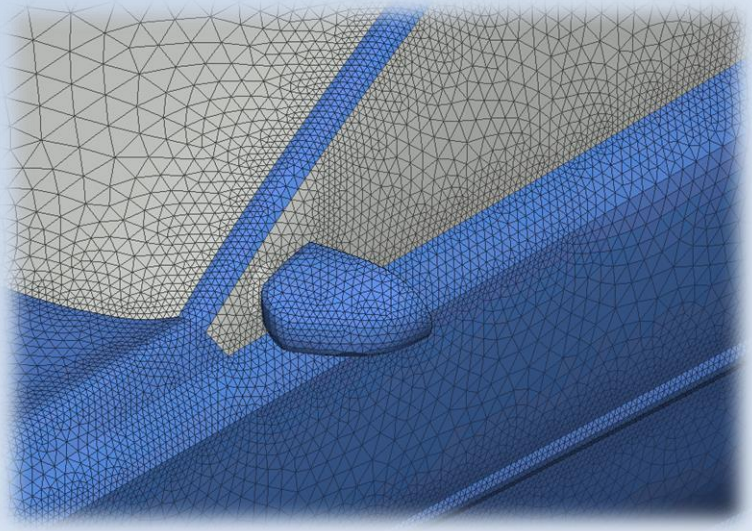
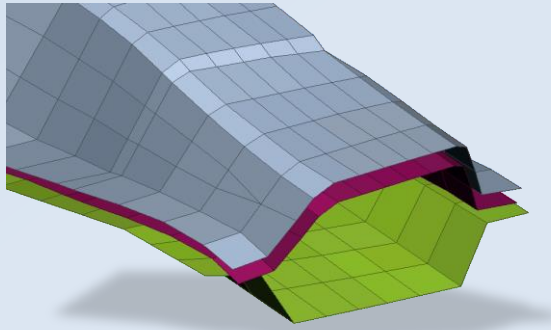
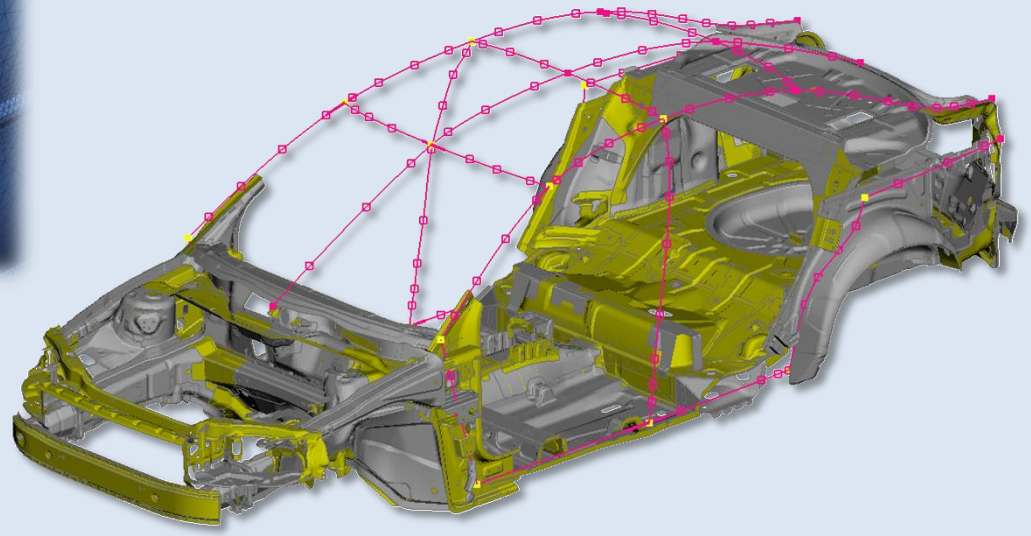
Model Parameterization in ANSA

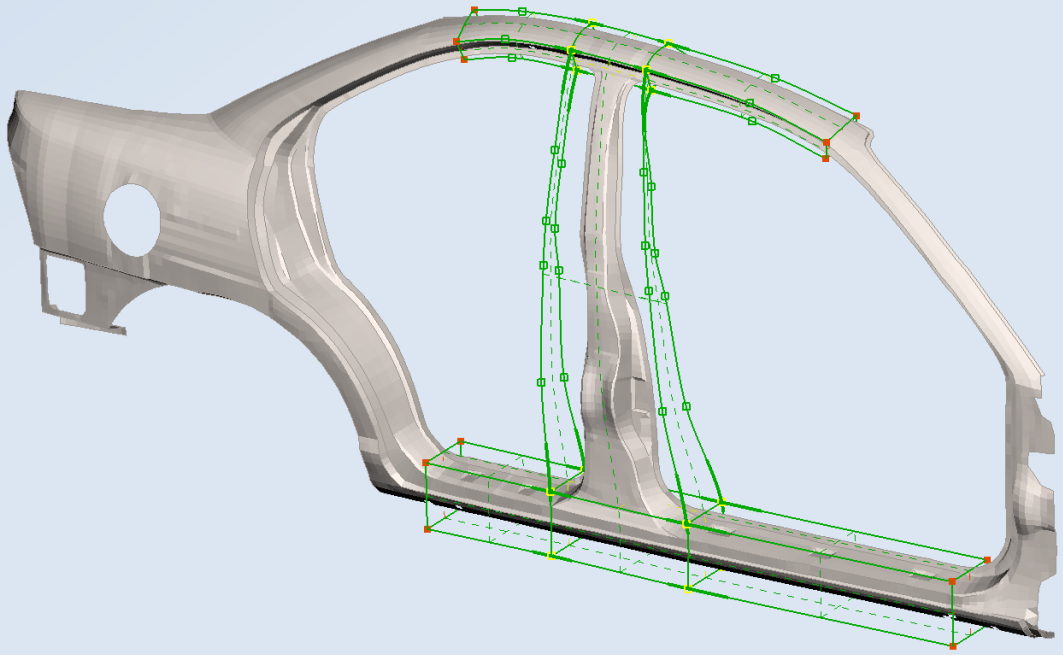






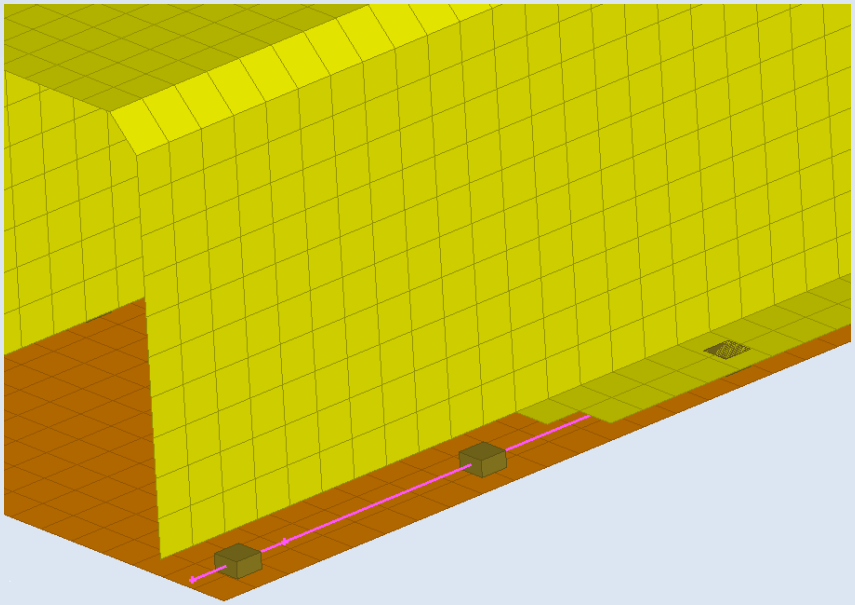
Types of Parameterization

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



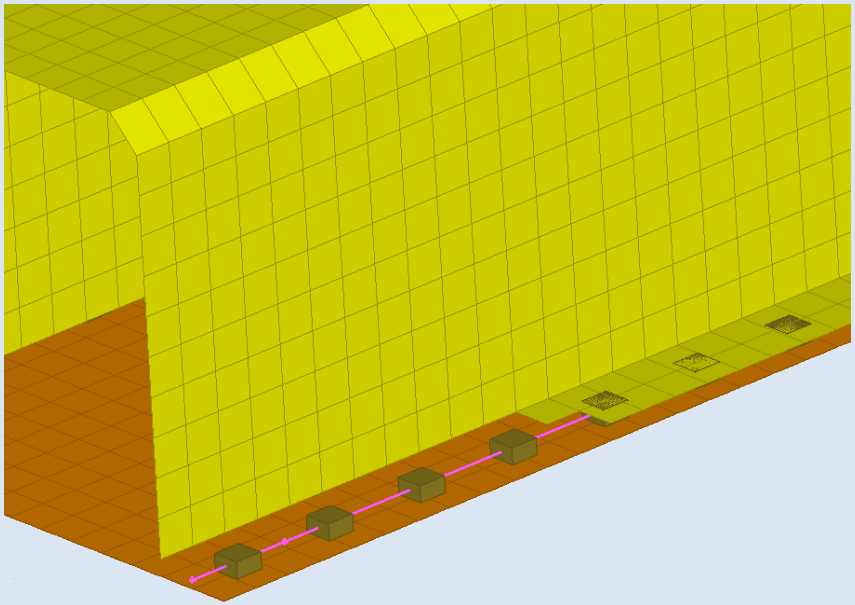
Types of Parameterization

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



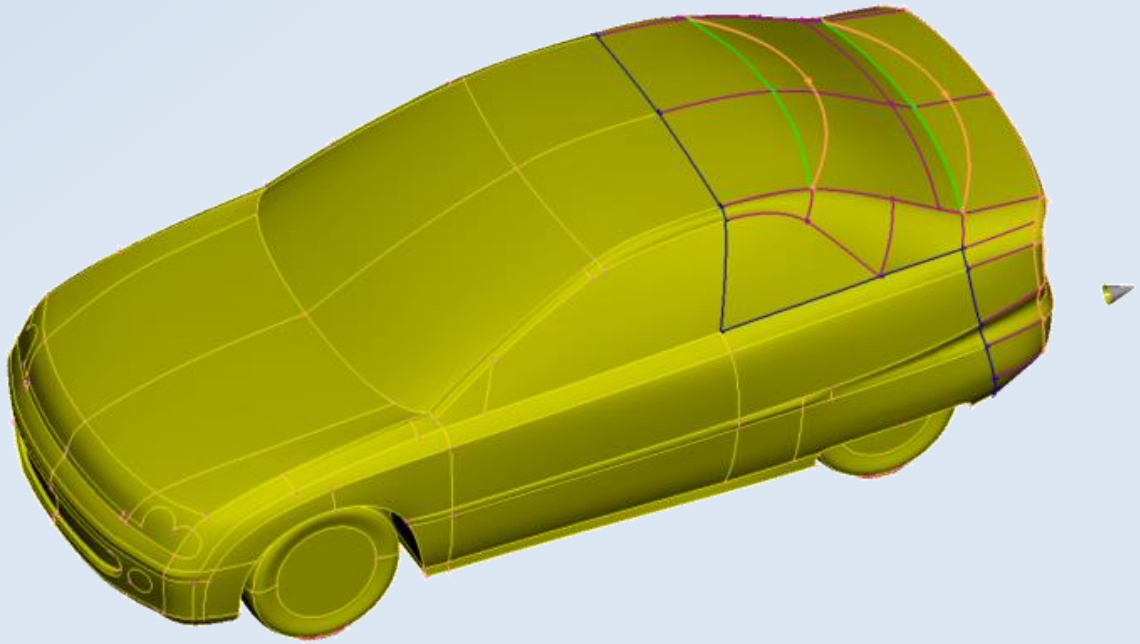
Types of Parameterization

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



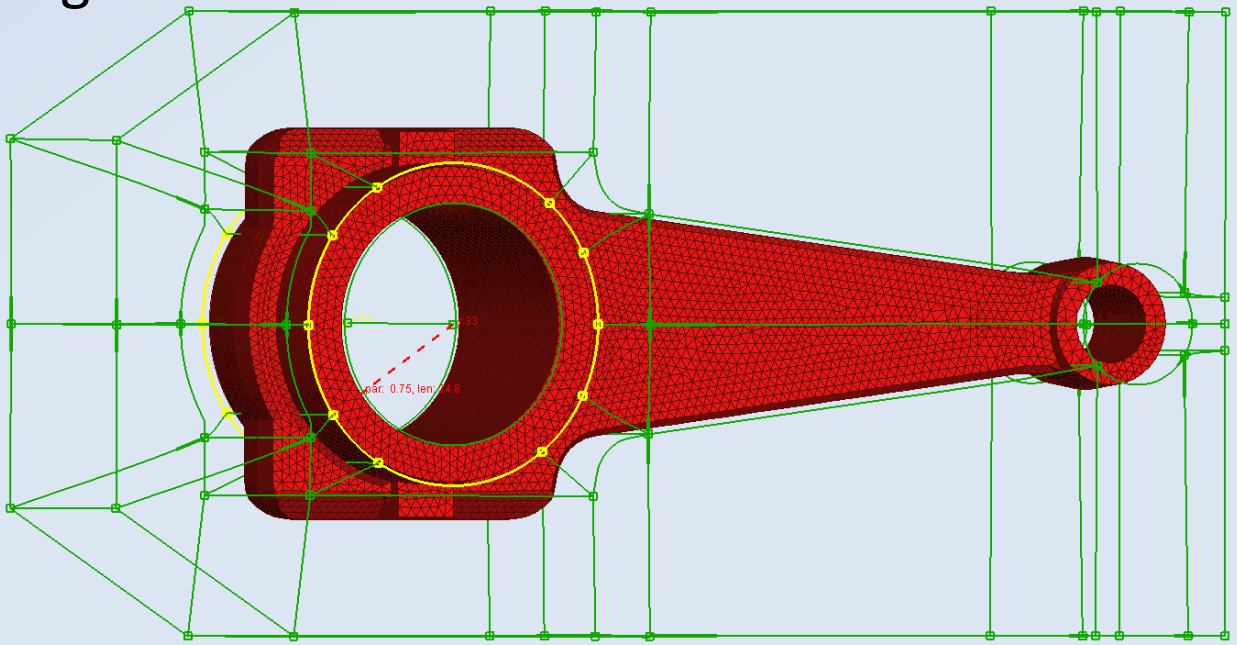
Morphing

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



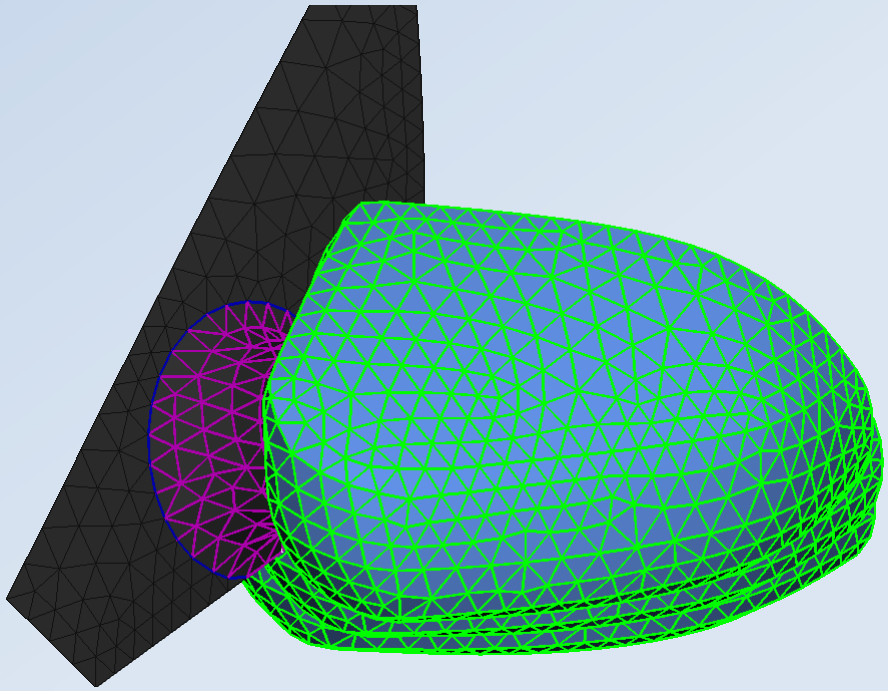
Morphing

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



Direct Morphing

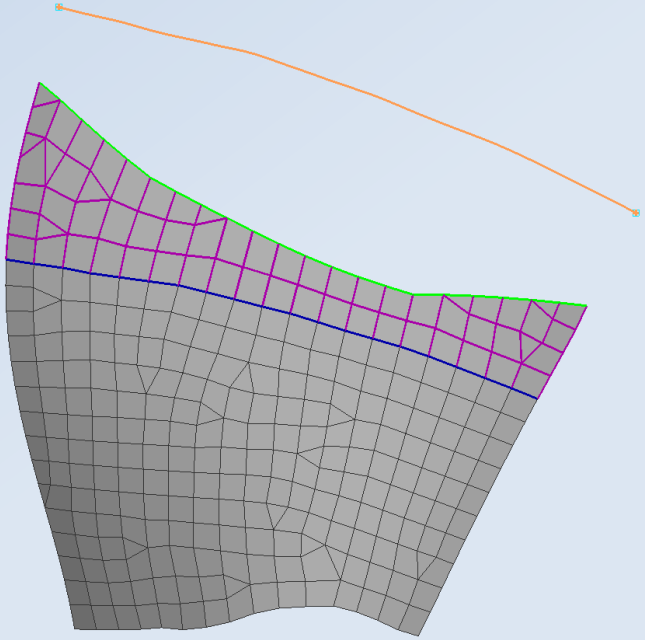
Translate, **rotate** or scale **FE-mesh** or Geometry entities



- Control Entities
- Morphed Entities
- Boundary
- Morphing

Direct Morphing

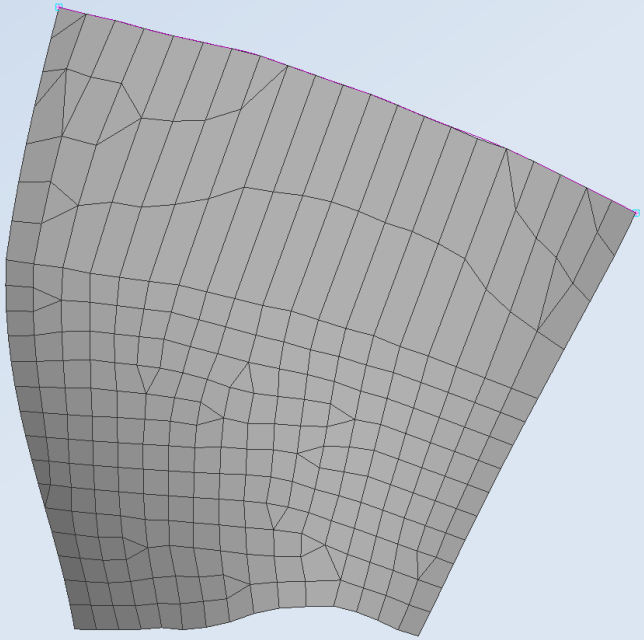
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target
- Morphed Entities
- Boundary

Direct Morphing

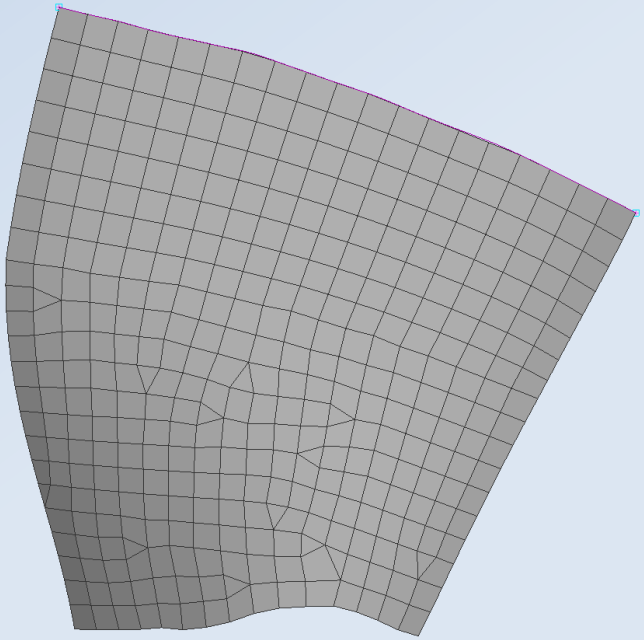
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target
- Morphed Entities
- Boundary
- Morphing

Direct Morphing

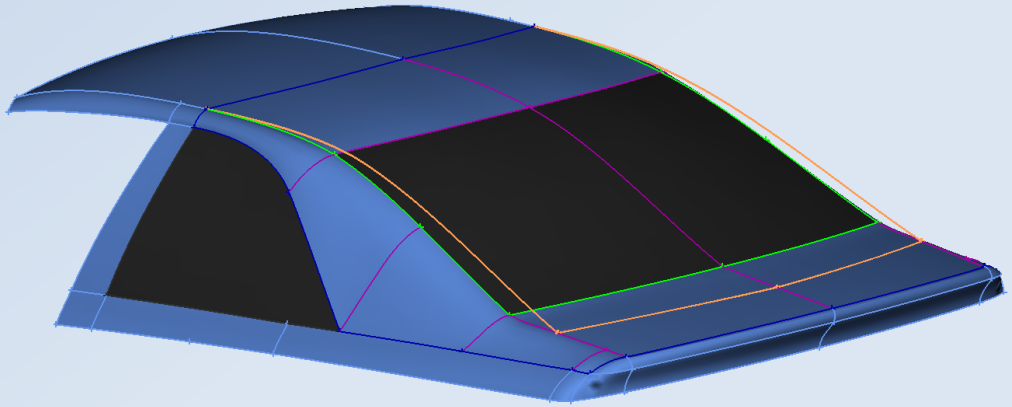
Snap **FE** or geometry edges to **single** or multiple target curves



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

Direct Morphing

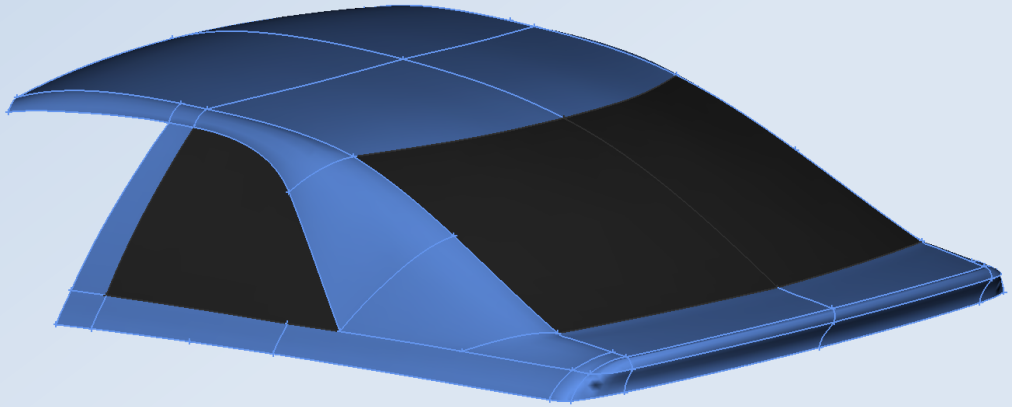
Snap FE or **geometry** edges to single or **multiple** target curves



- Origin
- Target
- Morphed Entities
- Boundary

Direct Morphing

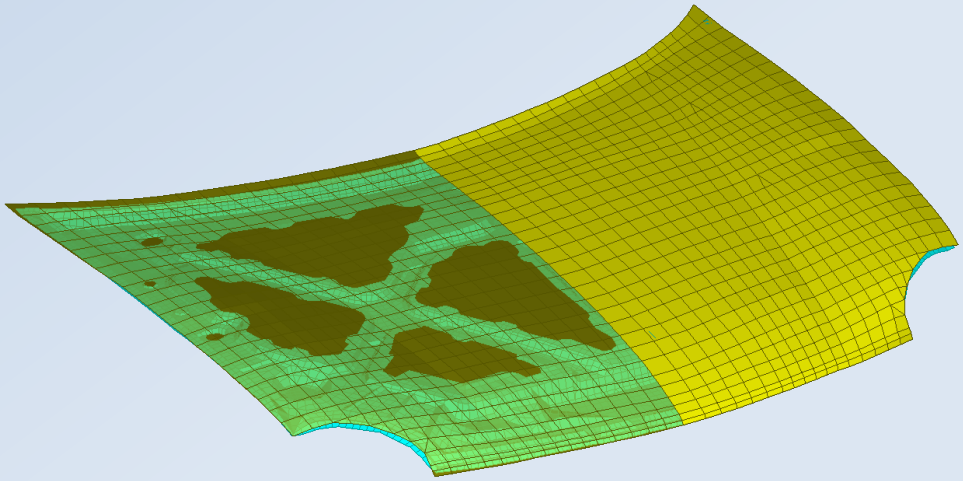
Snap FE or **geometry** edges to single or **multiple** target curves



- Origin
- Target
- Morphed Entities
- Boundary
- Morphing

Direct Morphing

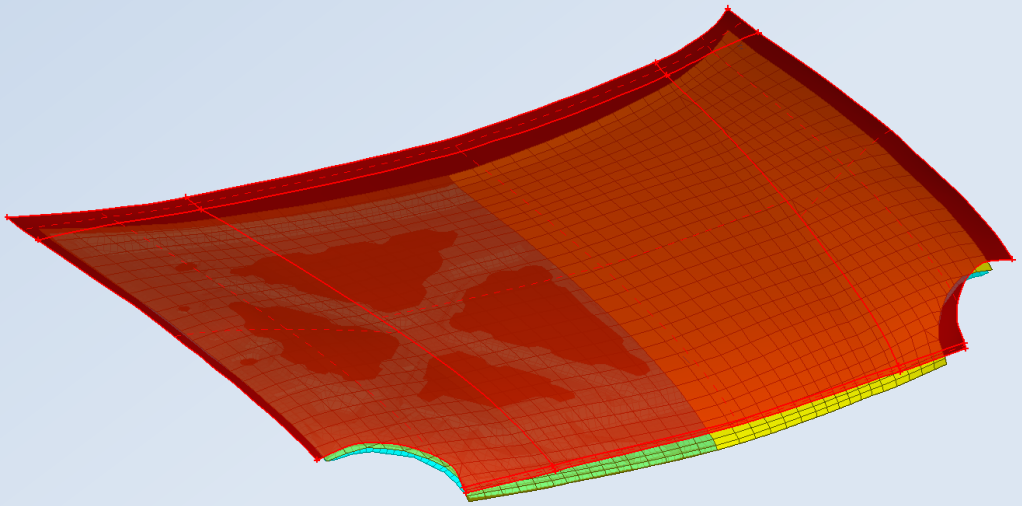
Fit surfaces – e.g. fit existing FE-mesh to new CAD-geometry



- Original FE-surface (with additional underlying parts)

Direct Morphing

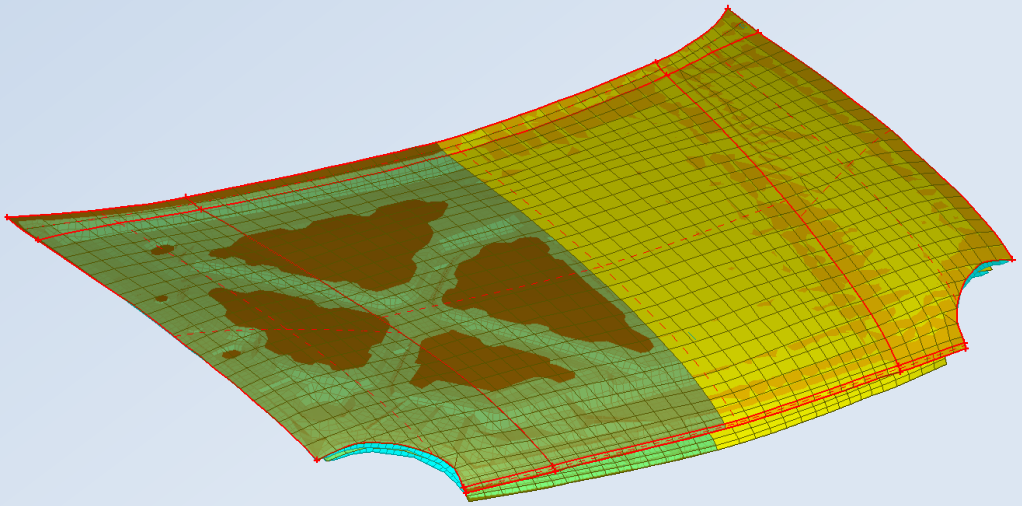
Fit surfaces – e.g. fit existing FE-mesh to new CAD-geometry



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

Direct Morphing

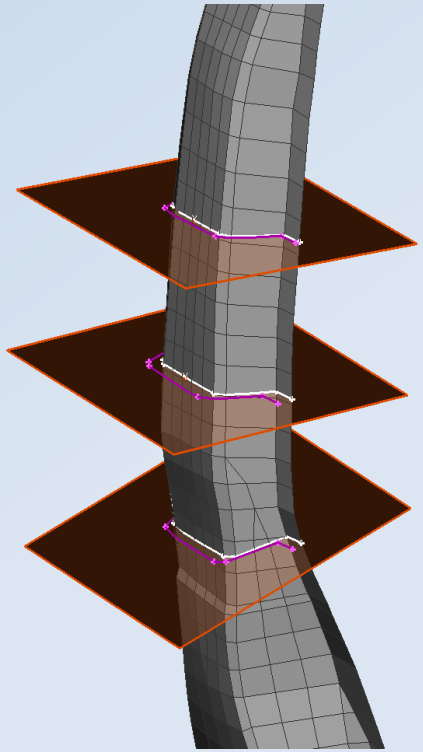
Fit surfaces – e.g. fit existing FE-mesh to new CAD-geometry



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

Direct Morphing

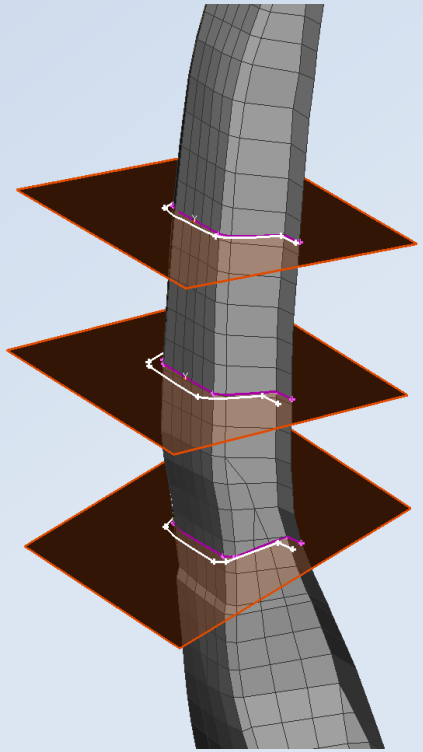
Fit cross sections (applicable on FE-mesh and geometry)



- Original cross section

Direct Morphing

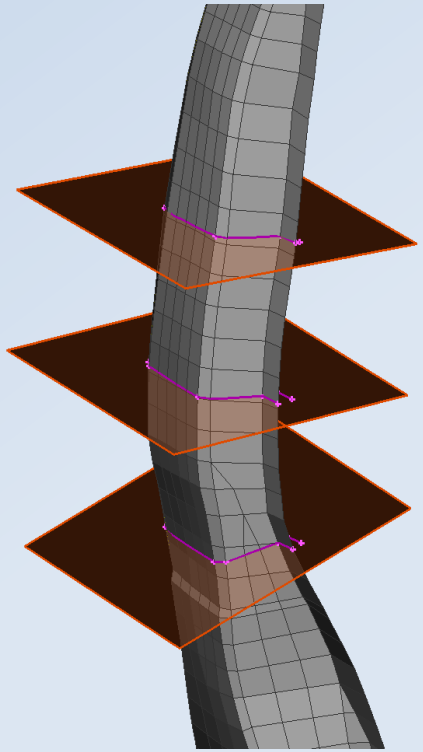
Fit cross sections (applicable on FE-mesh and geometry)



- Original cross section
- Target cross section

Direct Morphing

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

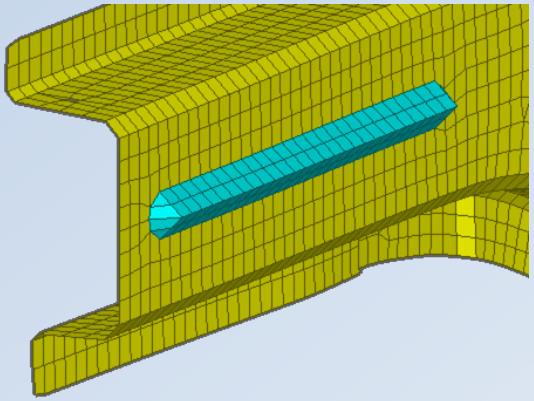


- Original cross section
- Target cross section
- Morphing

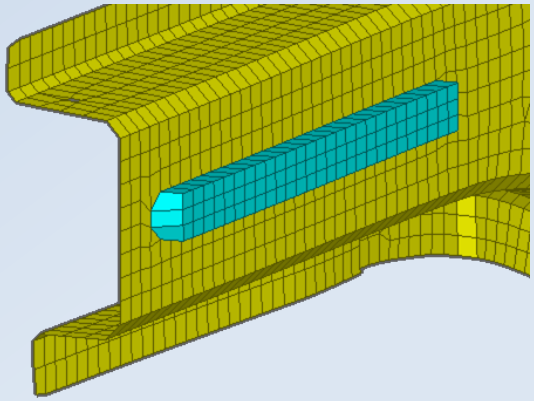
Direct Morphing

Generation & modification of beads and embosses

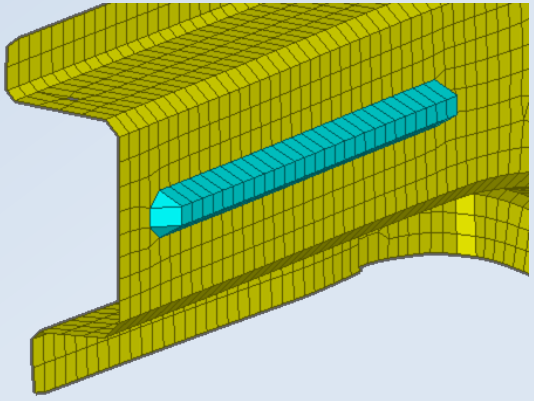
Triangular-shape



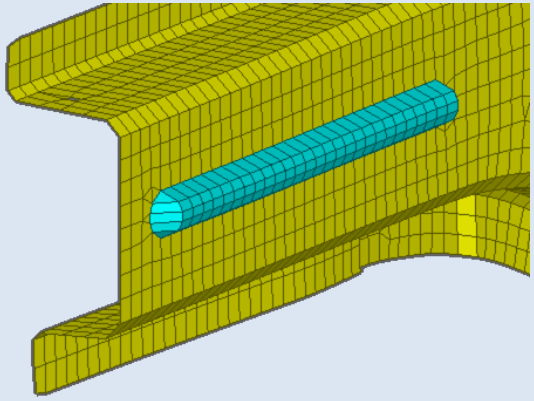
Box-shape

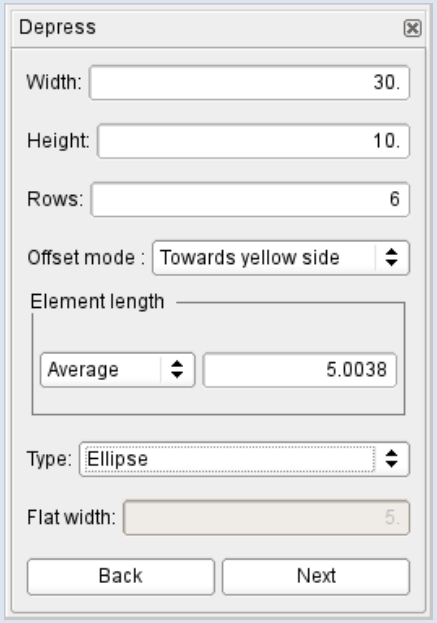


Trapezoidal-shape



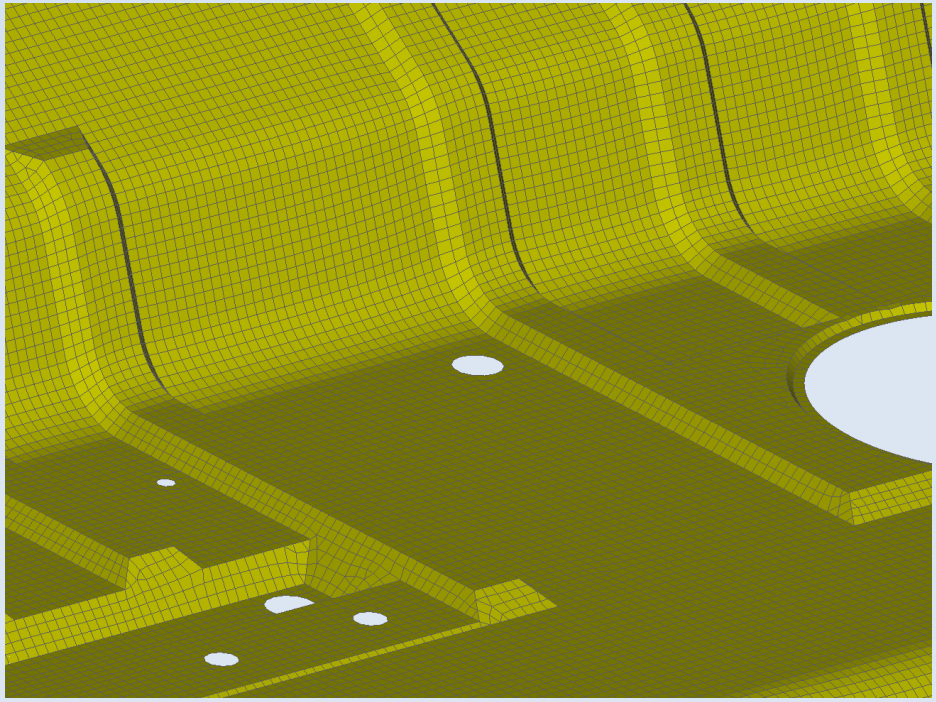
Ellipse-shape





Direct Morphing

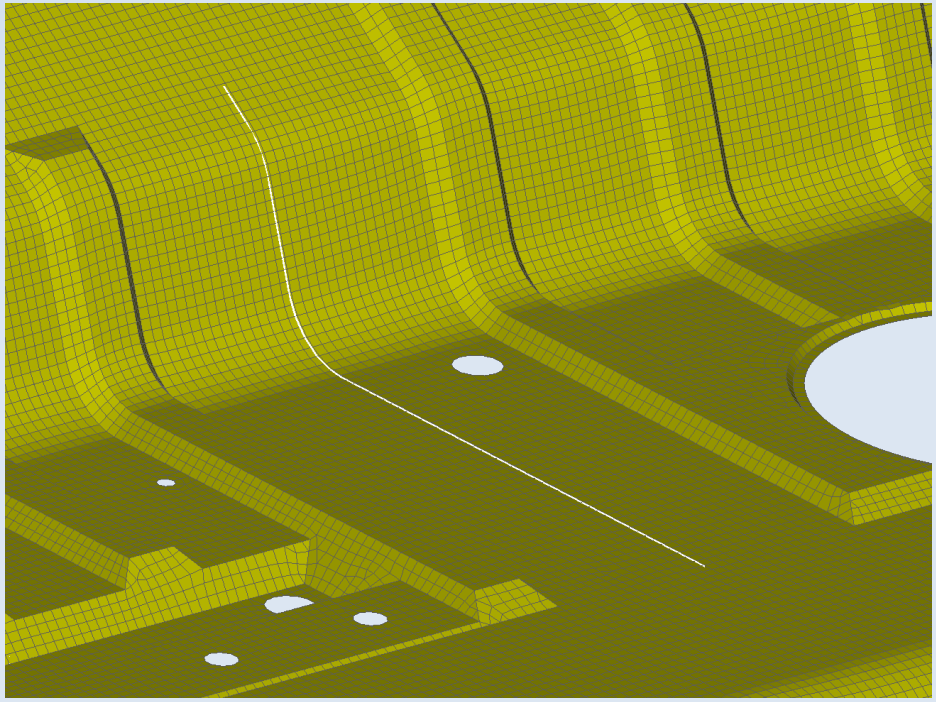
Generation & modification of beads and embosses



Direct Morphing

Generation & modification of beads and embosses

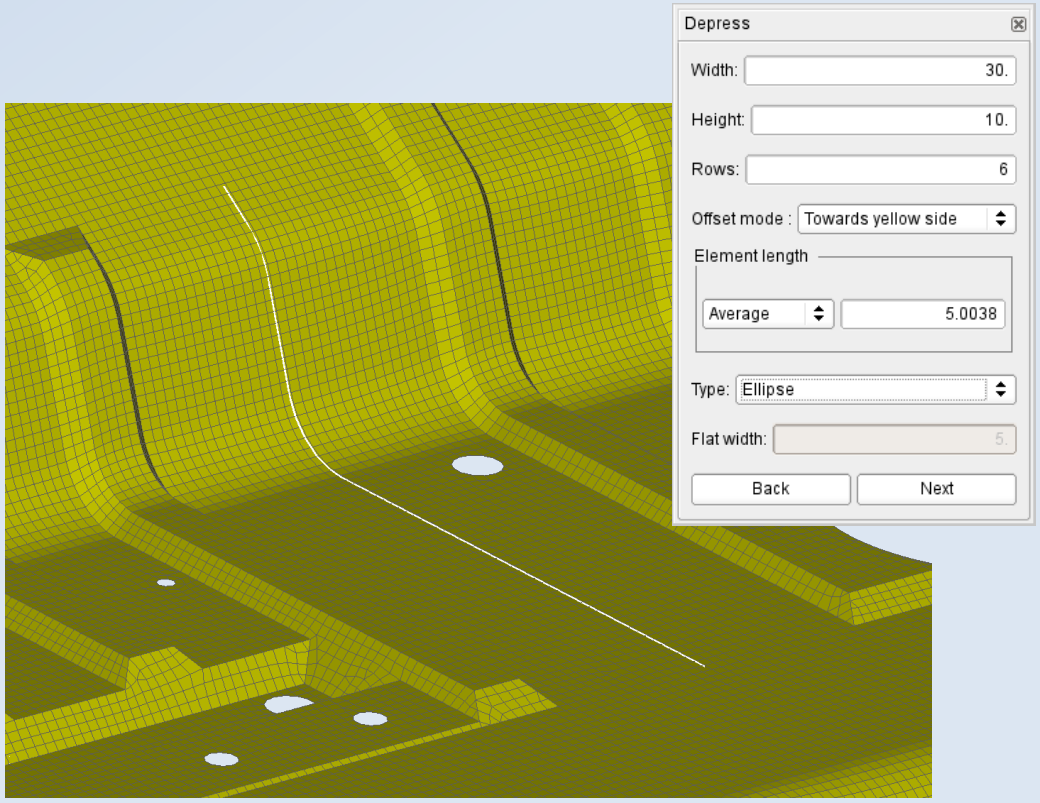
Curves



Direct Morphing

Generation & modification of beads and embosses

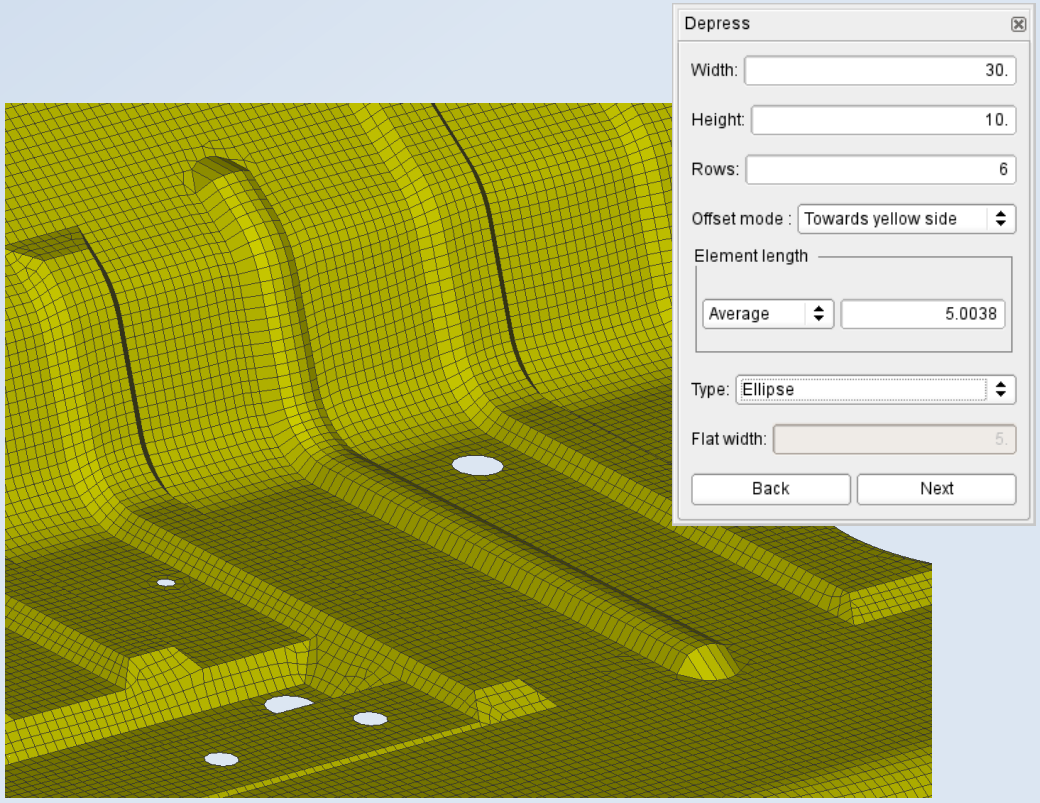
Curves
↓
Depress Parameter



Direct Morphing

Generation & modification of beads and embosses

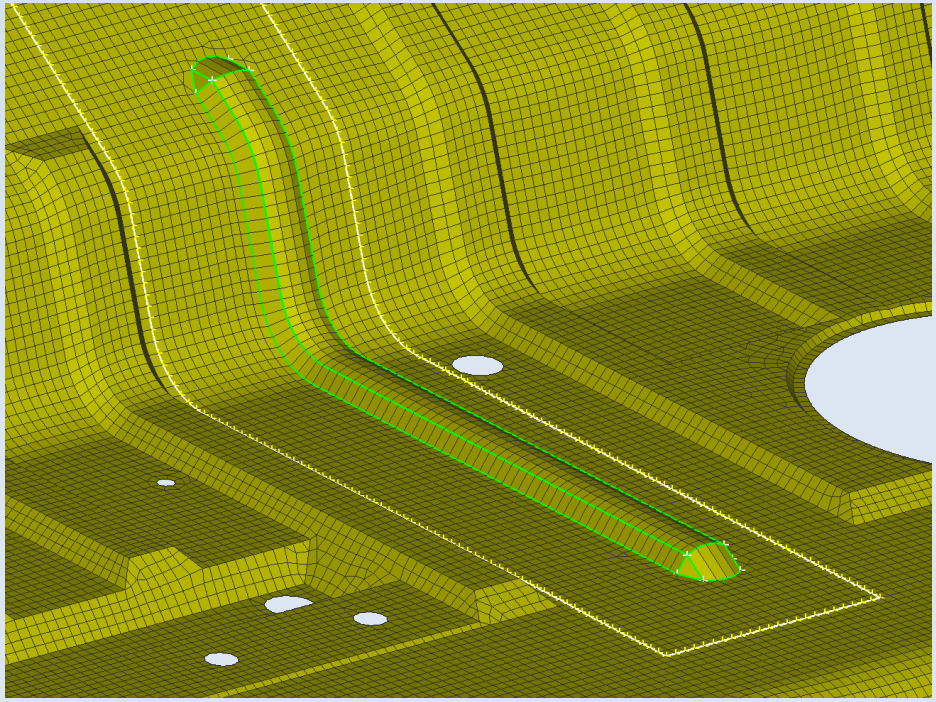
Curves
↓
Depress Parameter
↓
Depression



Direct Morphing

Generation & modification of beads and embosses

Curves
↓
Depress Parameter
↓
Depression
↓
Reconstruct



Direct Morphing

Generation & modification of beads and embosses

Curves
↓
Depress Parameter
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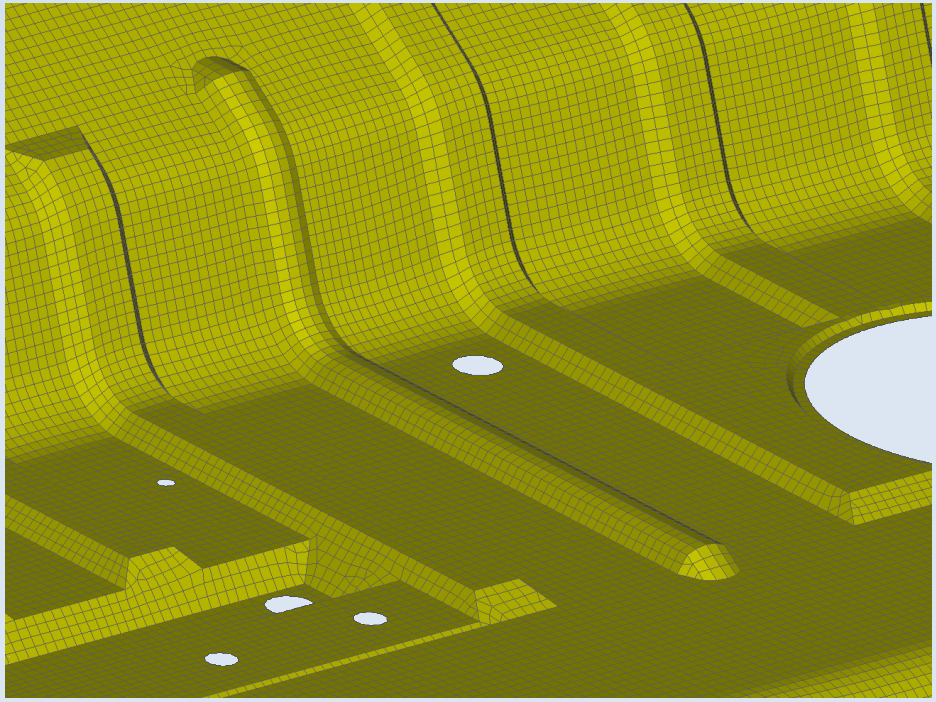
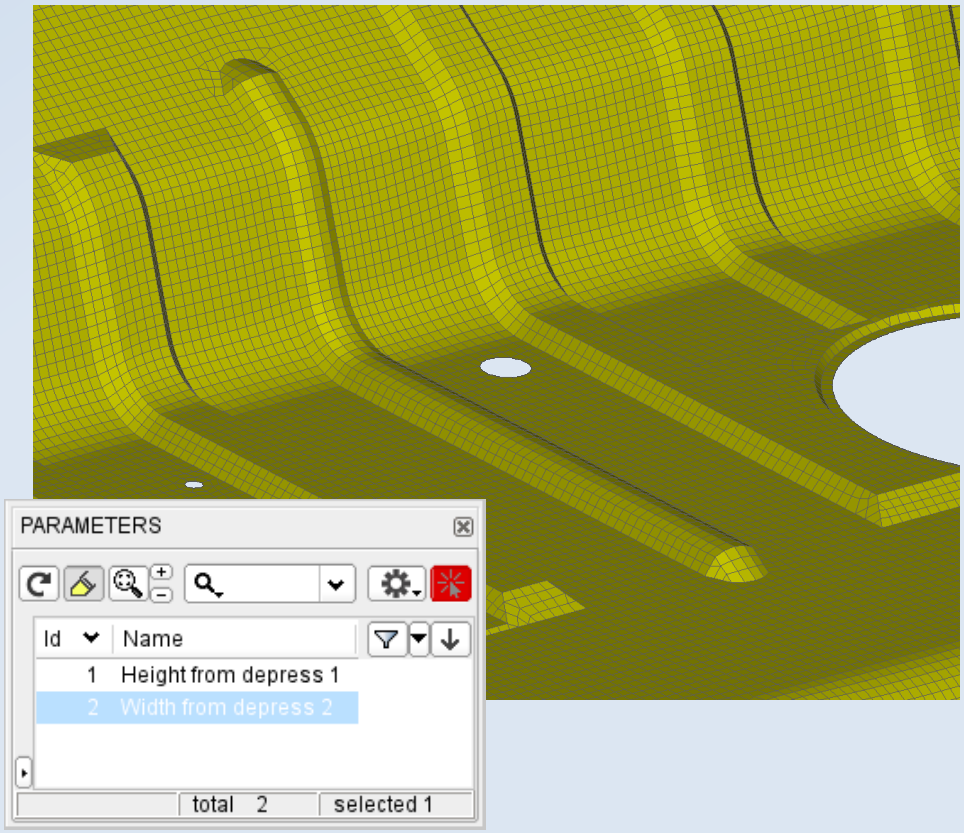
Depression
↓
Reconstruct



Direct Morphing

Generation & modification of beads and embosses

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



Direct Morphing

Generation & modification of beads and embosses

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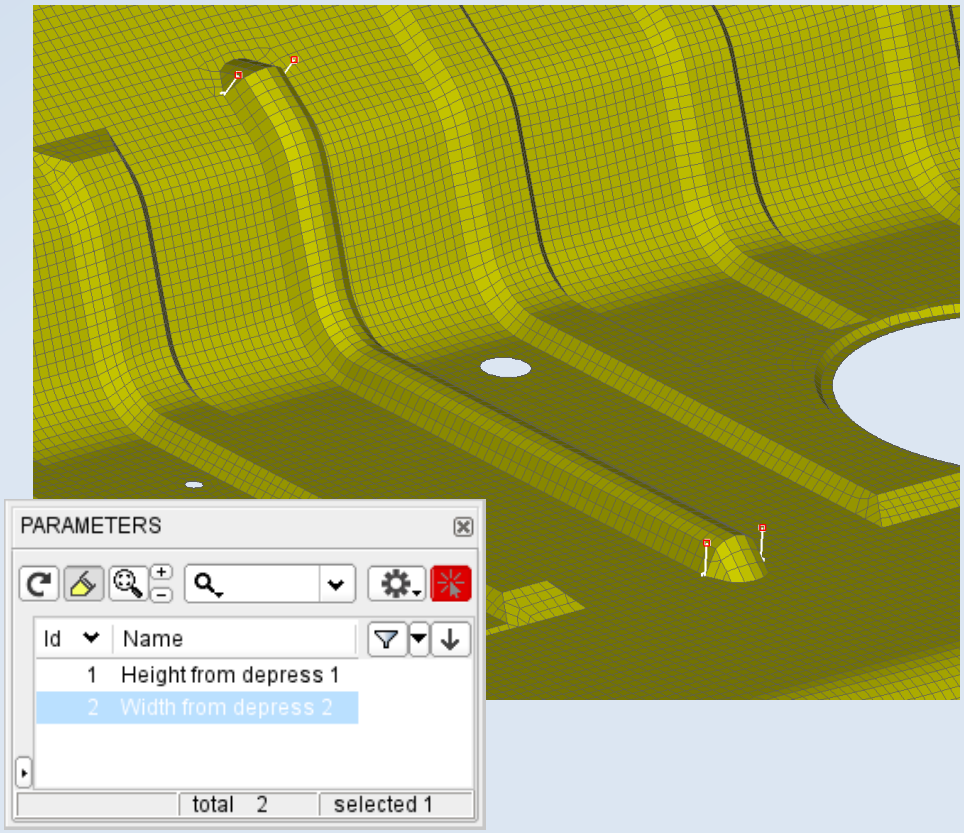
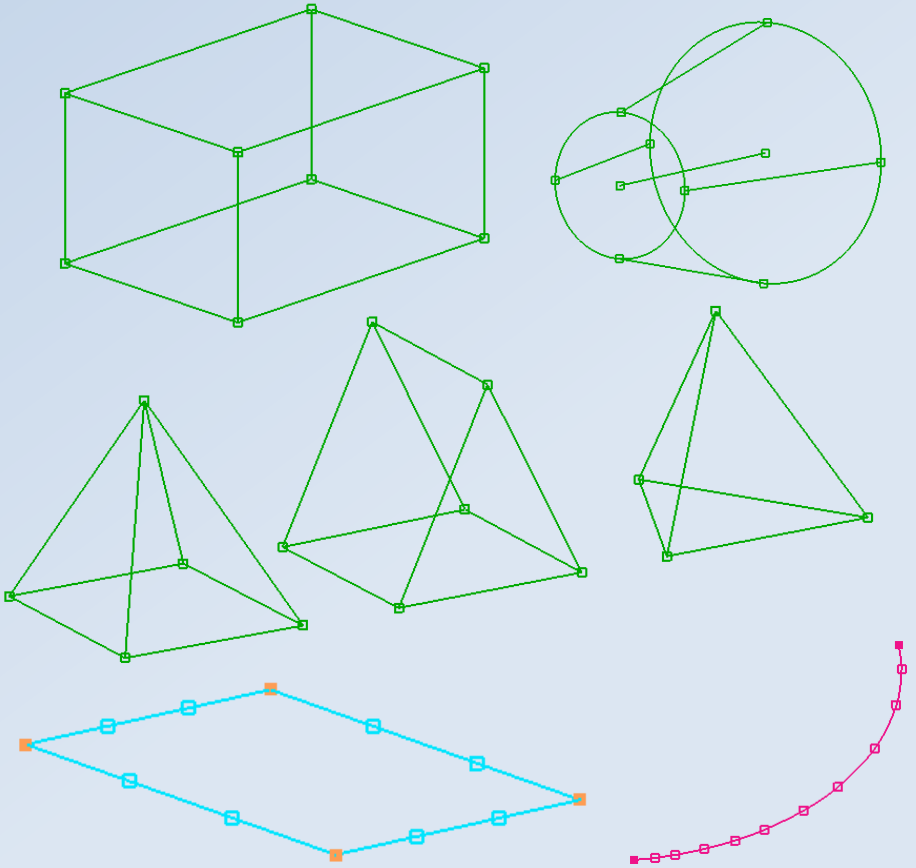
Auto-created morph boxes and parameters



Box Morphing

Types of boxes

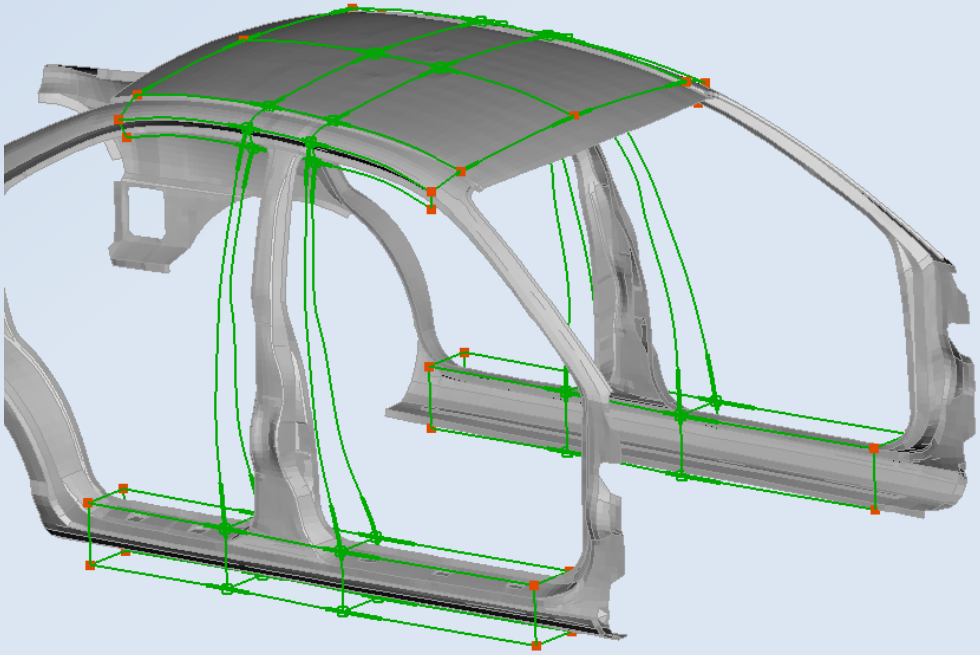


- 3D
  - Hexa
  - Penta
  - Tetra
  - Pyramid
  - Cylindrical
- 2D (specific thickness)
- 1D (specific diameter)

Box Morphing

Approach 1

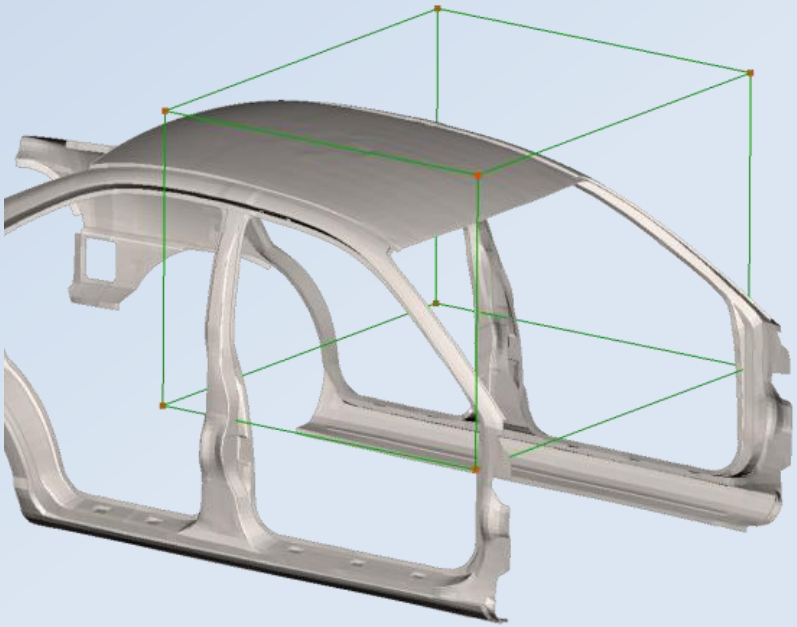
- Multiple boxes, following the shape of the structure
- Moving / sliding of control points reshapes the model
- **Rough modification** of model shape

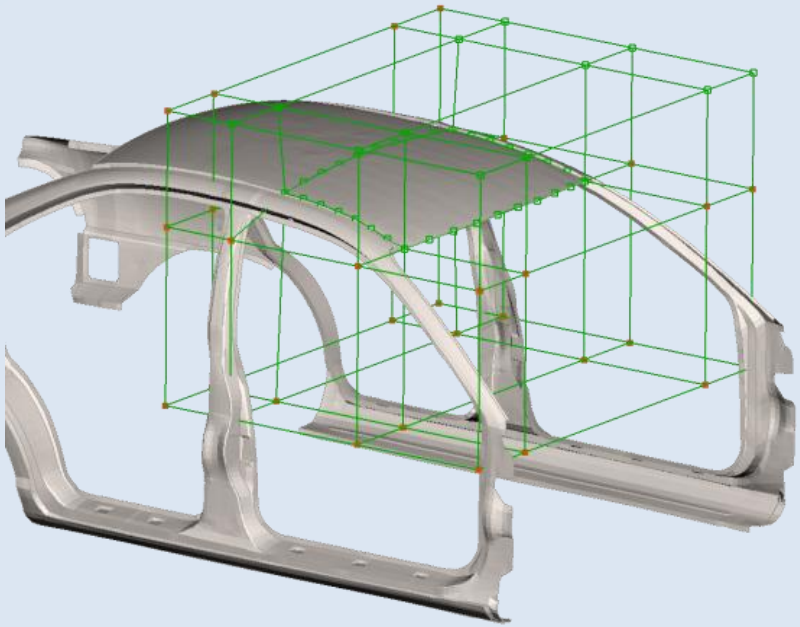


Box Morphing

Approach 2

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





Box Morphing

Approach 2

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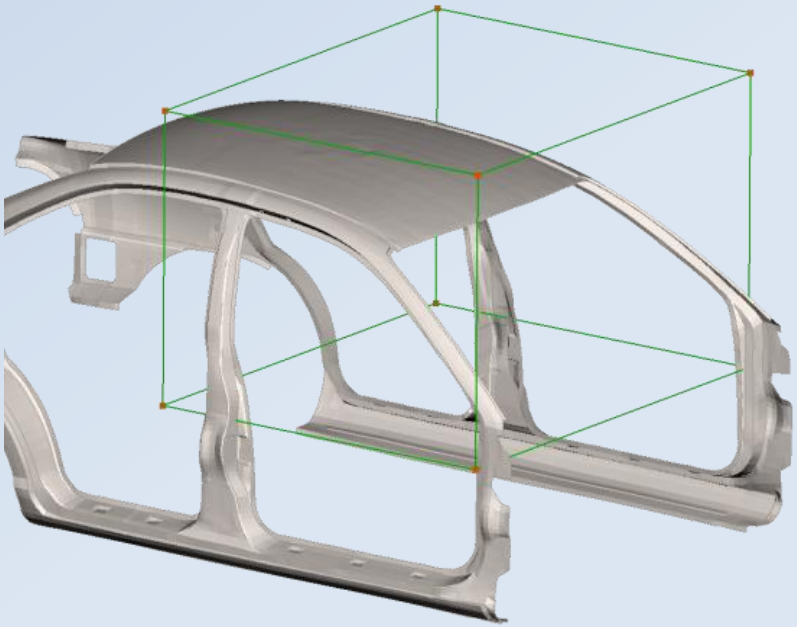
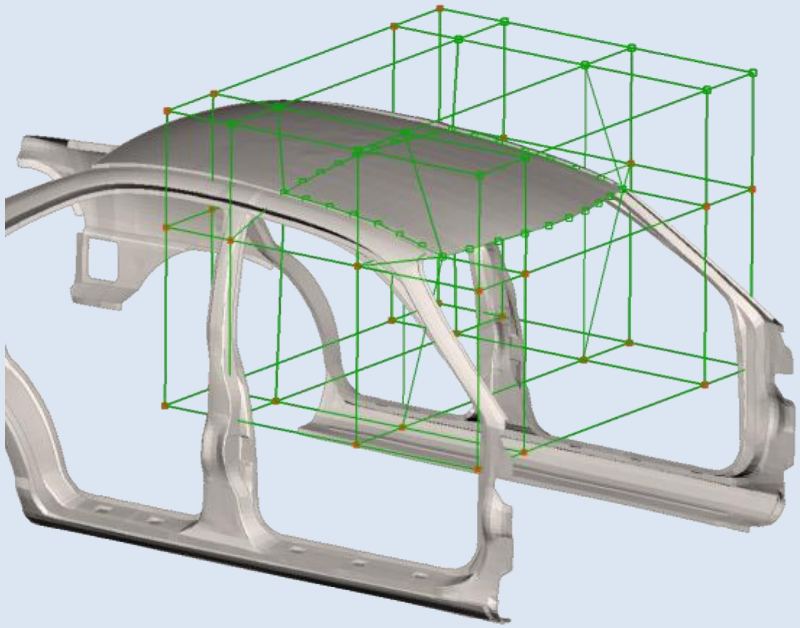
- Surrounding boxes as buffer zones
- **Precise modification** of model shape

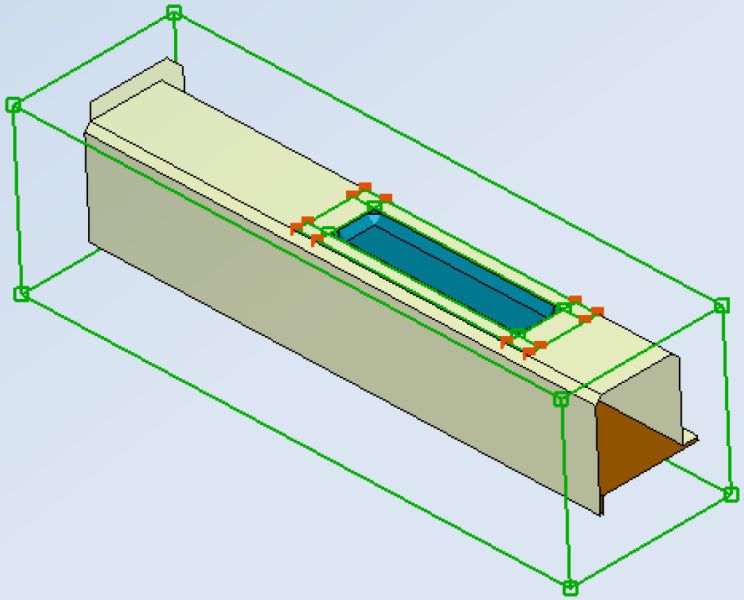


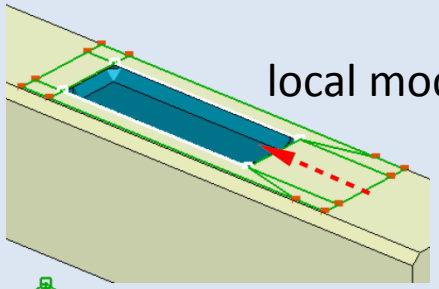


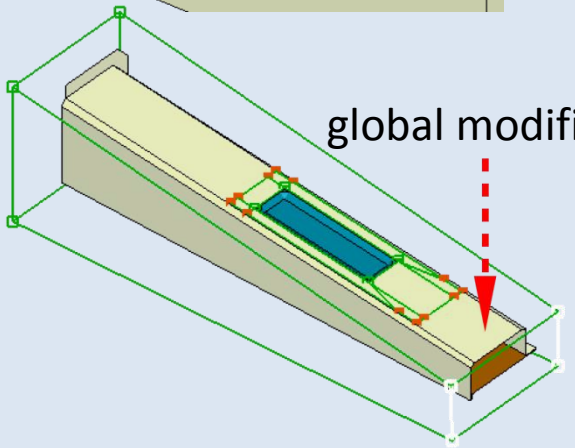
Box Morphing

Approach 3

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

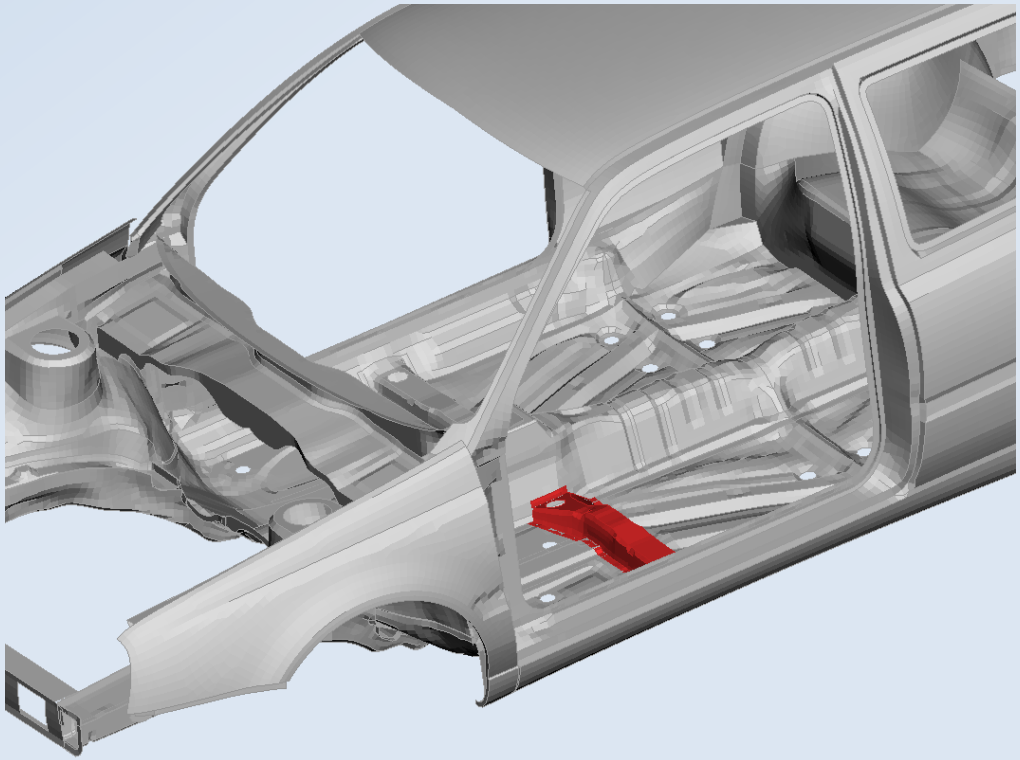






Box Morphing

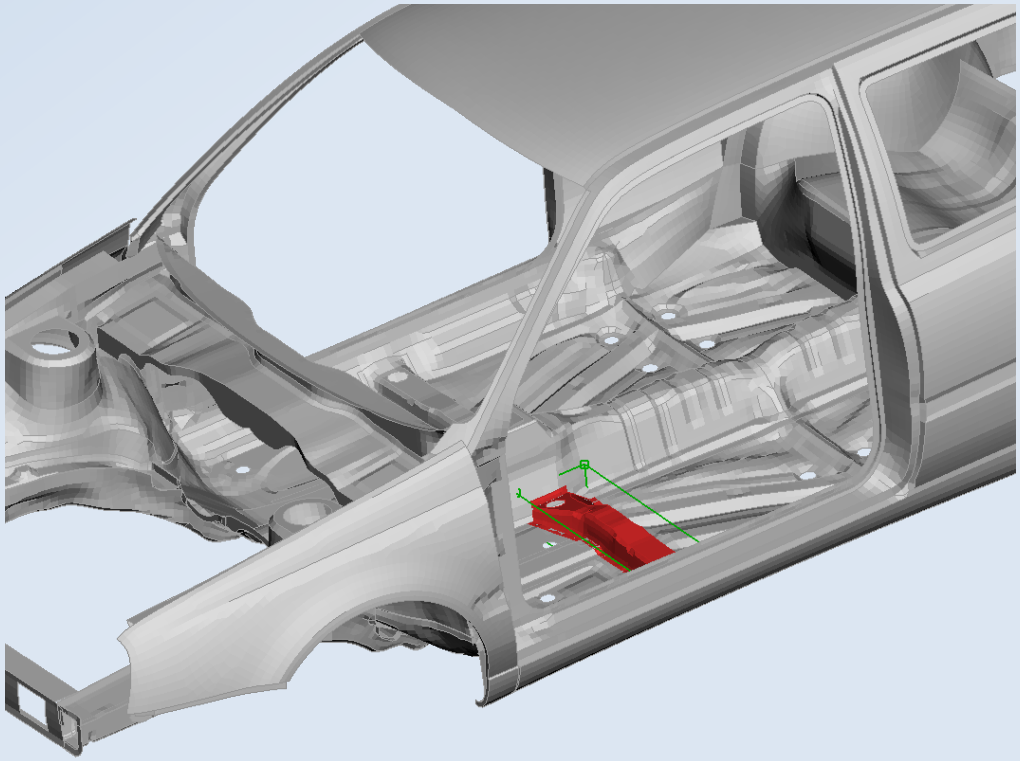
Creation of Boxes



Box Morphing

Creation of Boxes

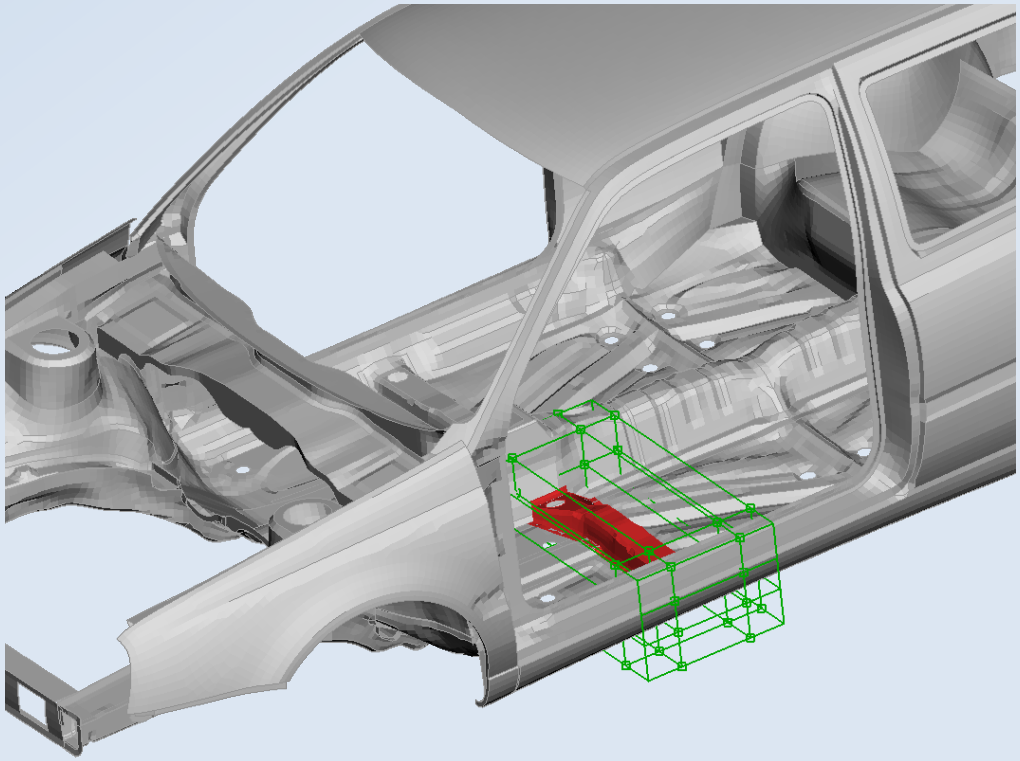
- Around Entities



Box Morphing

Creation of Boxes

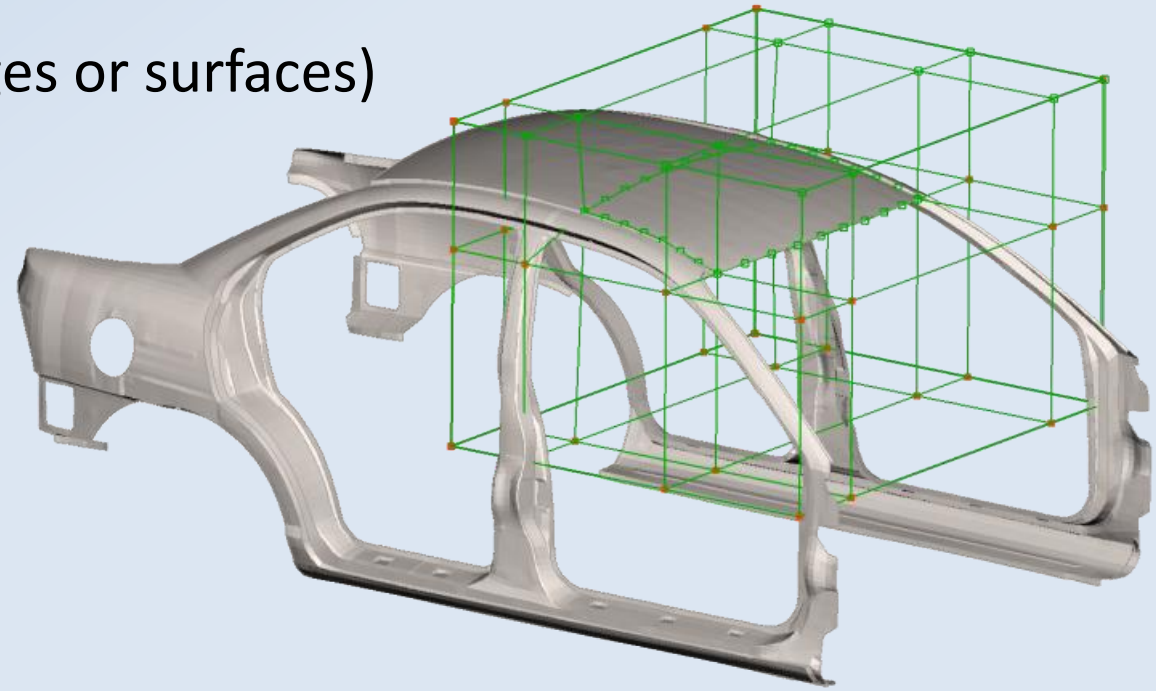
- Around Entities
- Buffer Zones



Box Morphing

Creation of Boxes

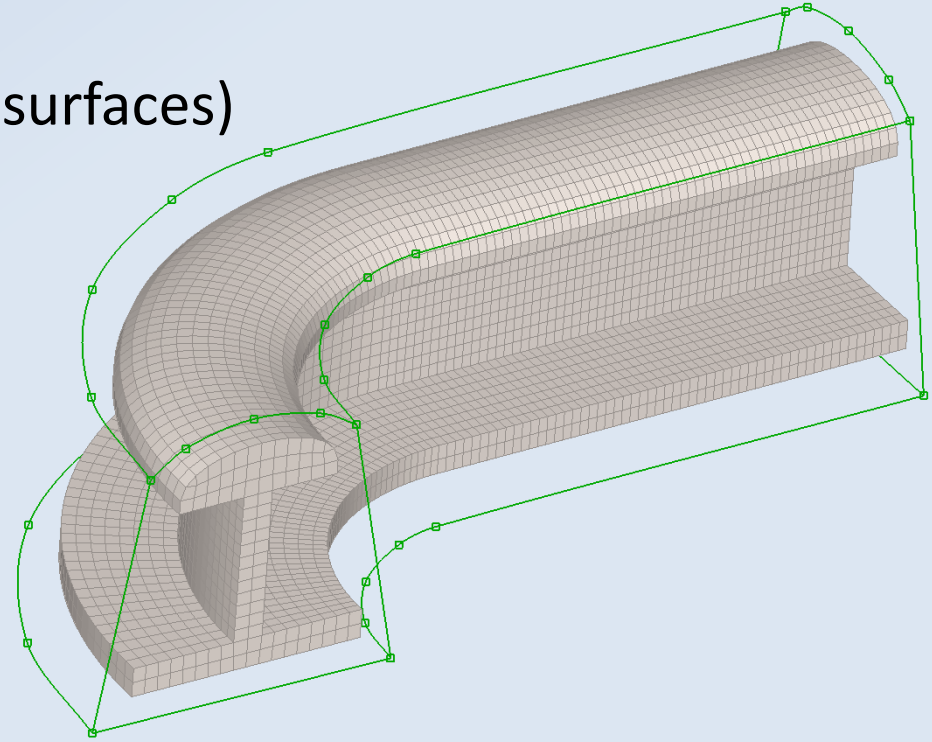
- Around Entities
- Buffer Zones
- Split + Fit (to edges or surfaces)



Box Morphing

Creation of Boxes

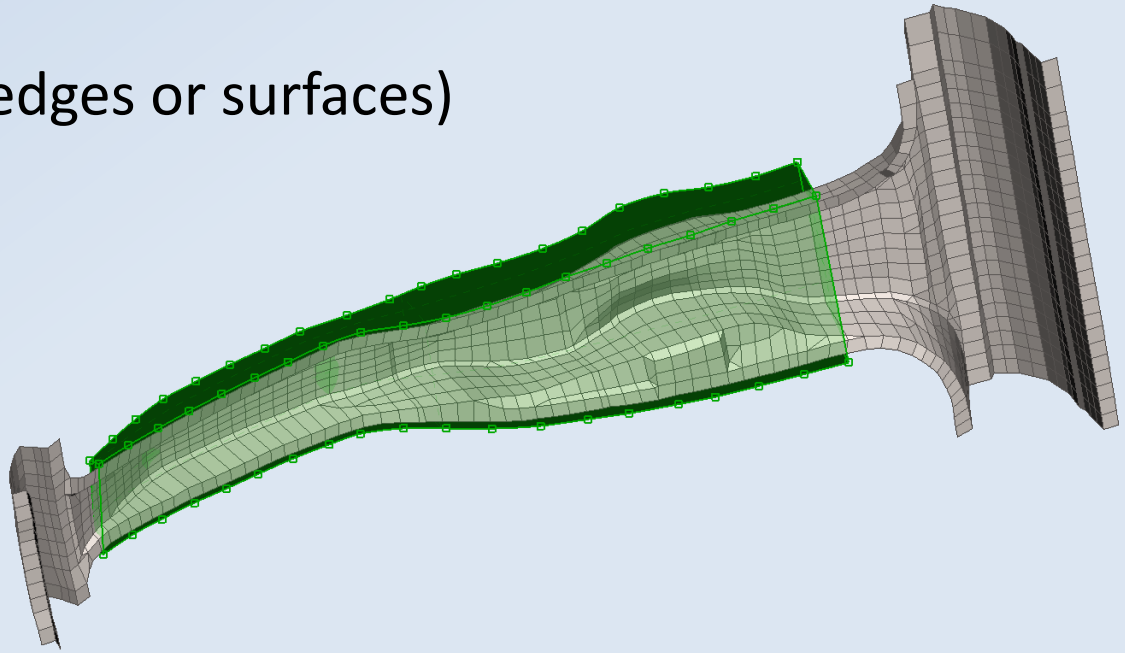
- Around Entities
- Buffer Zones
- Split + Fit (to edges or surfaces)
- Sweep / Glide



Box Morphing

Creation of Boxes

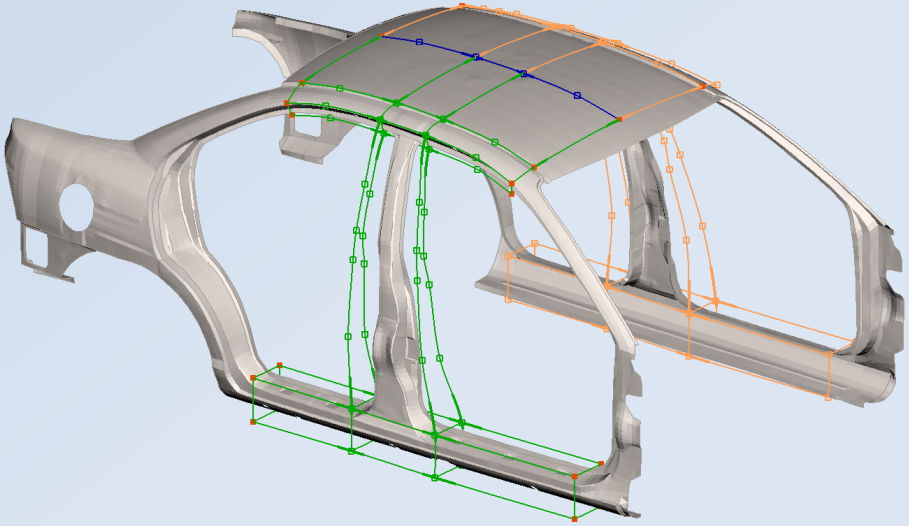
- Around Entities
- Buffer Zones
- Split + Fit (to edges or surfaces)
- Sweep / Glide
- Adapt
- etc.

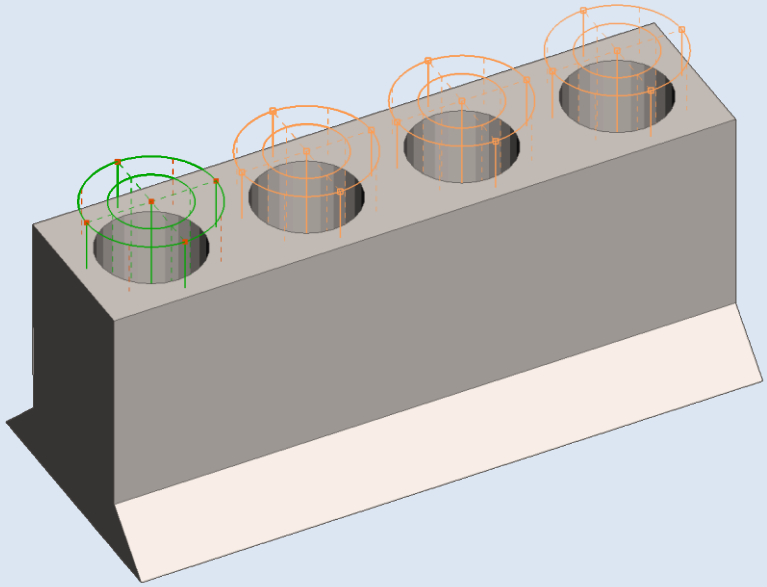


Box Morphing

Linked Morphing Boxes

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

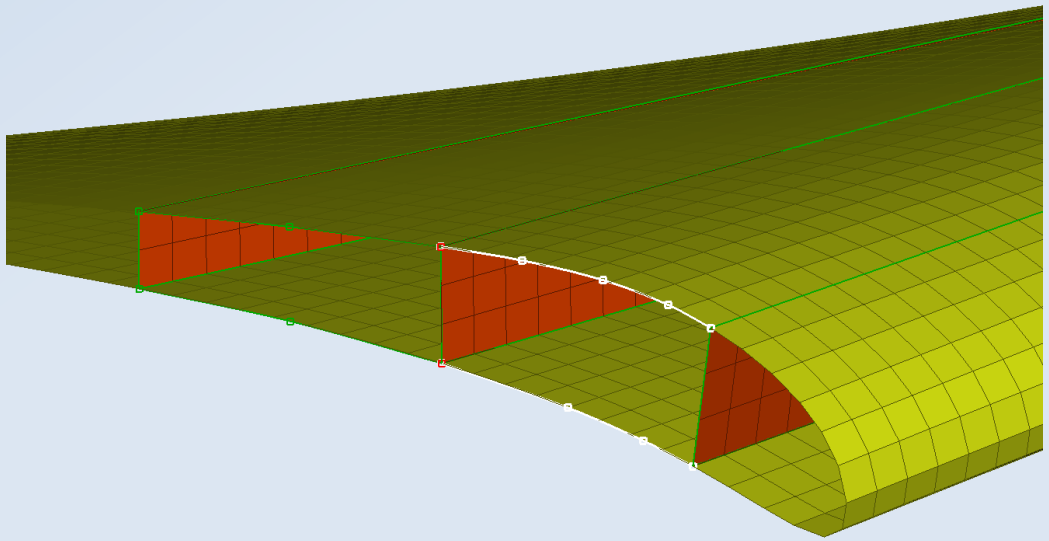




Box Morphing

Modification of Boxes

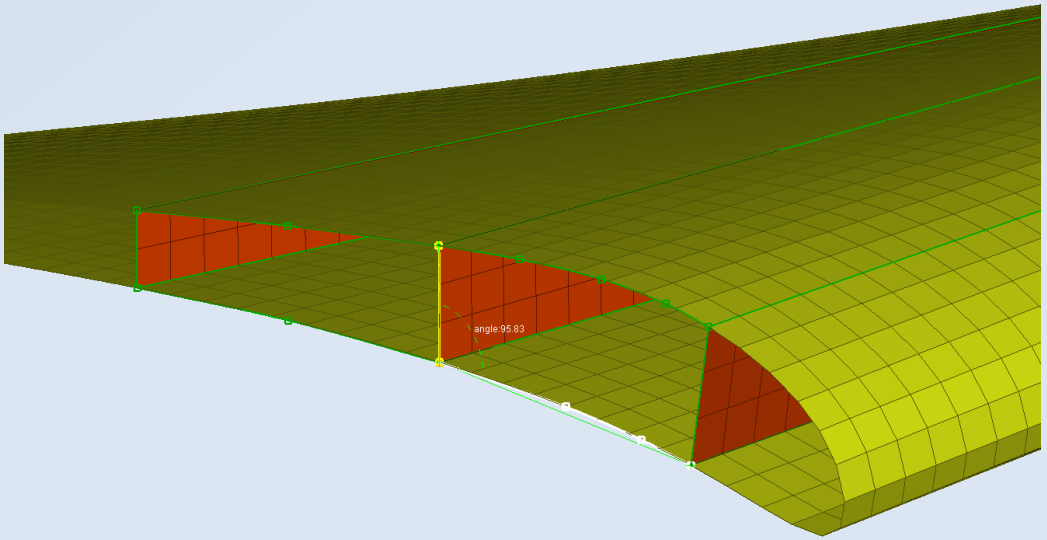
- Move (Translate, Rotate)
- Slide / Extend



Box Morphing

Modification of Boxes

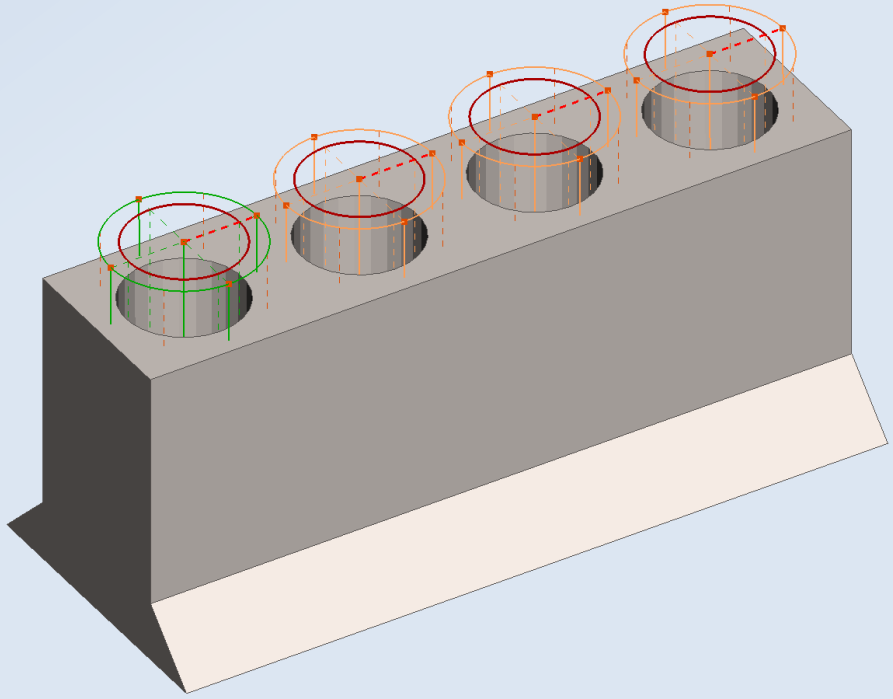
- Move (Translate, Rotate)
- Slide / Extend
- Angle



Box Morphing

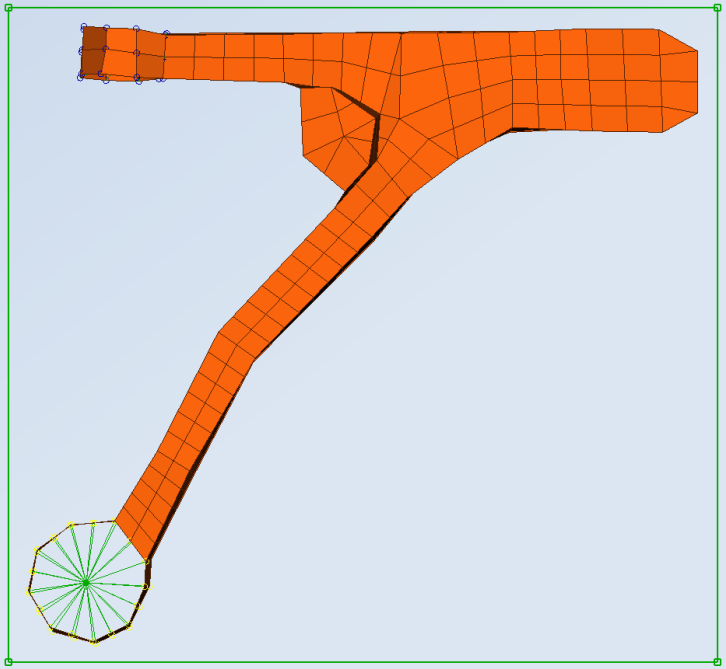
Modification of Boxes

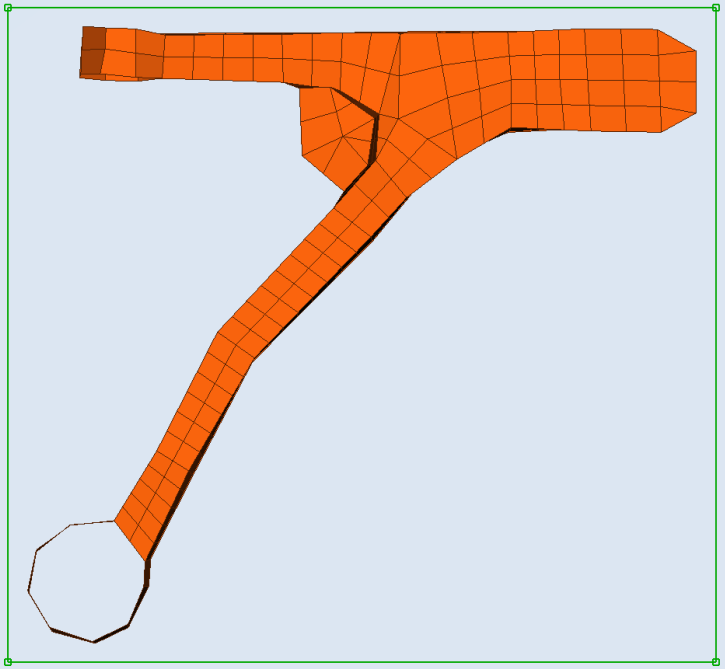
- Move (Translate, Rotate)
- Slide / Extend
- Angle
- Fit (edges, surfaces)
- Radius
- etc.



Morphing Constraints – Nested Elements

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





Morphing Constraints – Nested Elements

- Applicable for Direct and Box Morphing
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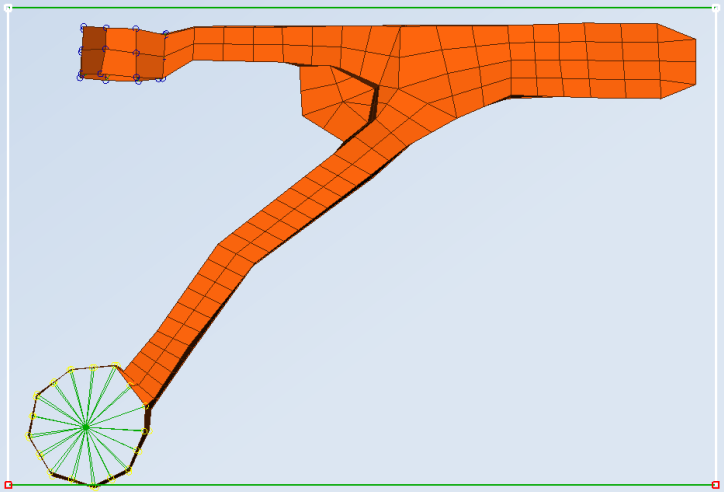
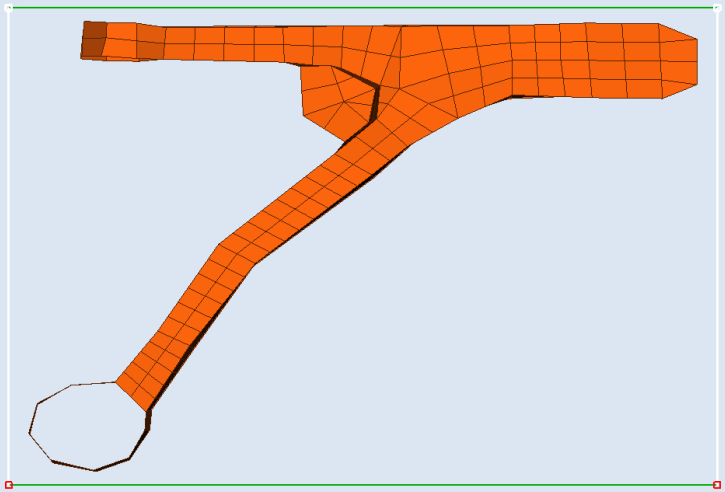


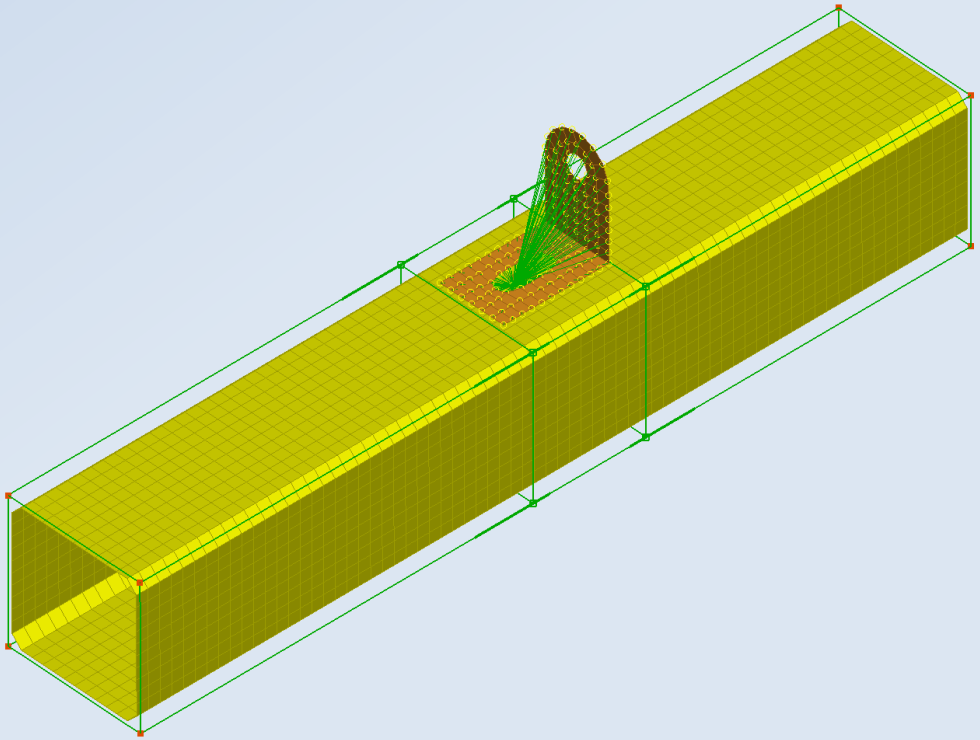
With Nested Elements



Without Nested Elements

Morphing Constraints – Nested Elements

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



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- Applicable for Direct and Box Morphing
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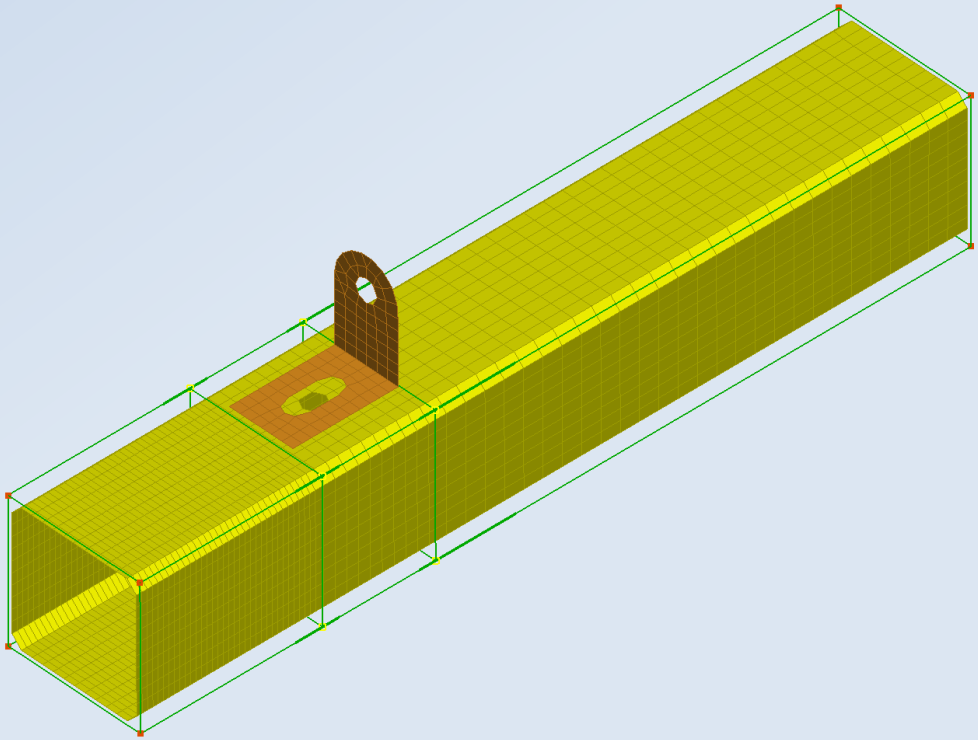

Morphing Constraints – Nested Elements

- Applicable for Direct and Box Morphing
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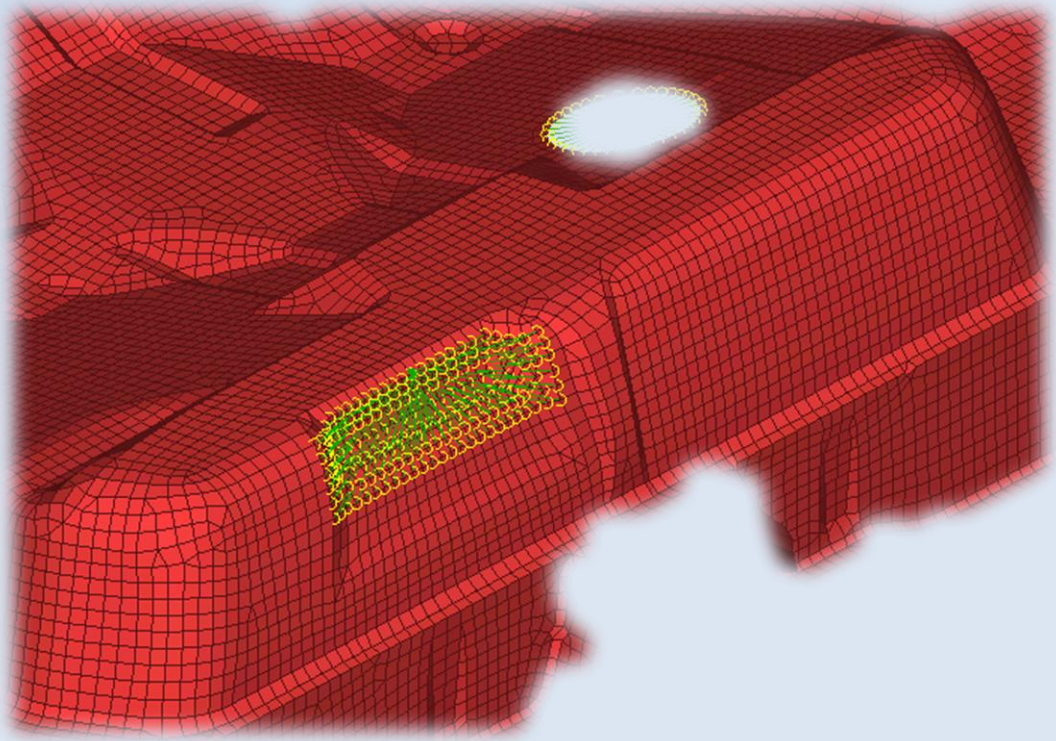
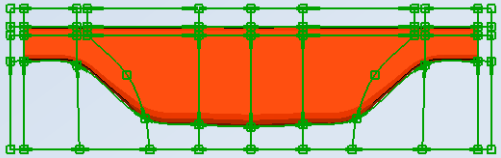


Record Morphing Actions

Deformation Parameter

- Records any direct or box morphing action
- Get any interpolation / extrapolation between undeformed and deformed shape with a single parameter

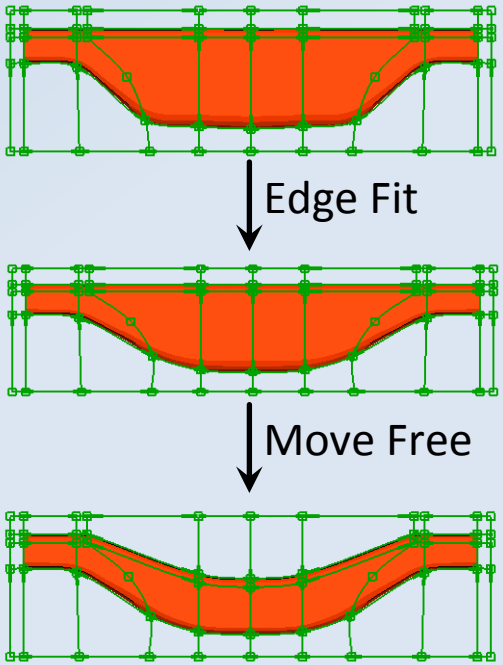


Initial shape – start recording

Record Morphing Actions

Deformation Parameter

- Records any direct or box morphing action
- Get any interpolation / extrapolation between undeformed and deformed shape with a single parameter



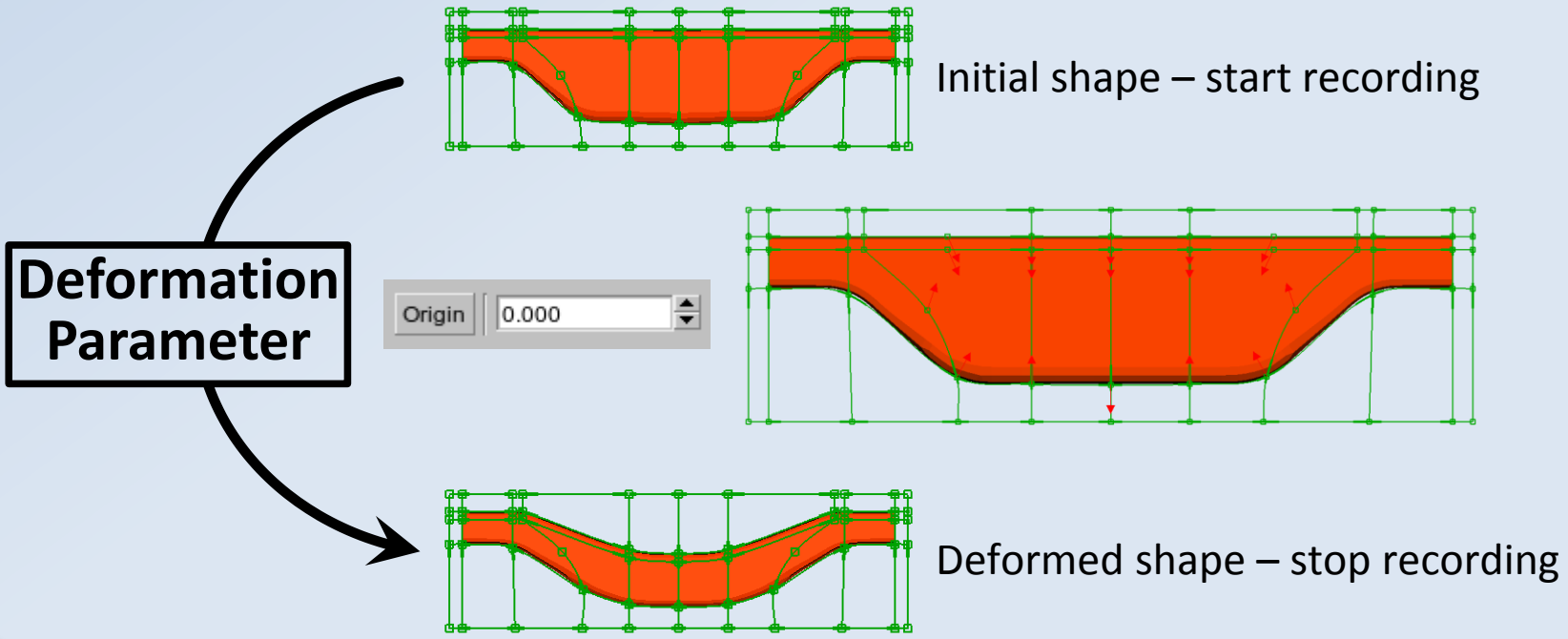
Initial shape – start recording

Deformed shape – stop recording

Record Morphing Actions

Deformation Parameter

- Records any direct or box morphing action
- Get any interpolation / extrapolation between undeformed and deformed shape with a single parameter



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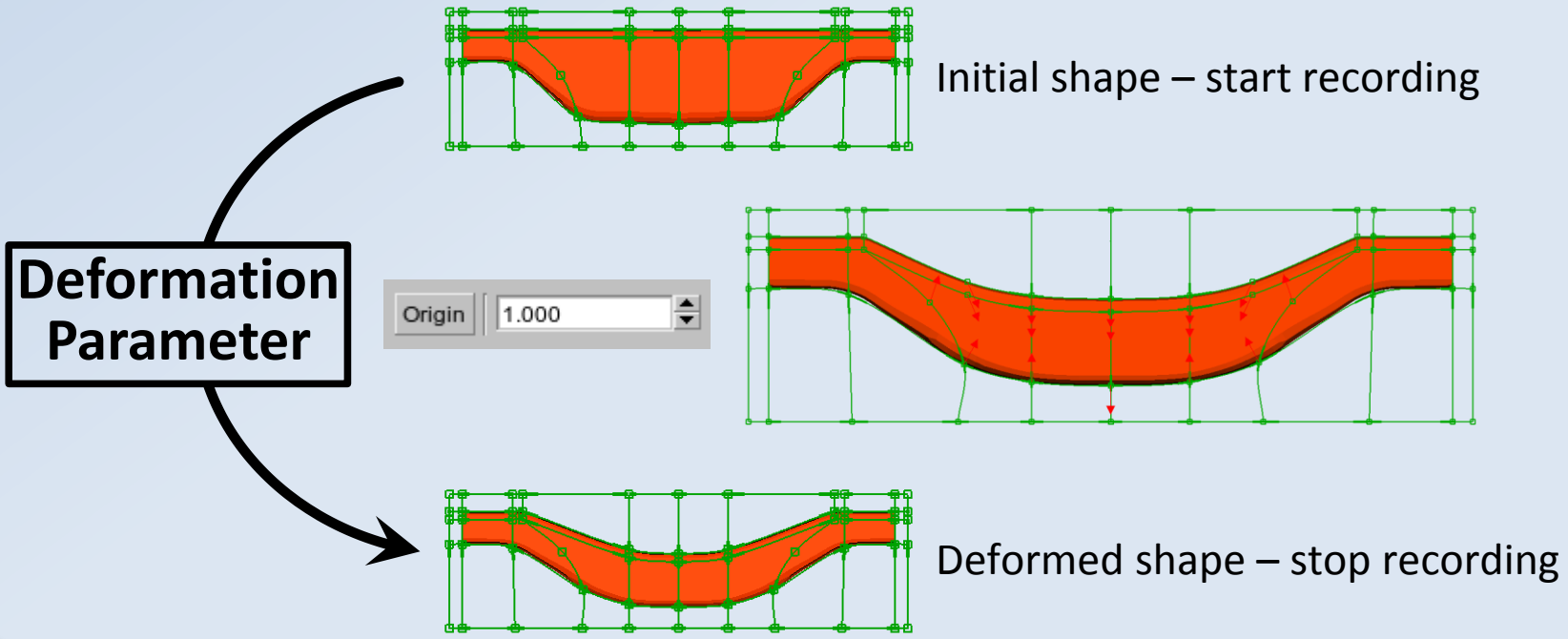
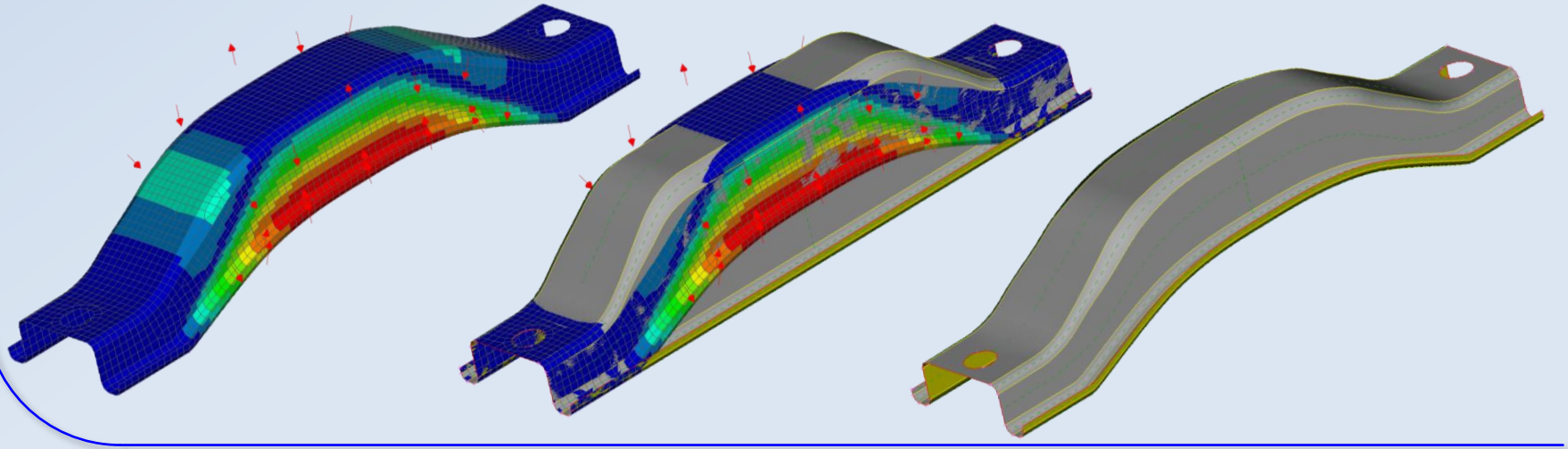


Mapping of Deformations

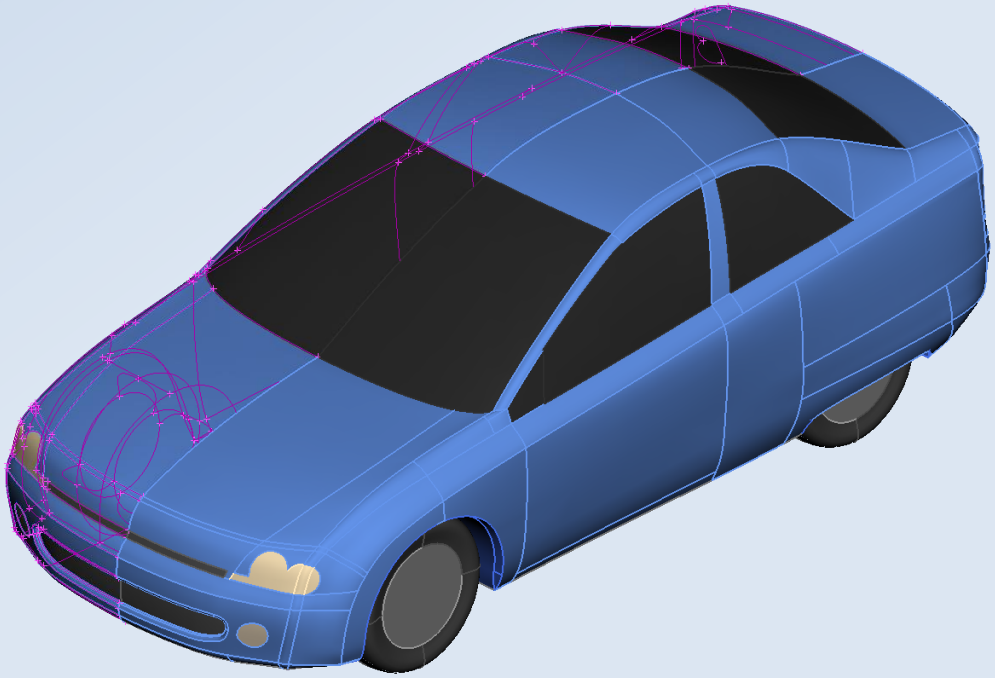
- Morph according existing deformation field:
  - Deformation Parameter
  - History States
  - DESVAR of Nastran SOL 200
  - Text file
- E.g. Modify geometry according optimized FE-model



Functionalities assisting Morphing

3D Points and Curves

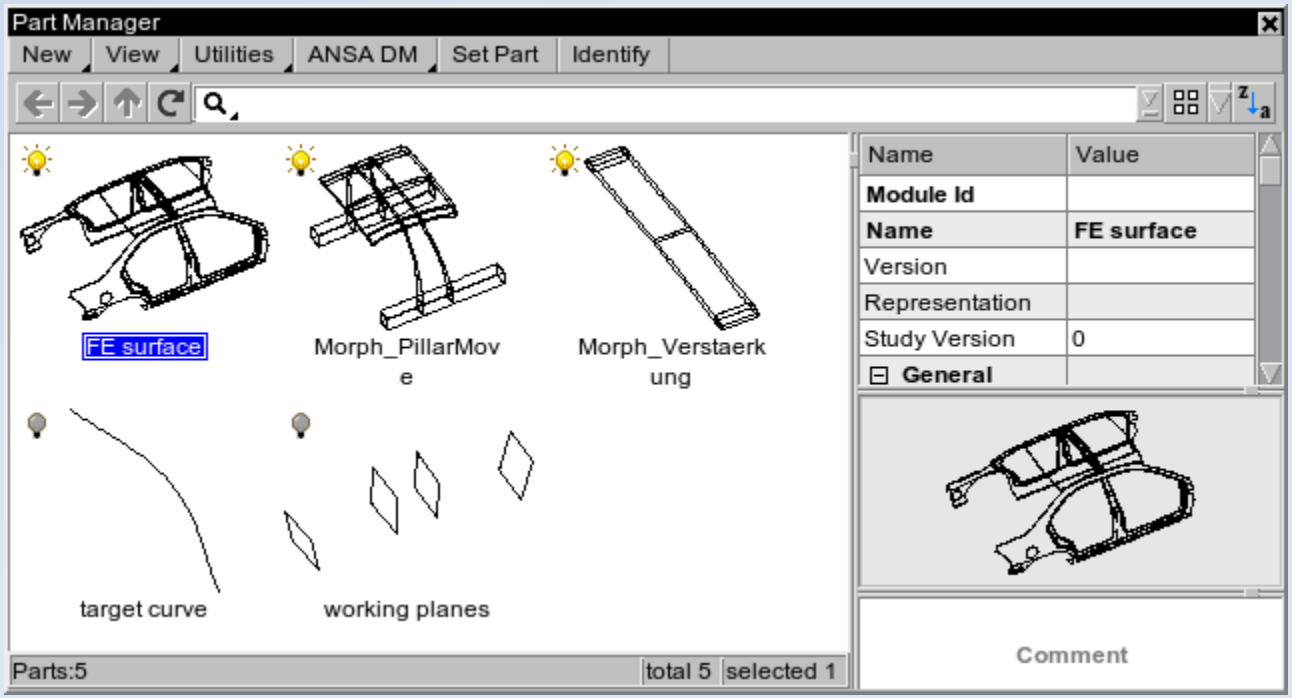
- Act as initial or target positions for fittings
- Suitable for Direct and Box Morphing
- Obtained from FE mesh or CAD geometry



Functionalities assisting Morphing

Part Manager

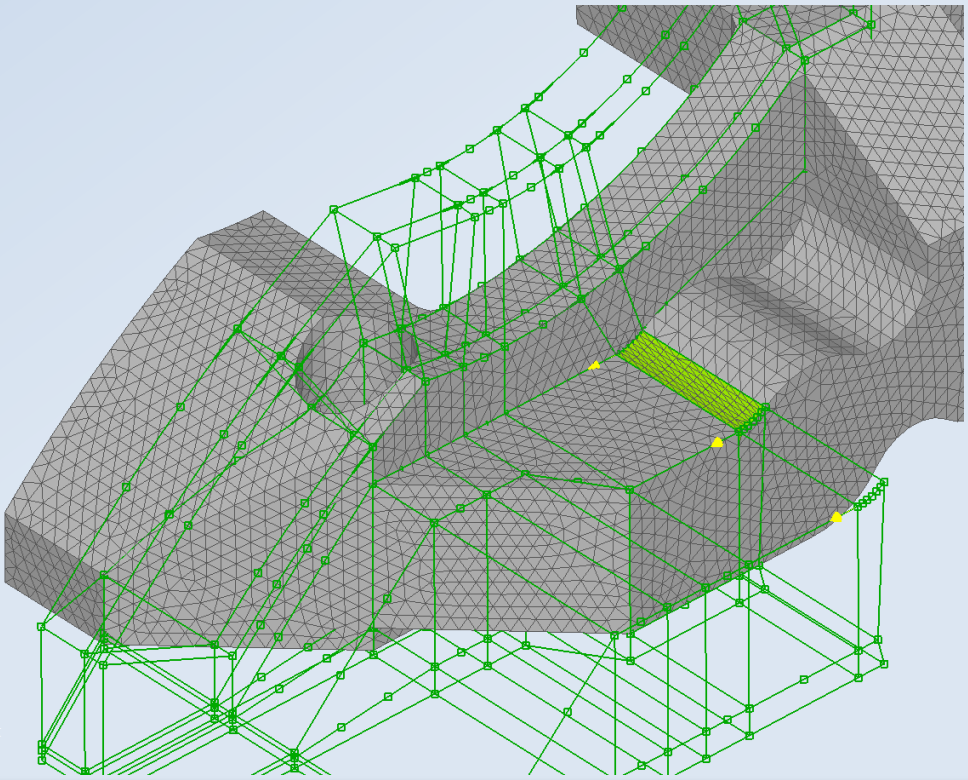
- Useful for Box Morphing (esp. complex configurations)
- To organize morph contents



Functionalities assisting Morphing

Reconstruct / Smooth morphed mesh

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



Functionalities assisting Morphing

Reconstruct / Smooth morphed mesh

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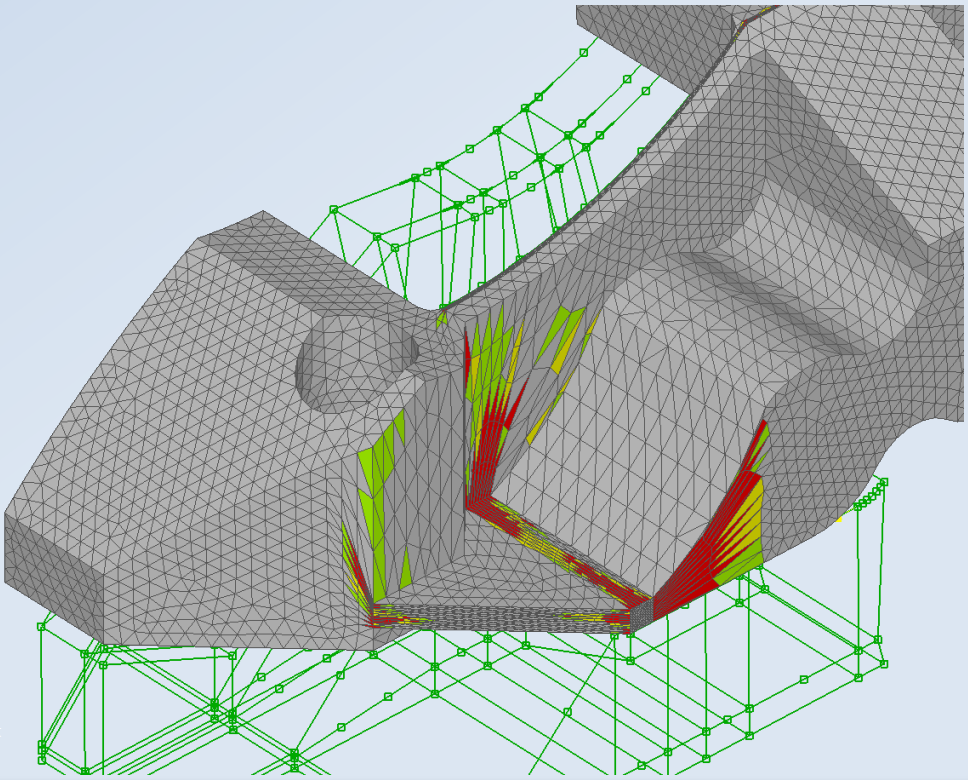
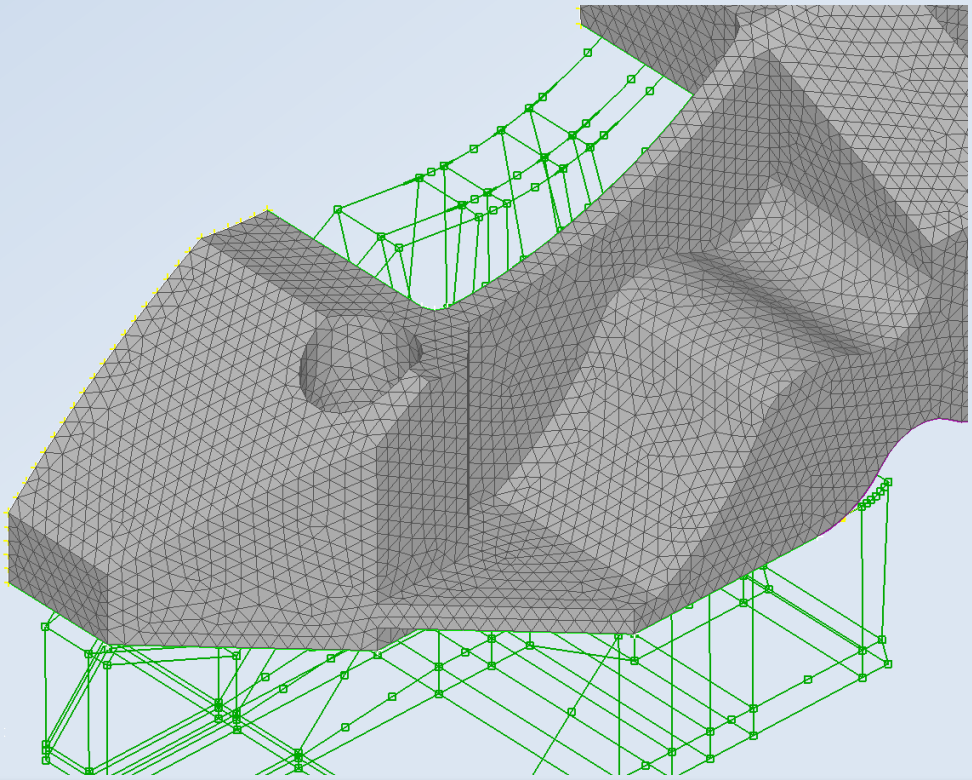


Functionalities assisting Morphing

Reconstruct / Smooth morphed mesh

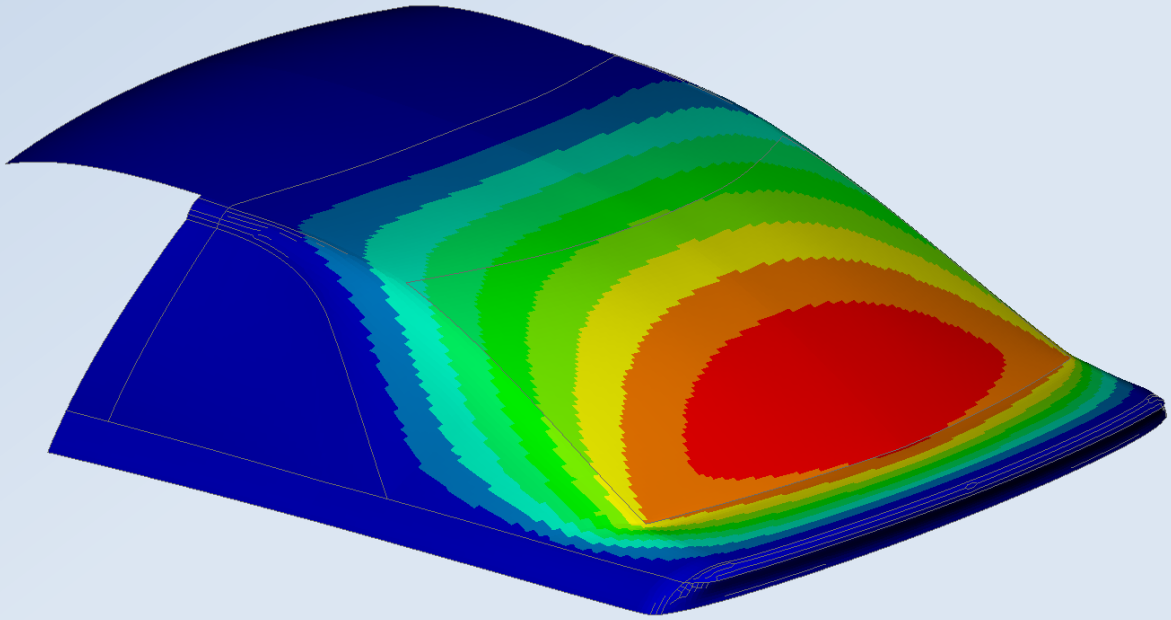
- Suitable for Direct and Box Morphing
- Improve mesh after morphing with large deformations

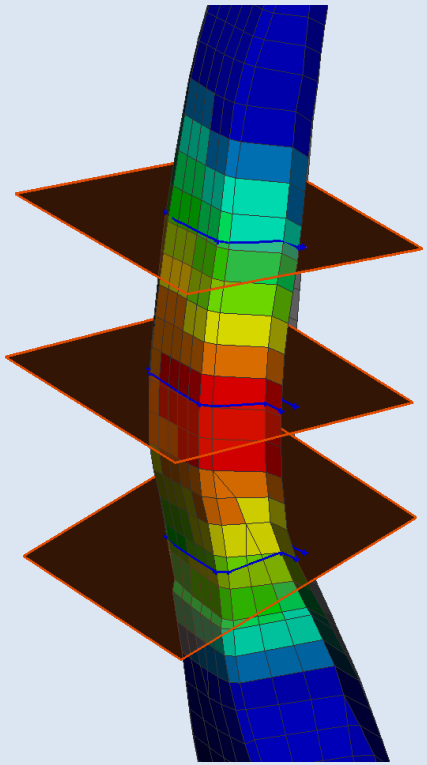


Functionalities assisting Morphing

Visualize Morphing Deviations

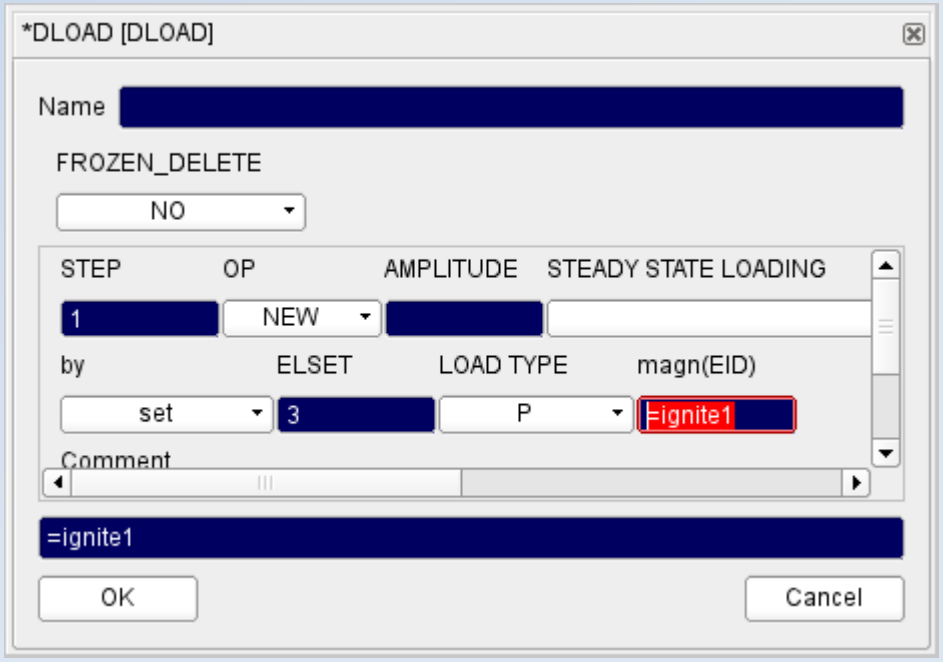
- Suitable for Direct and Box Morphing
- Measurement Tool
- Fringe Plot of deformed shape

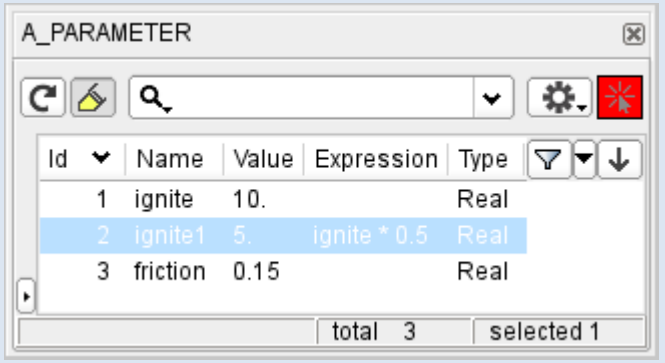




ANSA Parameter

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






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

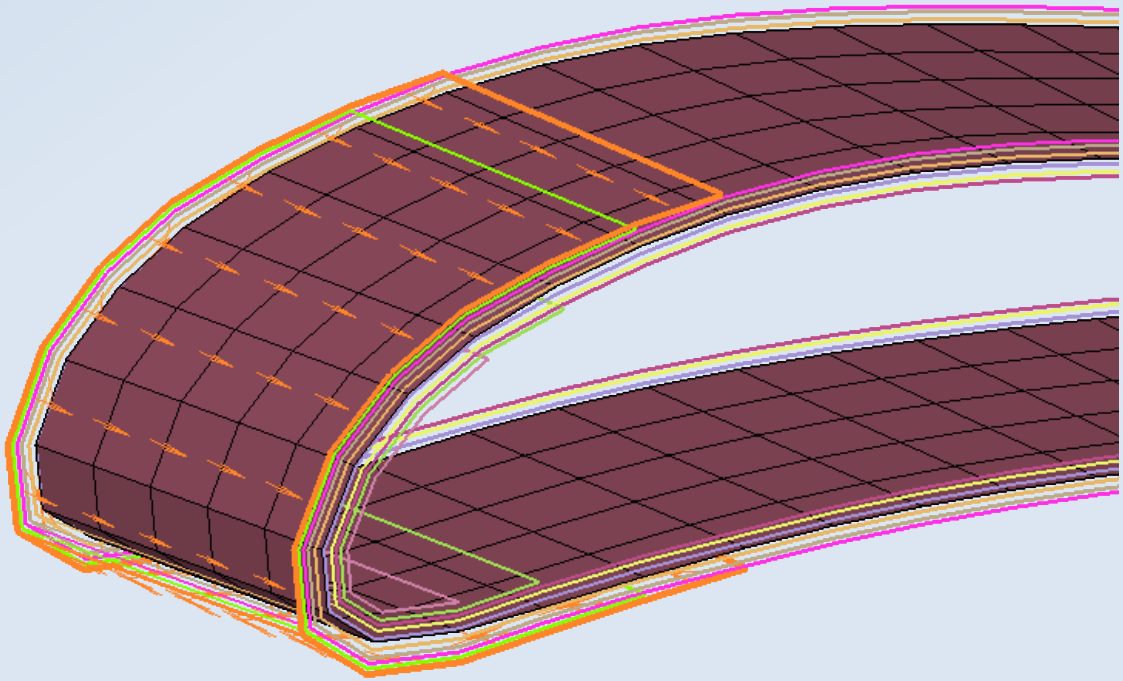
ANSA Parameter

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

Layers

PID	Z0	NSM	S
1			

A/A	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.	



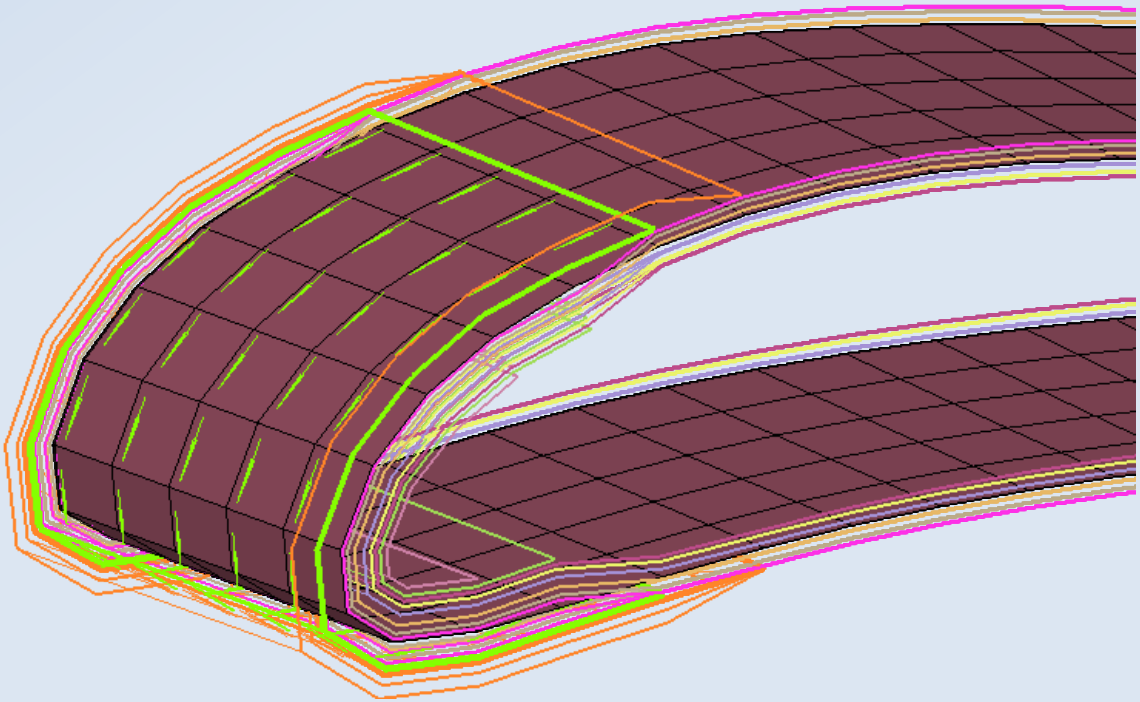
ANSA Parameter

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

Layers

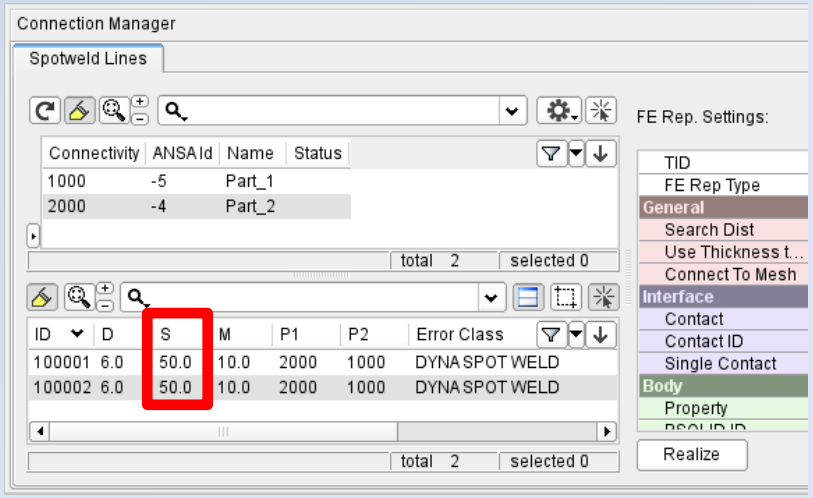
PID	Z0	NSM	S
1			

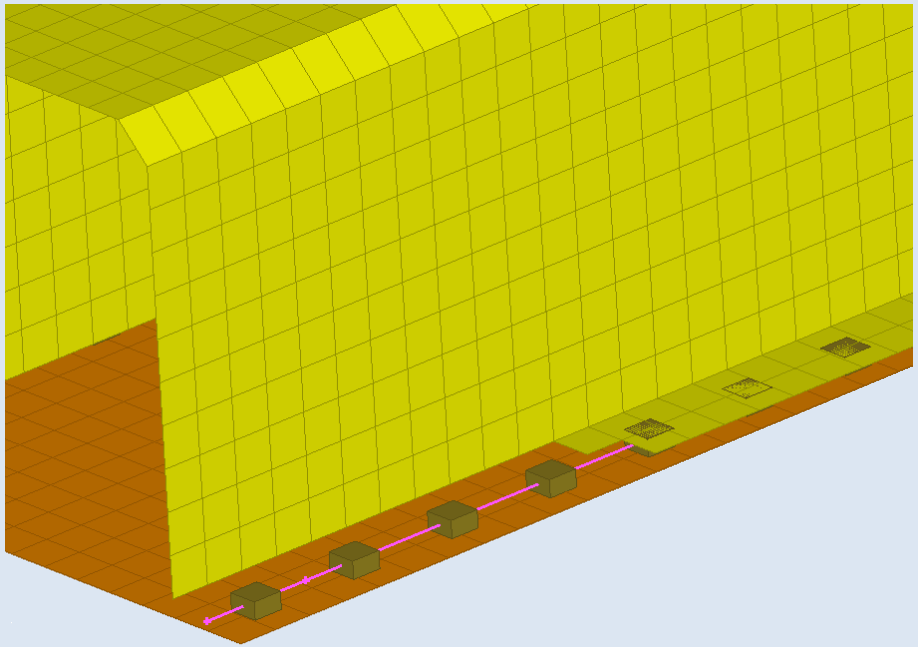
A/A	Type	T	THETA	m
1	Sequence			
1	Layer	0.2	90.	
2	Layer	0.1	-45.	
3	Layer	0.1	45.	
4	Layer	0.2	0.	
5	Layer	0.2	0.	
6	Layer	0.1	45.	
7	Layer	0.1	-45.	
8	Layer	0.2	90.	



ANSA Parameter

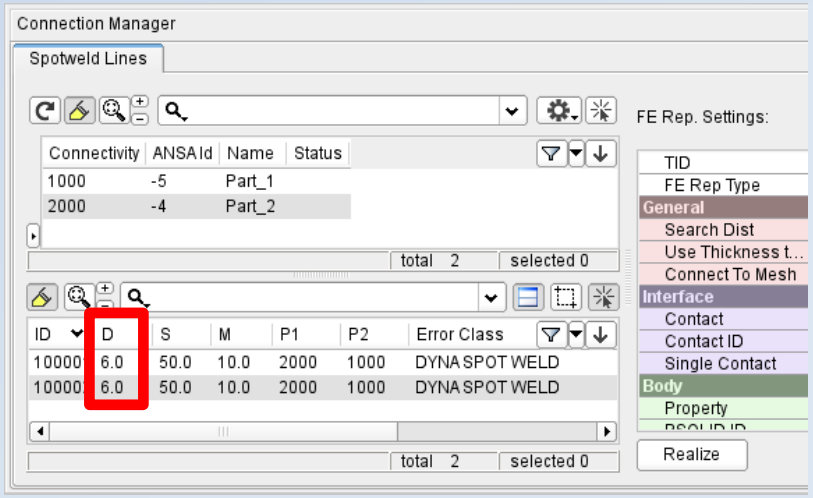
- For parameterization of connection properties, e.g.:
  - distance between weld spots

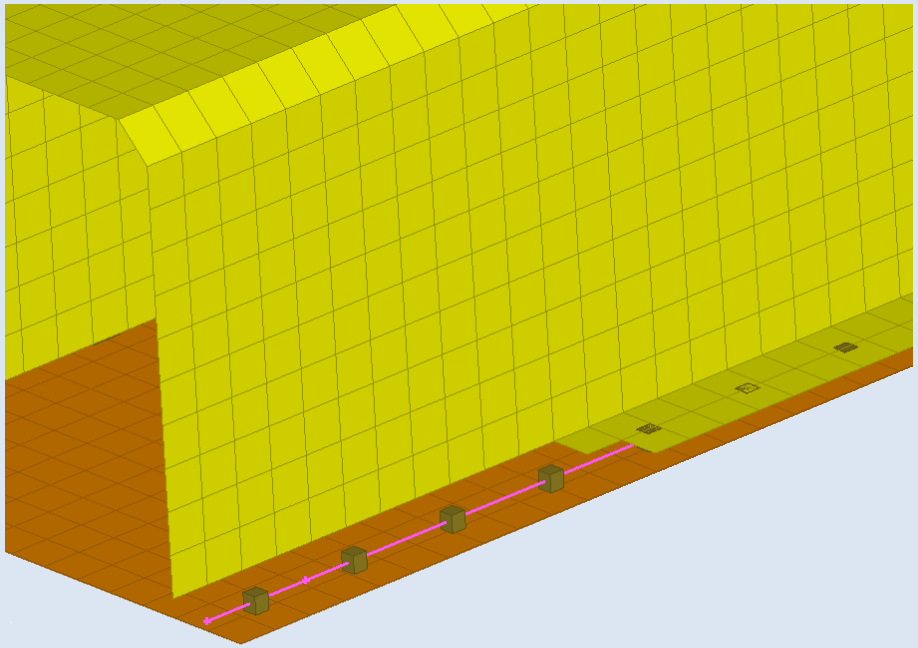
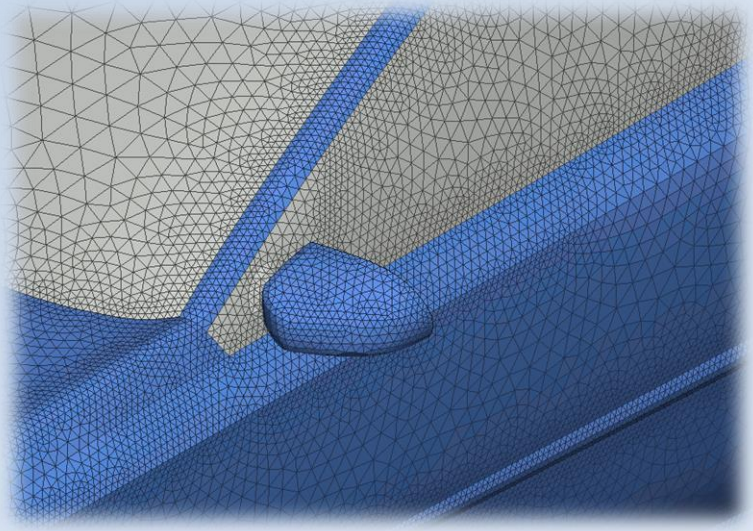
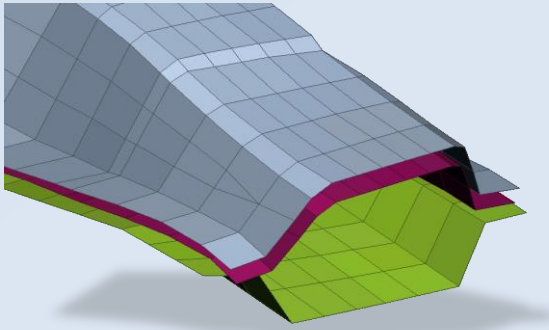
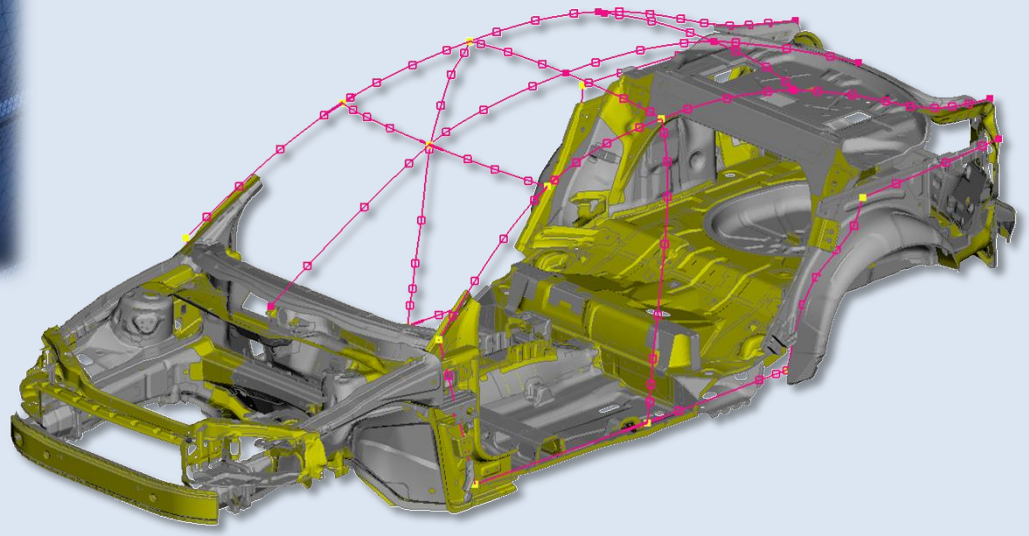




ANSA Parameter

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





Ευχαριστώ πολύ