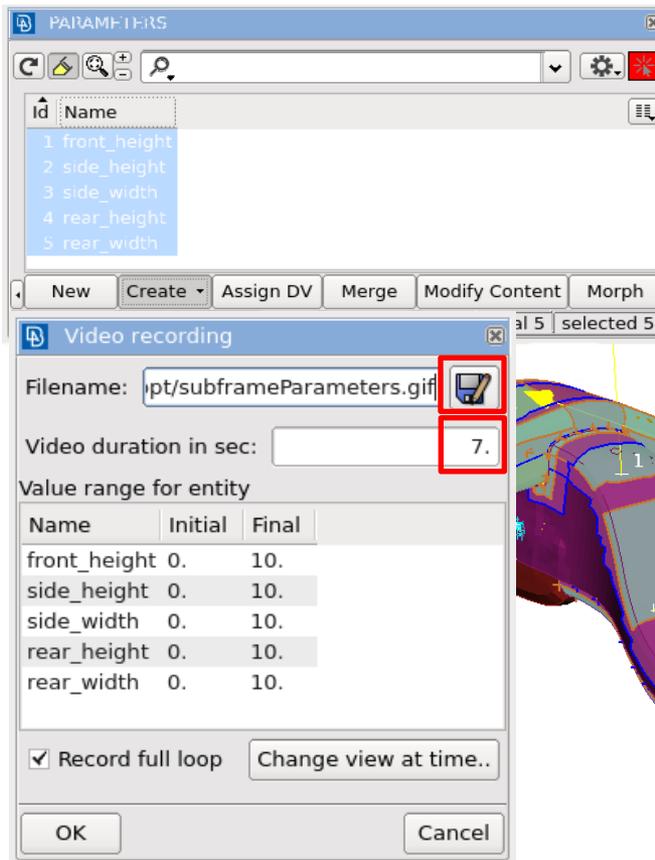
Morphing Parameters

Video Recording



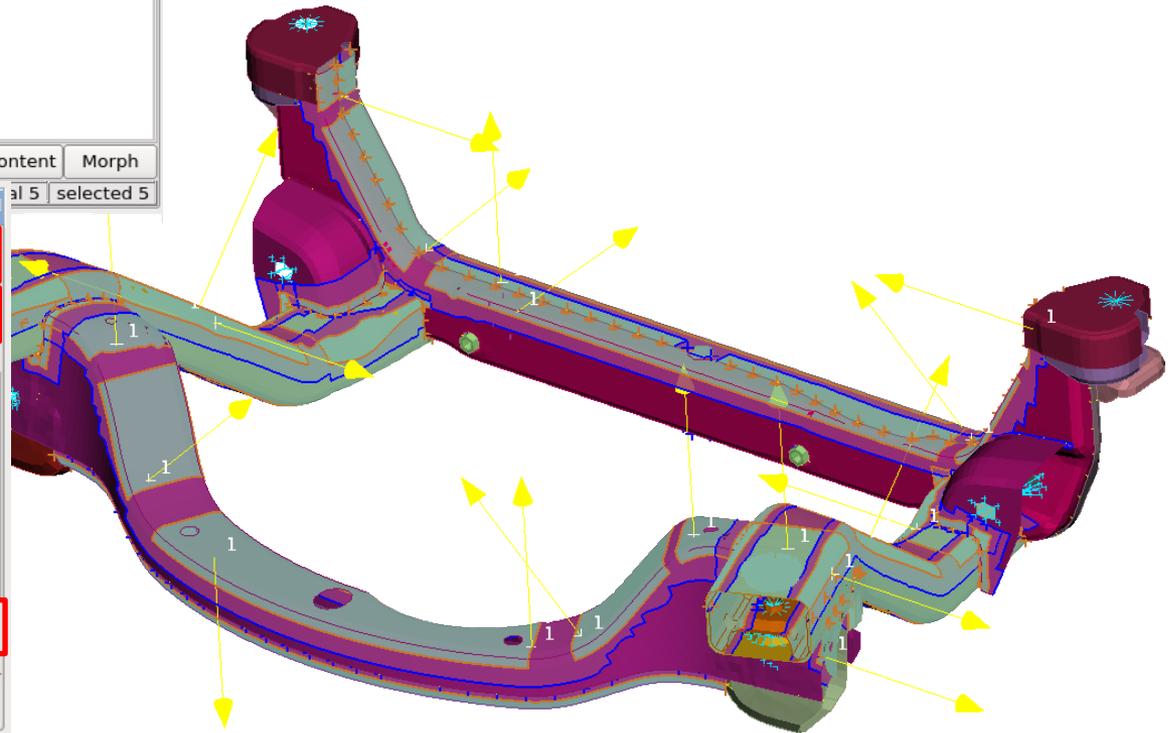
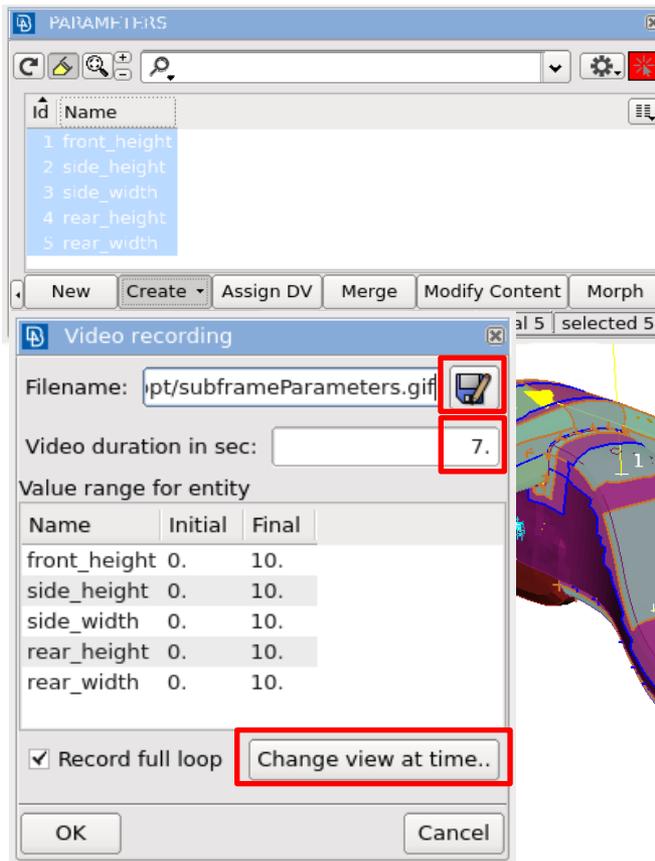
Morphing Parameters

Video Recording



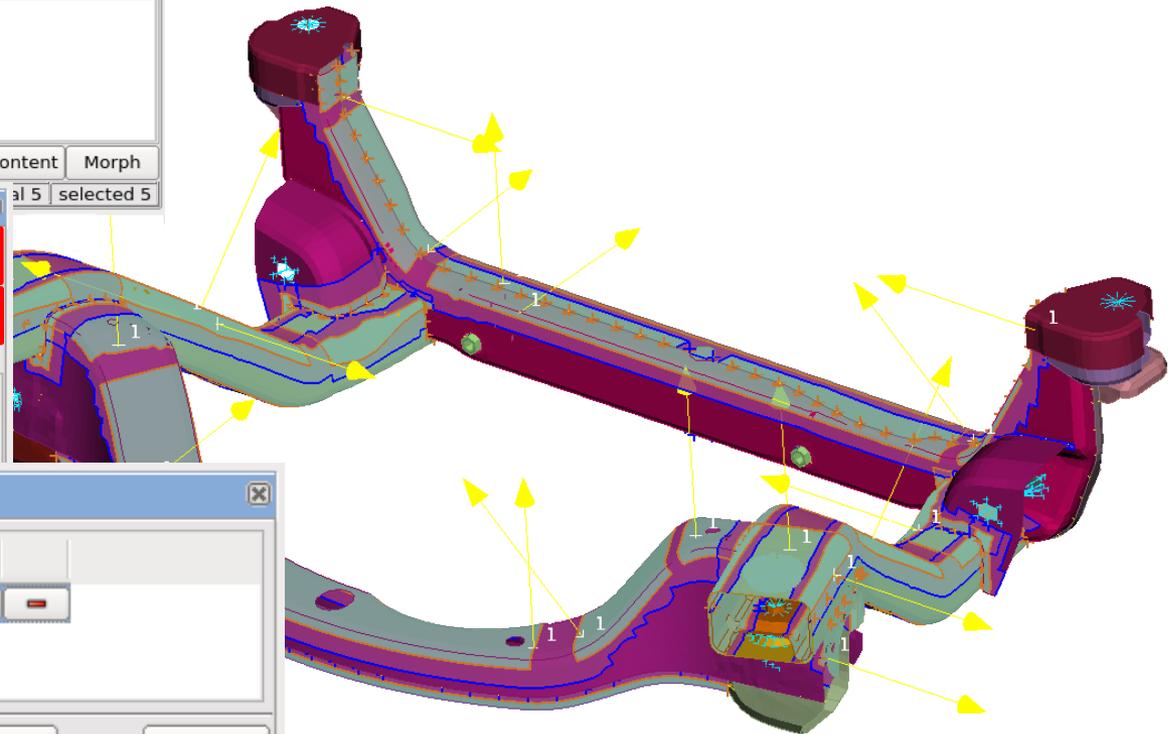
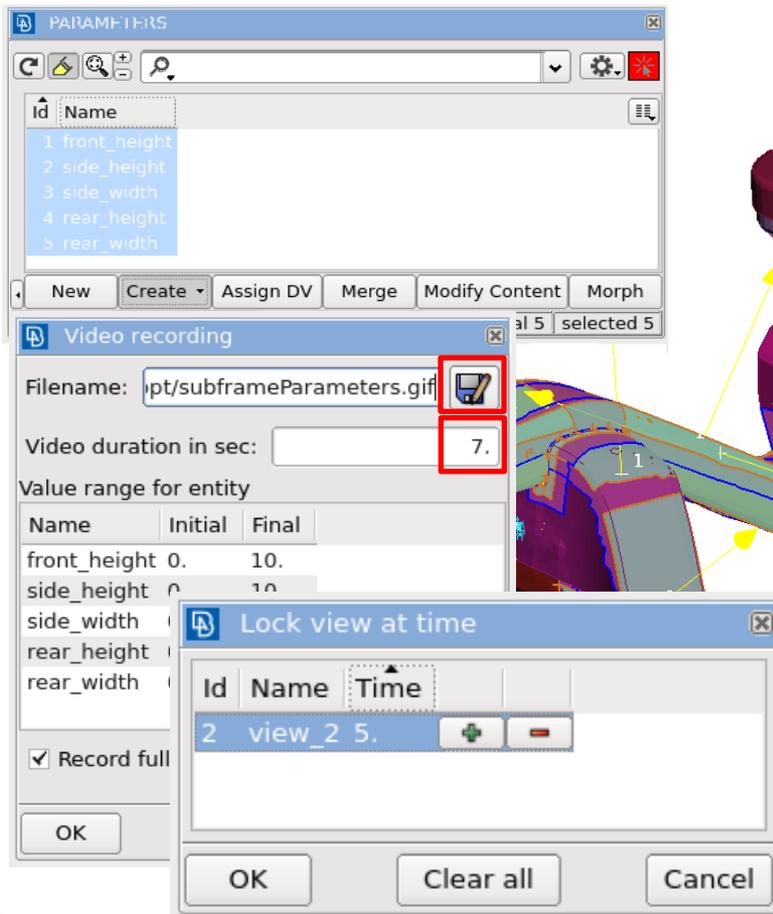
Morphing Parameters

Video Recording



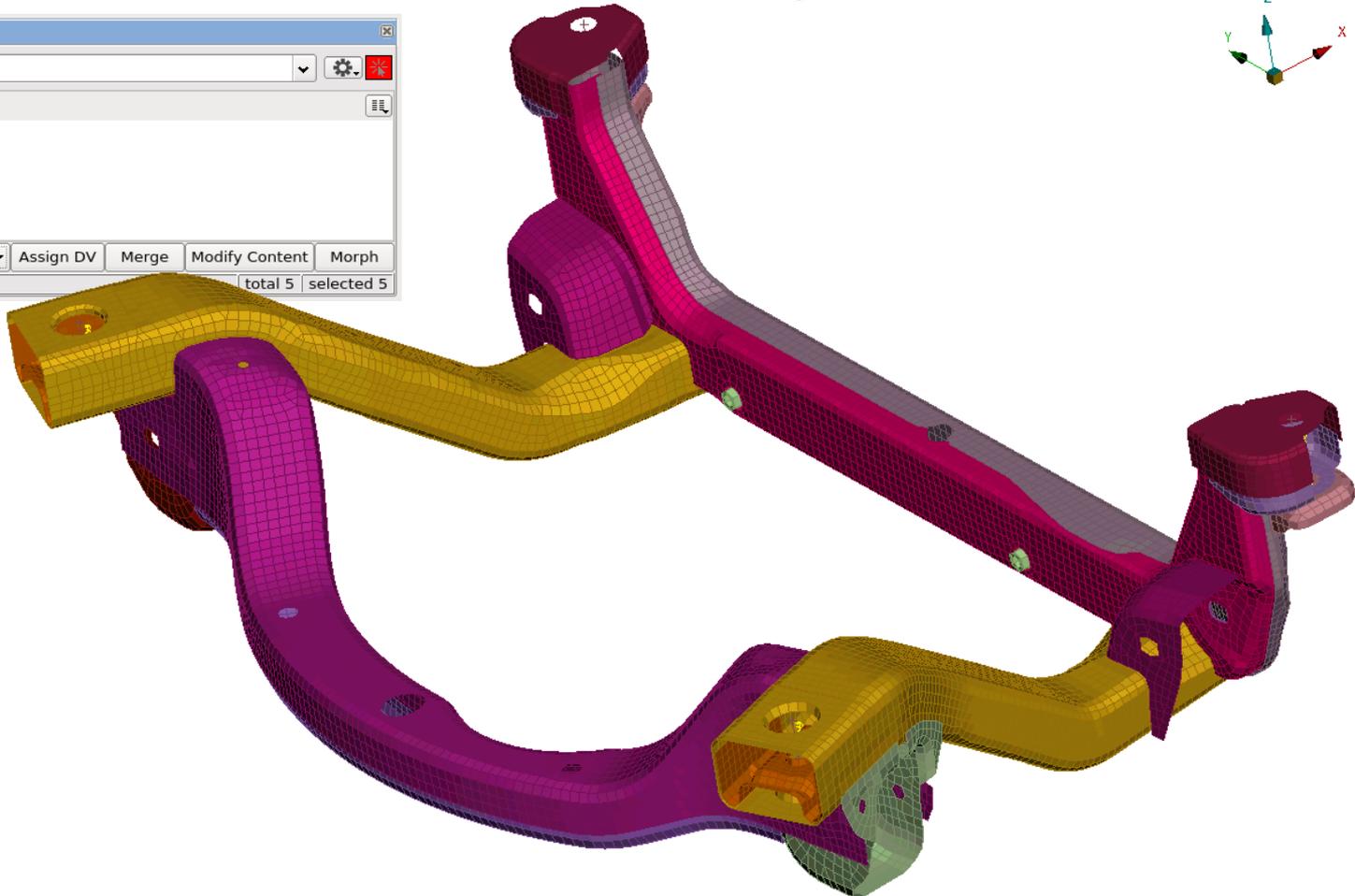
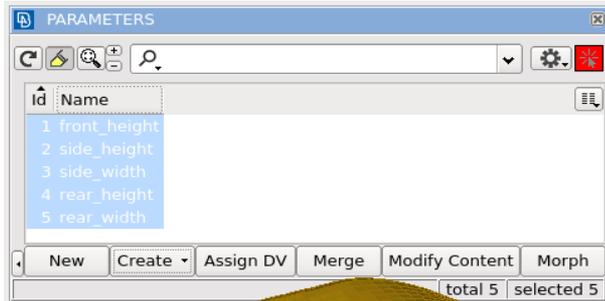
Morphing Parameters

Video Recording



Morphing Parameters

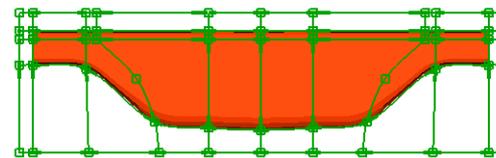
Video Recording



Record Morphing Actions

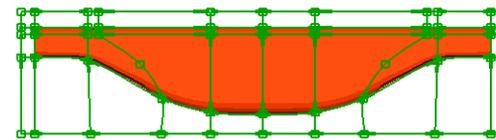
Deformation Parameter

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

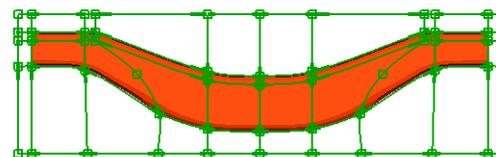


Initial shape – start recording

Edge Fit



Move Free

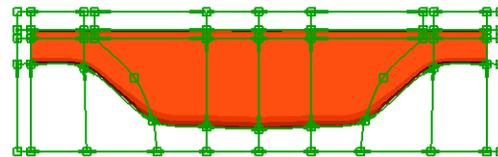


Deformed shape – stop recording

Record Morphing Actions

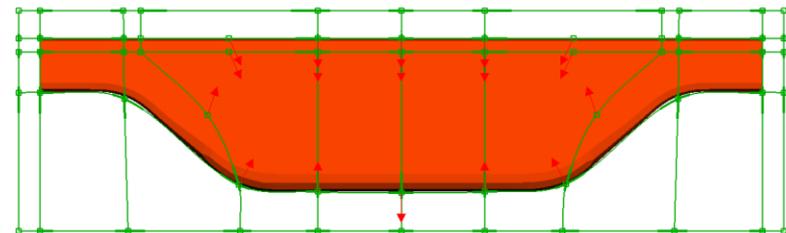
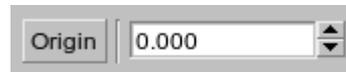
Deformation Parameter

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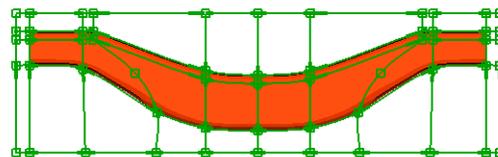


Initial shape – start recording

**Deformation
Parameter**



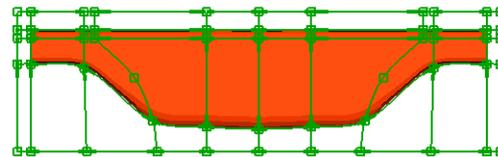
Deformed shape – stop recording



Record Morphing Actions

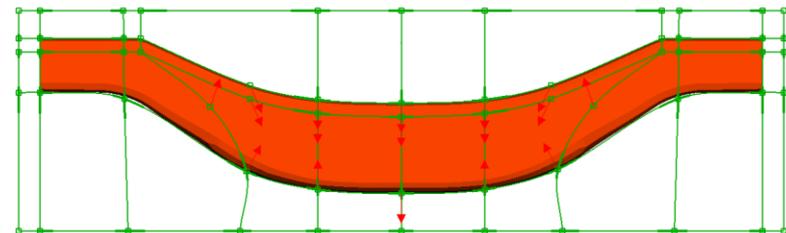
Deformation Parameter

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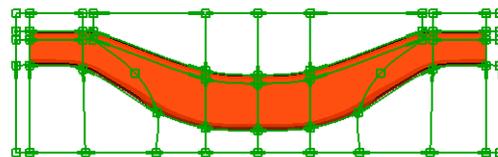


Initial shape – start recording

**Deformation
Parameter**

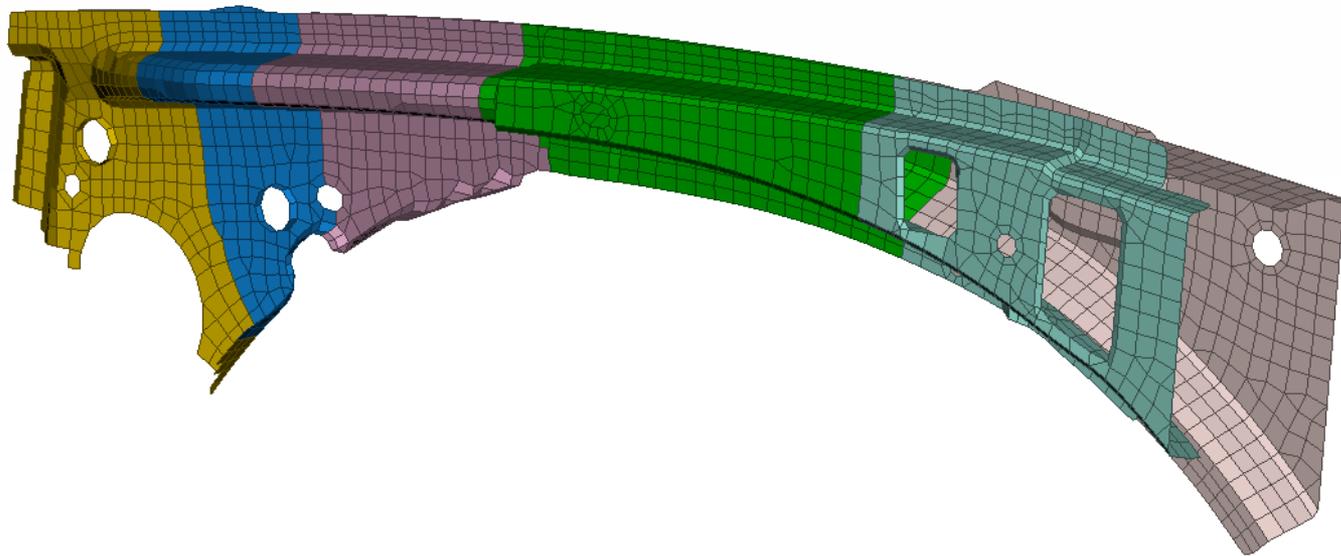


Deformed shape – stop recording



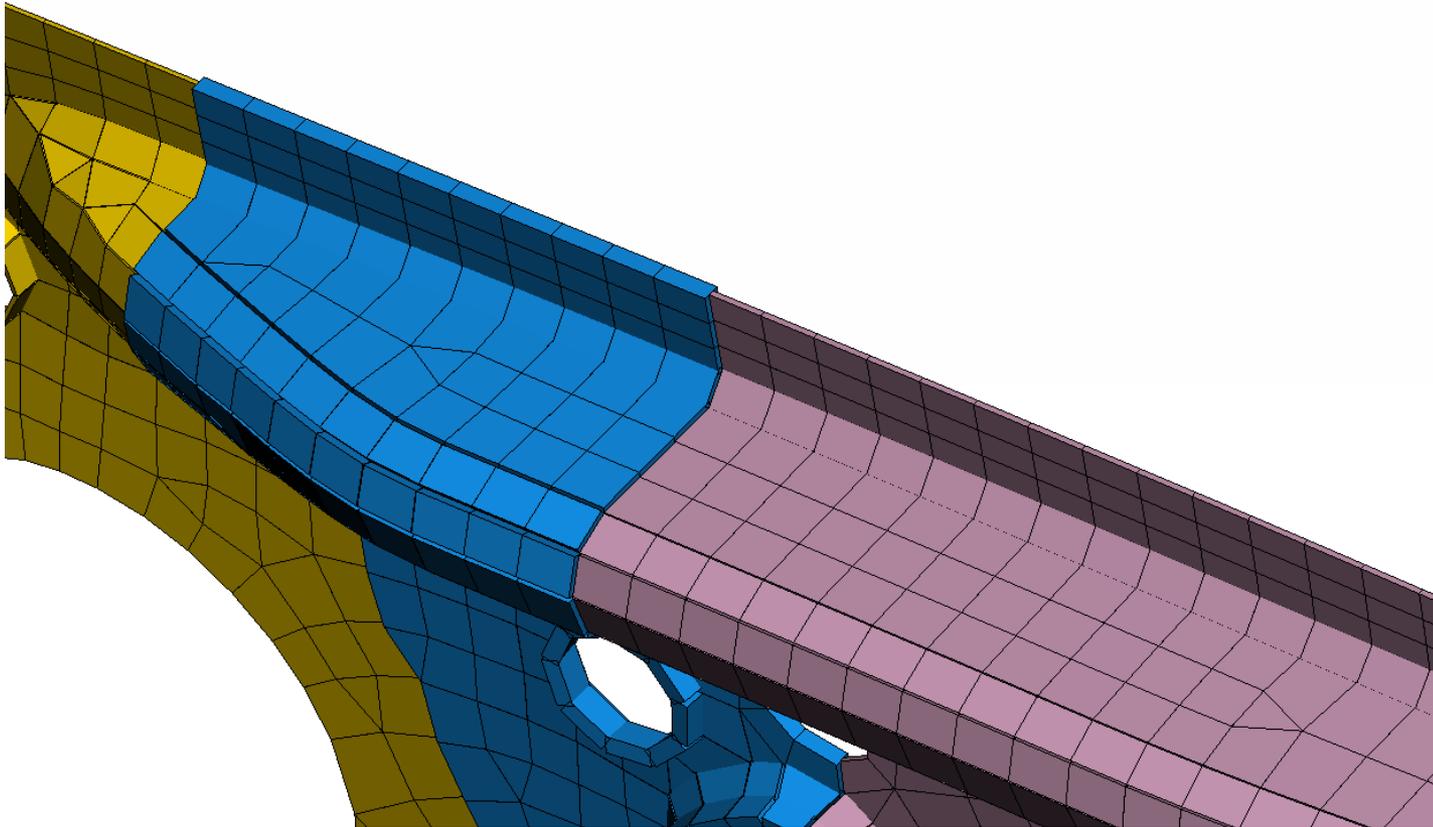
Taylor Welded Blanks Parameter

Parameterization and Optimization of Taylor Blanks



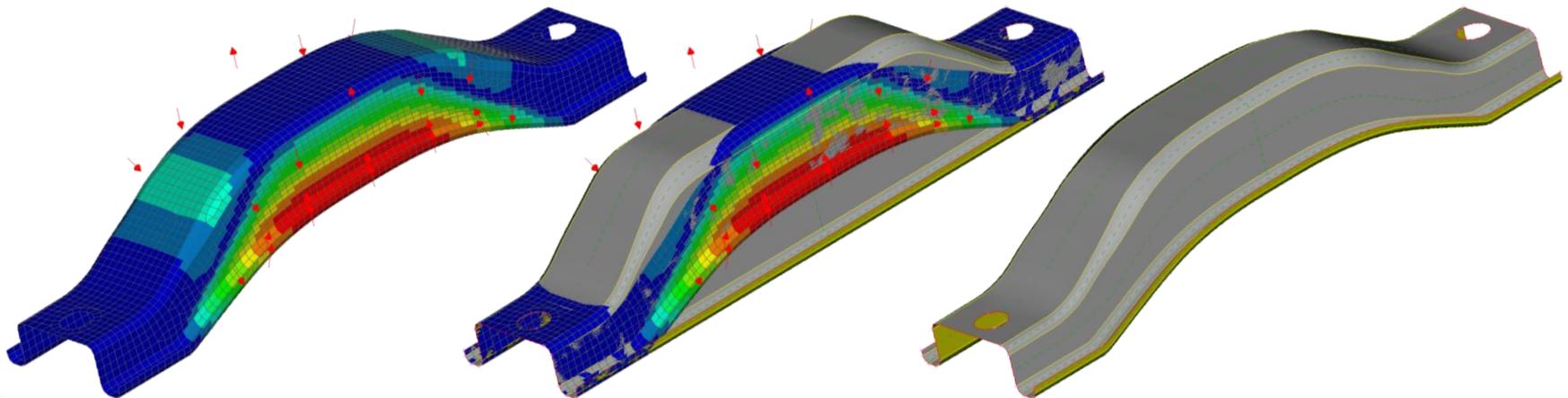
Taylor Welded Blanks Parameter

Parameterization and Optimization of Taylor Blanks



Mapping of Deformations

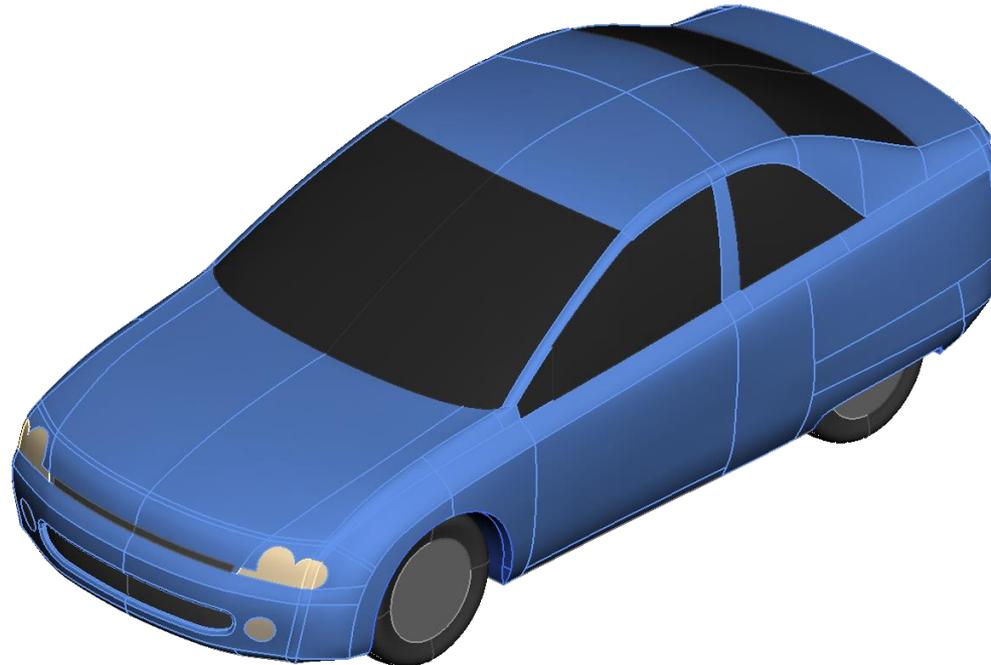
- Morph according existing deformation field from:
 - Deformation Parameter
 - History States
 - DESVAR of Nastran SOL 200
 - Text file
- E.g. Modify geometry according optimized FE-model



Functionalities assisting Morphing

3D Points and Curves

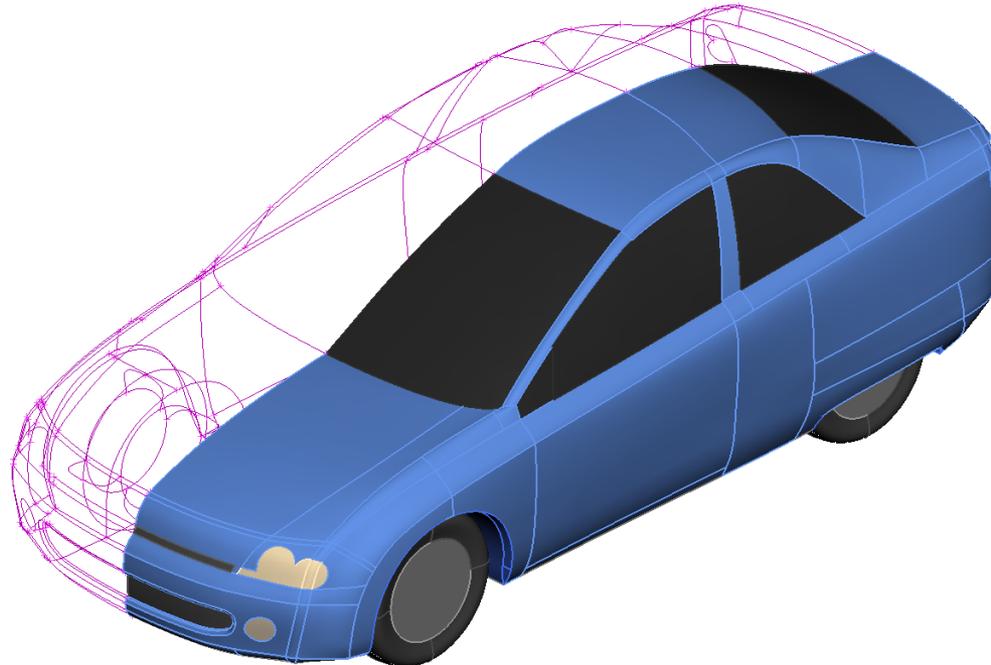
- Act as initial or target positions for fittings
- Suitable for Box and Direct Morphing
- Obtained from FE mesh or CAD geometry



Functionalities assisting Morphing

3D Points and Curves

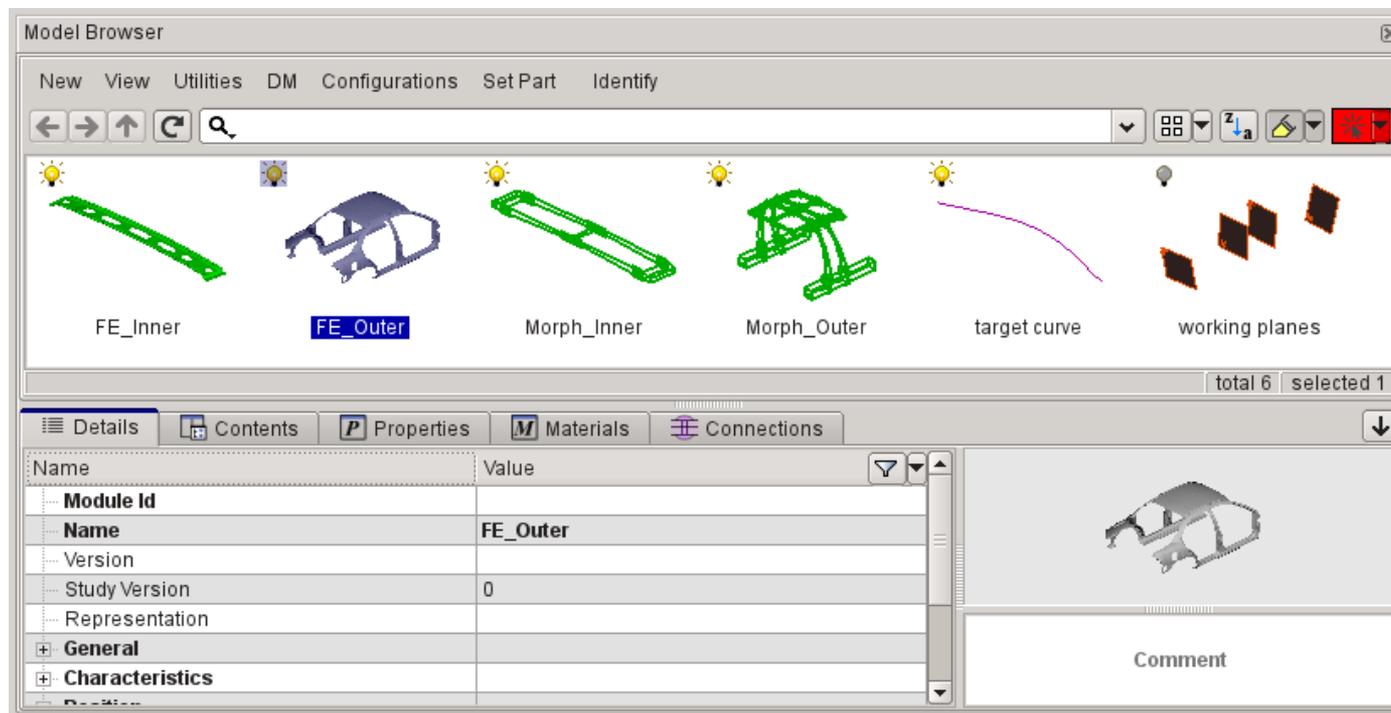
- Act as initial or target positions for fittings
- Suitable for Box and Direct Morphing
- Obtained from FE mesh or CAD geometry



Functionalities assisting Morphing

Model Browser

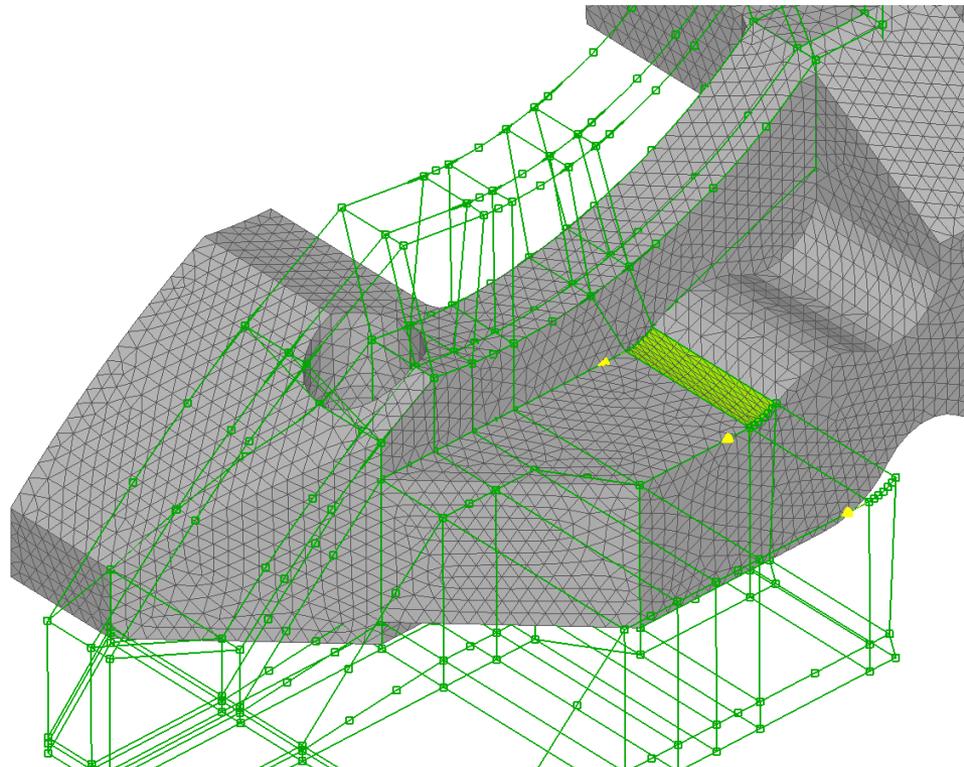
- Useful for Box Morphing (esp. complex configurations)
- To organize morph contents



Functionalities assisting Morphing

Reconstruct / Smooth morphed mesh

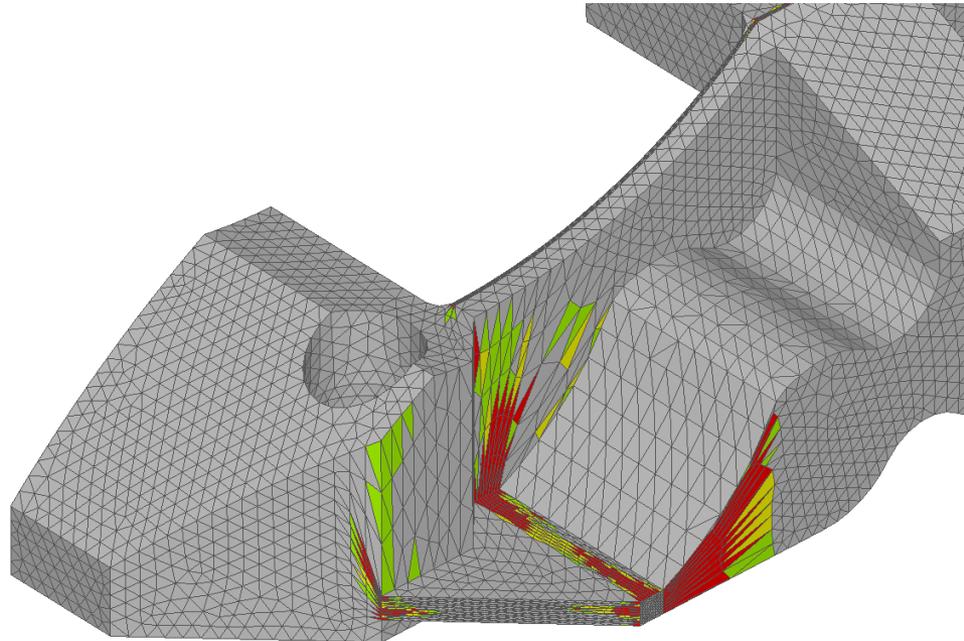
- Suitable for Box and Direct Morphing
- Improve mesh after morphing with large deformations



Functionalities assisting Morphing

Reconstruct / Smooth morphed mesh

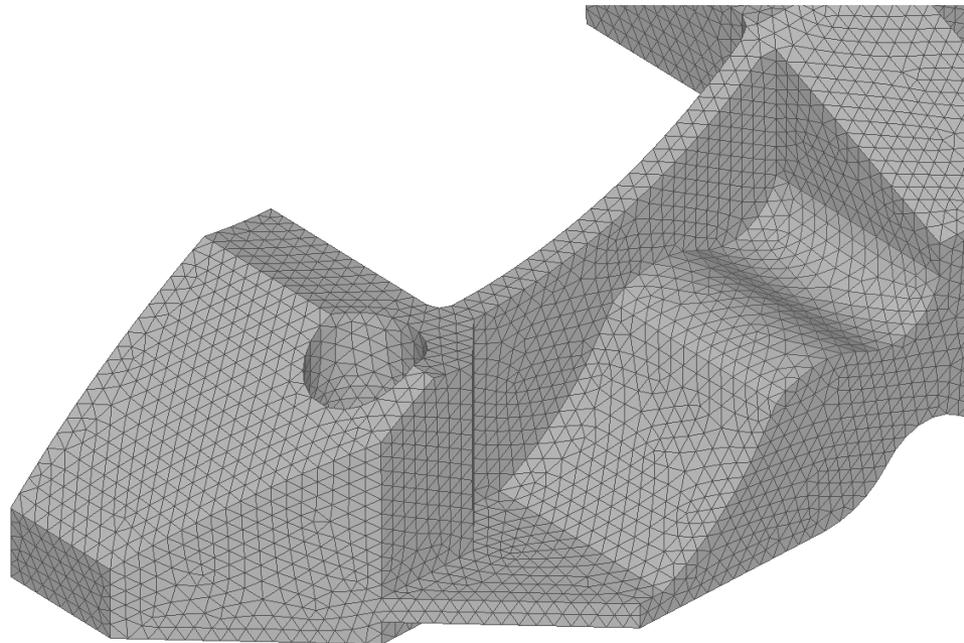
- Suitable for Box and Direct Morphing
- Improve mesh after morphing with large deformations



Functionalities assisting Morphing

Reconstruct / Smooth morphed mesh

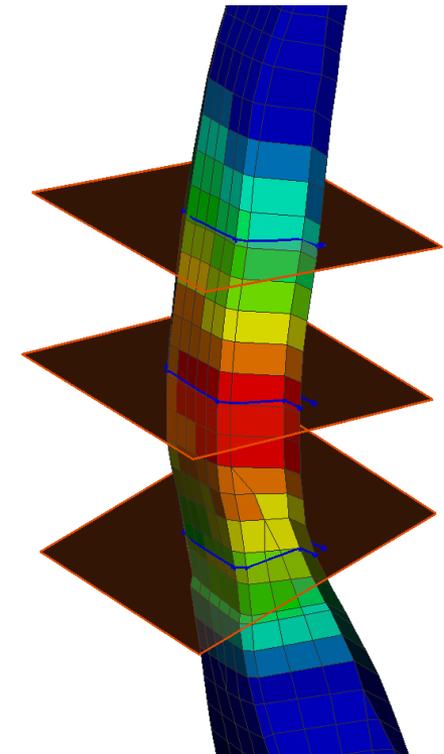
- Suitable for Box and Direct Morphing
- Improve mesh after morphing with large deformations



Functionalities assisting Morphing

Visualize Morphing Deviations

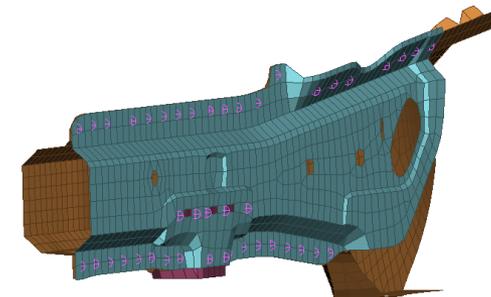
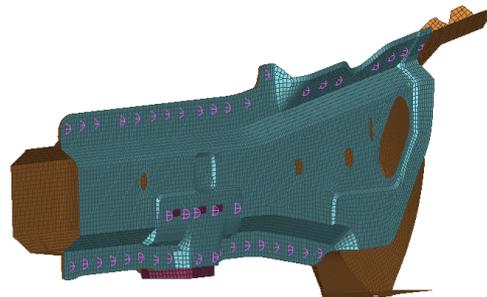
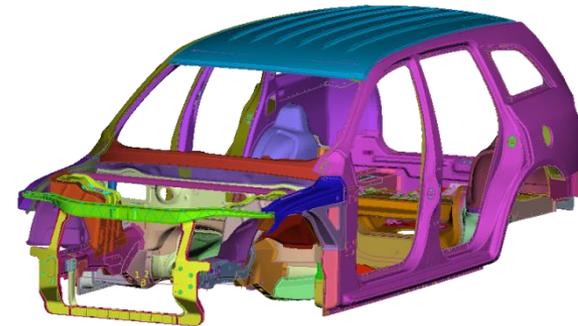
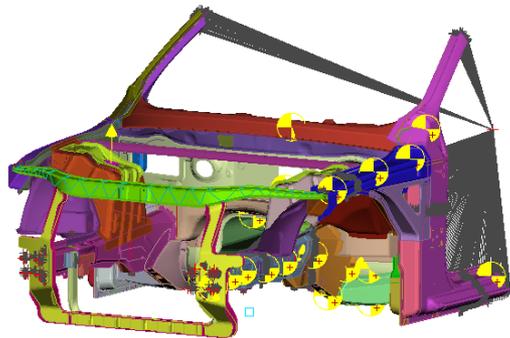
- Suitable for Box and Direct Morphing
- Measurement Tool
- Fringe Plot of deformed shape



Functionalities assisting Morphing

Design Migrate

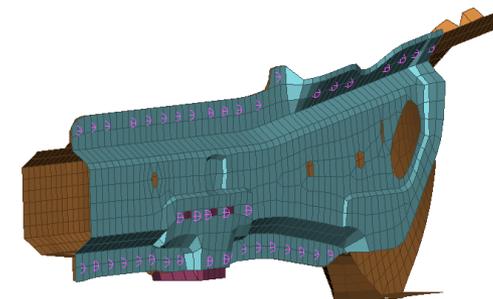
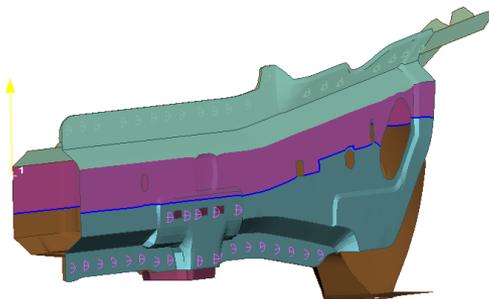
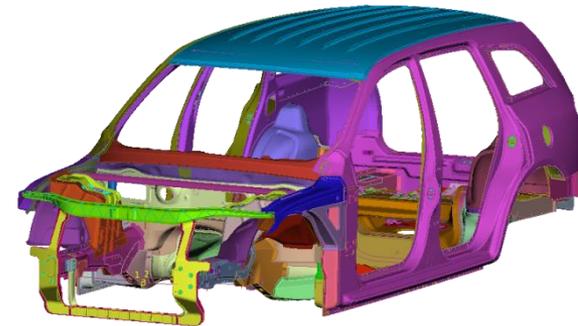
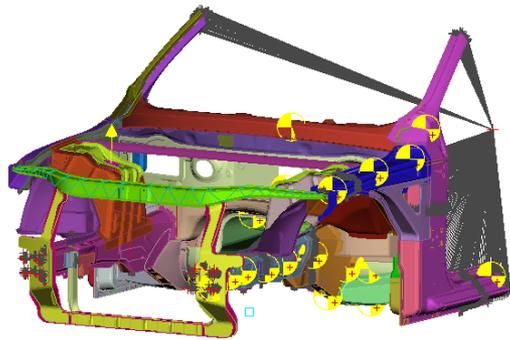
Re-application of Morph Parameters, Morph Constraints and Optimization Task items on different models



Functionalities assisting Morphing

Design Migrate

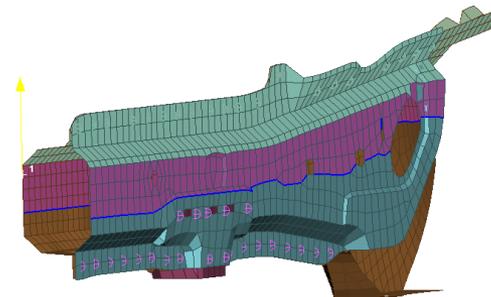
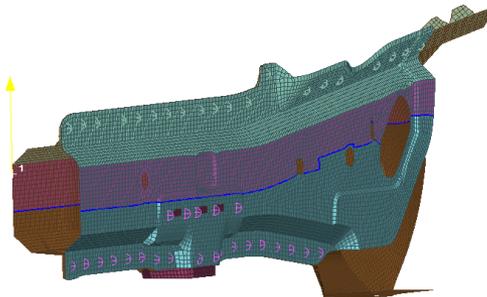
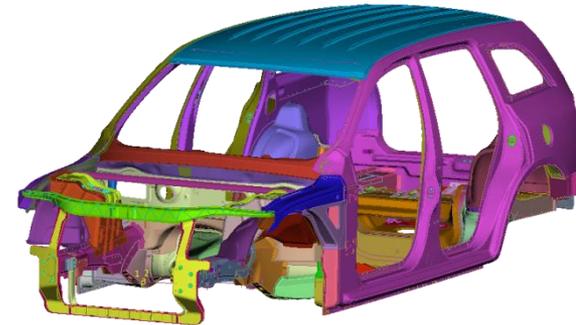
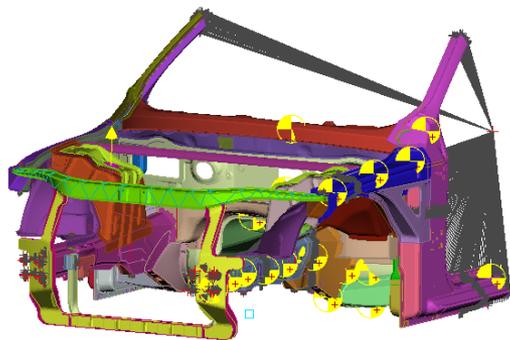
Re-application of Morph Parameters, Morph Constraints and Optimization Task items on different models



Functionalities assisting Morphing

Design Migrate

Re-application of Morph Parameters, Morph Constraints and Optimization Task items on different models



ANSA Parameter

- For parameterization of solver card entries, e.g. thicknesses
- 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

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, e.g. thicknesses
- Different types; Expressions

*DLOAD [DLOAD]

Name

FROZEN_DELETE
NO

STEP	OP	AMPLITUDE	STEADY STATE LOADING
1	NEW		

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, e.g. thicknesses
- 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"/>	<input type="text"/>

by ELSET LOAD TYPE magn(EID)

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 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>

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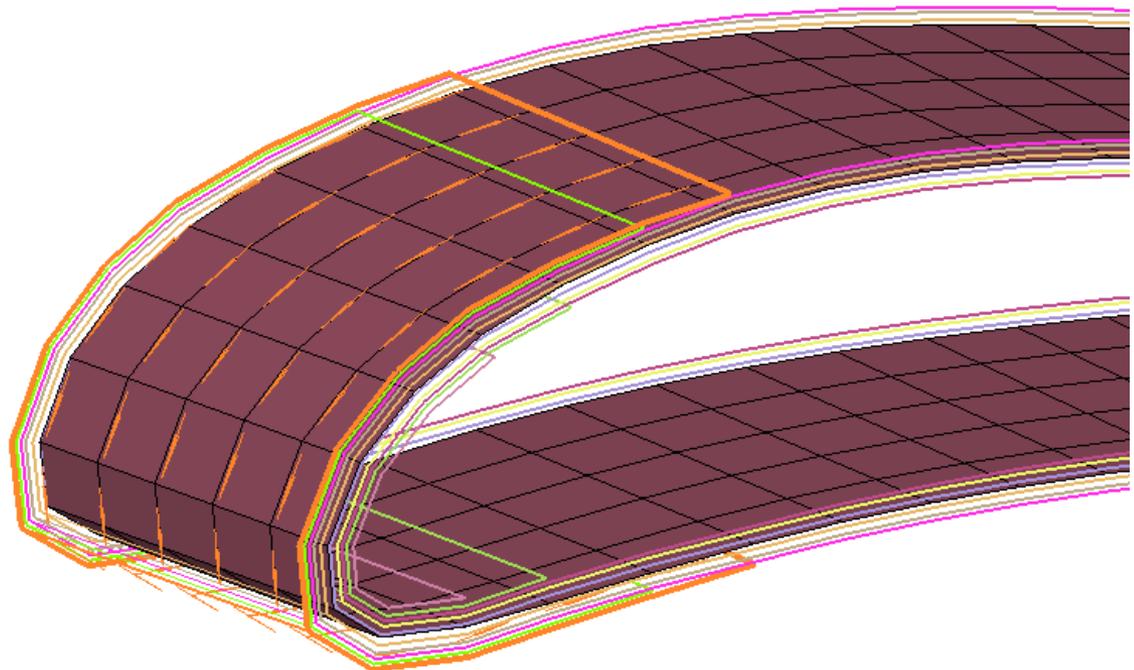
ANSA Parameter

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

Layers

PID	Z0	NSM	S
1			

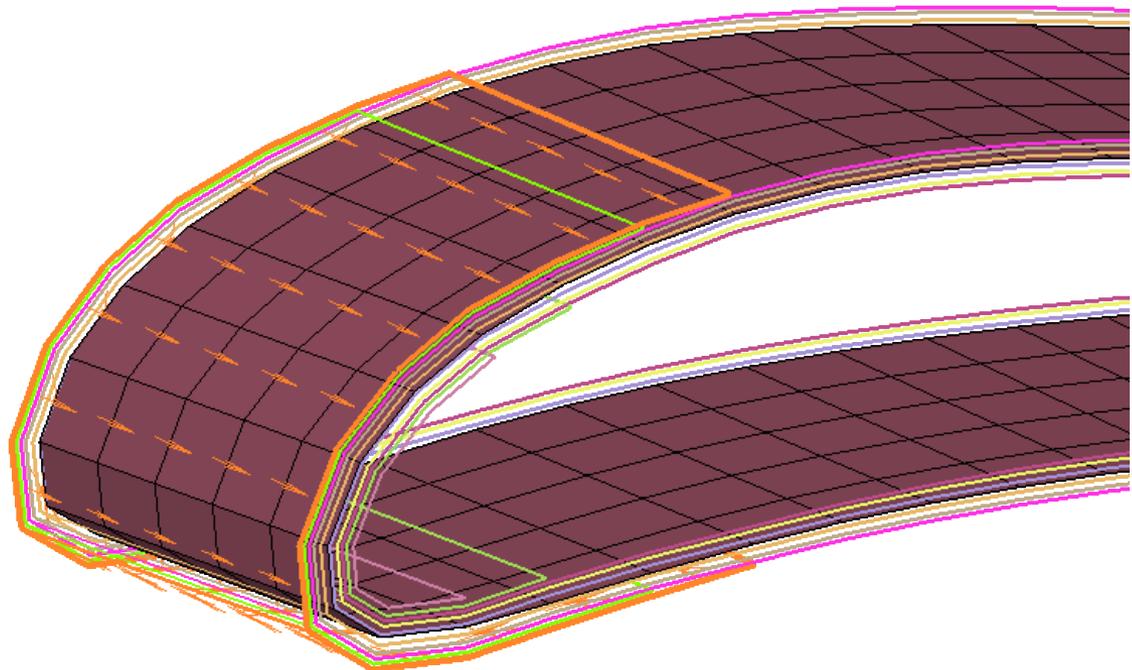
AVA	Type	T	THETA	m:
1	Sequence			
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2	Layer	0.1	-45.	
3	Layer	0.1	45.	
4	Layer	0.2	0.	
5	Layer	0.2	0.	
6	Layer	0.1	45.	
7	Layer	0.1	-45.	
8	Layer	0.2	90.	



ANSA Parameter

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

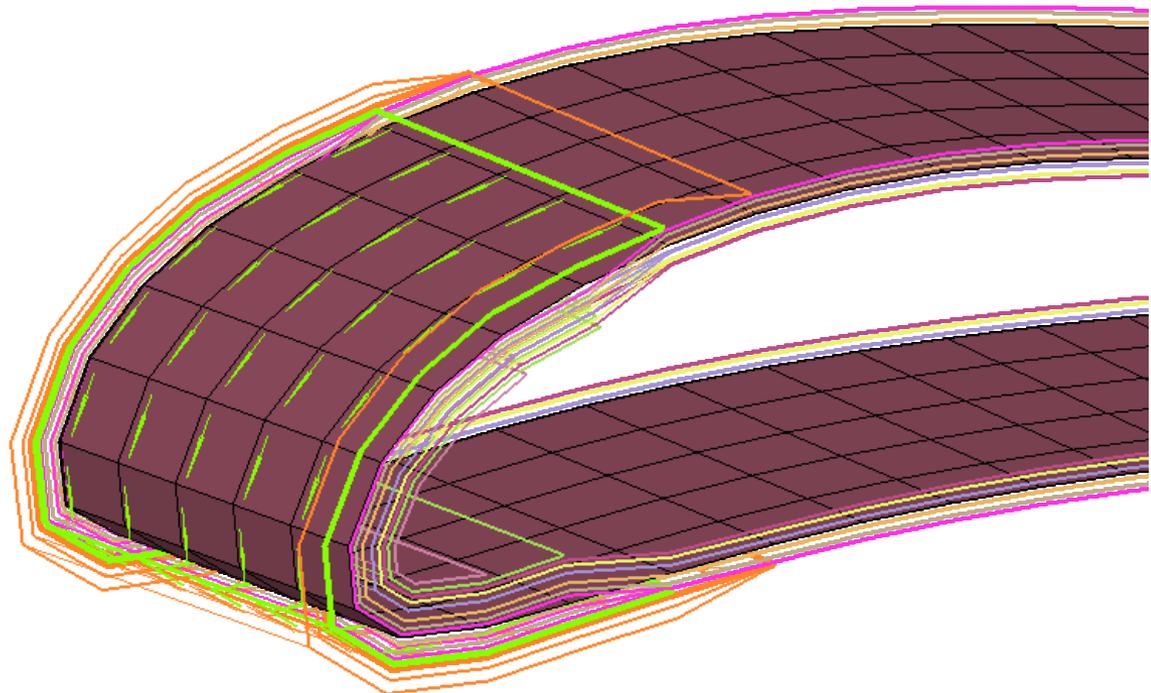
Layers				
PID	Z0	NSM	S	
1				
AVA	Type	T	THETA	m:
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1	Layer	0.2	90.	
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3	Layer	0.1	45.	
4	Layer	0.2	0.	
5	Layer	0.2	0.	
6	Layer	0.1	45.	
7	Layer	0.1	-45.	
8	Layer	0.2	90.	



ANSA Parameter

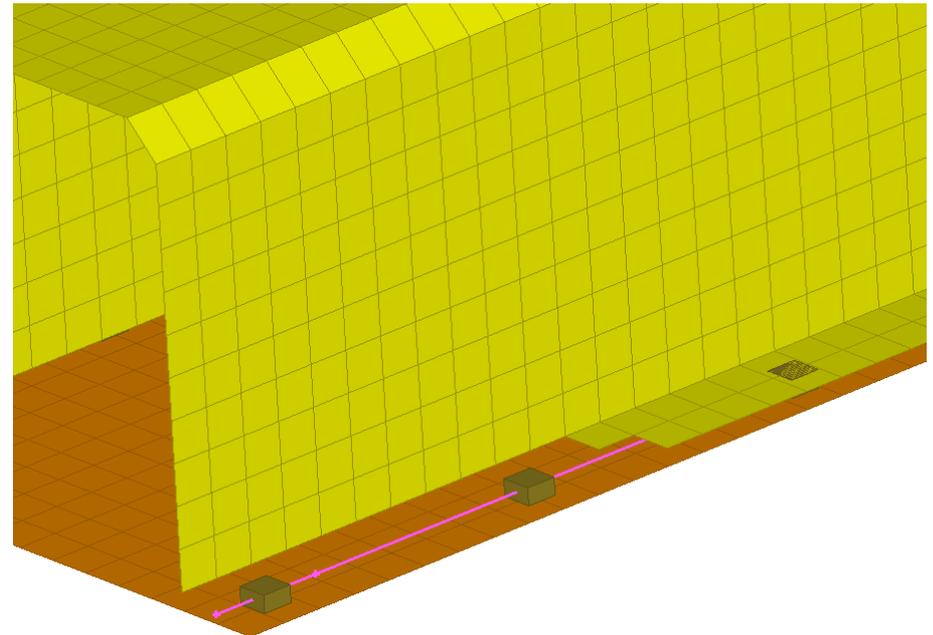
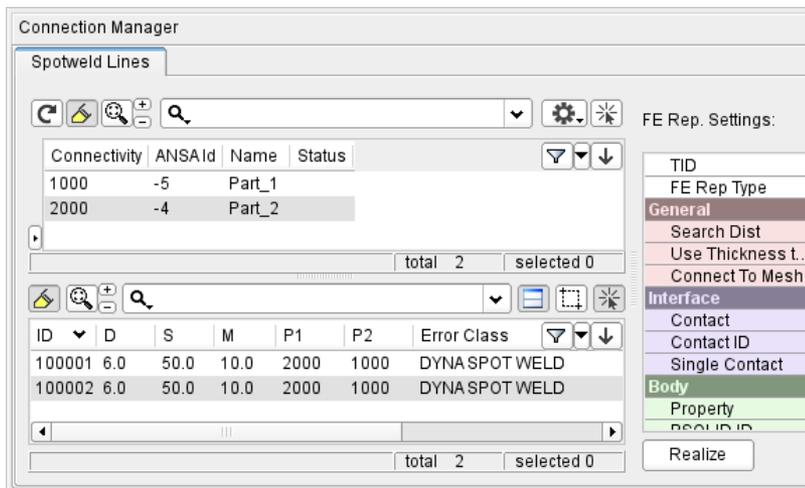
- For parameterization of composite properties, e.g.:
 - fabric orientation
 - layer thickness

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.	



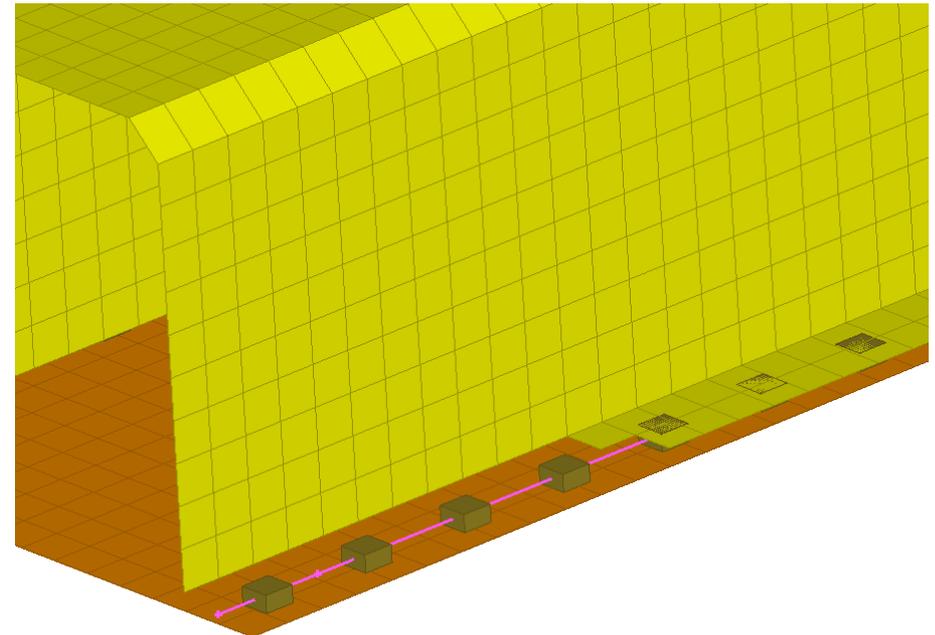
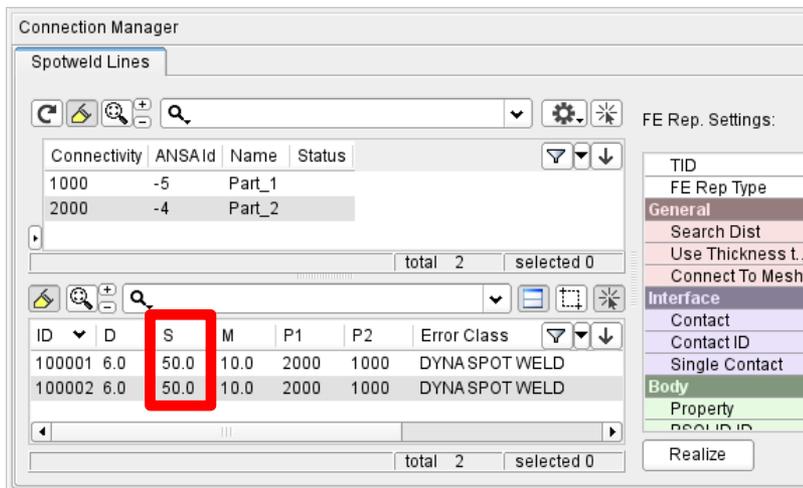
ANSA Parameter

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



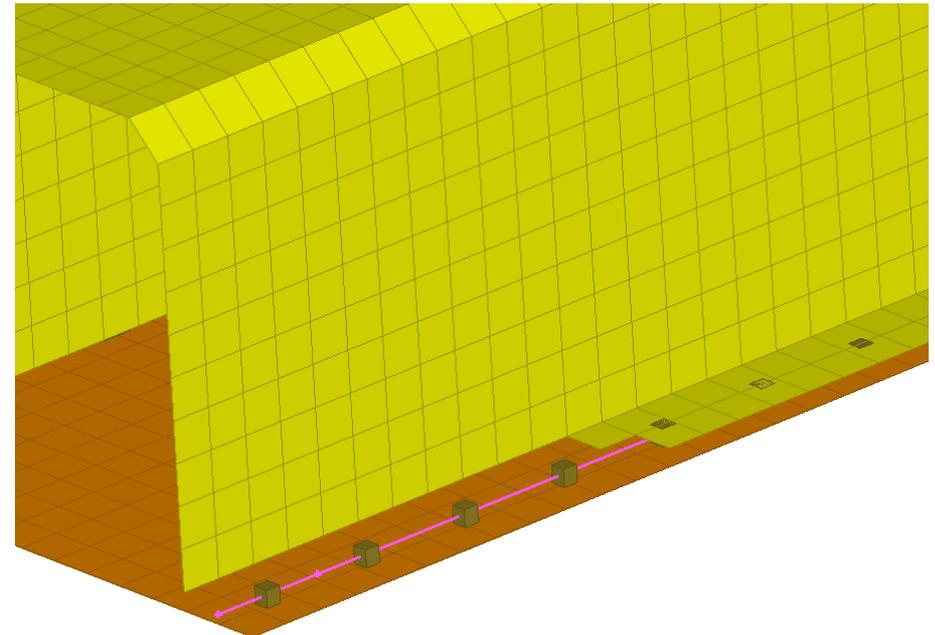
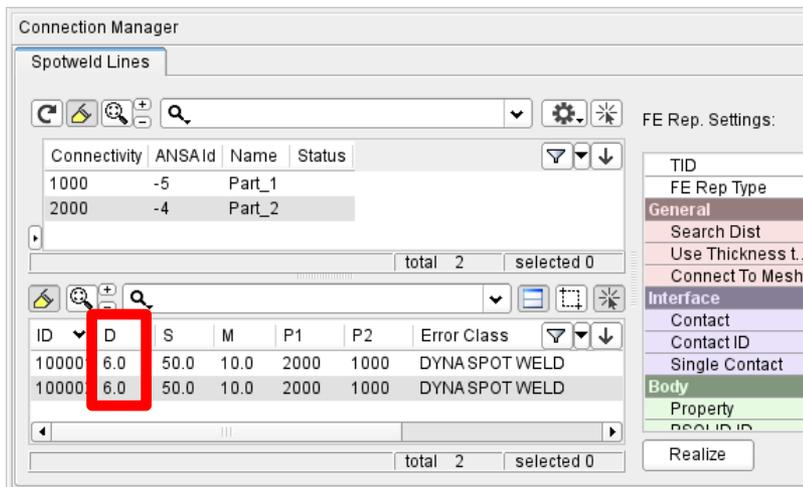
ANSA Parameter

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

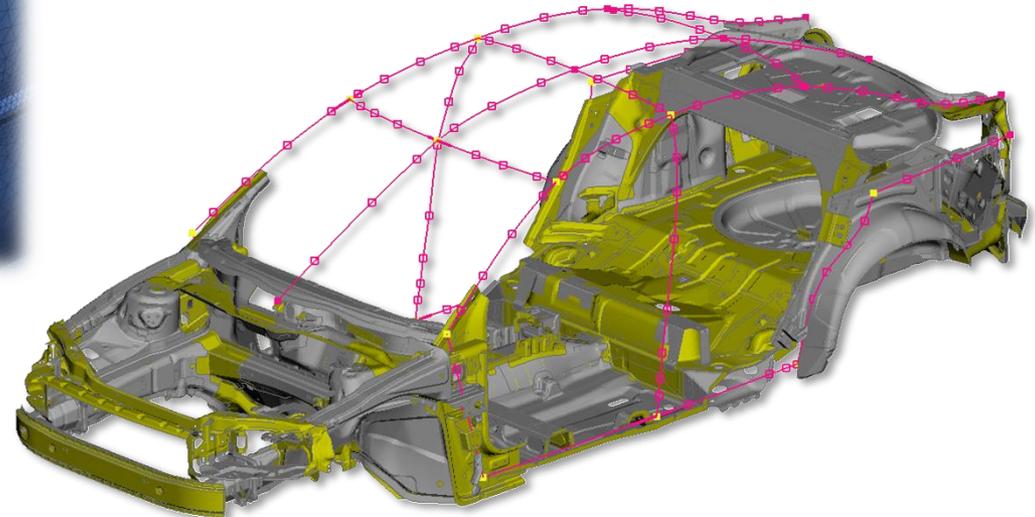
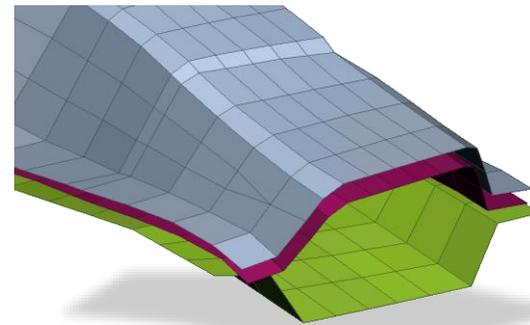
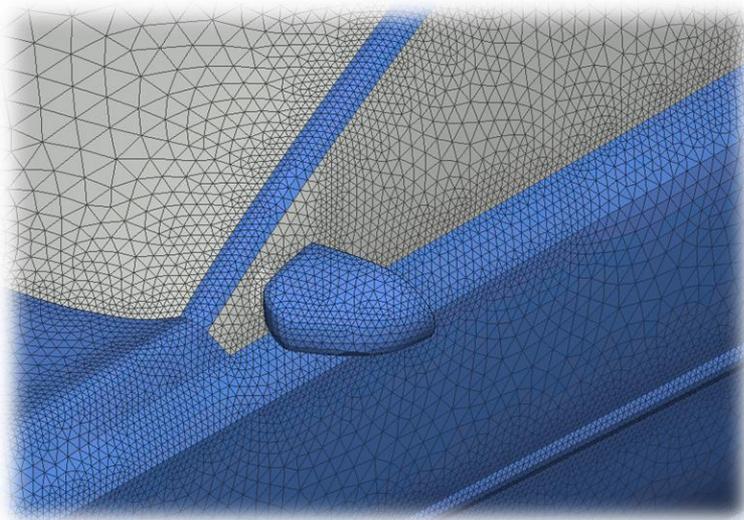


ANSA Parameter

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



Ευχαριστώ πολύ



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