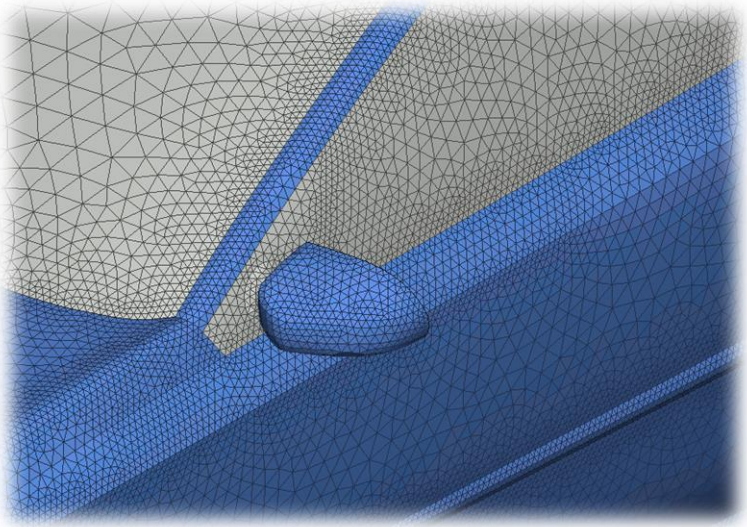
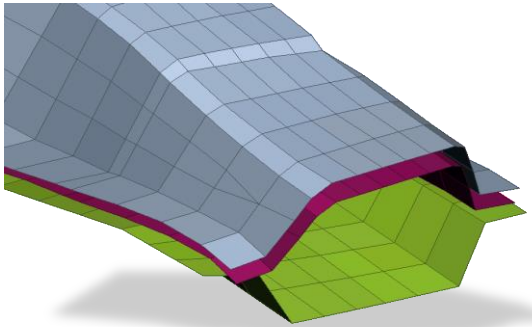
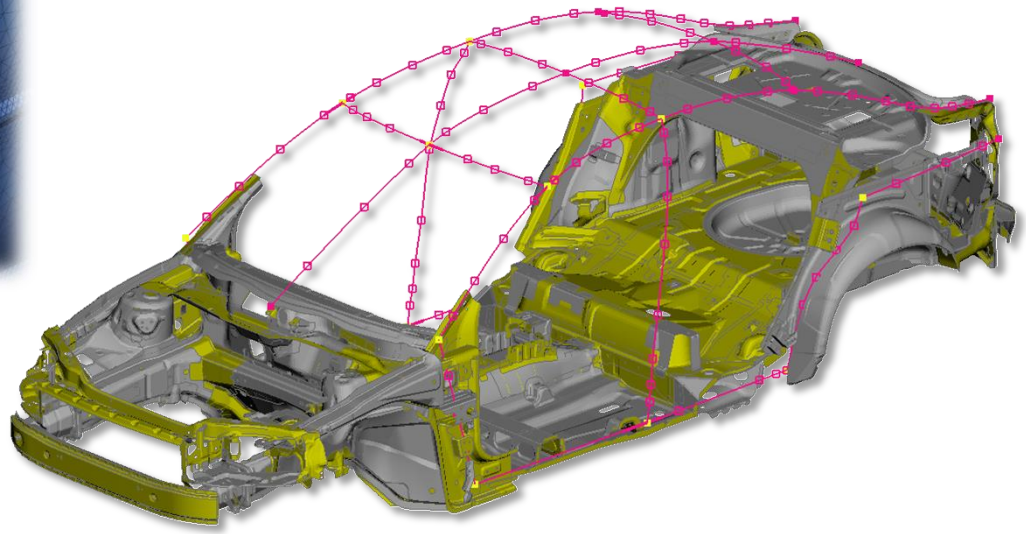
Model Parameterization in ANSA



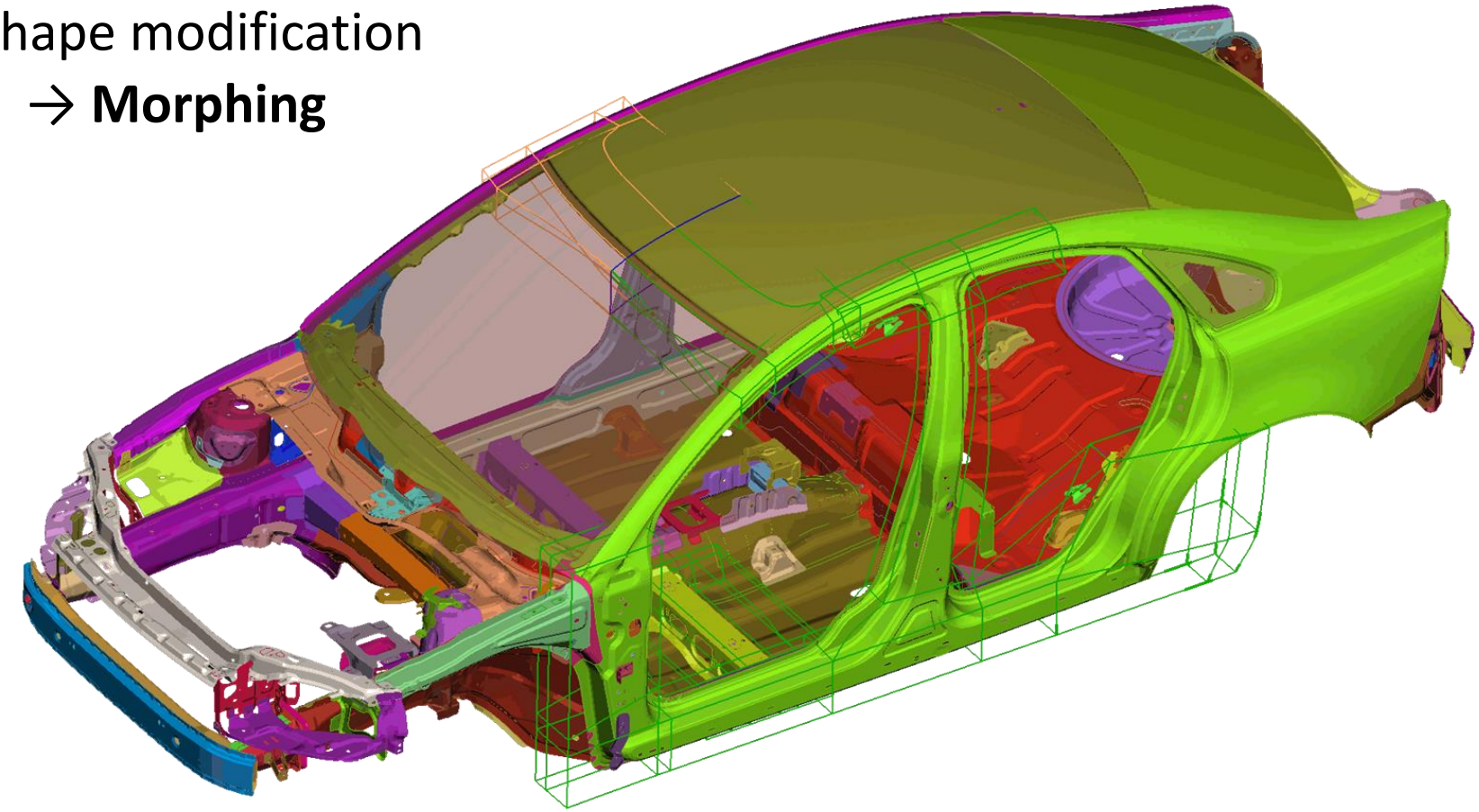




Dirk Dreißig
Mail: ansa@lasso.de

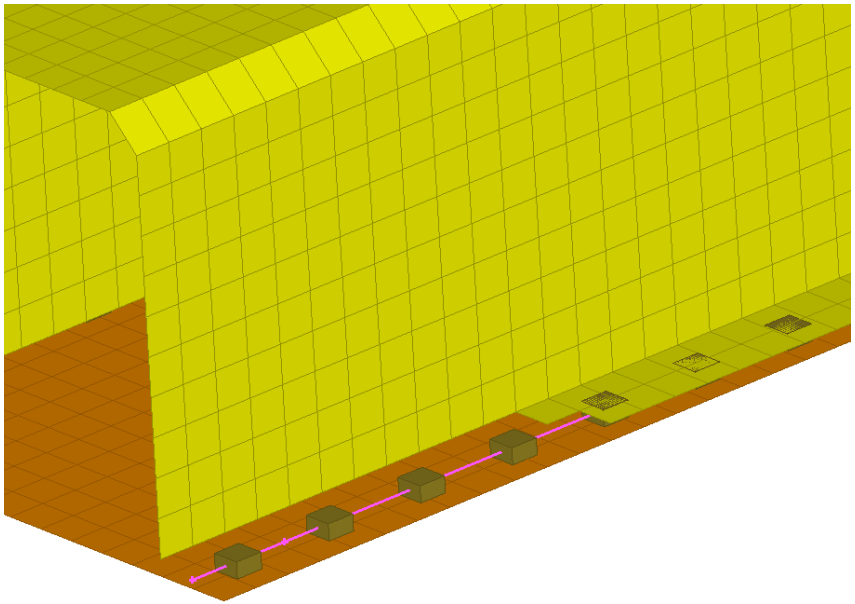
Types of Parameterization

- Shape modification
  → **Morphing**



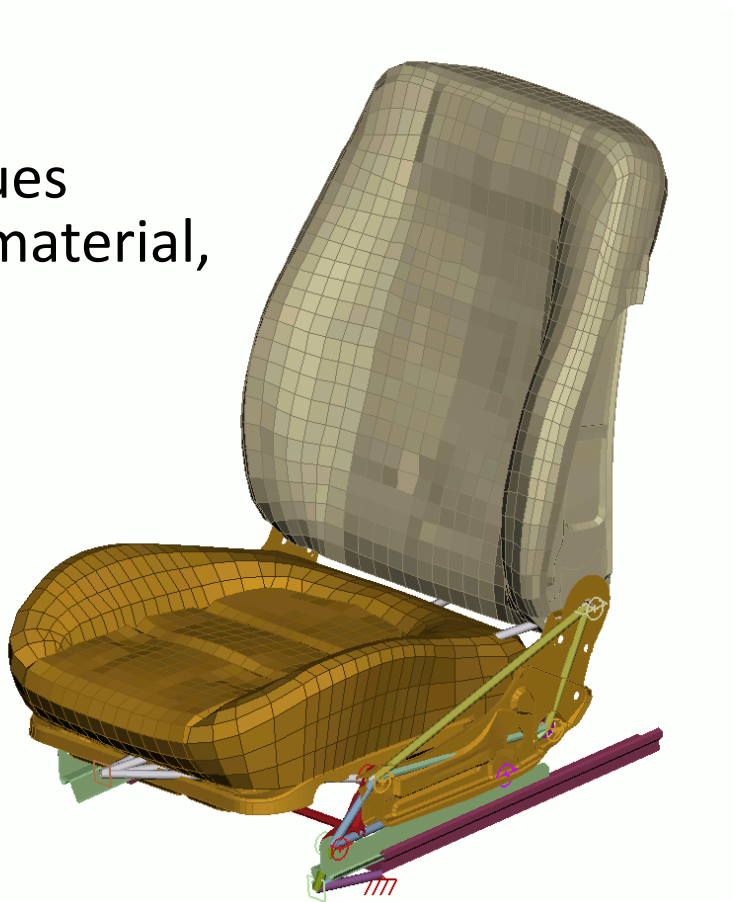
Types of Parameterization

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



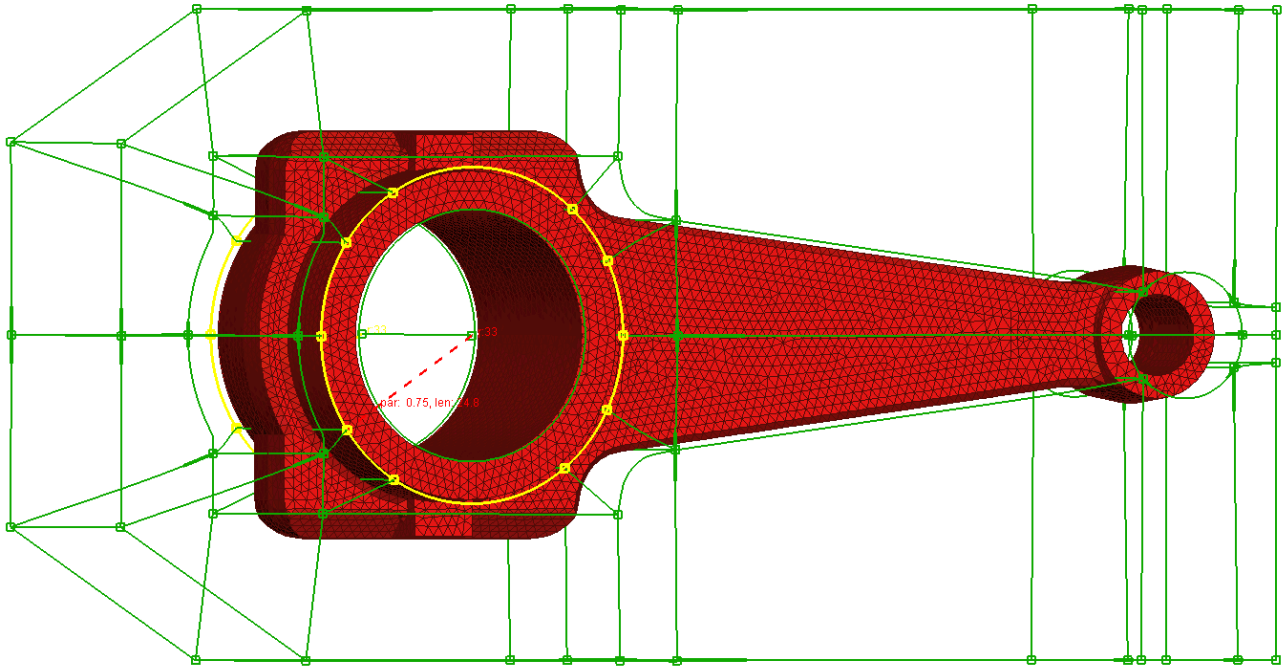
Types of Parameterization

- 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**



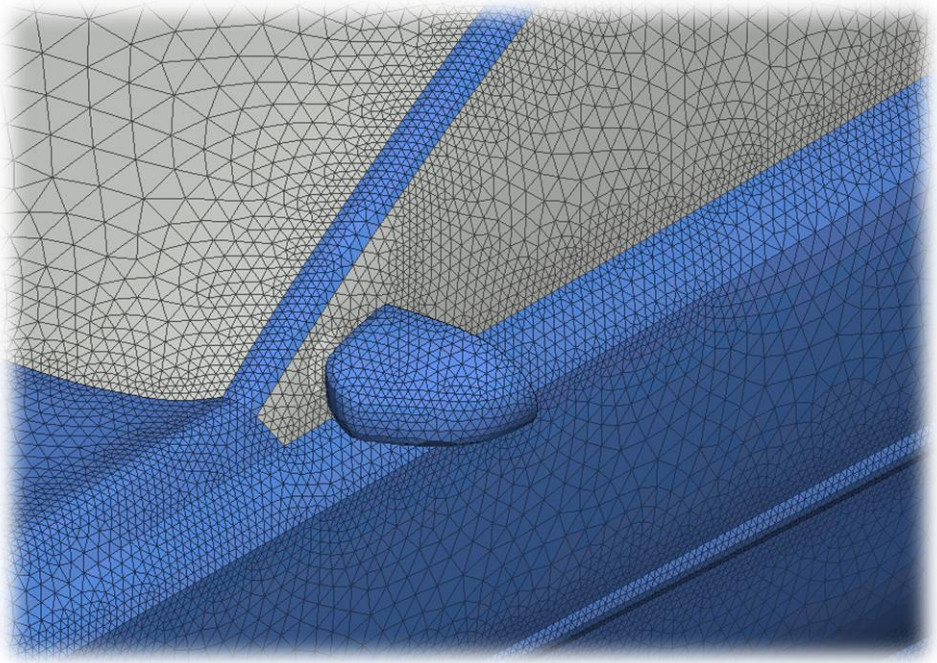
Morphing

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



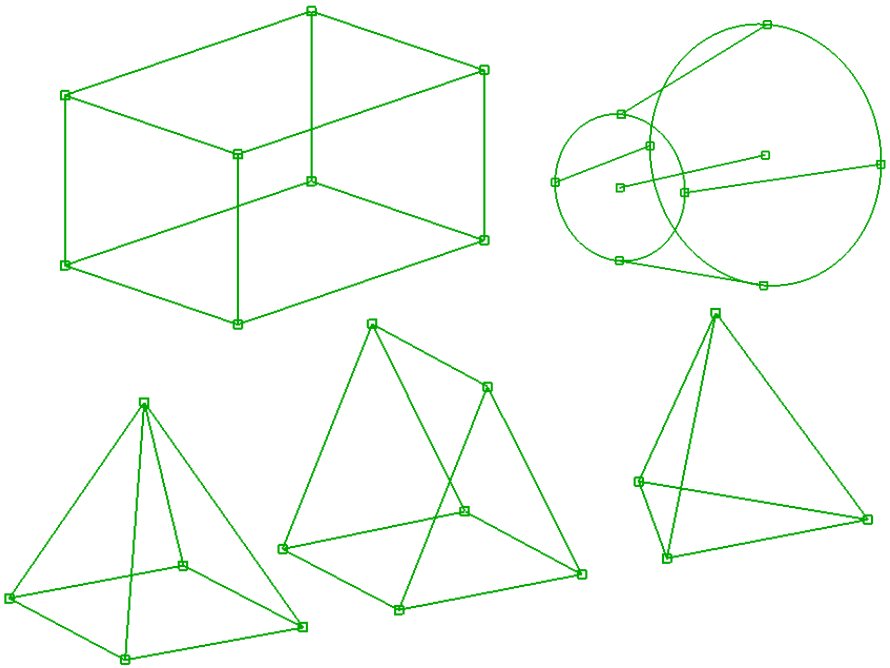
Morphing

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



Box Morphing

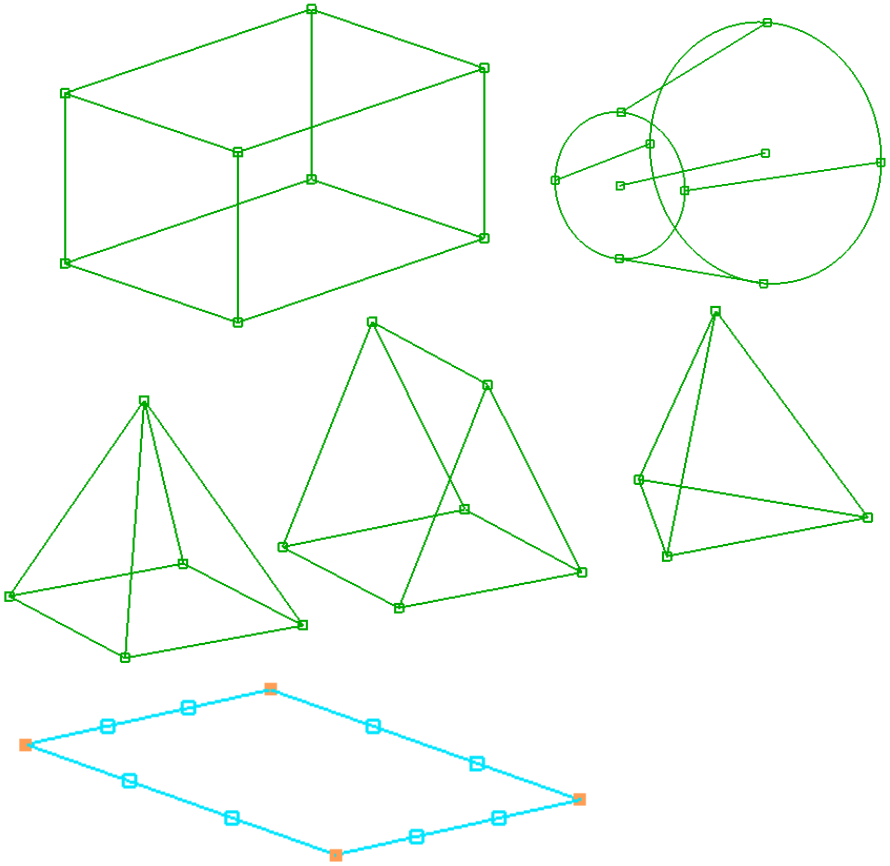
Types of boxes



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

Box Morphing

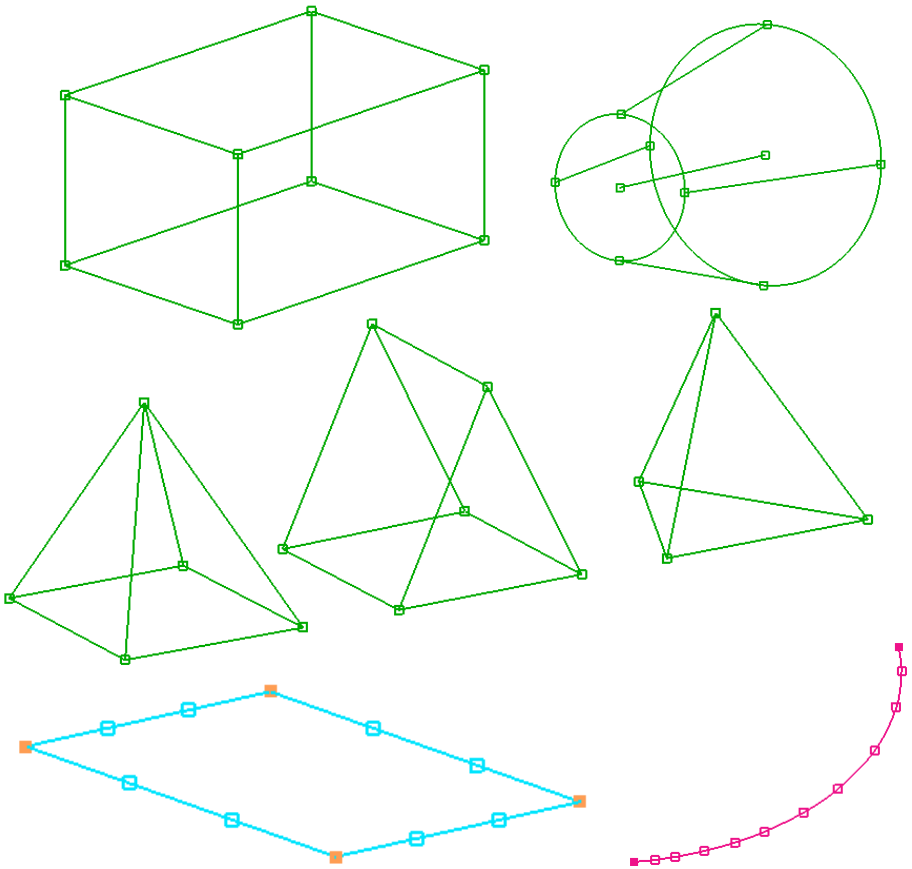
Types of boxes



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

Box Morphing

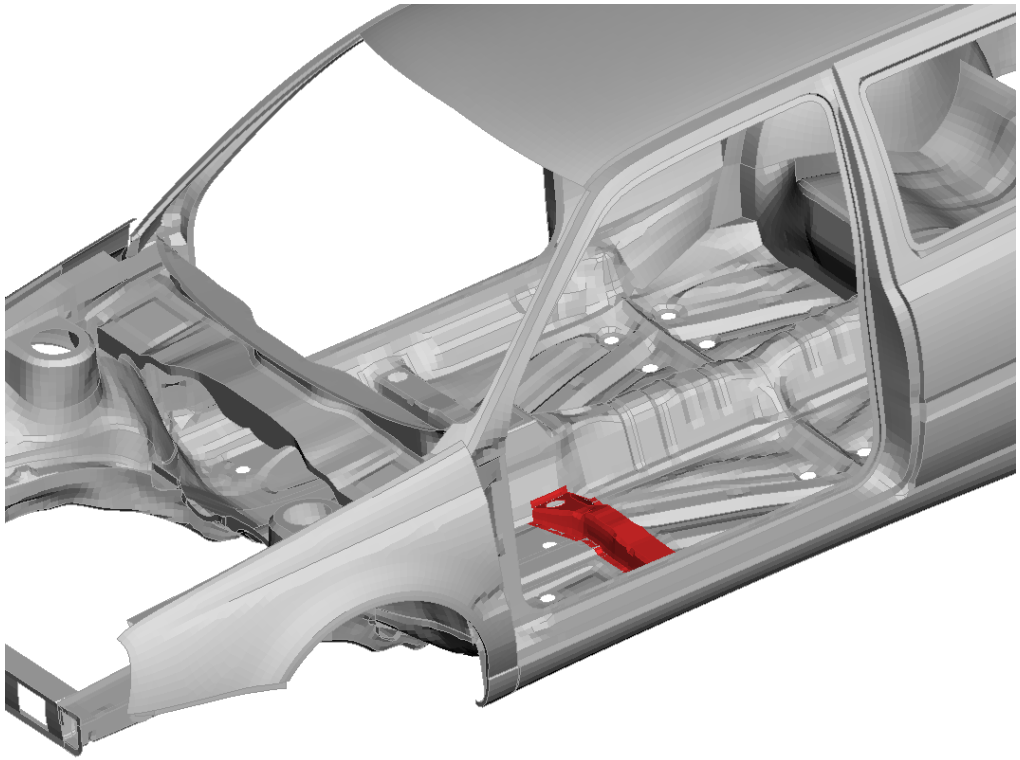
Types of boxes



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

Box Morphing

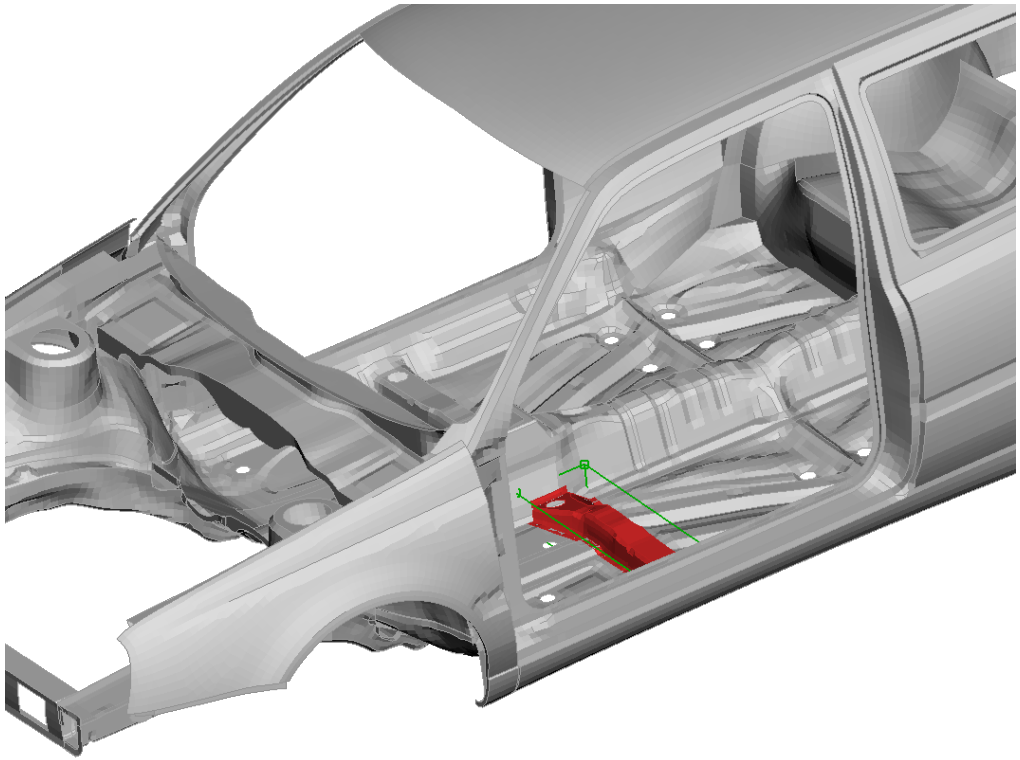
Creation of Boxes



Box Morphing

Creation of Boxes

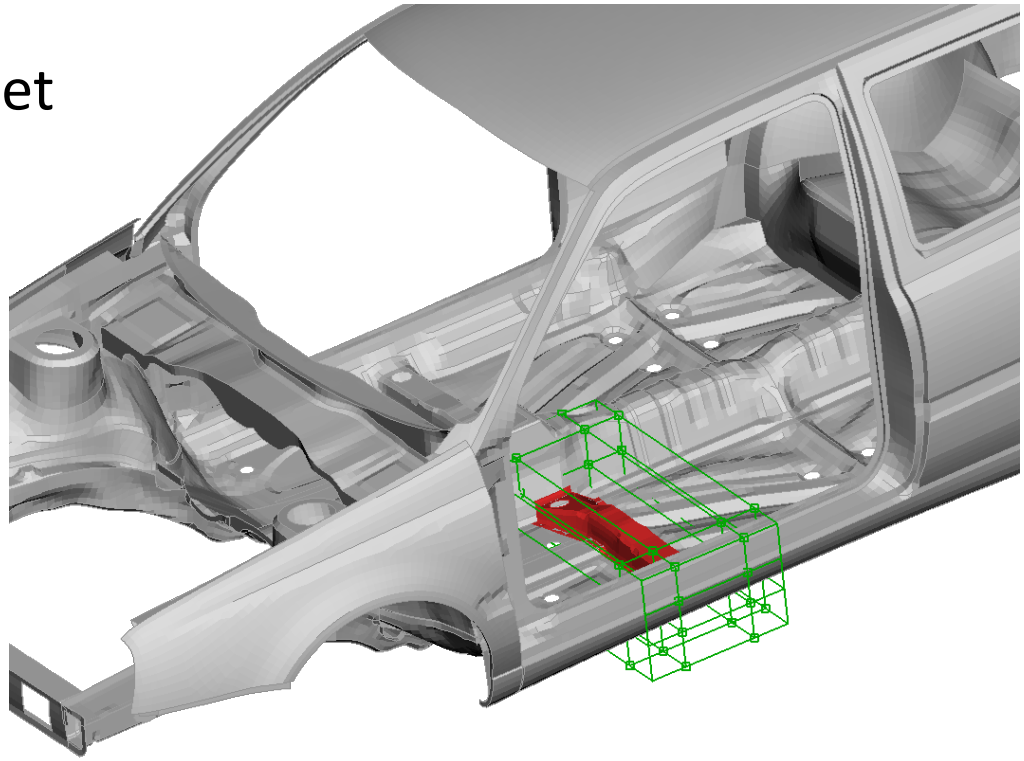
- Around Entities



Box Morphing

Creation of Boxes

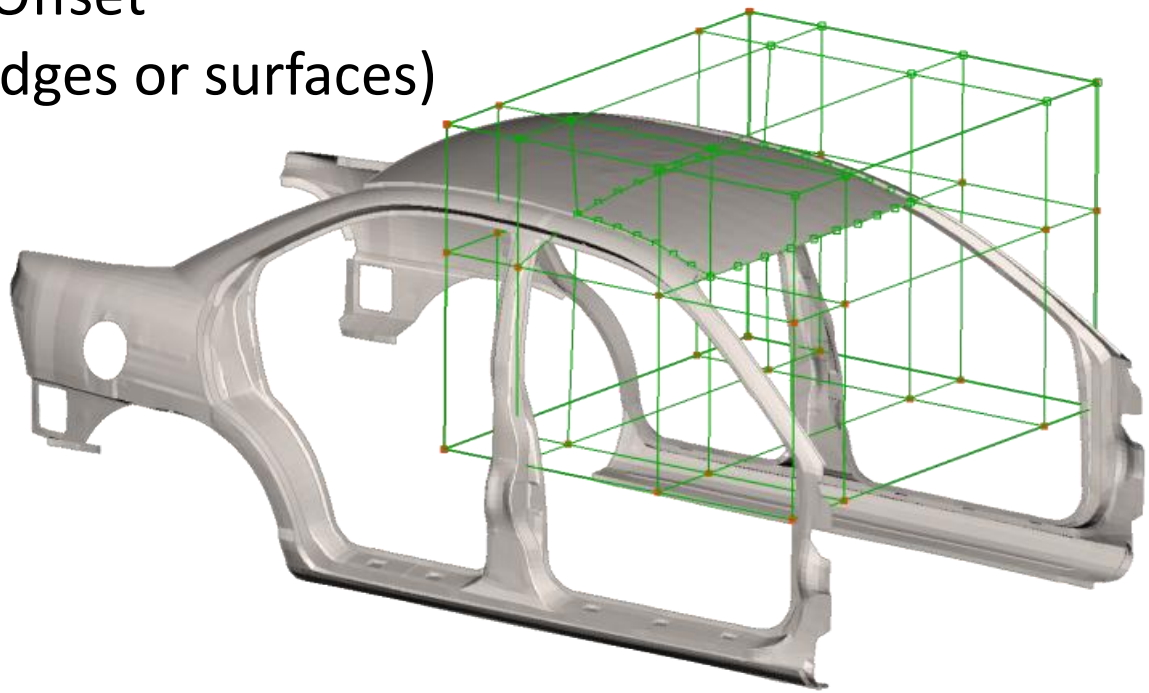
- Around Entities
- Buffer Zones via Offset



Box Morphing

Creation of Boxes

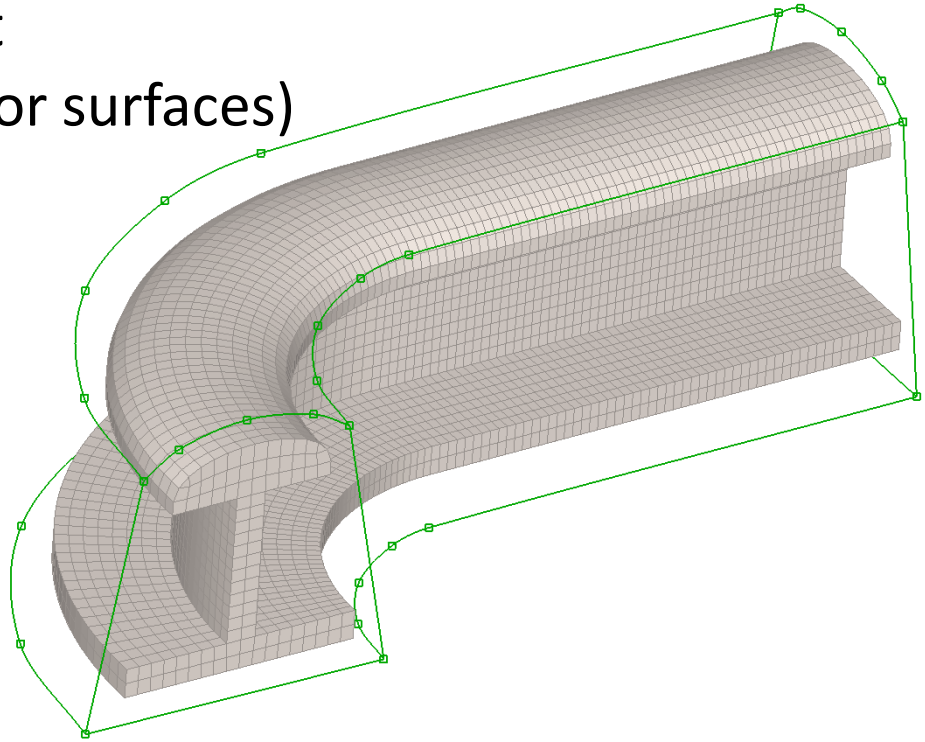
- Around Entities
- Buffer Zones via Offset
- Split + Fit (onto edges or surfaces)



Box Morphing

Creation of Boxes

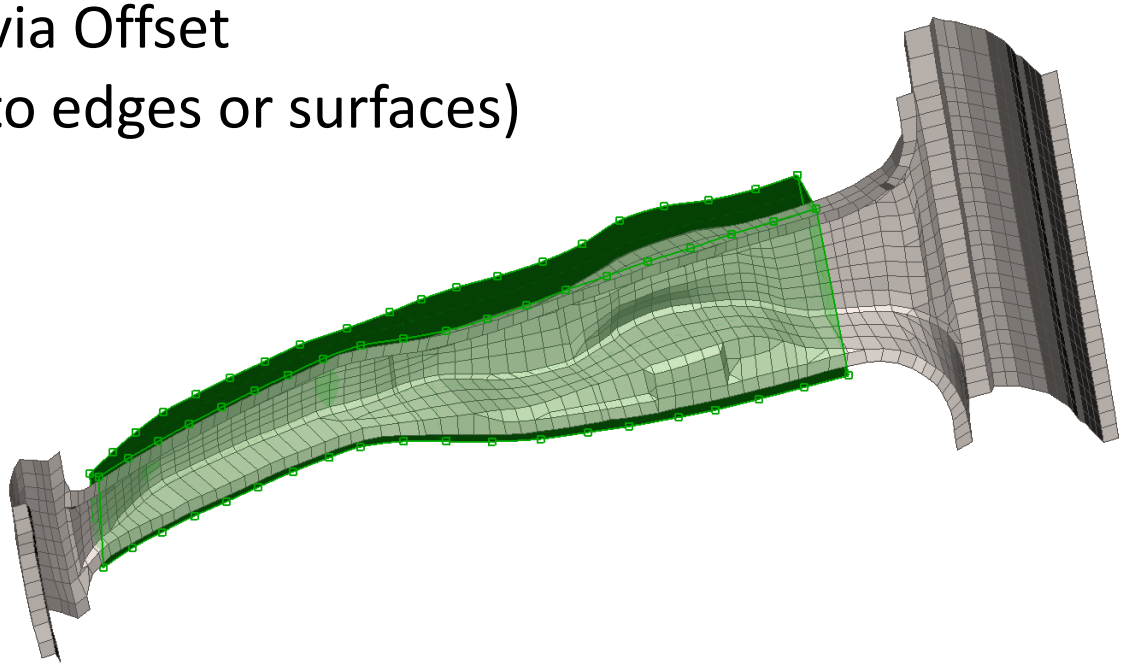
- Around Entities
- Buffer Zones via Offset
- Split + Fit (onto edges or surfaces)
- Sweep / Glide



Box Morphing

Creation of Boxes

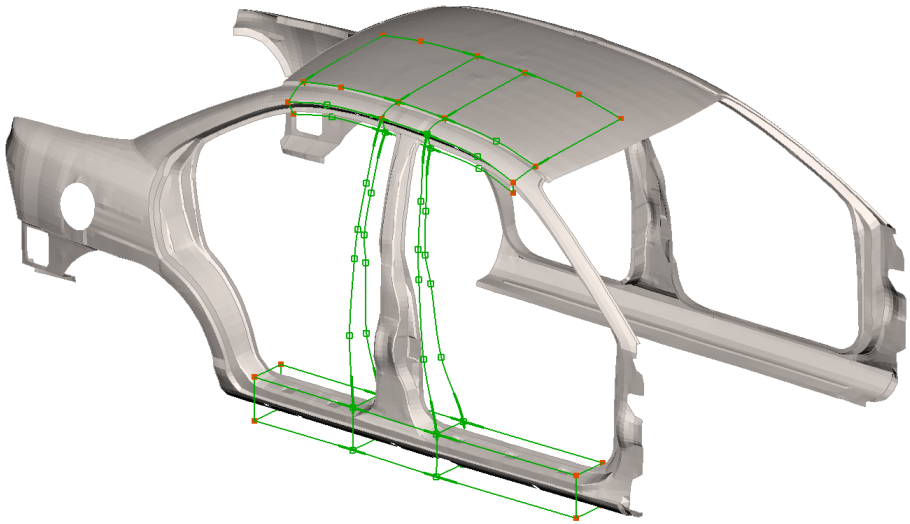
- Around Entities
- Buffer Zones via Offset
- Split + Fit (onto edges or surfaces)
- Sweep / Glide
- Adapt
- …



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

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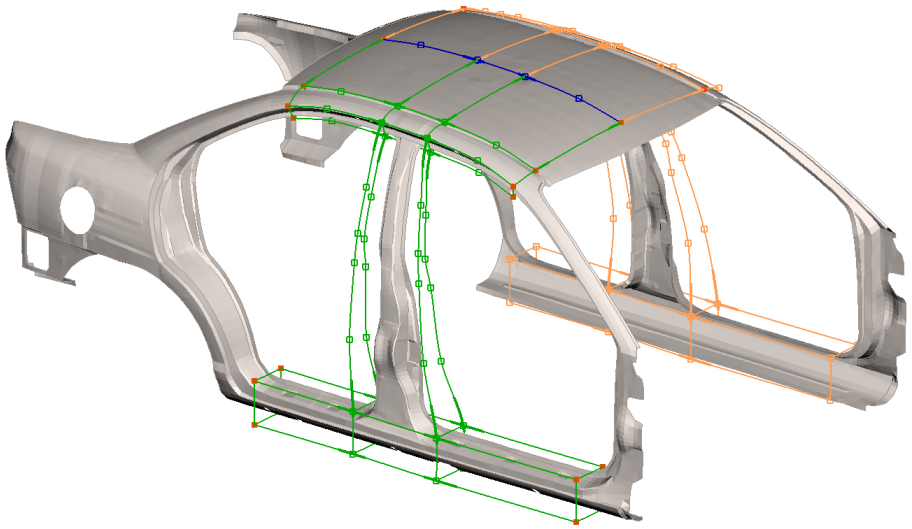

Box Morphing

Linked Morphing Boxes

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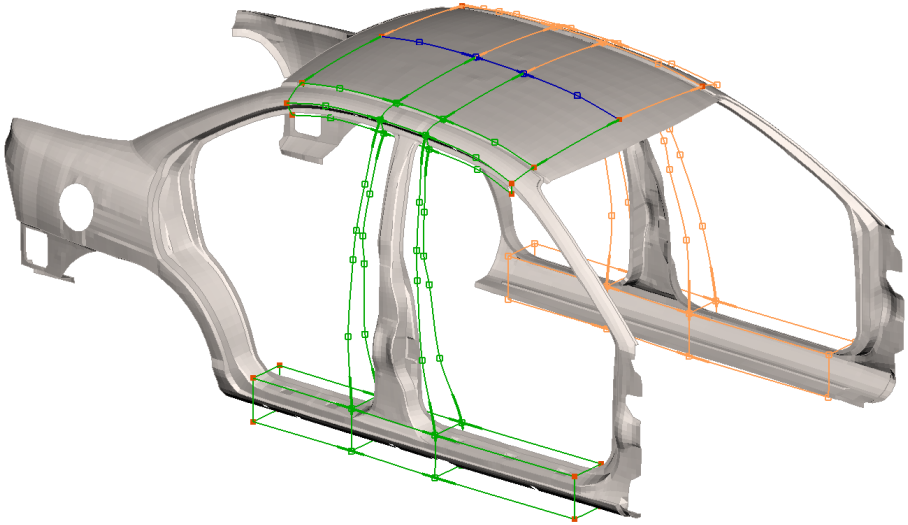

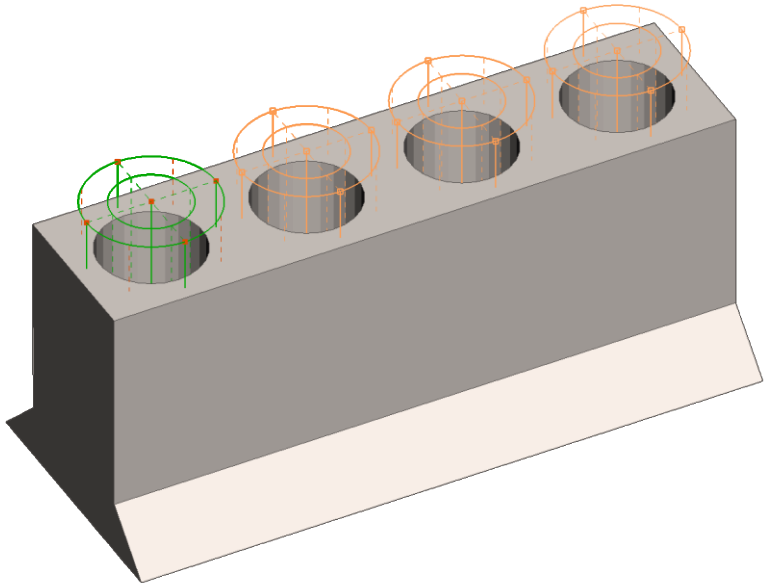

Box Morphing

Linked Morphing Boxes

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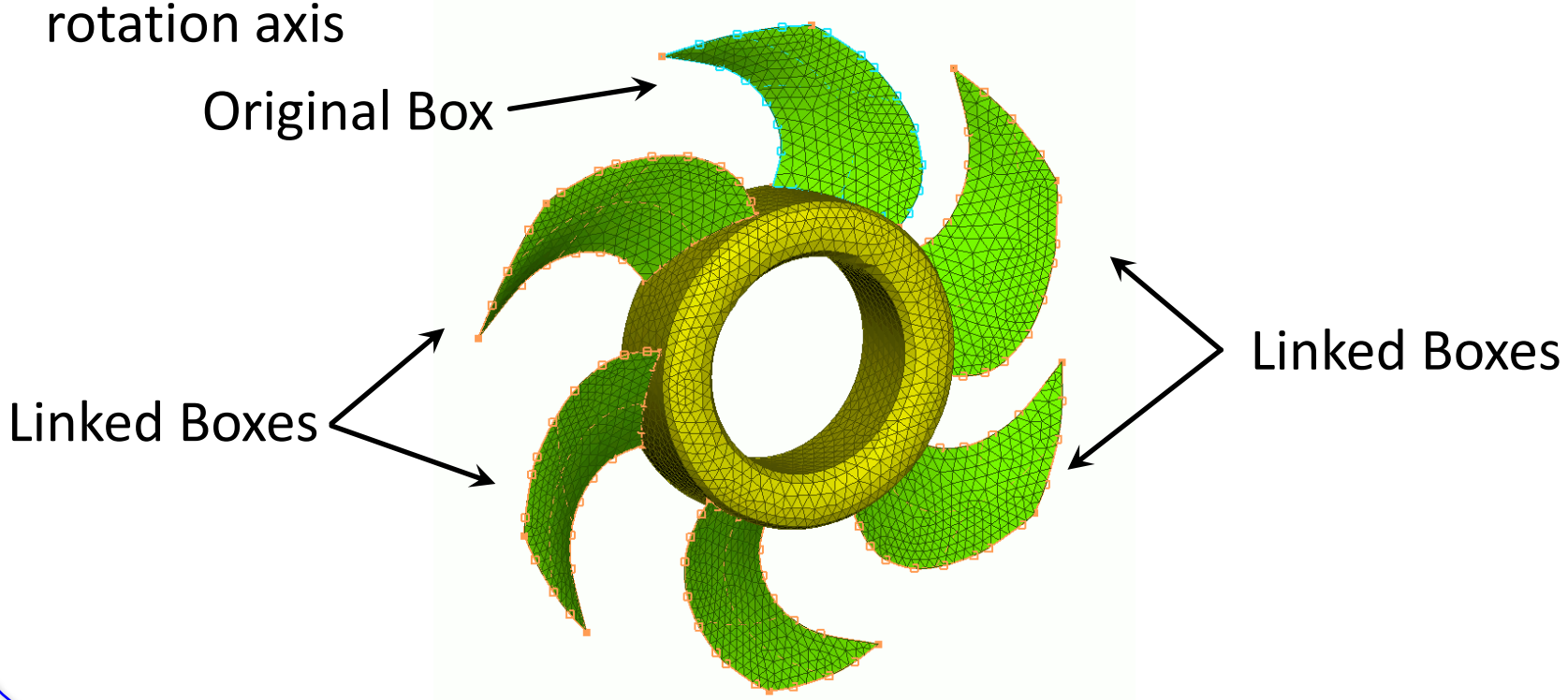
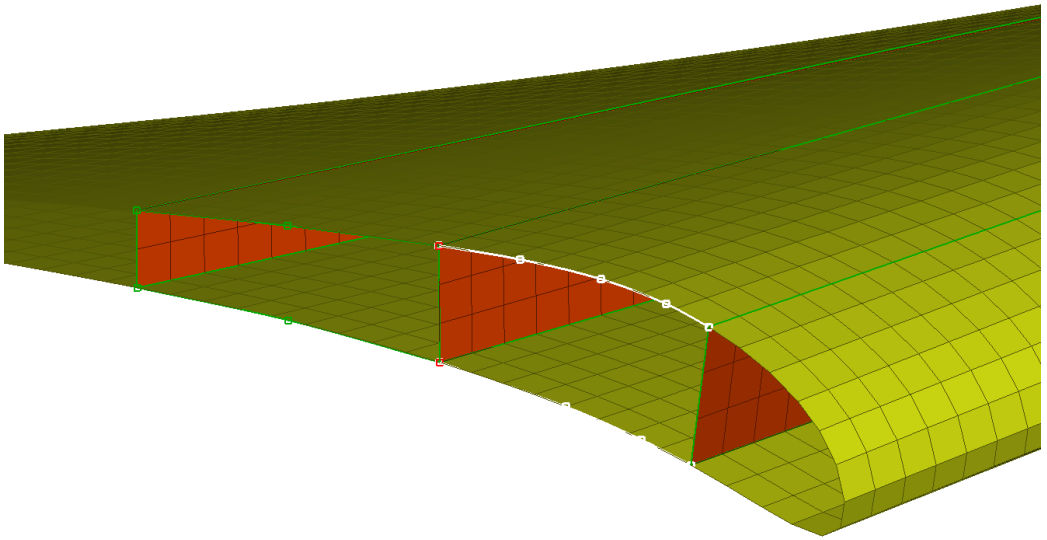


Box Morphing

Modification of Boxes

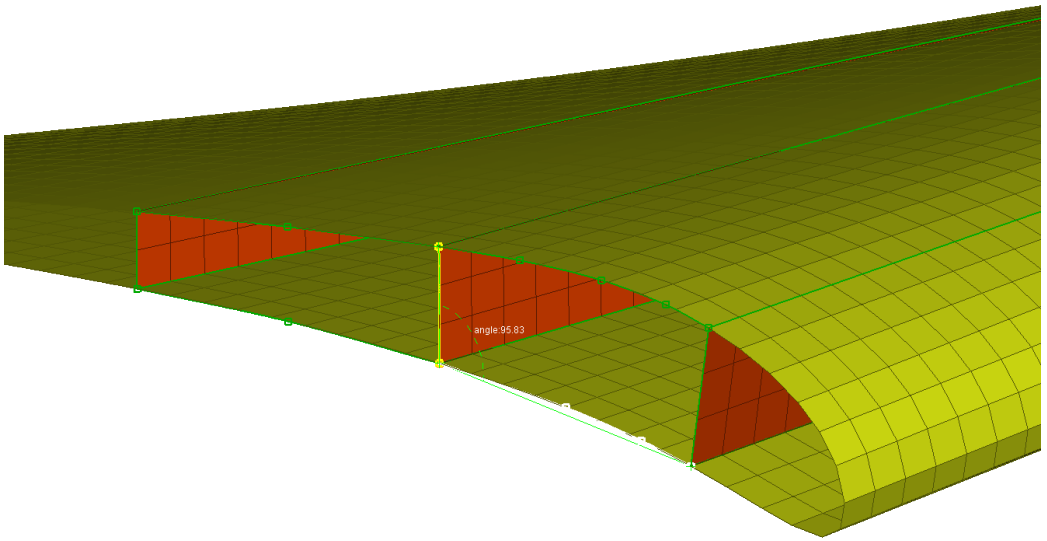
- Move (Translate, Rotate)
- Slide / Extend



Box Morphing

Modification of Boxes

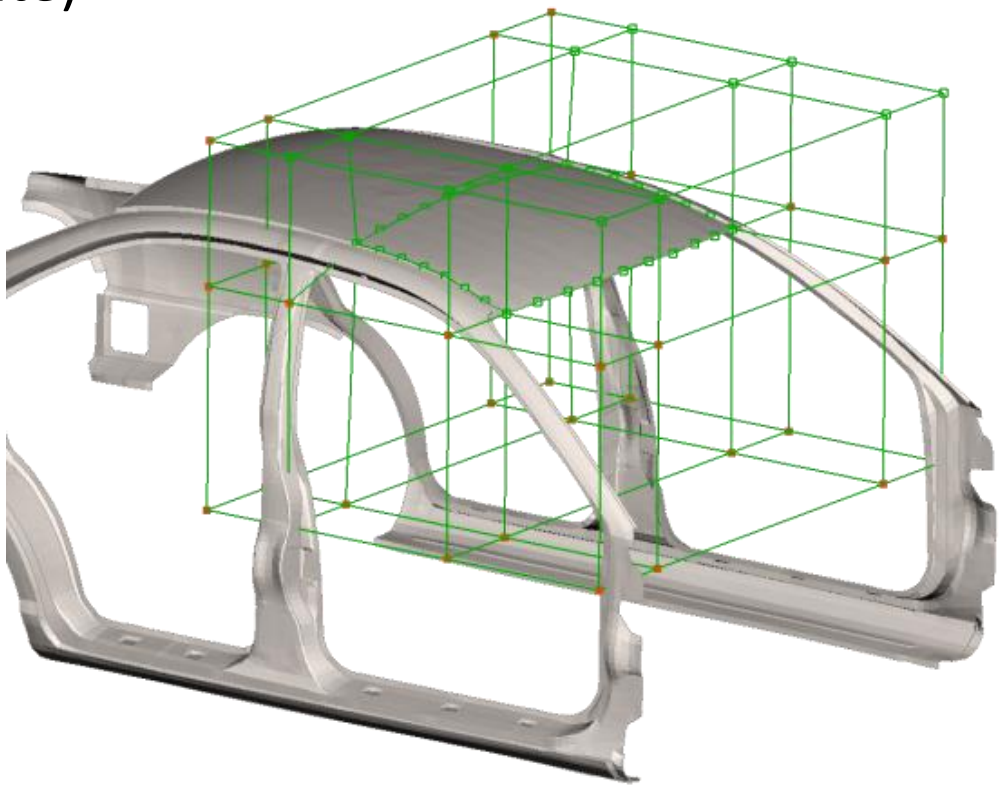
- Move (Translate, Rotate)
- Slide / Extend
- Angle



Box Morphing

Modification of Boxes

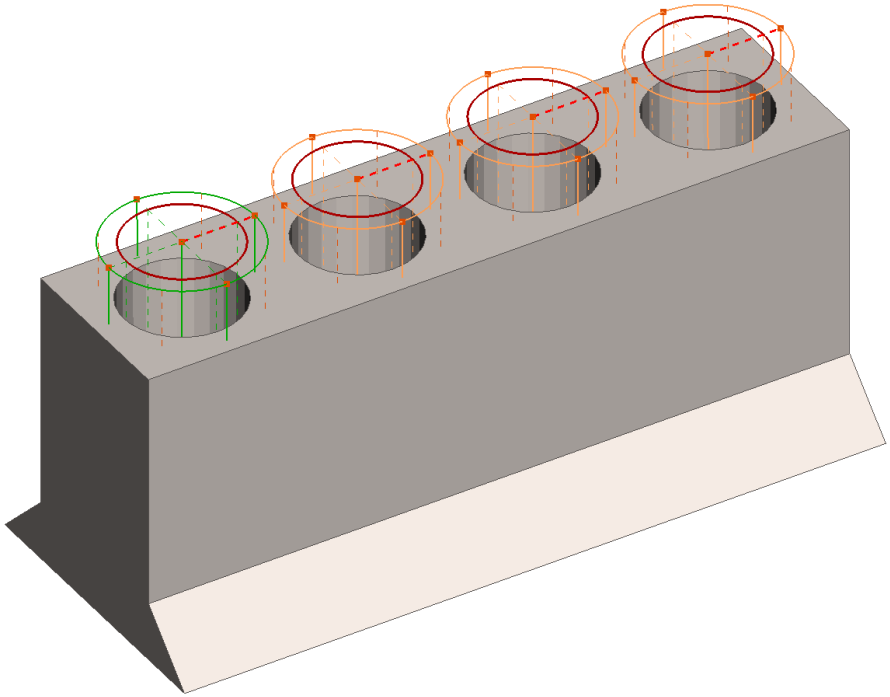
- Move (Translate, Rotate)
- Slide / Extend
- Angle
- Fit (edges, surfaces)



Box Morphing

Modification of Boxes

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



Box Morphing

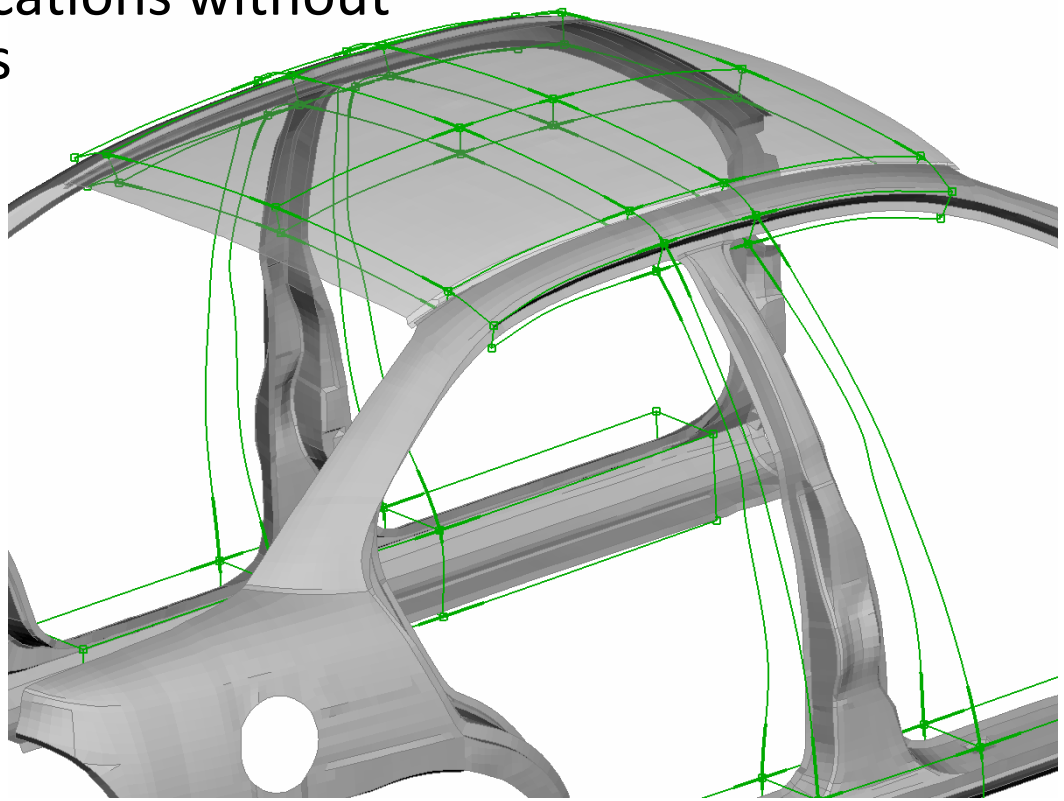
Box in Box

- 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
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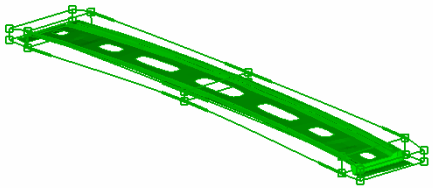


- Global: B-pillar position
- Local: cross member width

Box Morphing

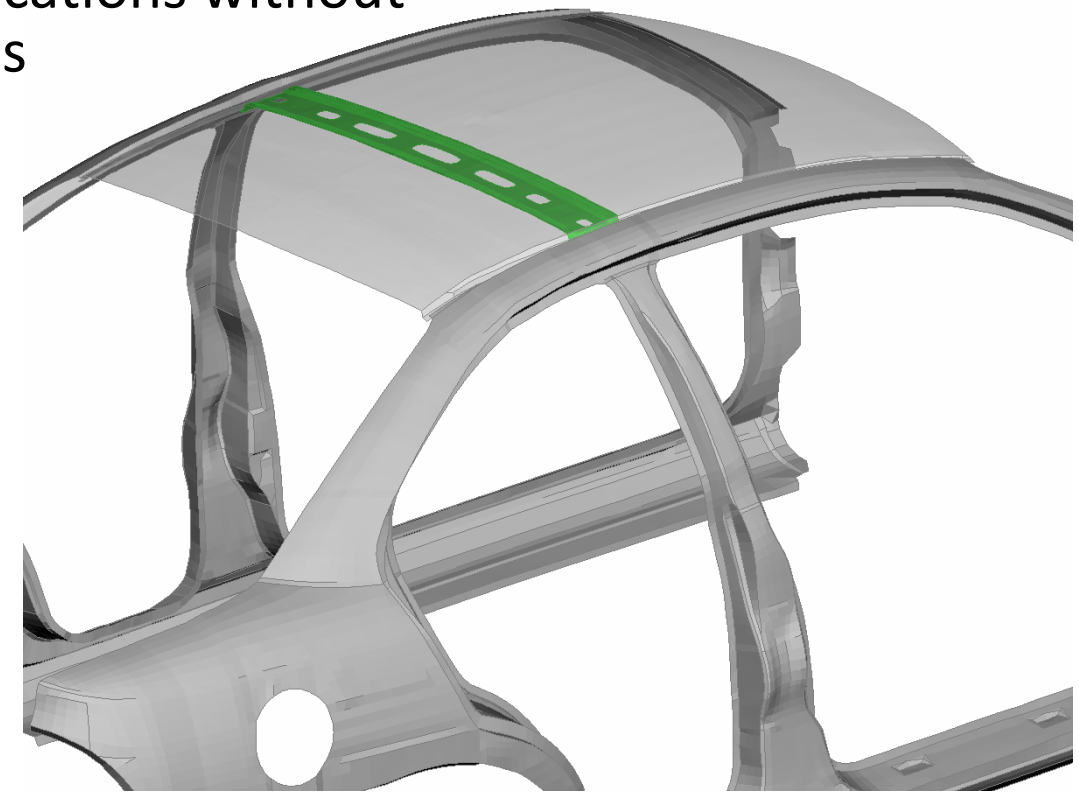
Box in Box

- 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

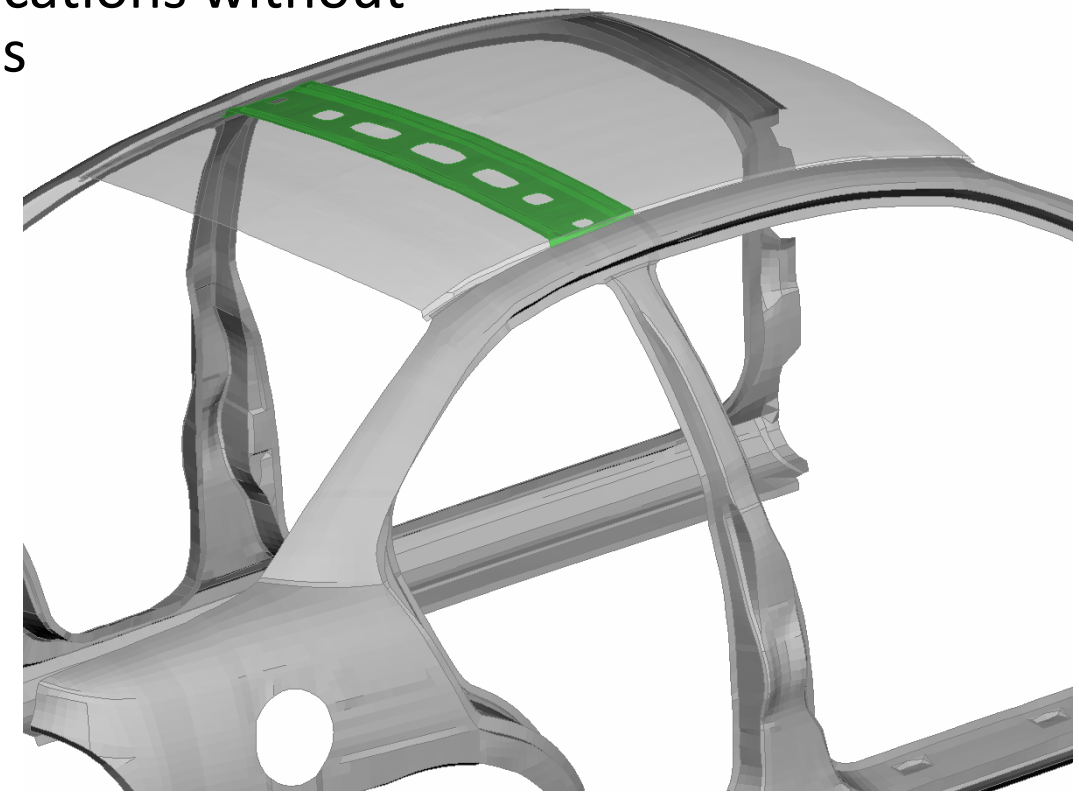


- Global morphing

Box Morphing

Box in Box

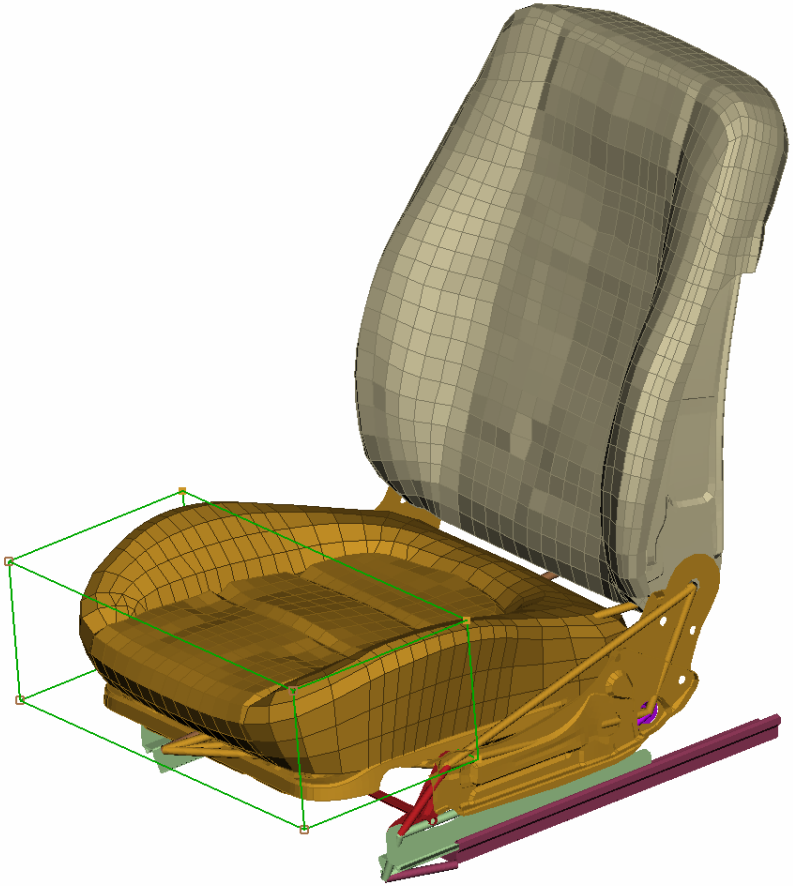
- Separate groups of boxes handle different features
- Global and local modifications without excessive splits of boxes



- Global morphing
- Local morphing

Box Morphing

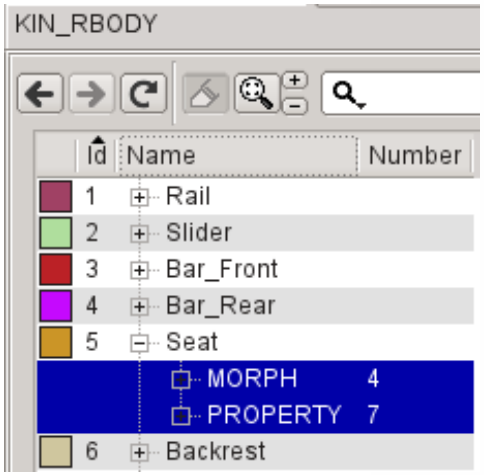
Coupled with Kinetics

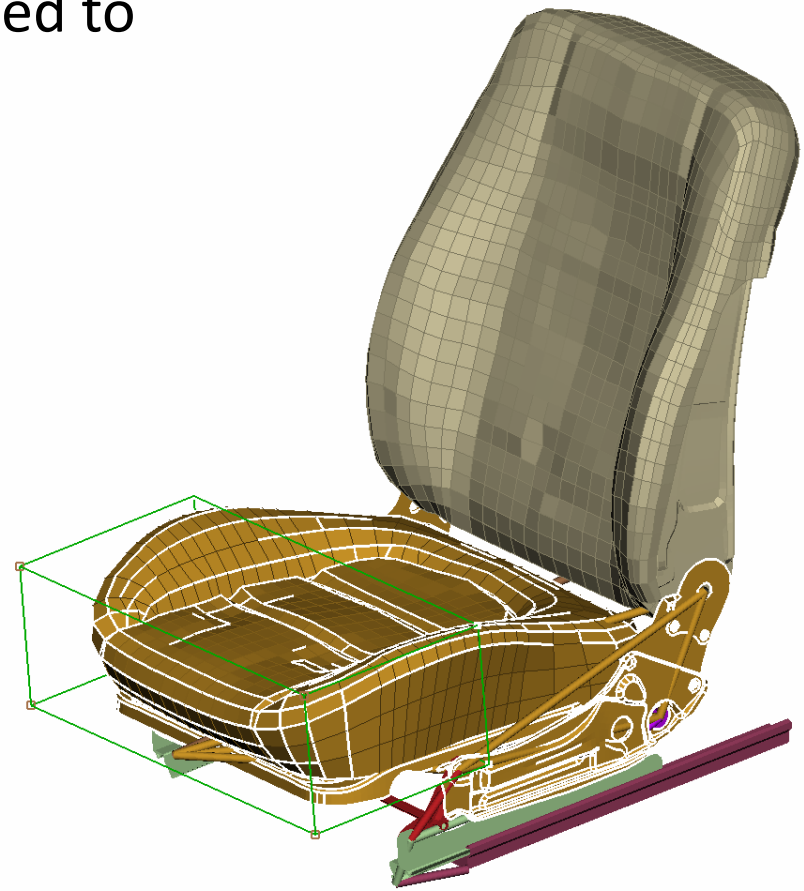


Box Morphing

Coupled with Kinetics

- Morph Control Points added to Kinetic Rigid Bodies

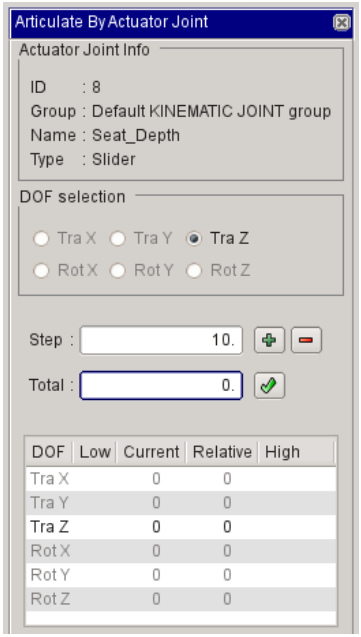


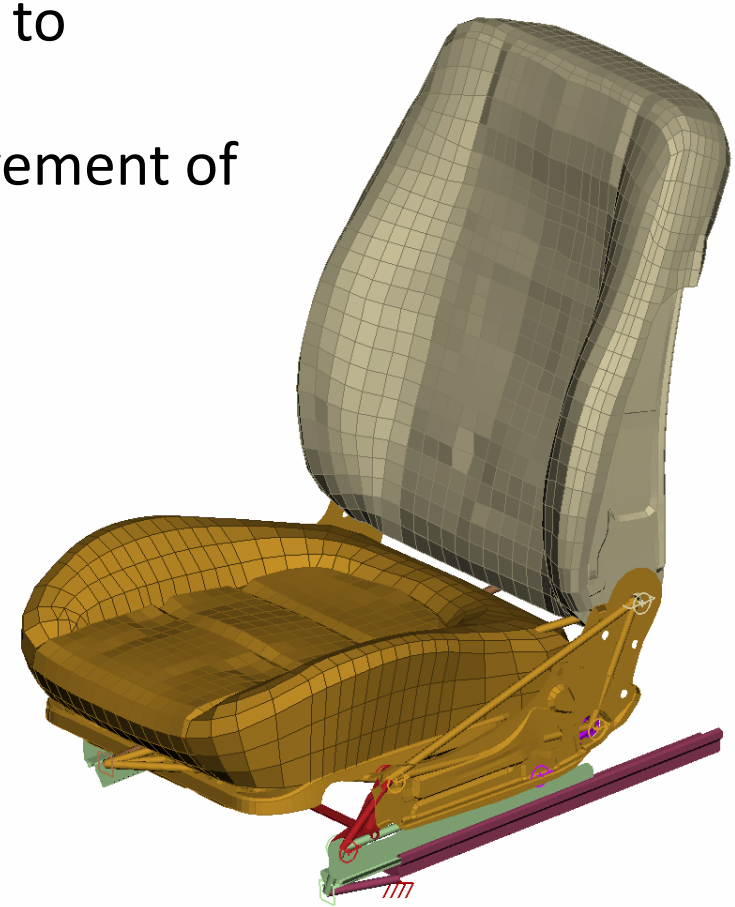


Box Morphing

Coupled with Kinetics

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





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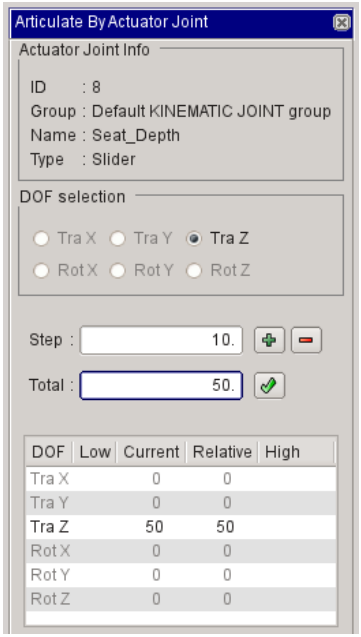
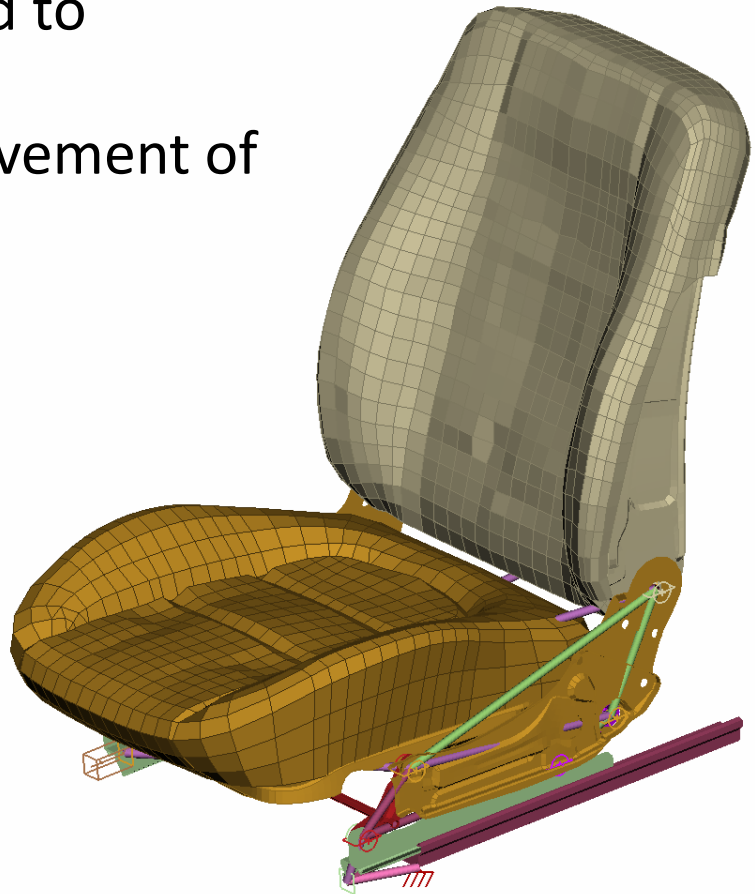
Coupled with Kinetics

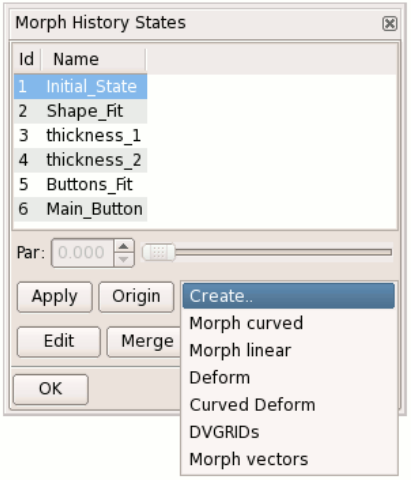
- Morph Control Points added to Kinetic Rigid Bodies
- Morphing controlled by movement of Rigid Bodies





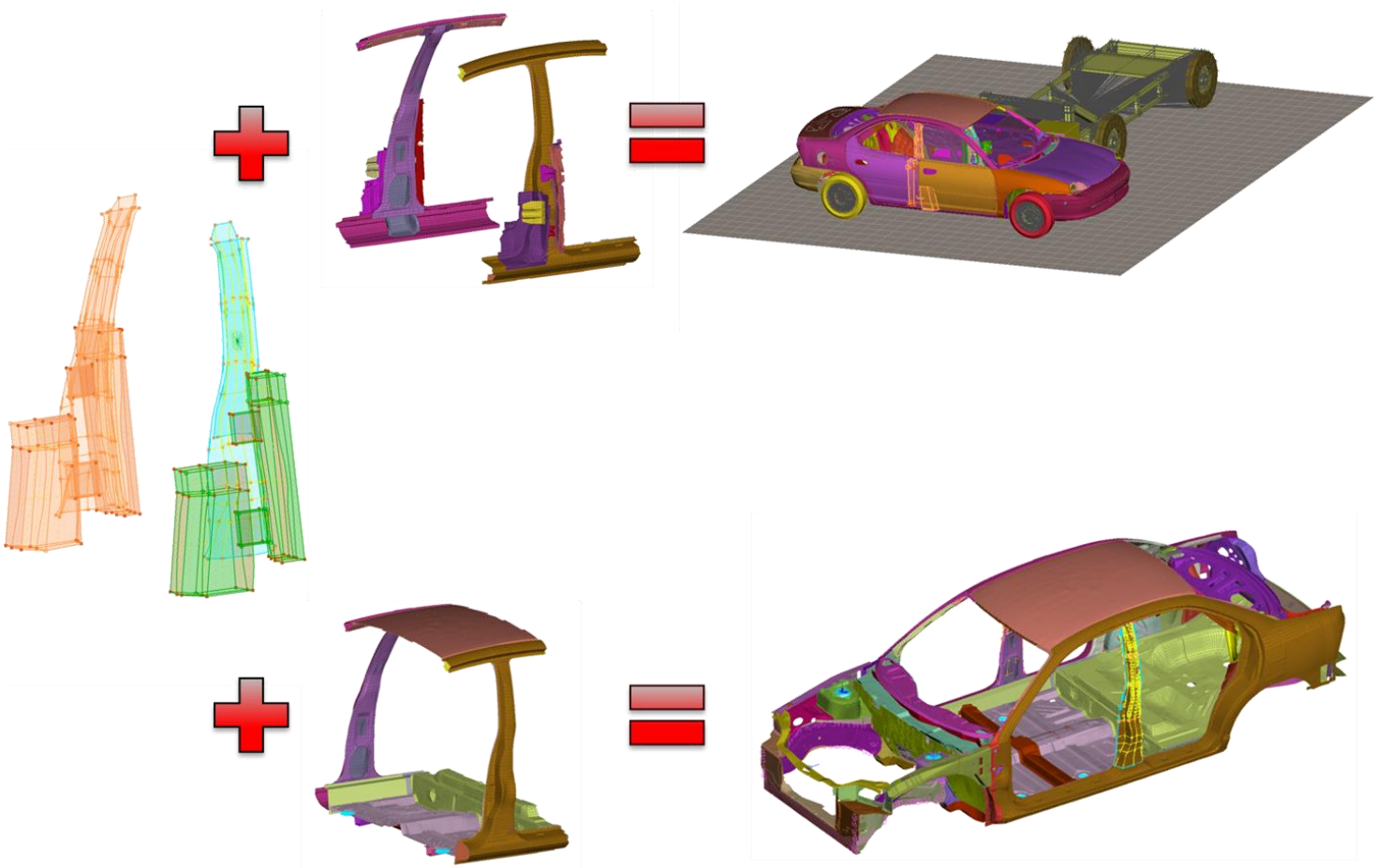
Box Morphing

Recording History



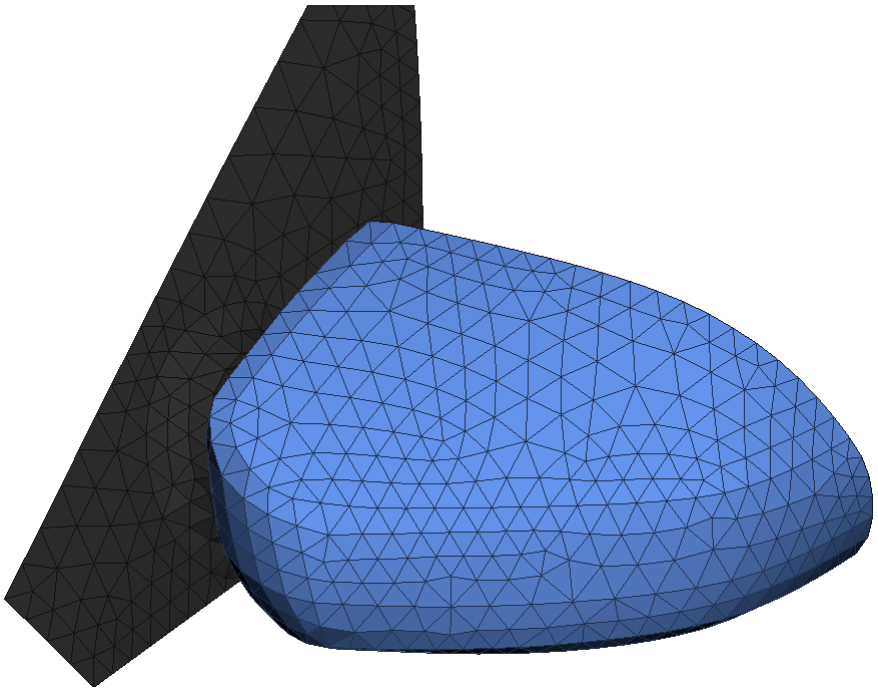
Box Morphing

Re-use of boxes and parameters for multiple models



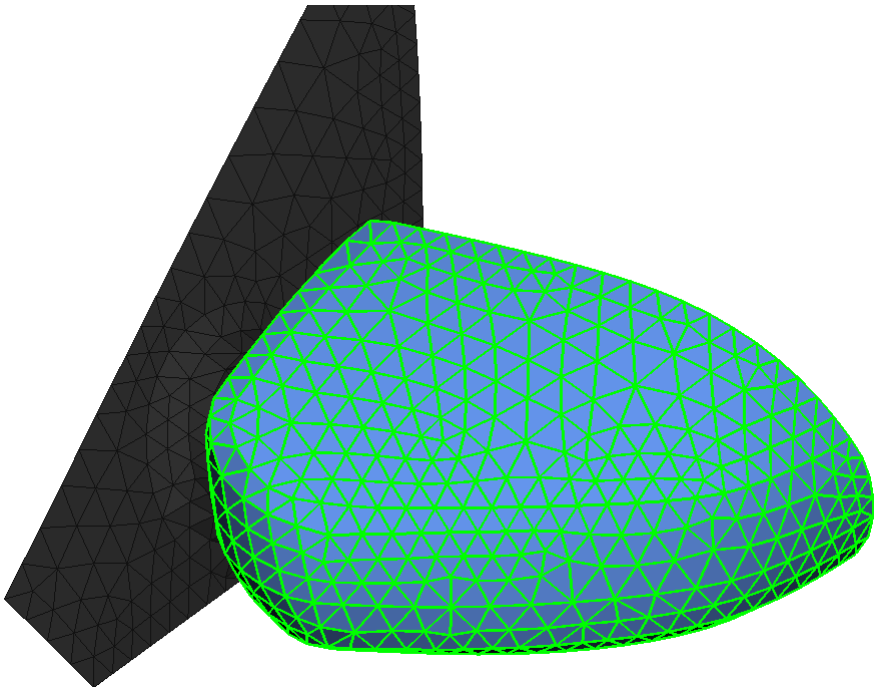
Direct Morphing

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



Direct Morphing

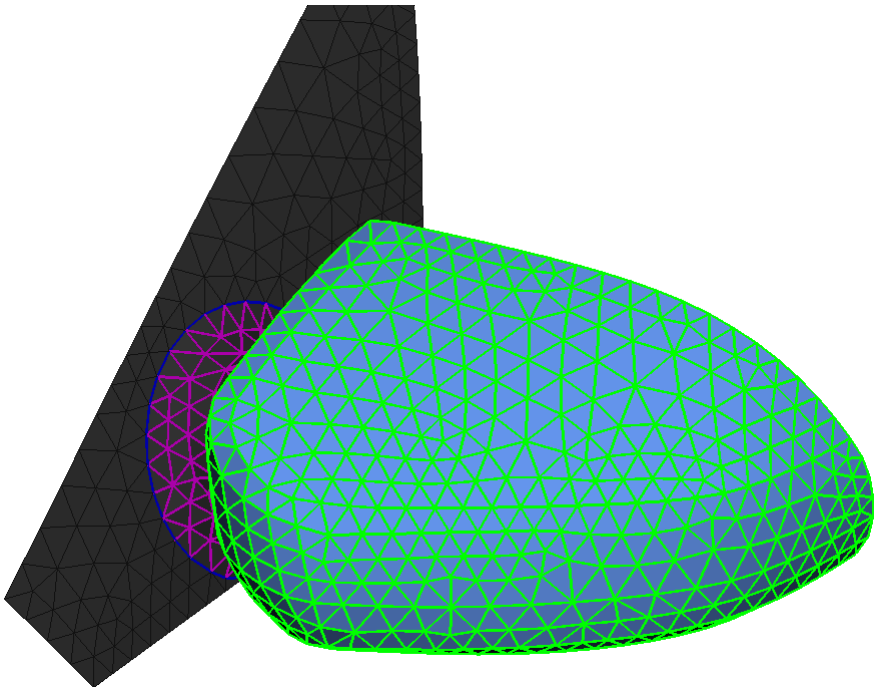
Translate, **rotate** or scale **FE-mesh** or Geometry entities



- Control Entities

Direct Morphing

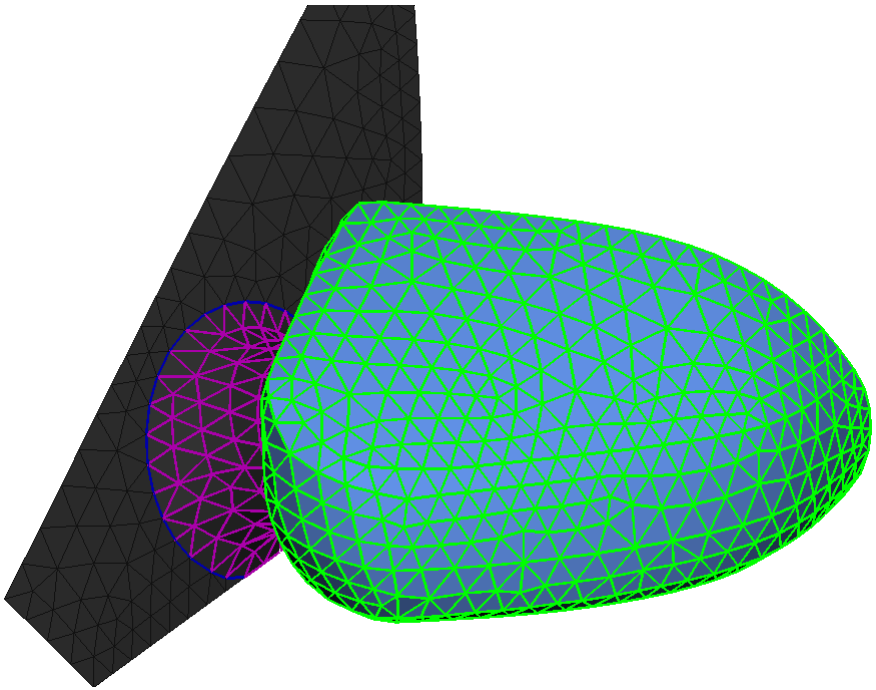
Translate, **rotate** or scale **FE-mesh** or Geometry entities



- Control Entities
- Morphed Entities
- Boundary

Direct Morphing

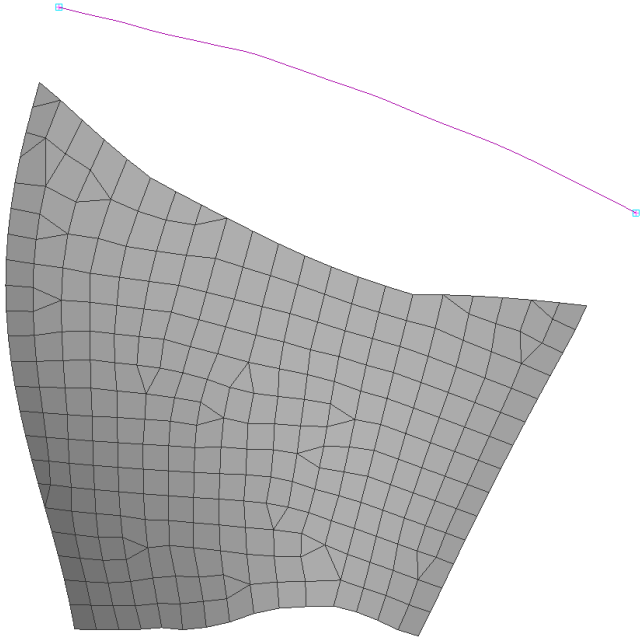
Translate, **rotate** or scale **FE-mesh** or Geometry entities



- Control Entities
- Morphed Entities
- Boundary
- Morphing

Direct Morphing

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



Direct Morphing

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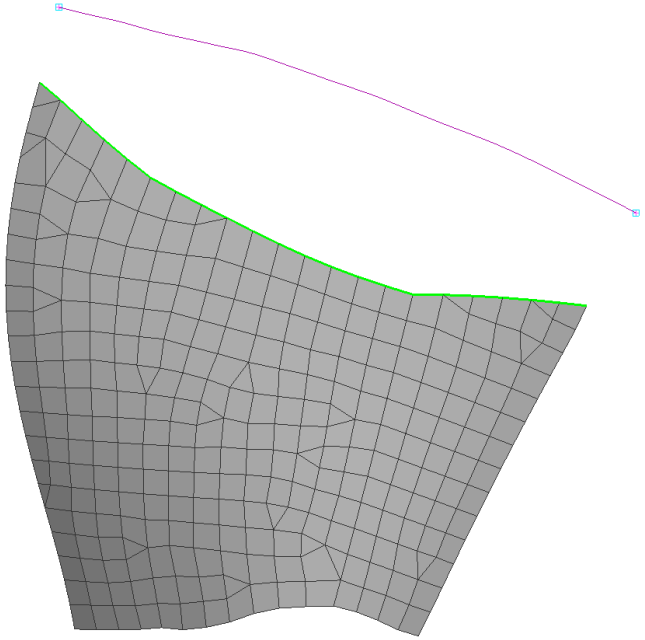
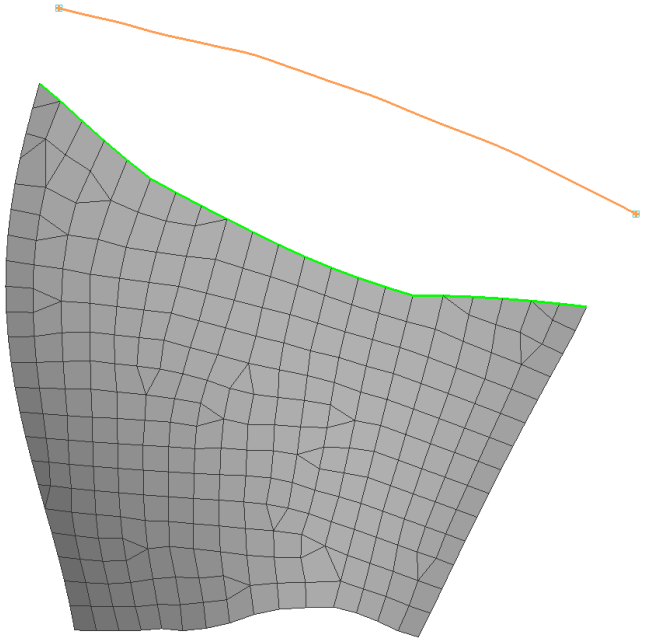


- Origin

Direct Morphing

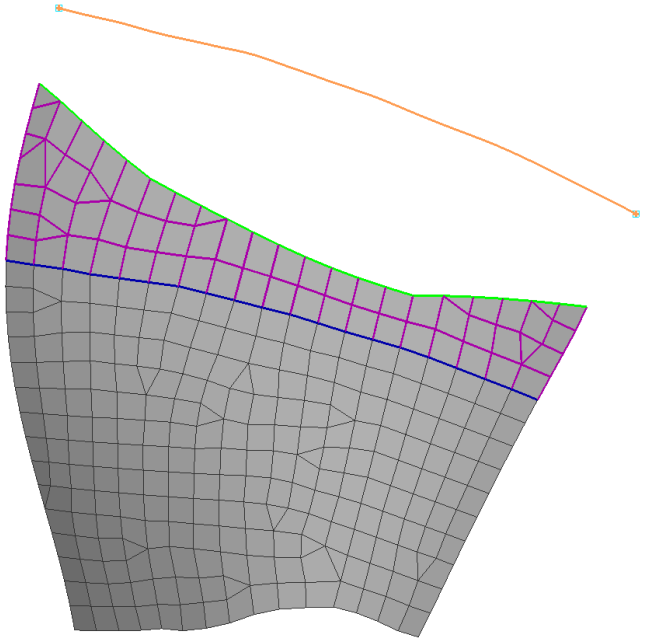
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target

Direct Morphing

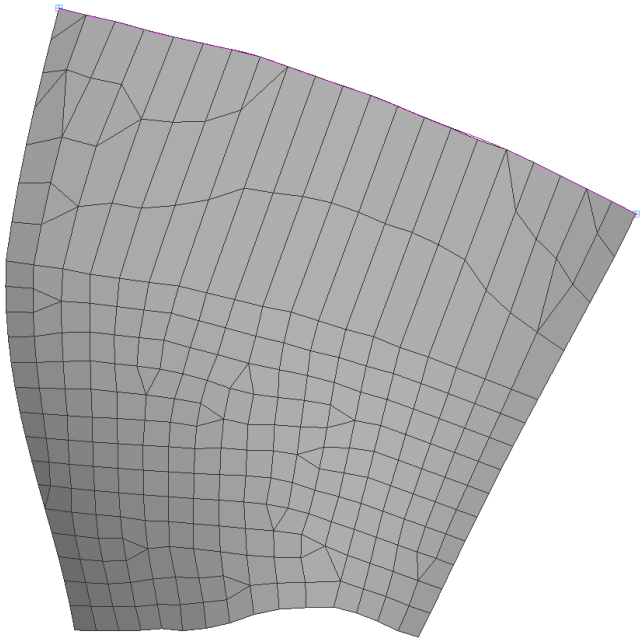
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target
- Morphed Entities
- Boundary

Direct Morphing

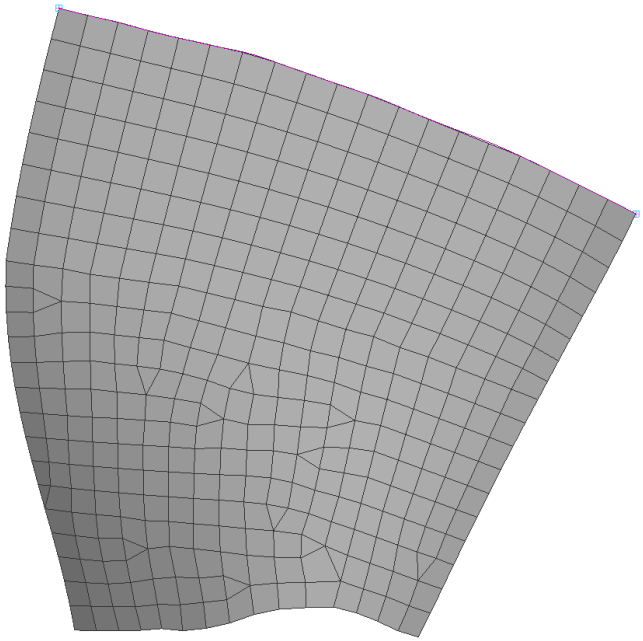
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target
- Morphed Entities
- Boundary
- Morphing

Direct Morphing

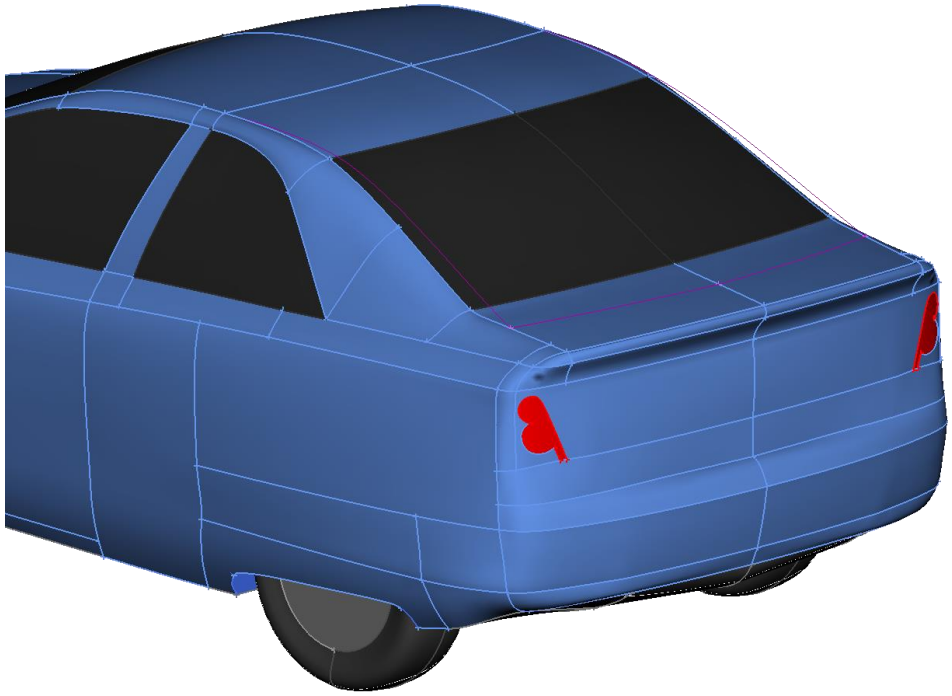
Snap **FE** or geometry edges to **single** or multiple target curves



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

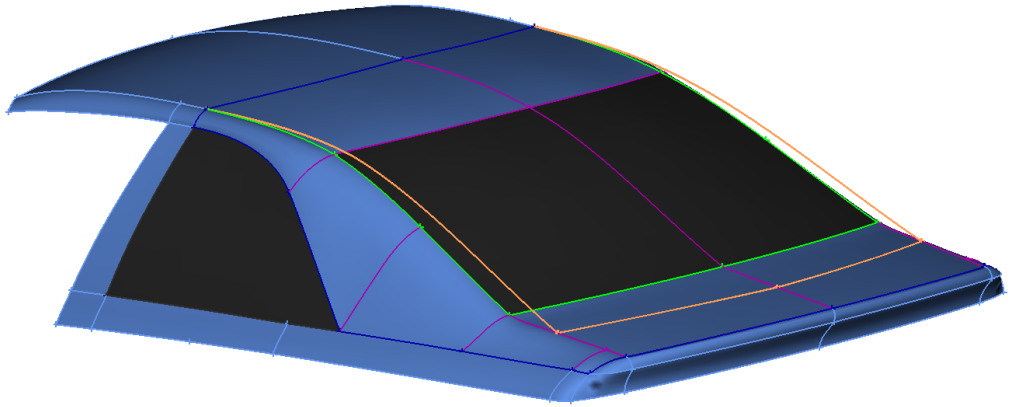
Direct Morphing

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



Direct Morphing

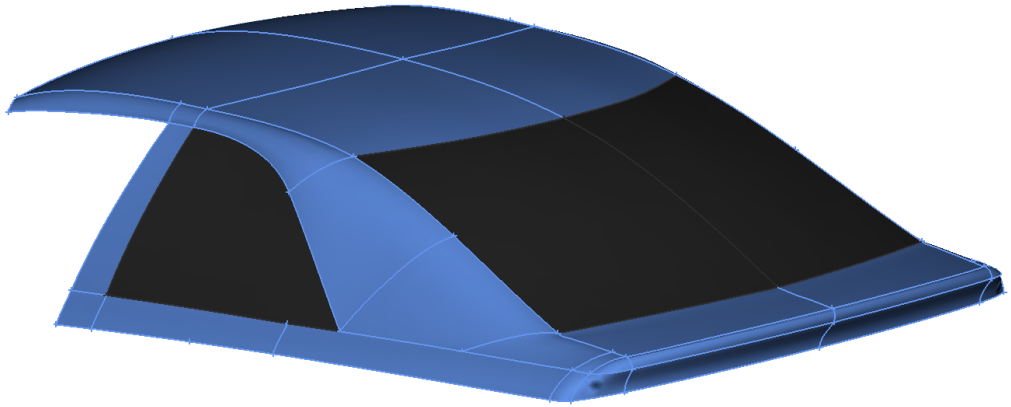
Snap FE or **geometry** edges to single or **multiple** target curves



- Origin
- Target
- Morphed Entities
- Boundary

Direct Morphing

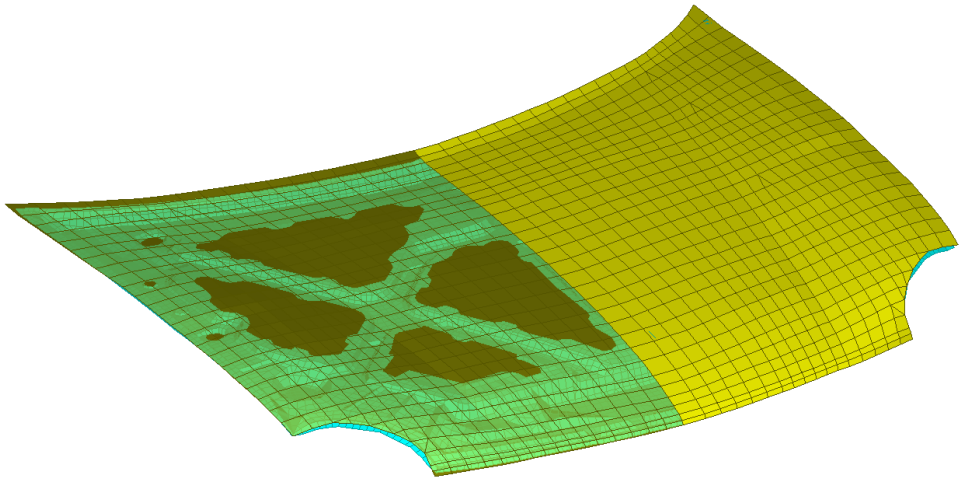
Snap FE or **geometry** edges to single or **multiple** target curves



- Origin
- Target
- Morphed Entities
- Boundary
- Morphing

Direct Morphing

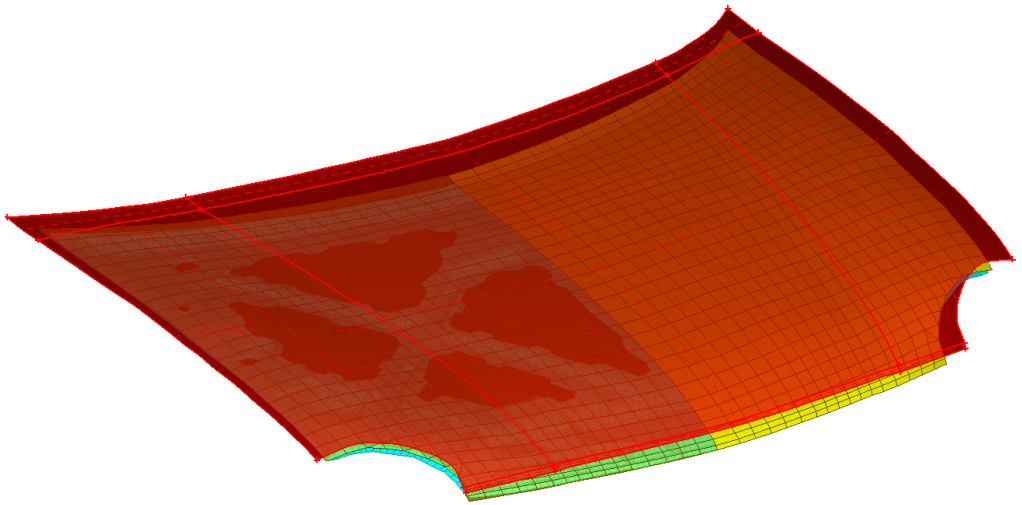
Fit surfaces – e.g. fit existing FE-mesh onto new CAD-geometry



- Original FE-surface (with additional underlying parts)

Direct Morphing

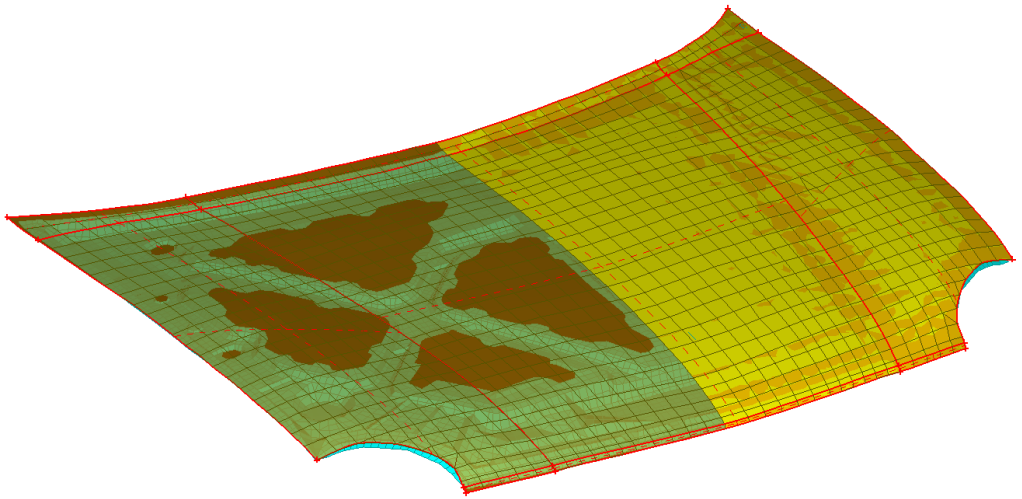
Fit surfaces – e.g. fit existing FE-mesh onto new CAD-geometry



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

Direct Morphing

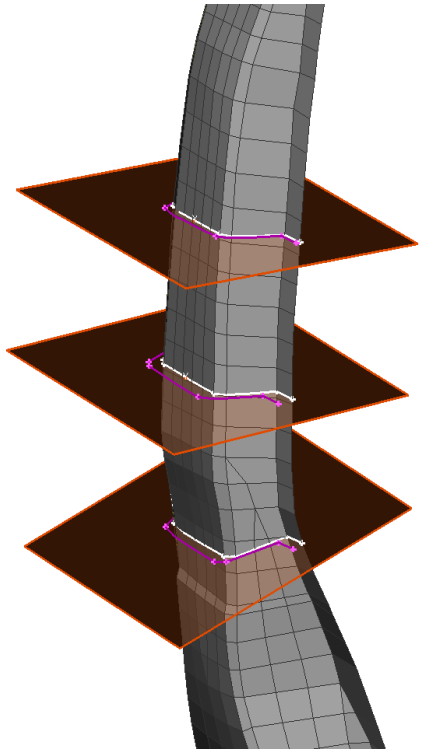
Fit surfaces – e.g. fit existing FE-mesh onto new CAD-geometry



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

Direct Morphing

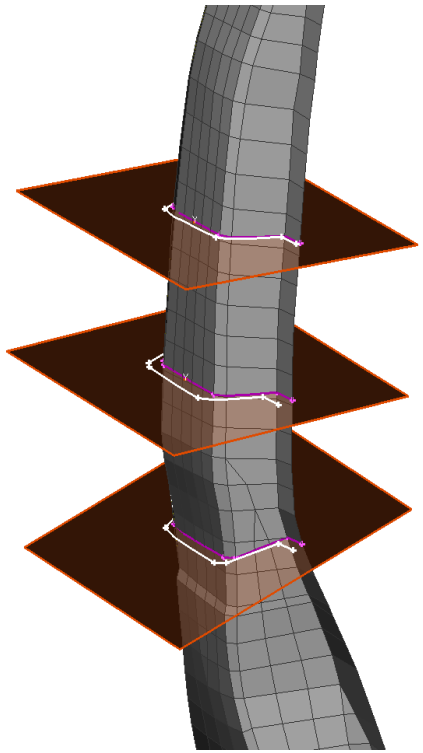
Fit cross sections (applicable on FE-mesh and geometry)



- Original cross section

Direct Morphing

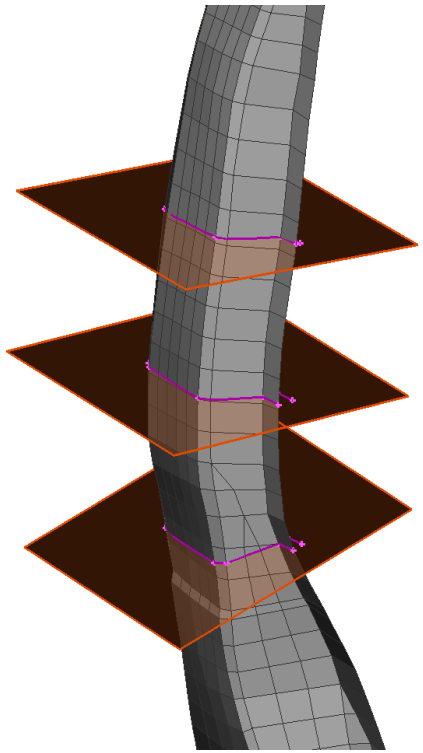
Fit cross sections (applicable on FE-mesh and geometry)



- Original cross section
- Target cross section

Direct Morphing

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

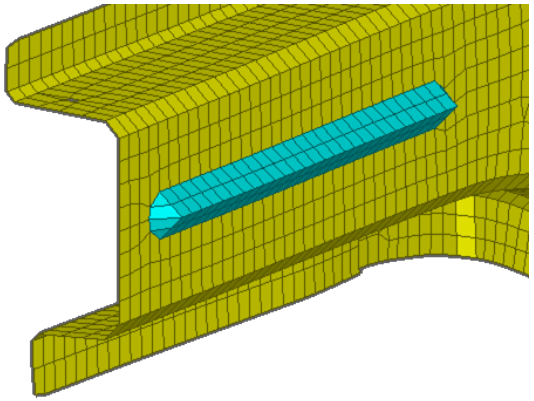


- Original cross section
- Target cross section
- Morphing

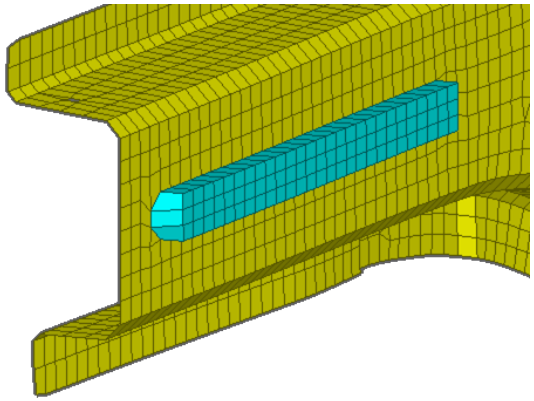
Direct Morphing

Generation & modification of beads and embosses

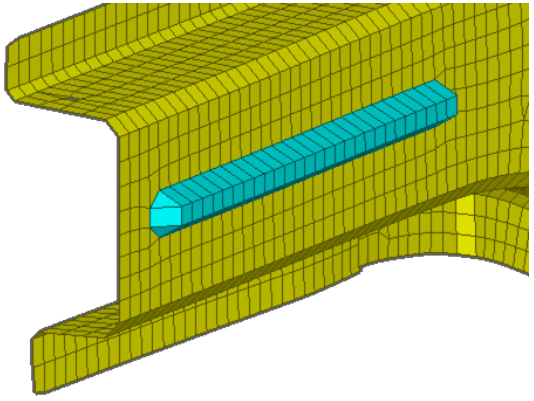
Triangular-shape



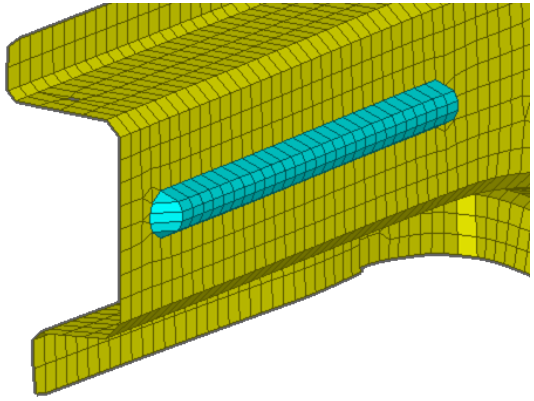
Box-shape

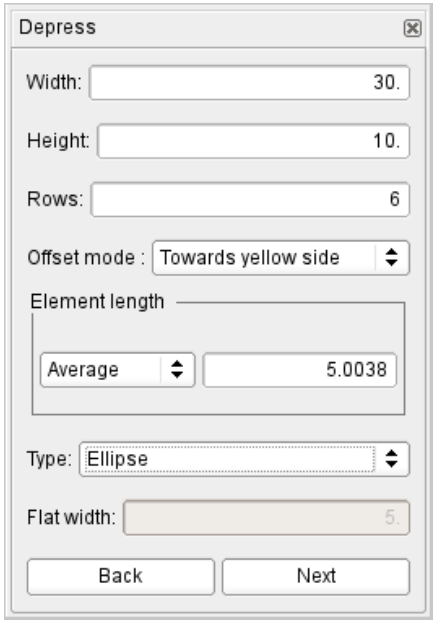


Trapezoidal-shape



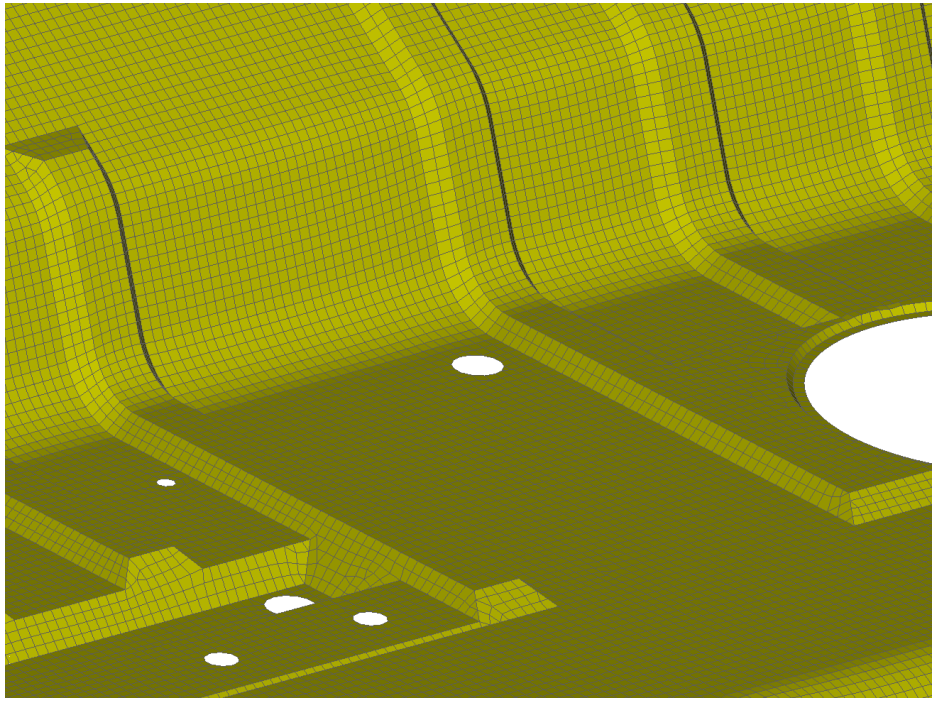
Ellipse-shape





Direct Morphing

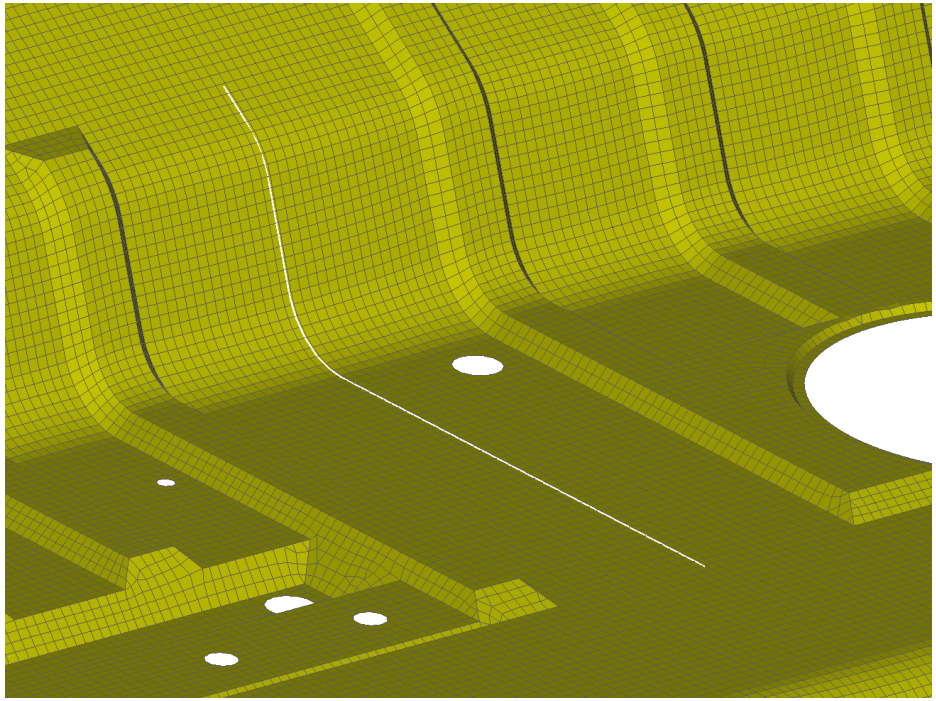
Generation & modification of beads and embosses



Direct Morphing

Generation & modification of beads and embosses

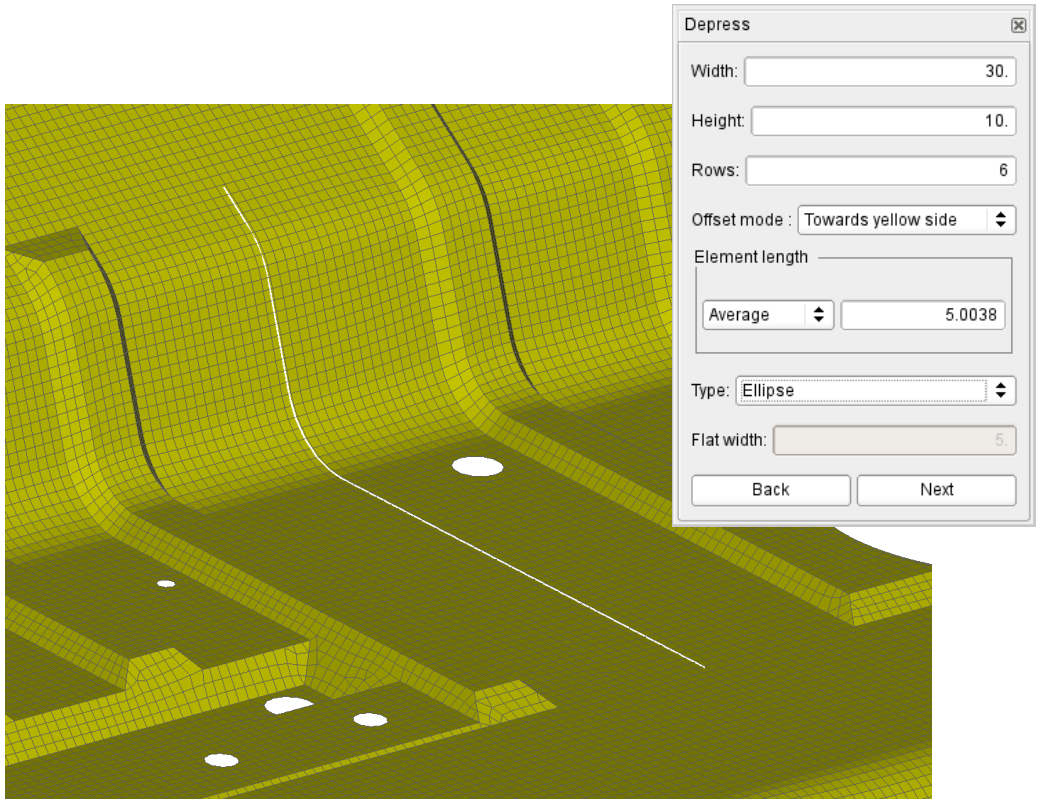
Curves



Direct Morphing

Generation & modification of beads and embosses

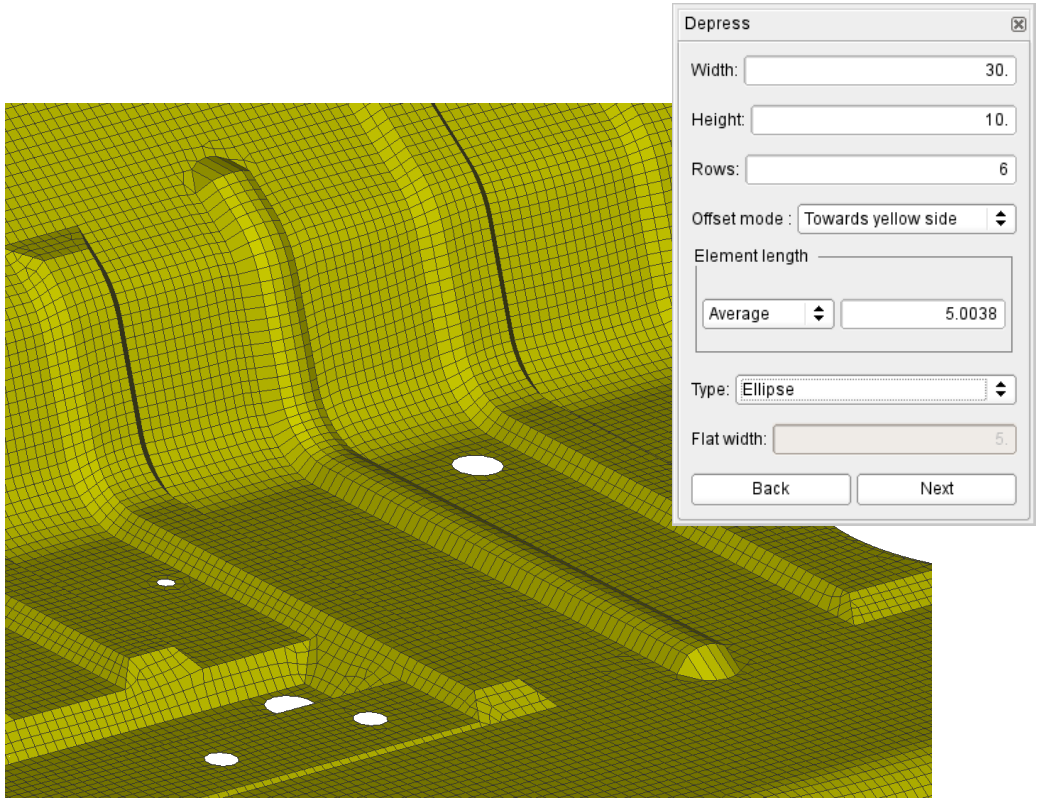
Curves
↓
Depress Parameter



Direct Morphing

Generation & modification of beads and embosses

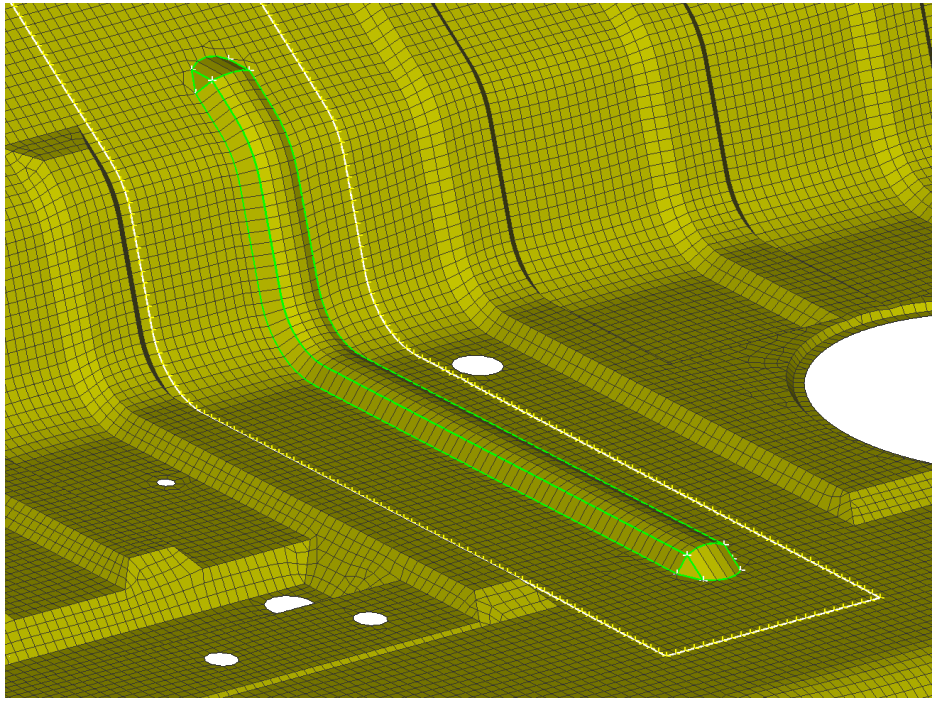
Curves
↓
Depress Parameter
↓
Depression



Direct Morphing

Generation & modification of beads and embosses

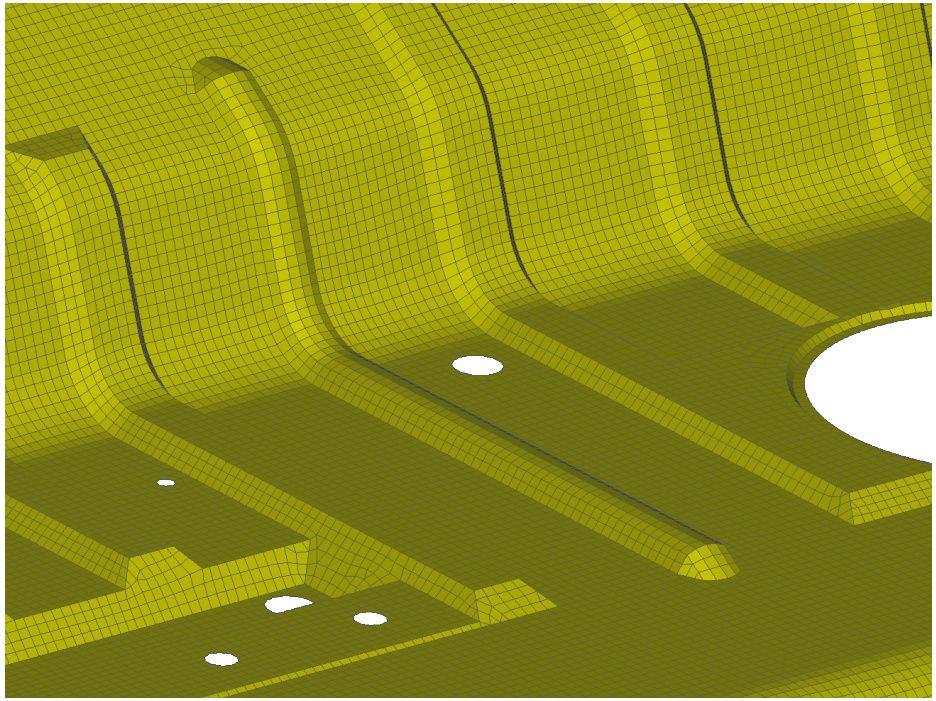
Curves
↓
Depress Parameter
↓
Depression
↓
Reconstruct



Direct Morphing

Generation & modification of beads and embosses

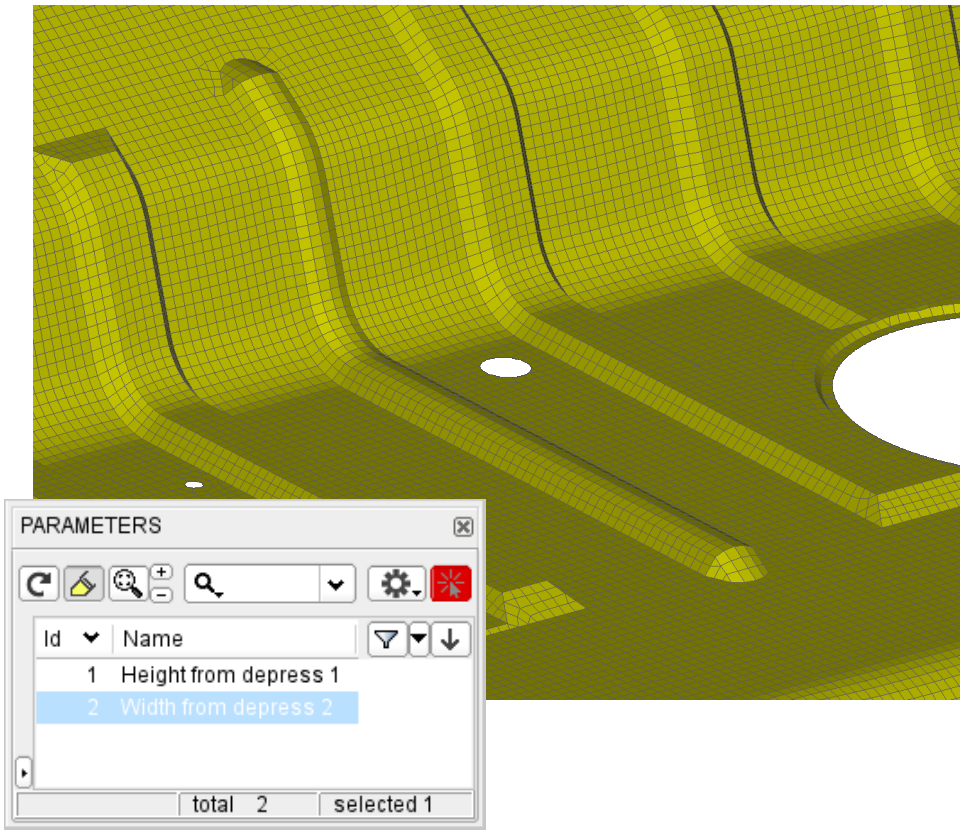
Curves
↓
Depress Parameter
↓
Depression
↓
Reconstruct



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
↓
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Depression
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Reconstruct
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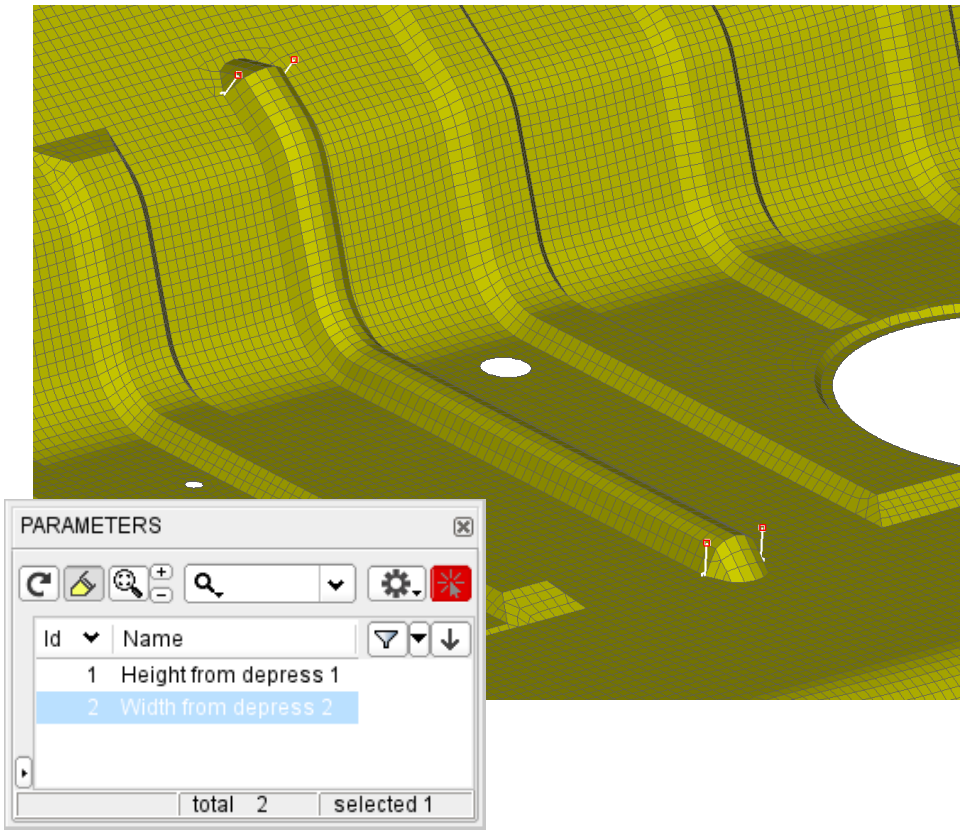
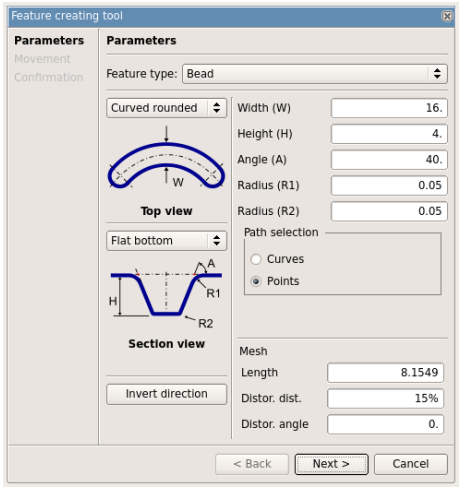
Auto-created morph boxes and parameters

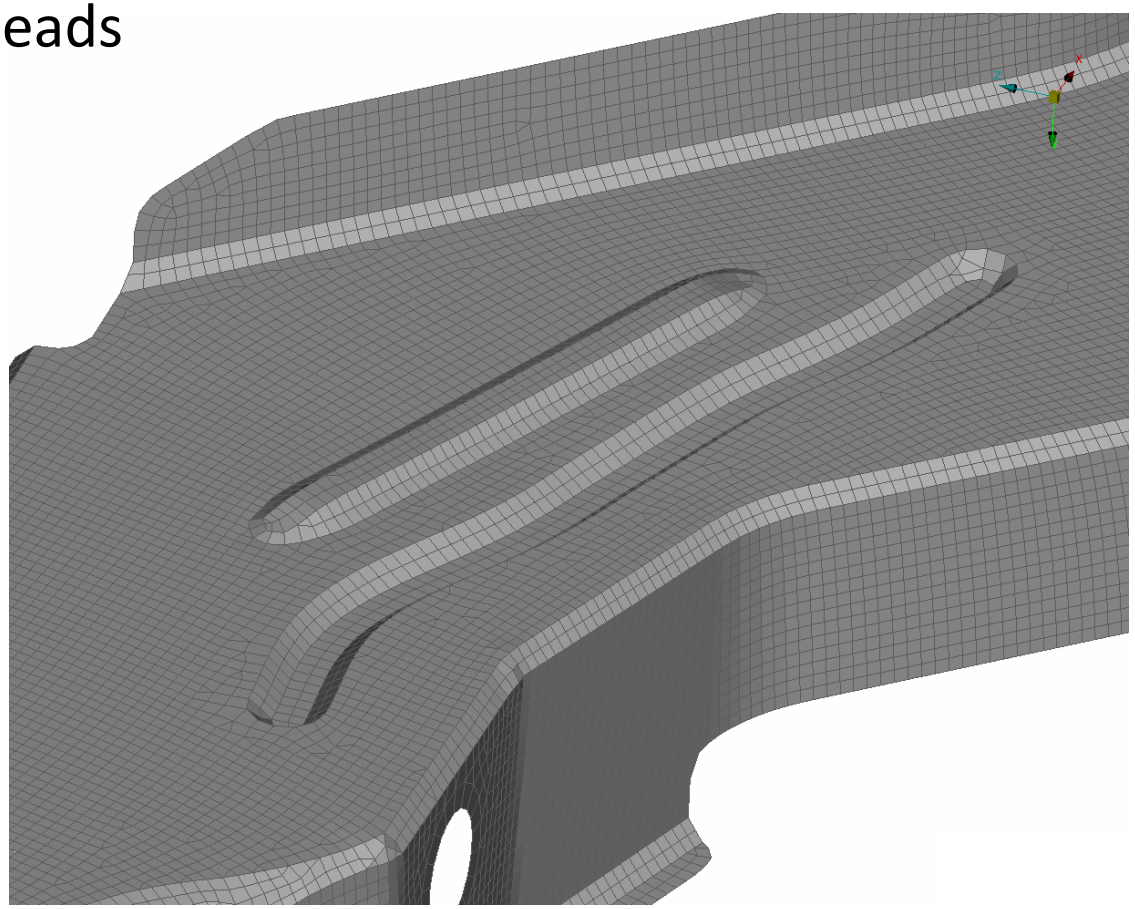


Direct Morphing

Generation & modification of beads and embosses

- Curved & Rounded Beads

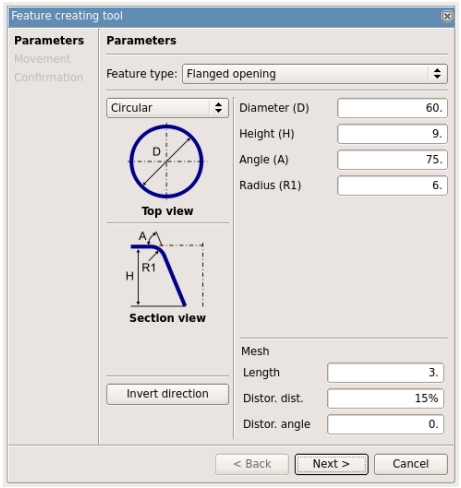


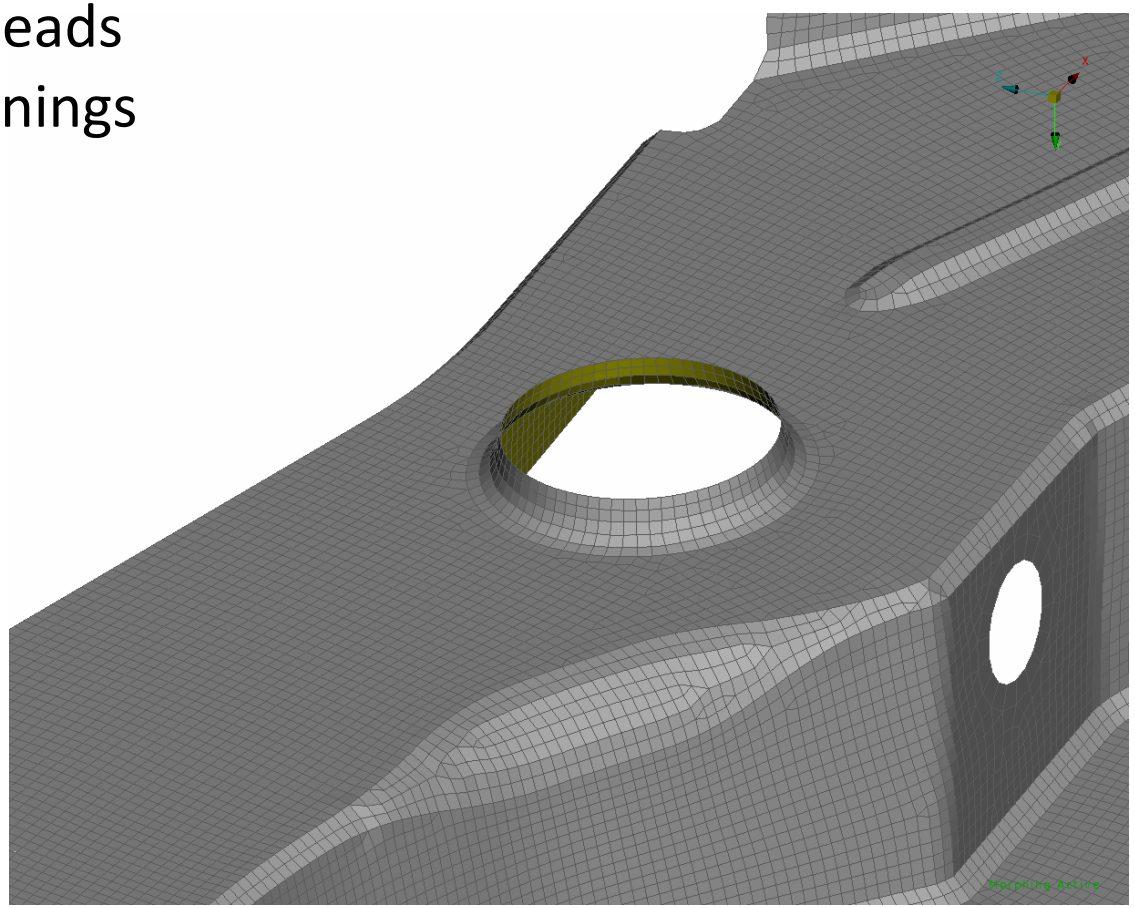


Direct Morphing

Generation & modification of beads and embosses

- Curved & Rounded Beads
- Circular Flanged Openings

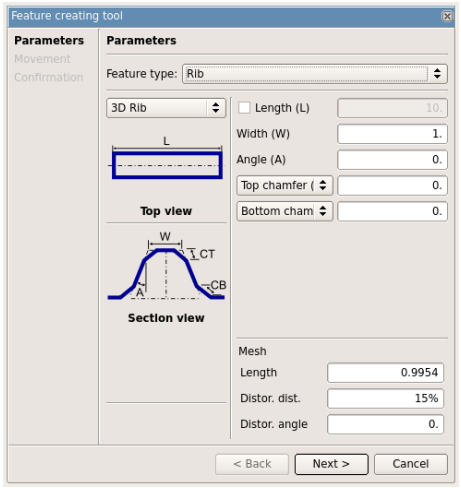


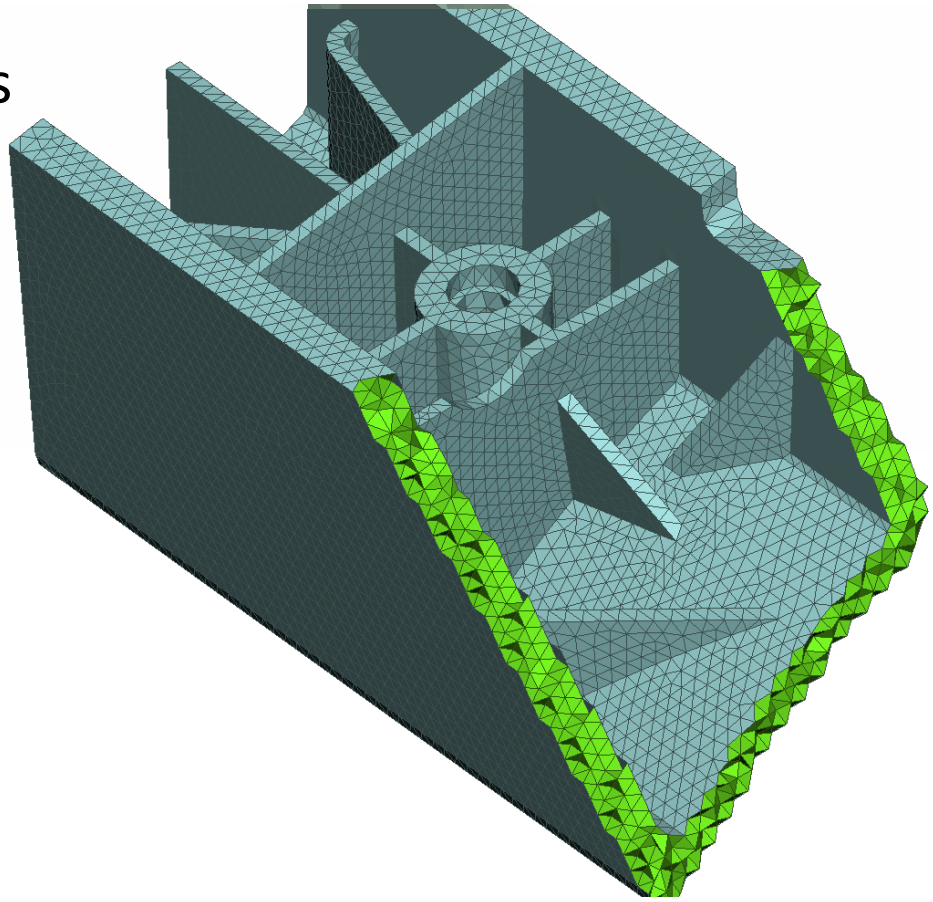


Direct Morphing

Generation & modification of beads and embosses

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

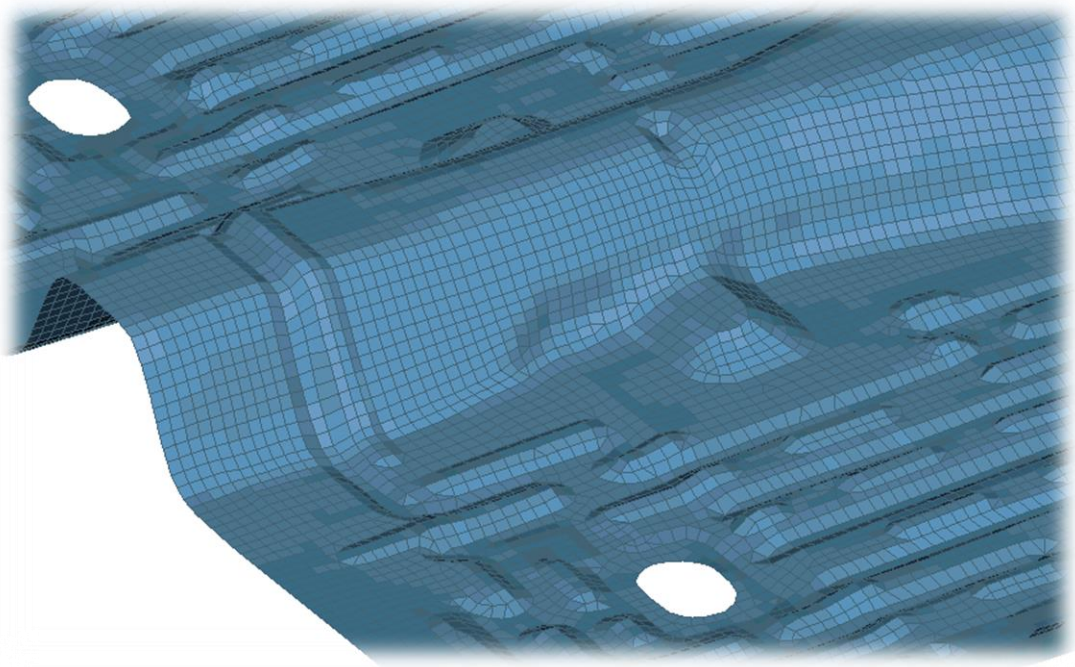




Direct Morphing

Slide Feature

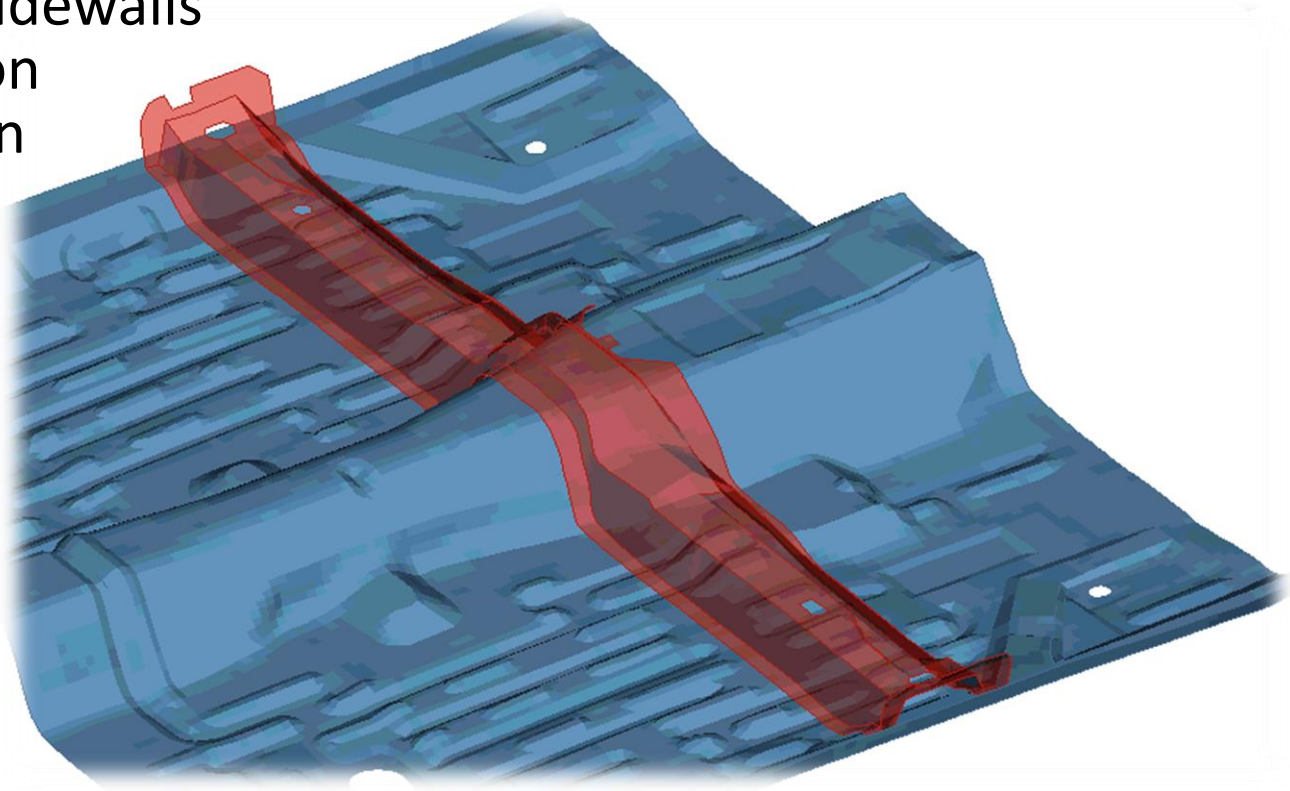
- Features of any shape (e.g. holes, beads, ribs) slide on underlying surface
- Mesh of origin and target areas is reconstructed
- Features are moved or copied



Direct Morphing

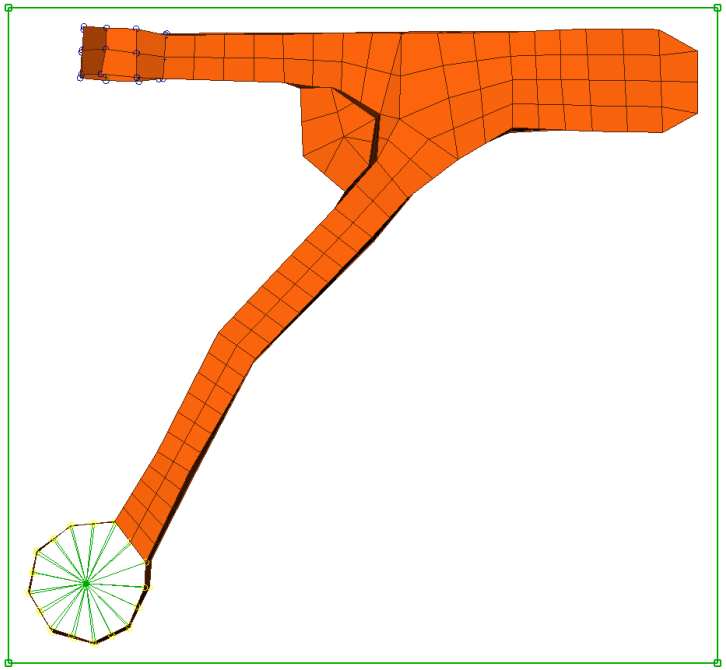
Slide Member

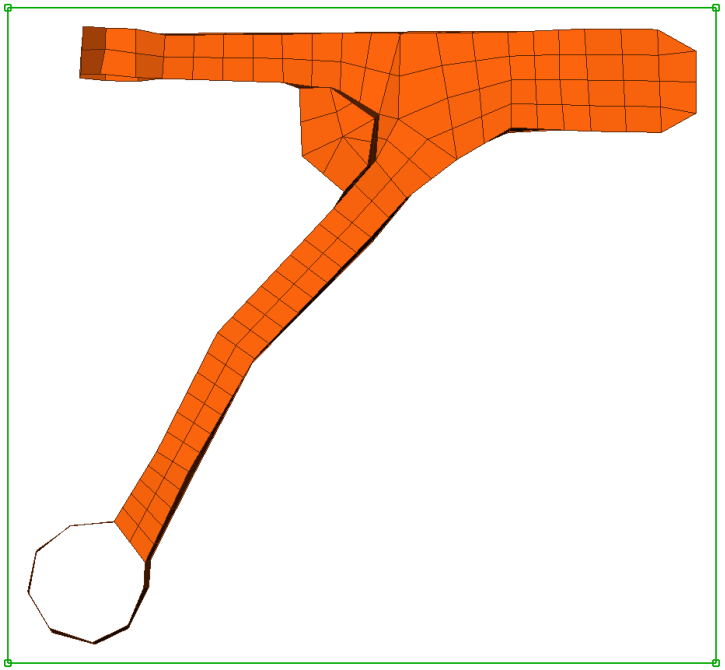
- Movement of members on their underlying surface
- Flanges and sidewalls are adapted on target position



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





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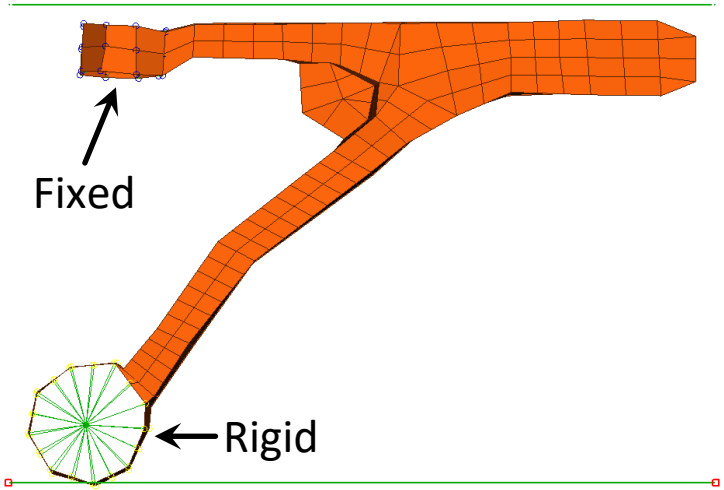
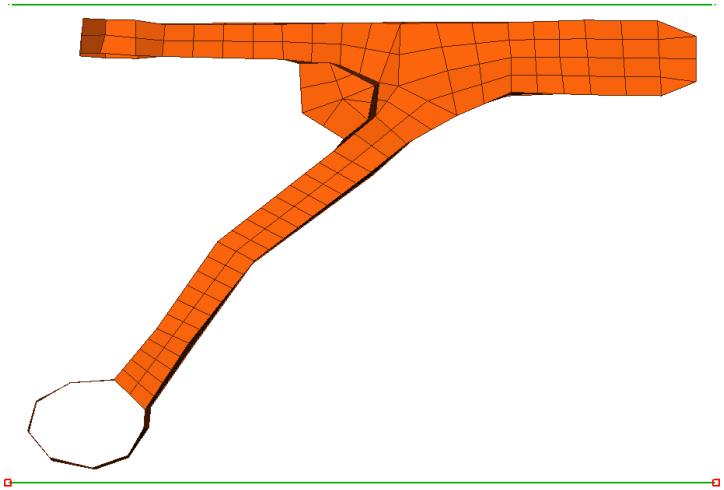


With Constraints



Without Constraints

Morphing Constraints

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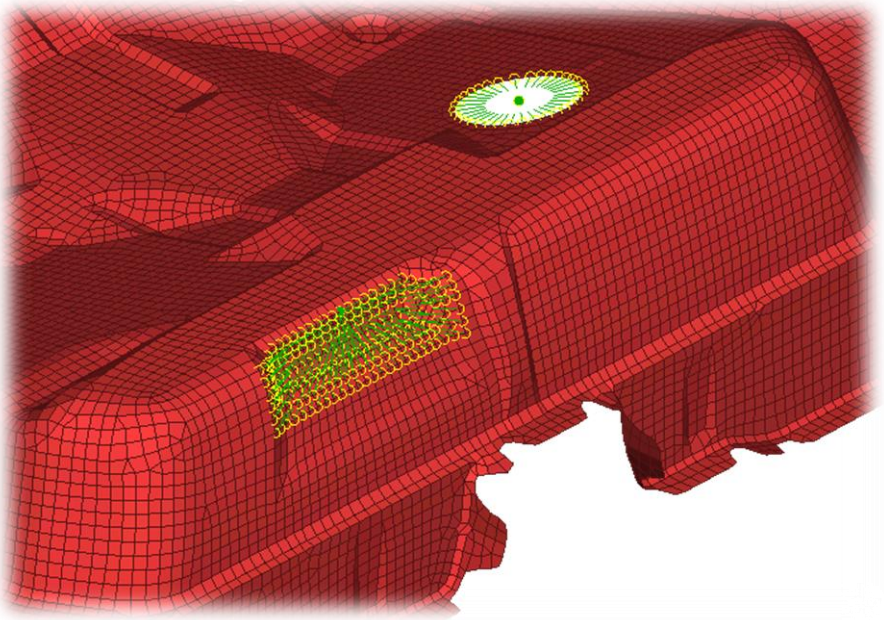

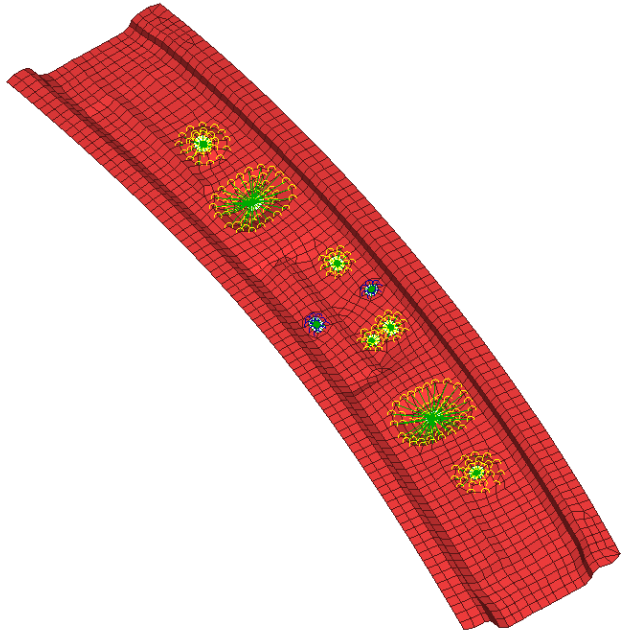

Record Morphing Actions

Deformation Parameter

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

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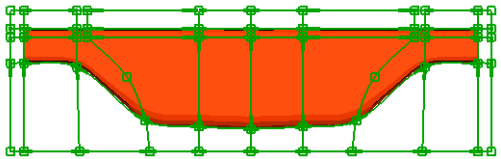

Initial shape – start recording

Record Morphing Actions

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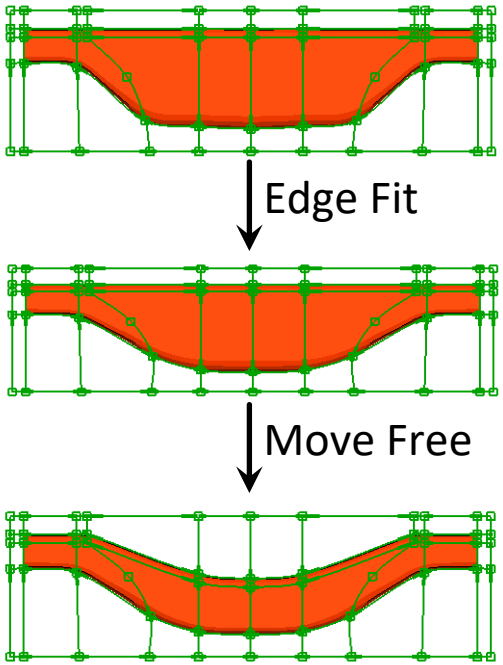

Initial shape – start recording

Deformed shape – stop recording

Record Morphing Actions

Deformation Parameter

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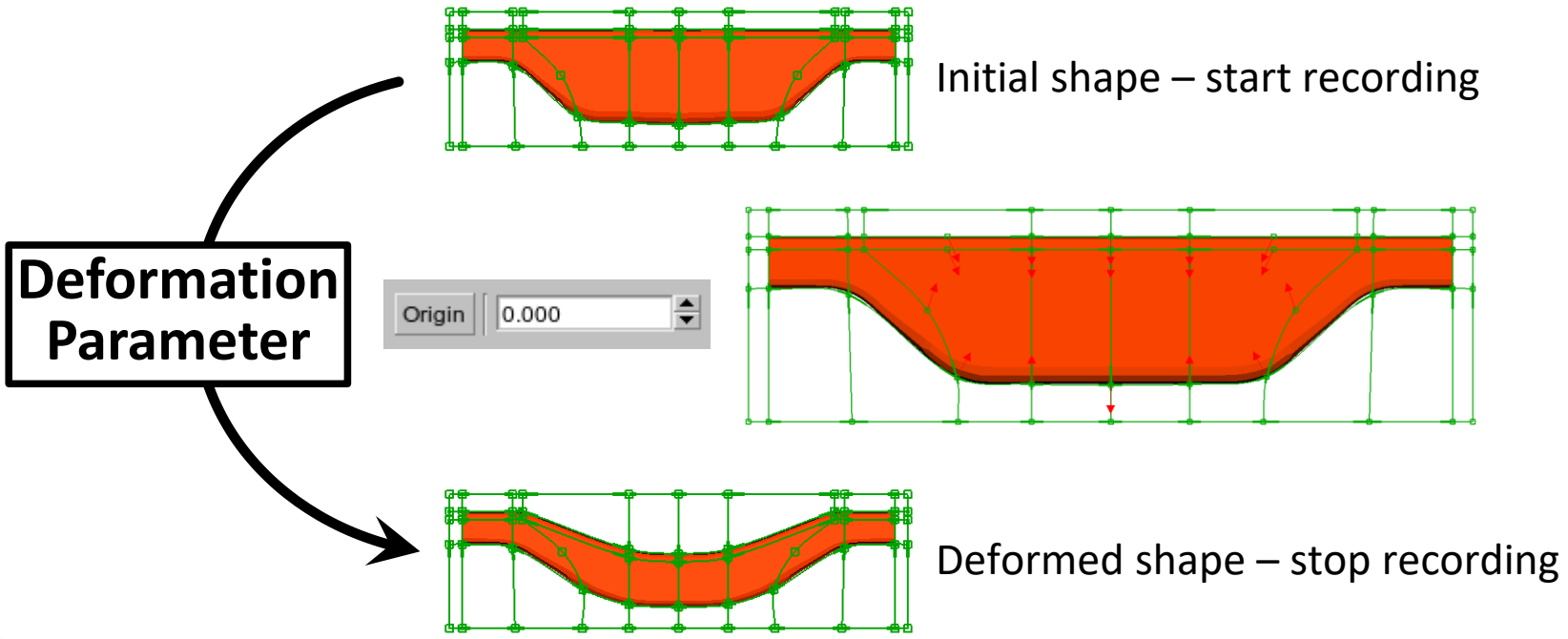

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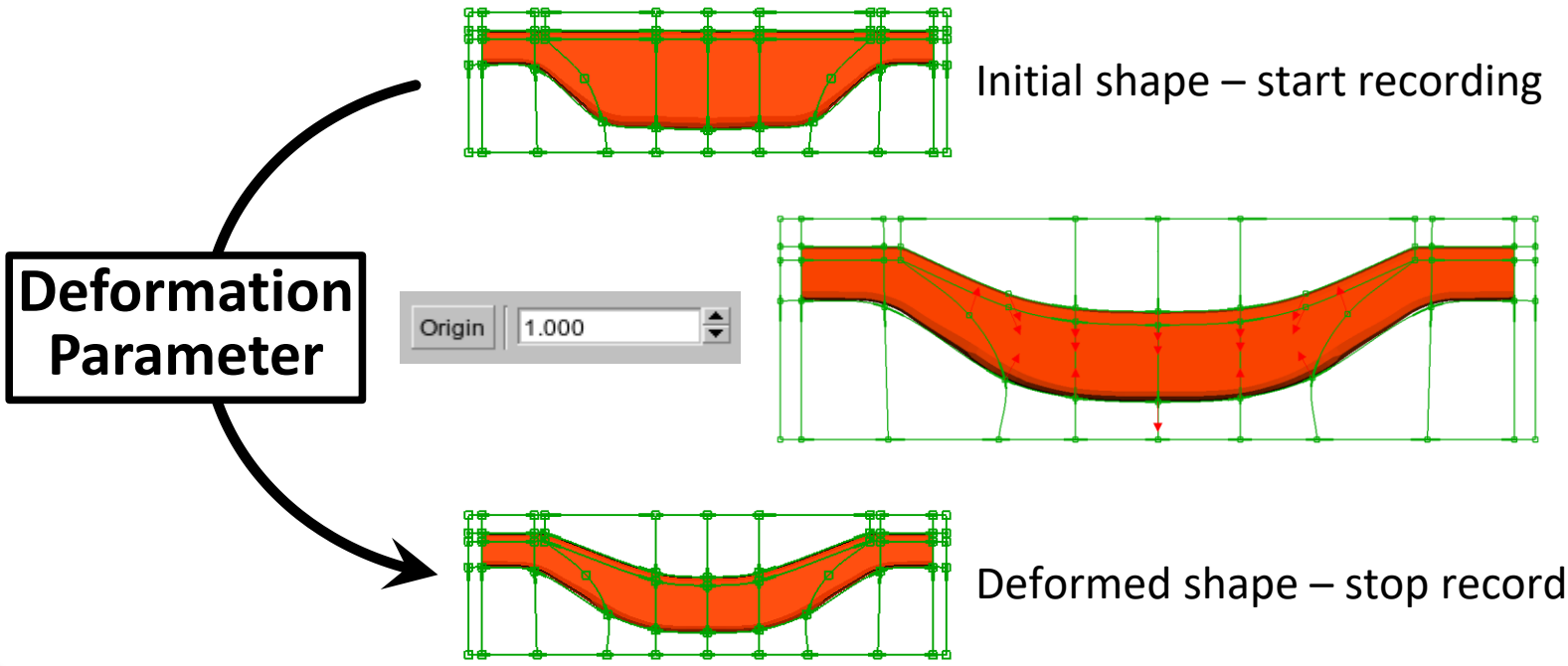
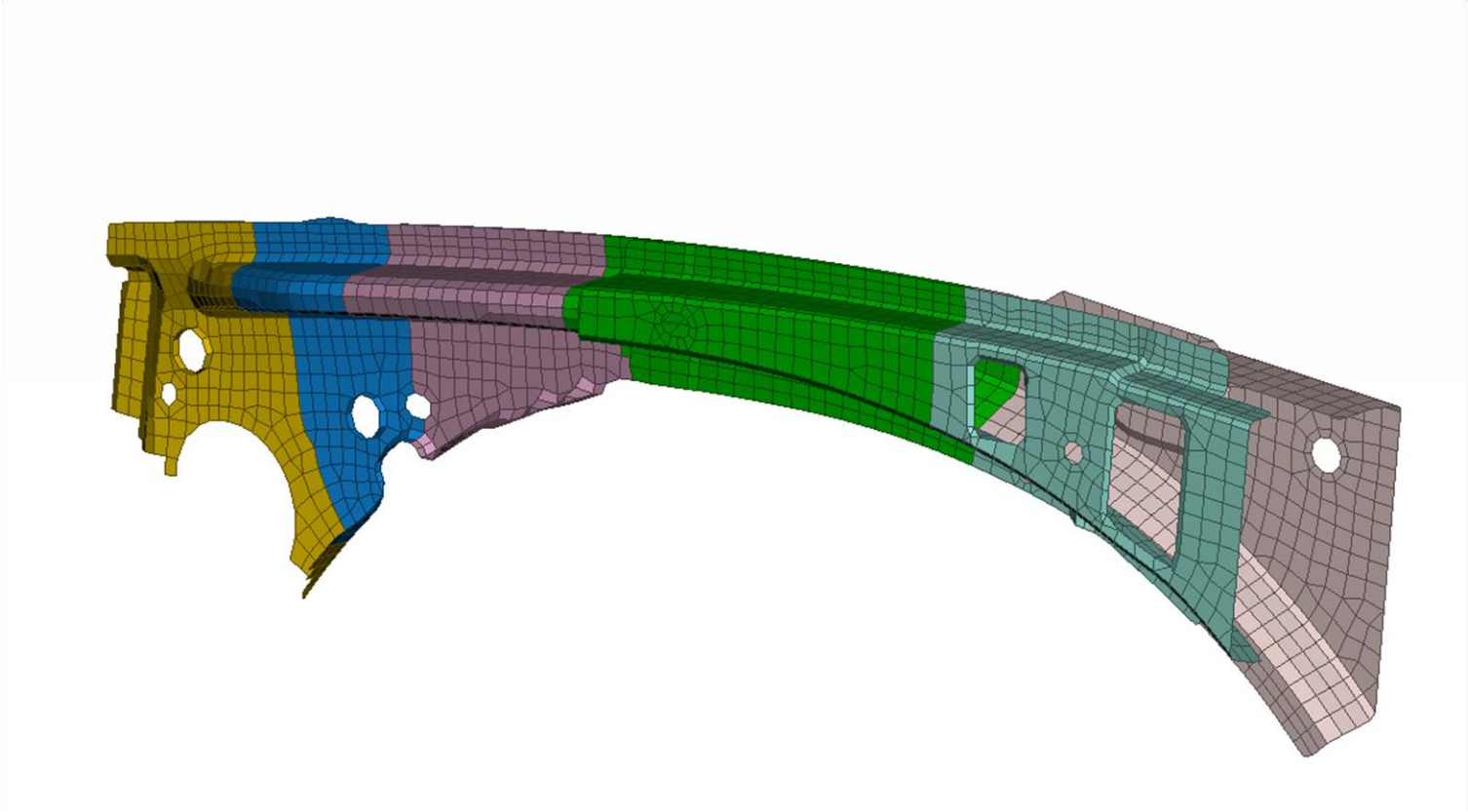


Taylor Welded Blanks Parameter

Parameterization and Optimization of Taylor Blanks



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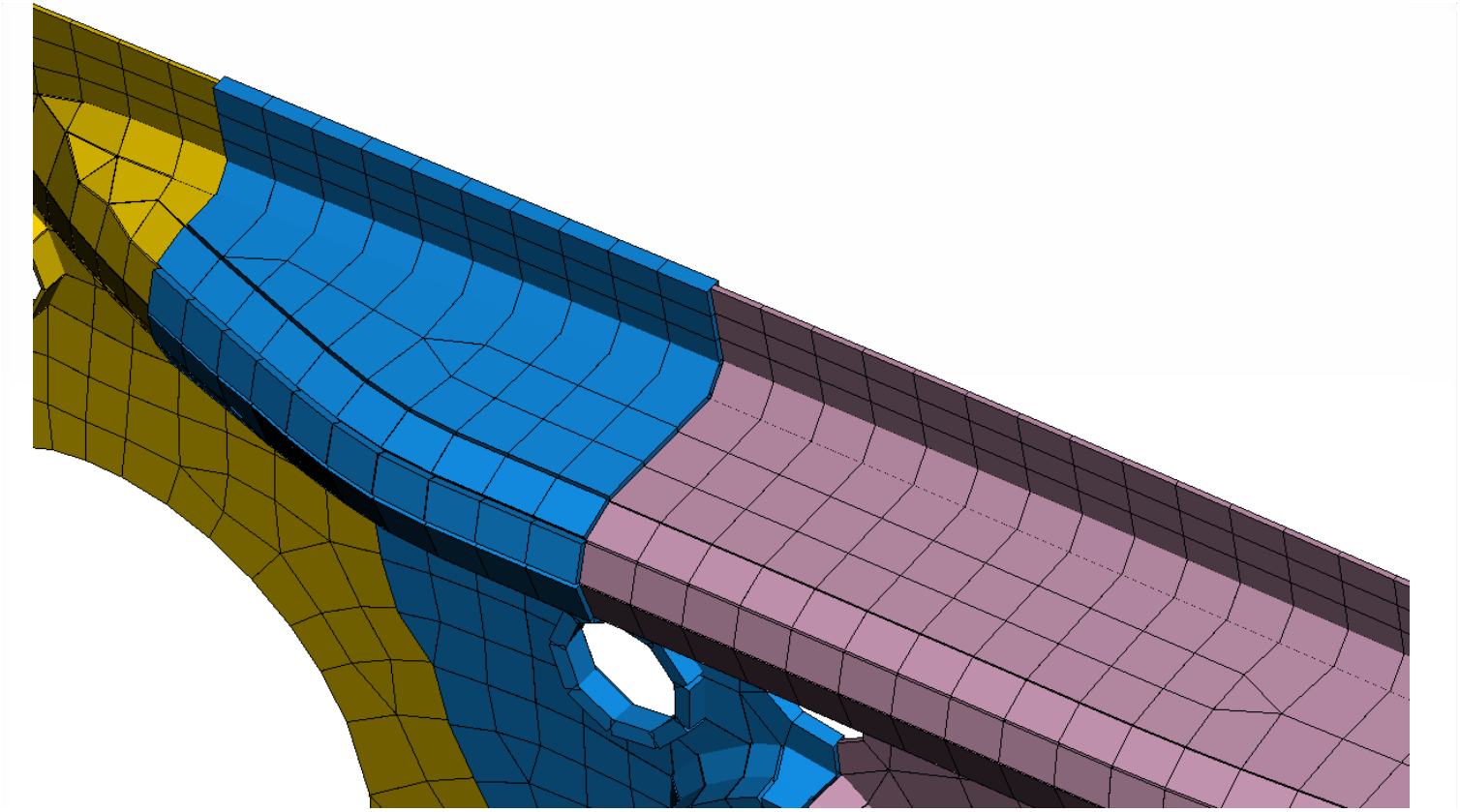

Mapping of Deformations

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

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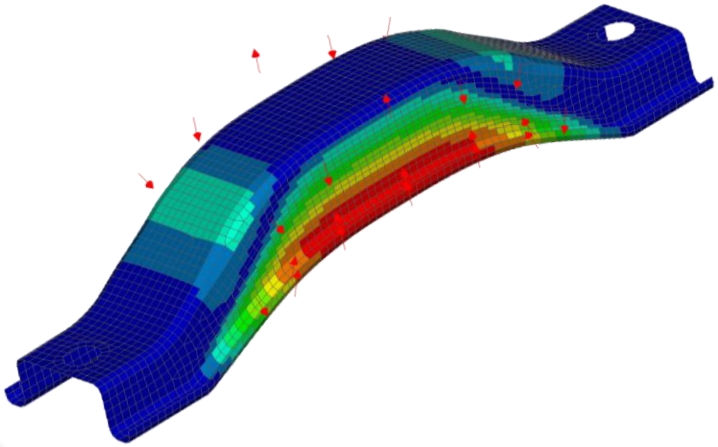

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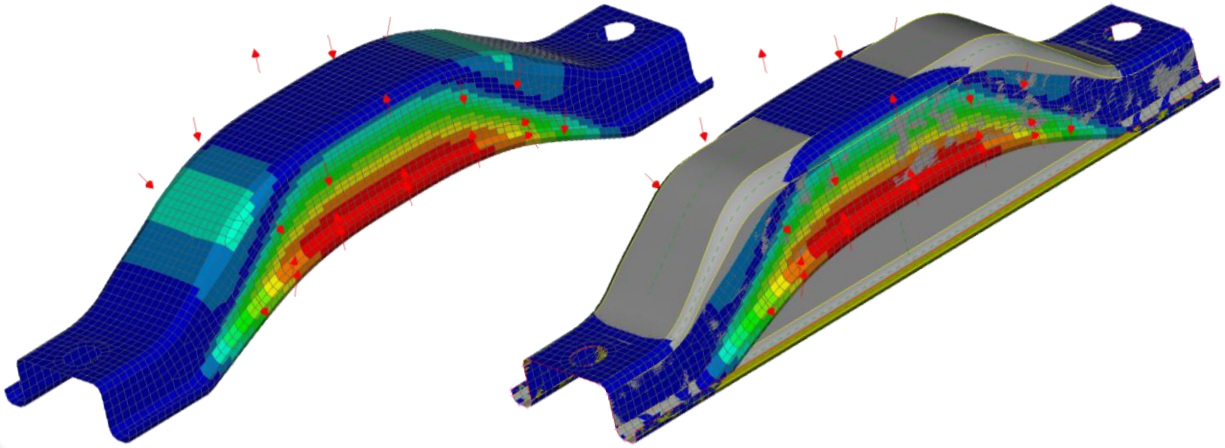

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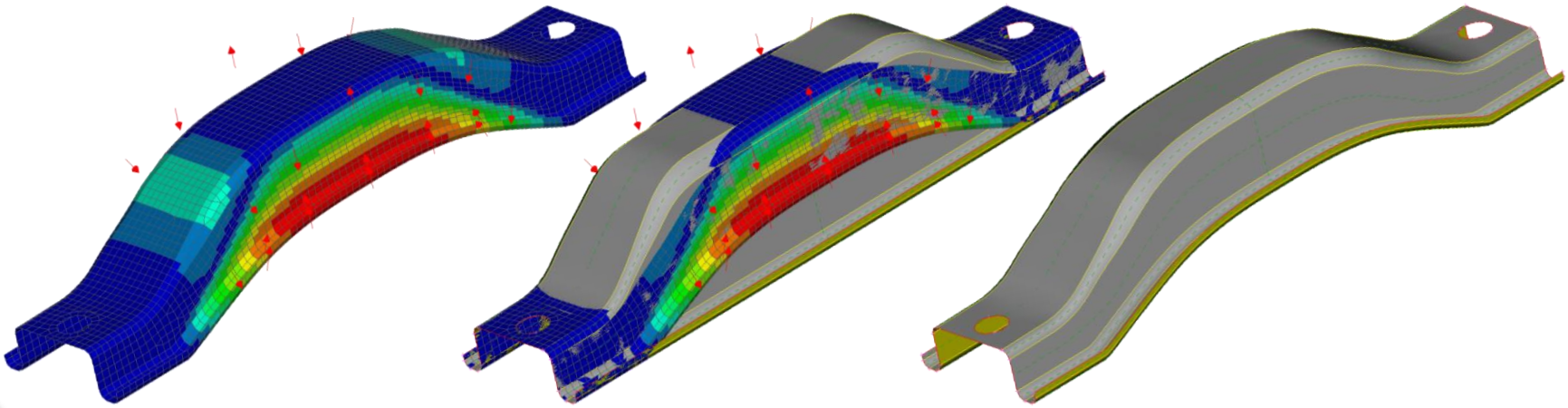
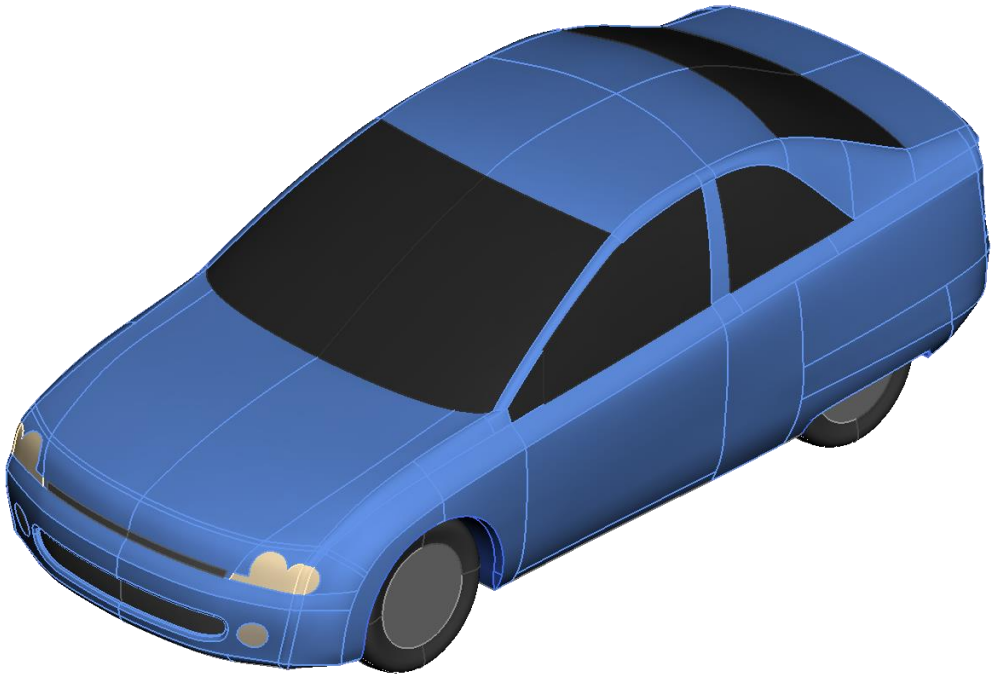
  - Text file
- E.g. Modify geometry according optimized FE-model



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



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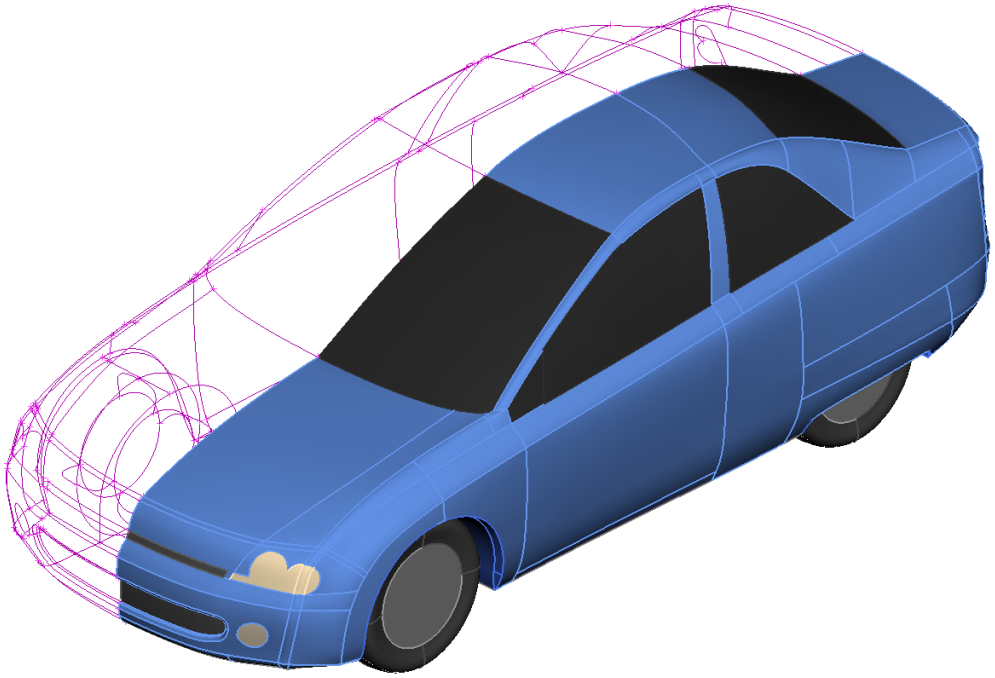
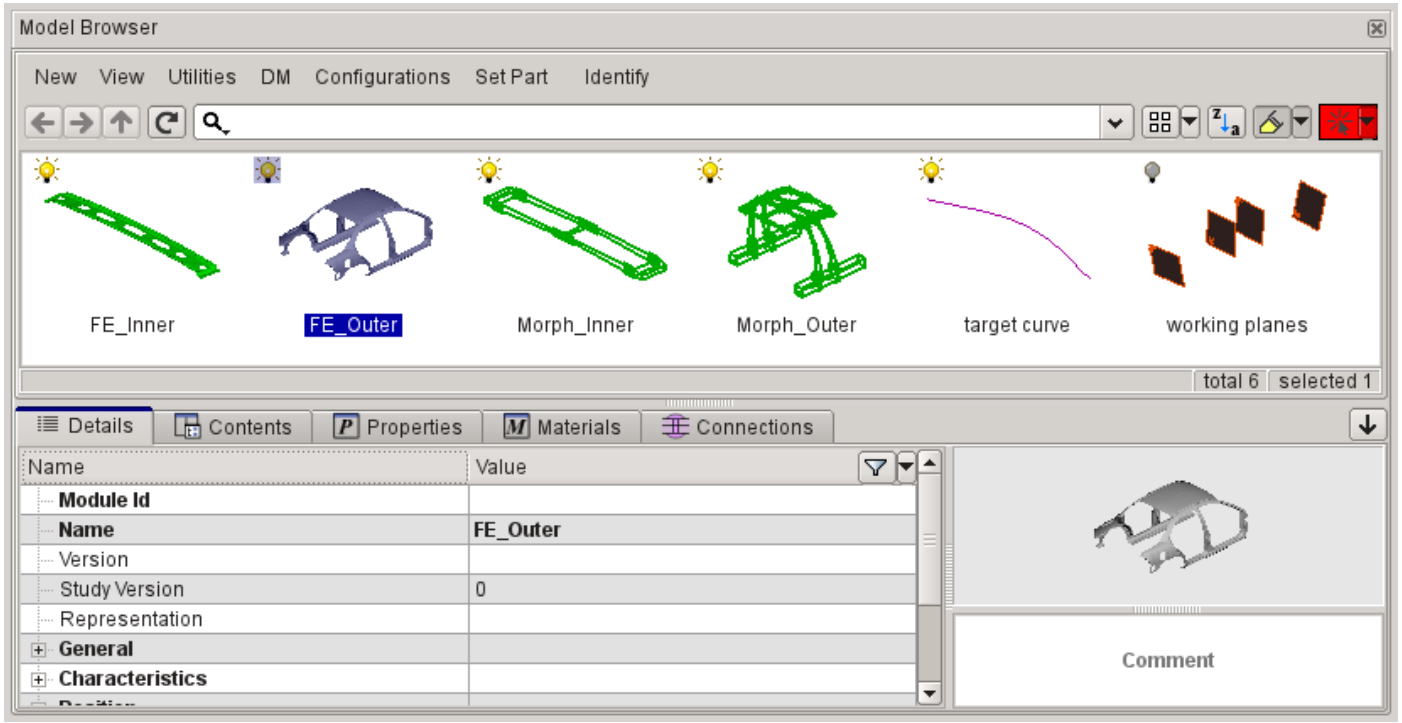


Functionalities assisting Morphing

Model Browser

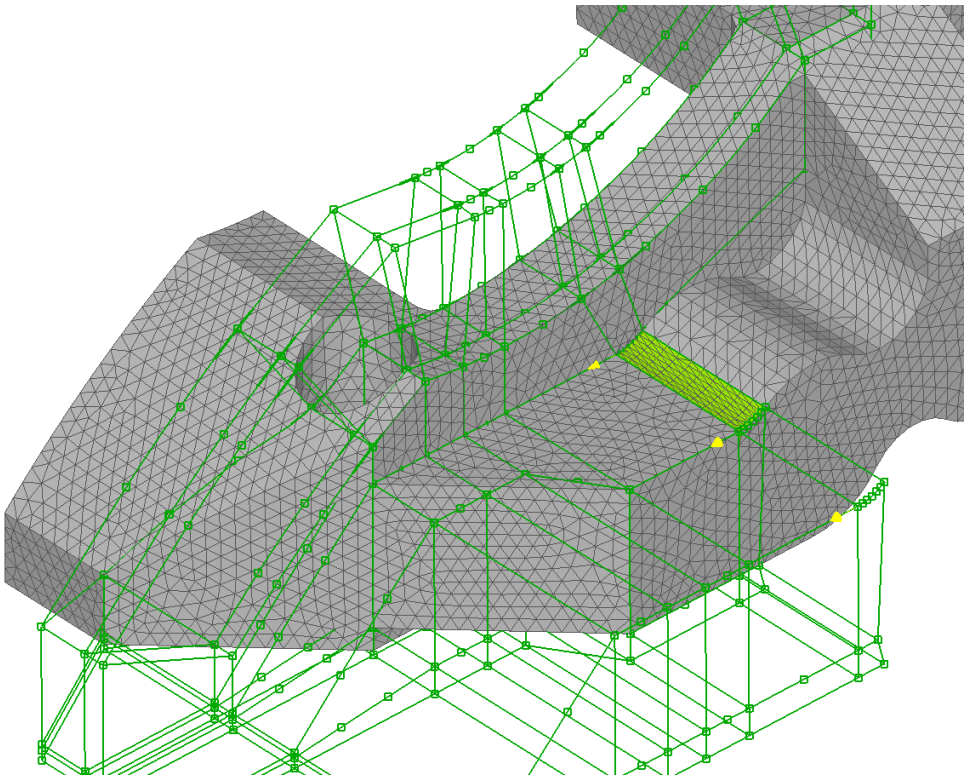
- Useful for Box Morphing (esp. complex configurations)
- To organize morph contents



Functionalities assisting Morphing

Reconstruct / Smooth morphed mesh

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



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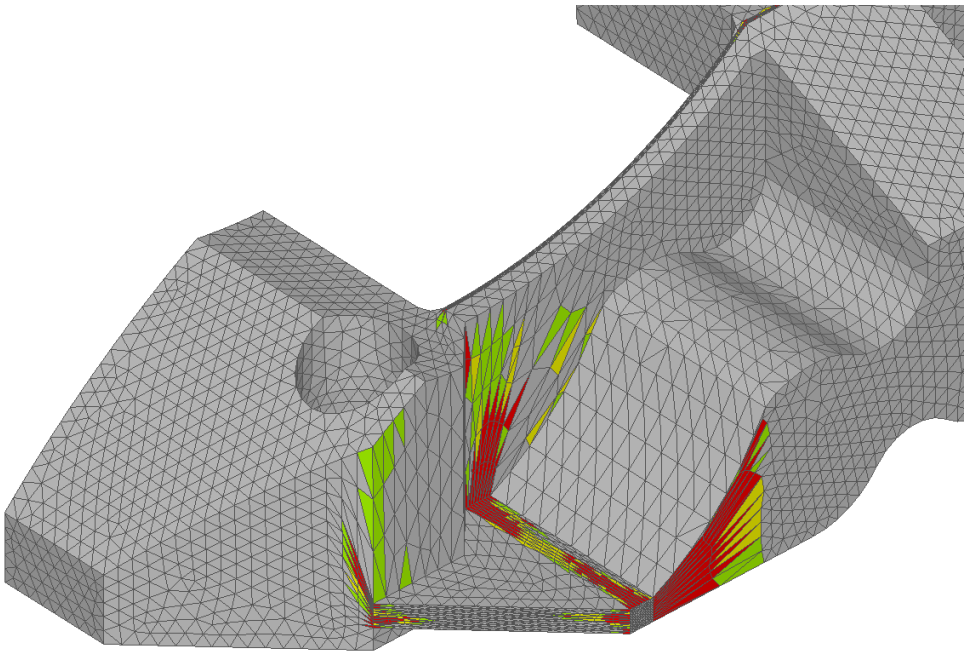

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Reconstruct / Smooth morphed mesh

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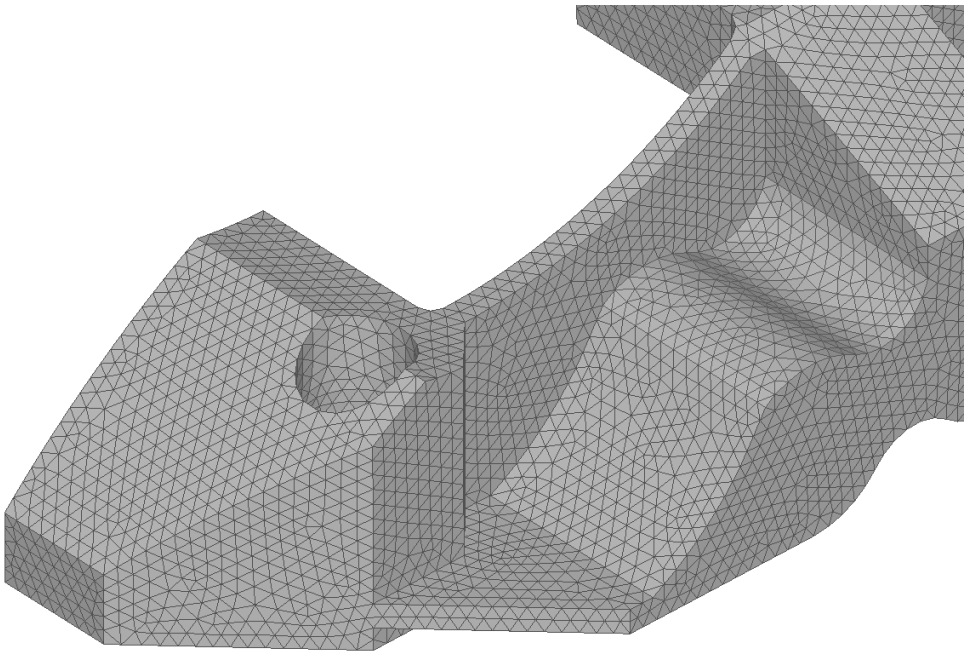
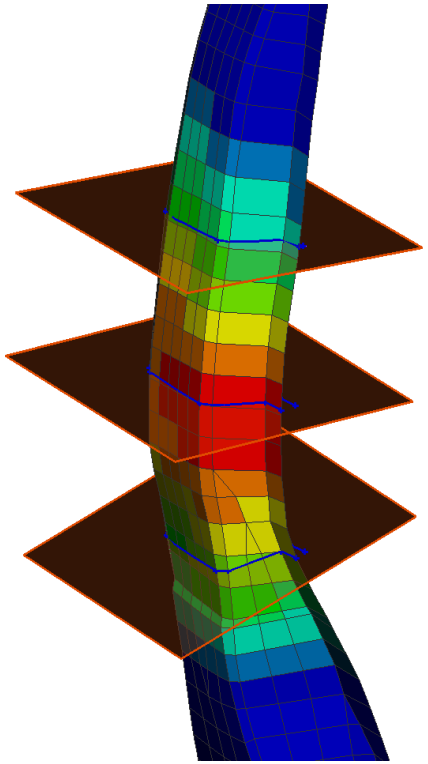


Functionalities assisting Morphing

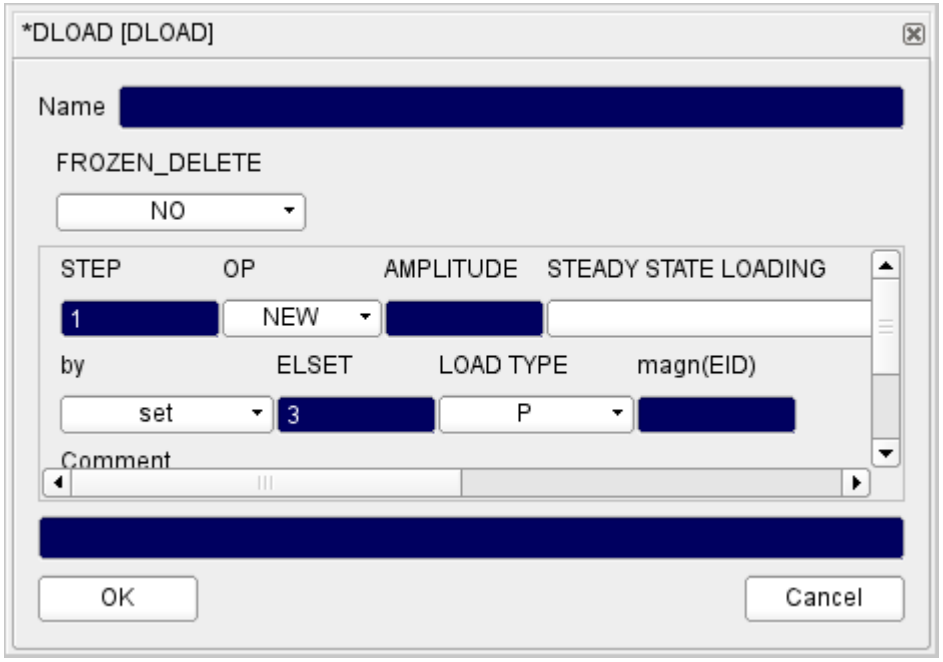
Visualize Morphing Deviations

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



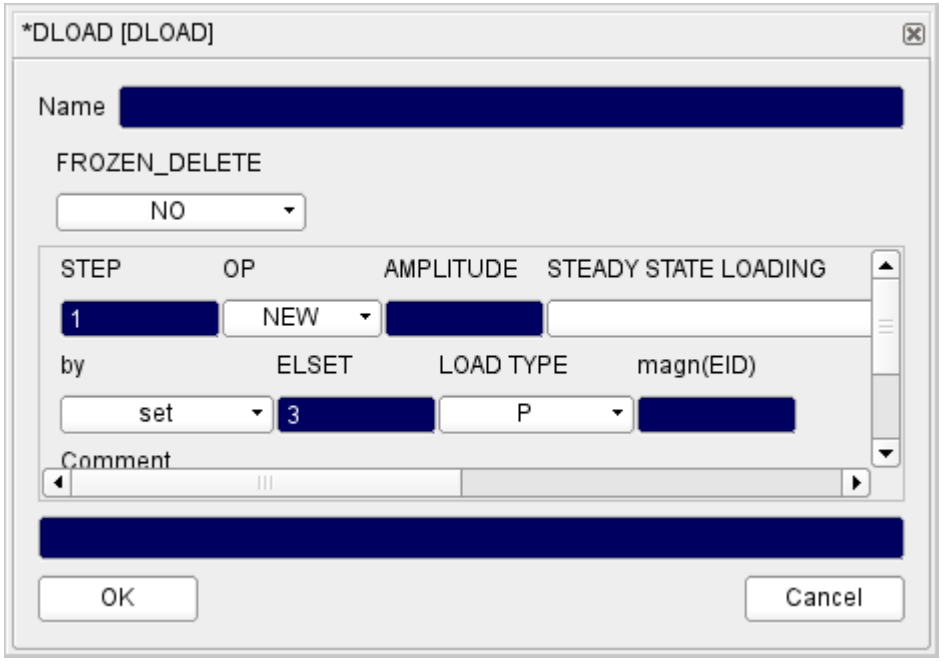
ANSA Parameter

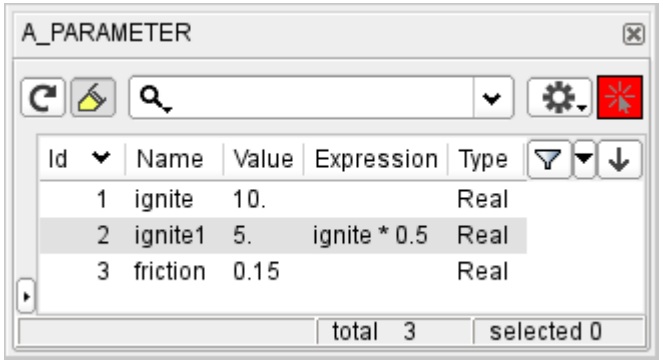
- For parameterization of solver card entries



ANSA Parameter

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





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- For parameterization of solver card entries
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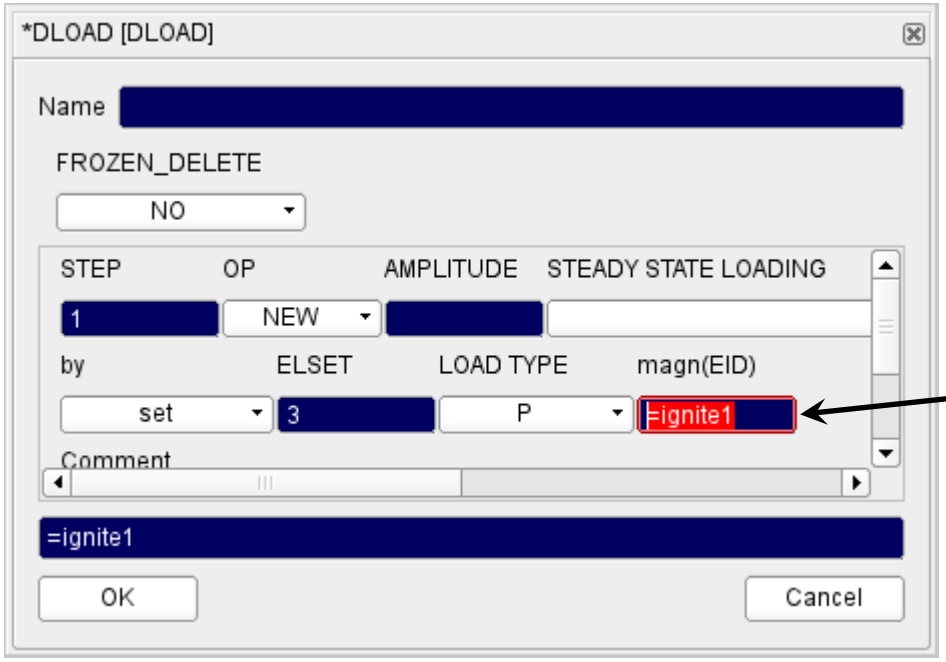
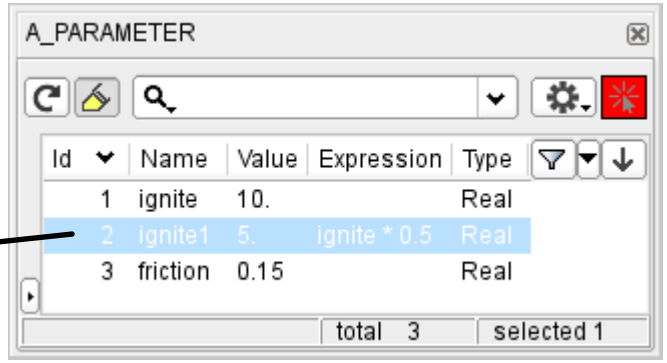
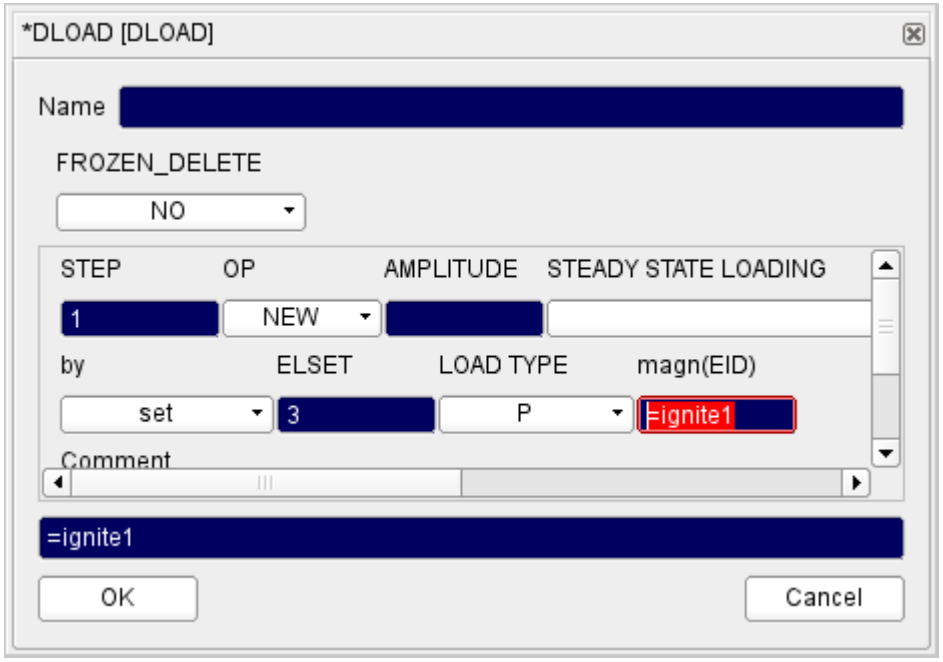
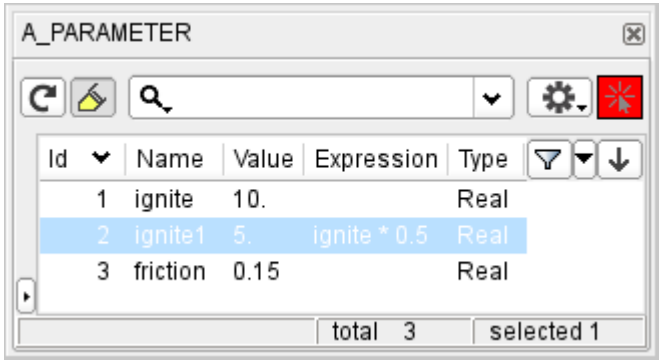




ANSA Parameter

- 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
**
**
*DSLOAD, OP=NEW
  S_zkd_zuenden_zy6,   P, <ignite1>
  S_brennraum_zy6,   P, <ignite>
```

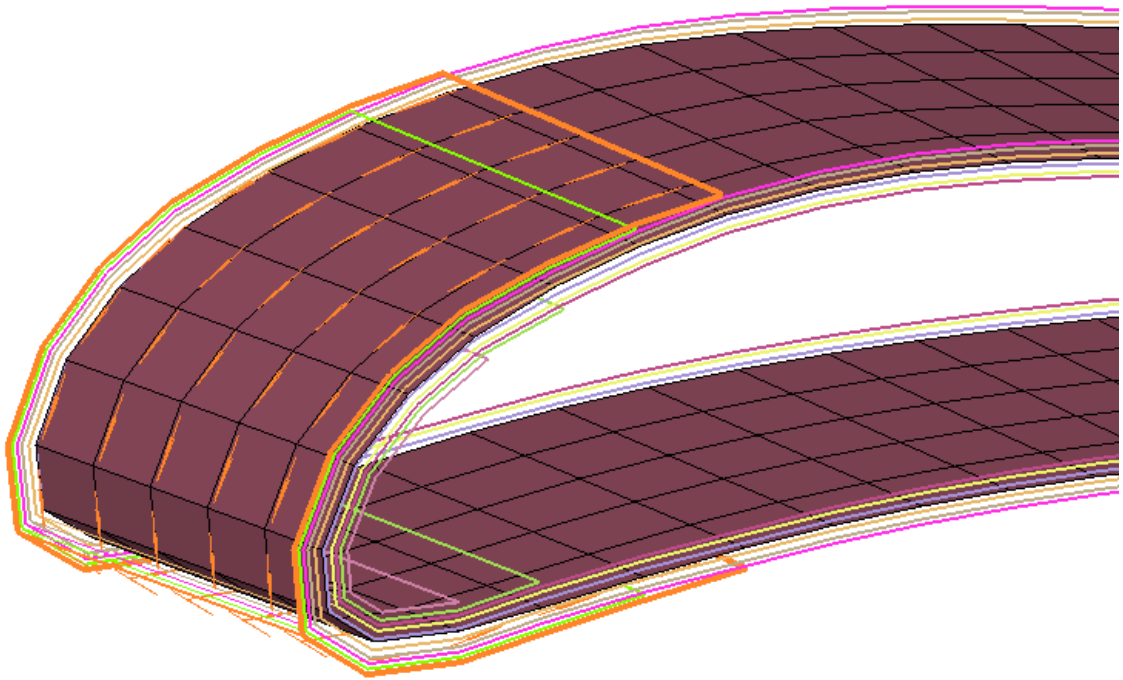
ANSA Parameter

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

Layers

PID	Z0	NSM	S
1			

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.	



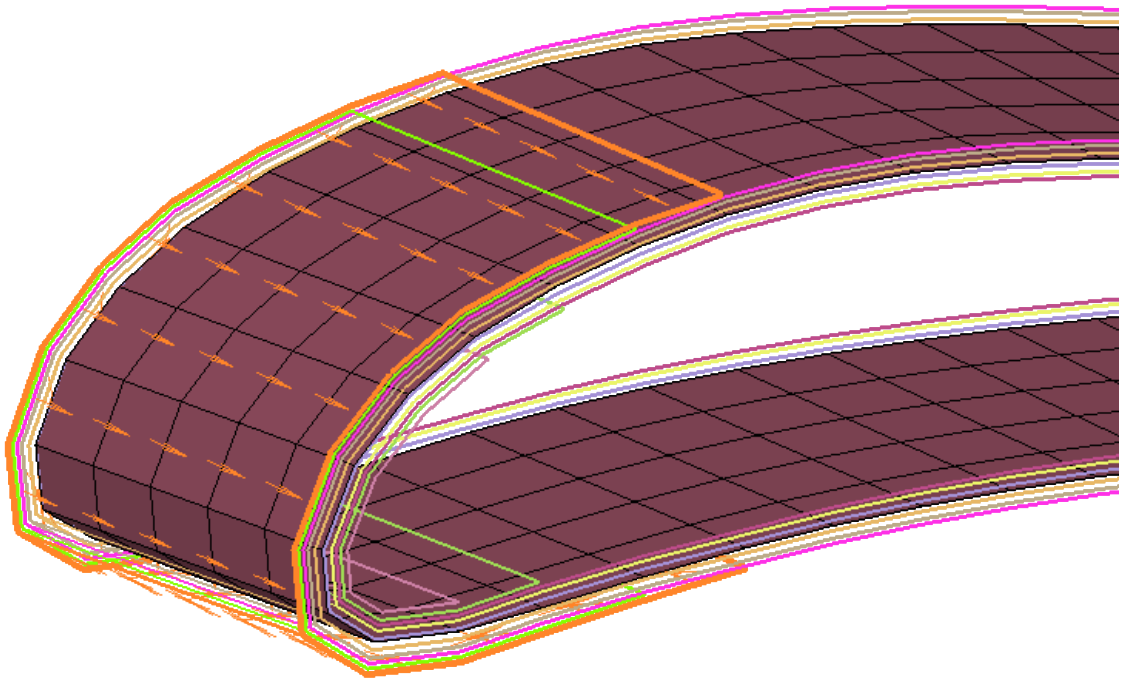
ANSA Parameter

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

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.	



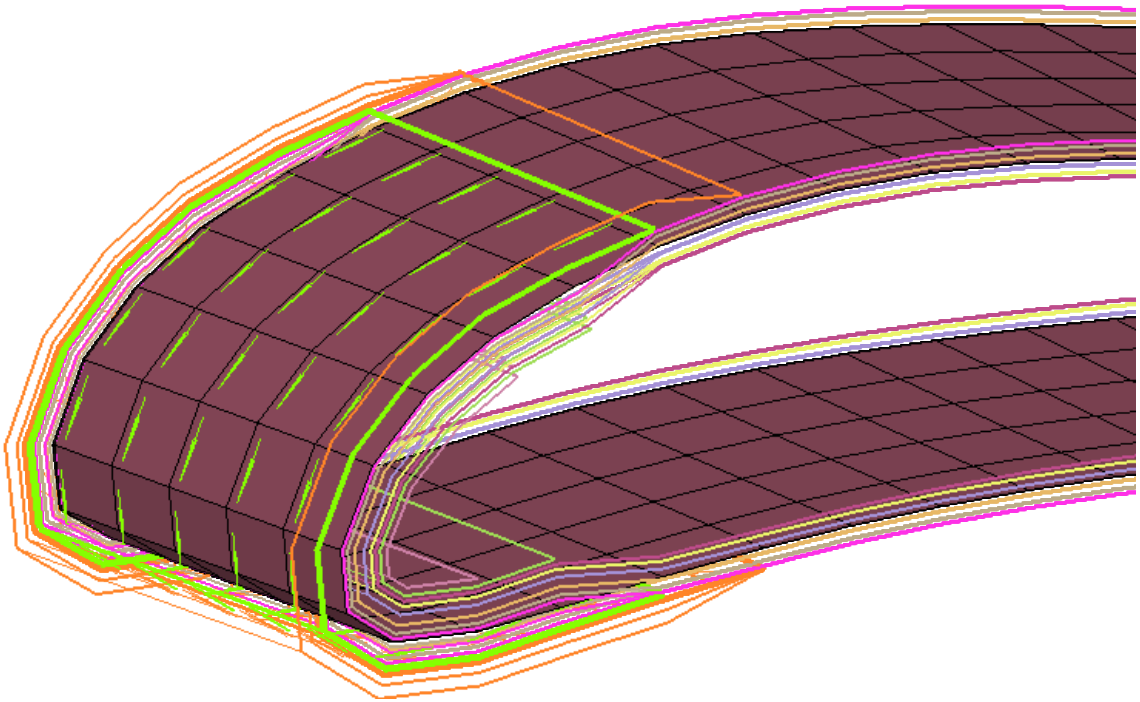
ANSA Parameter

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

Layers

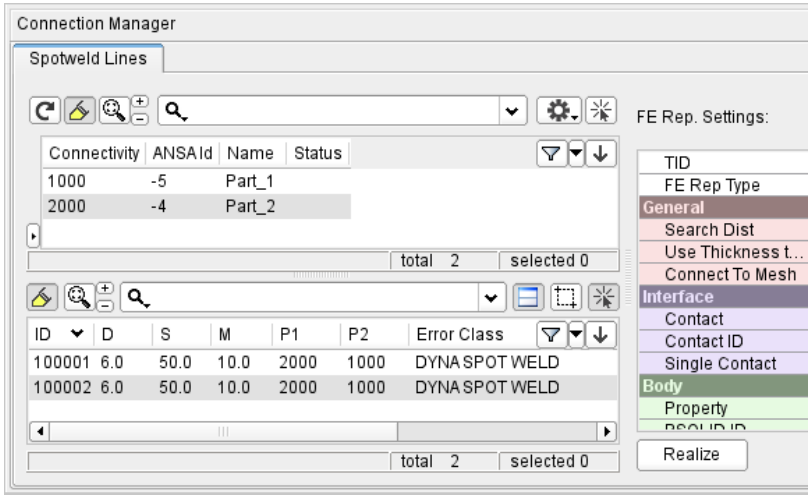
PID	Z0	NSM	S
1			

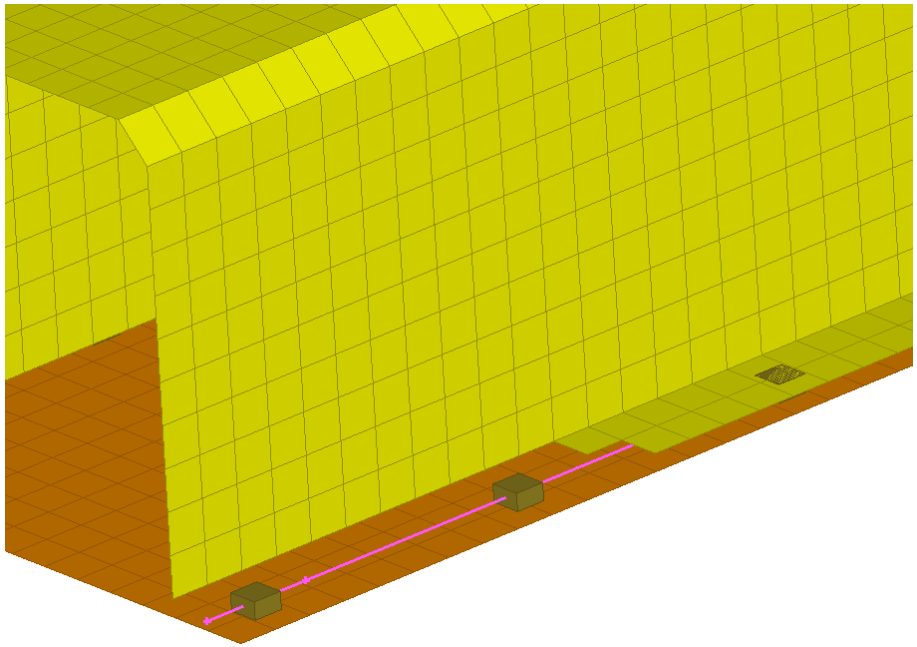
A/A	Type	T	THETA	m
1	Sequence			
1	Layer	0.2	90.	
2	Layer	0.1	-45.	
3	Layer	0.1	45.	
4	Layer	0.2	0.	
5	Layer	0.2	0.	
6	Layer	0.1	45.	
7	Layer	0.1	-45.	
8	Layer	0.2	90.	



ANSA Parameter

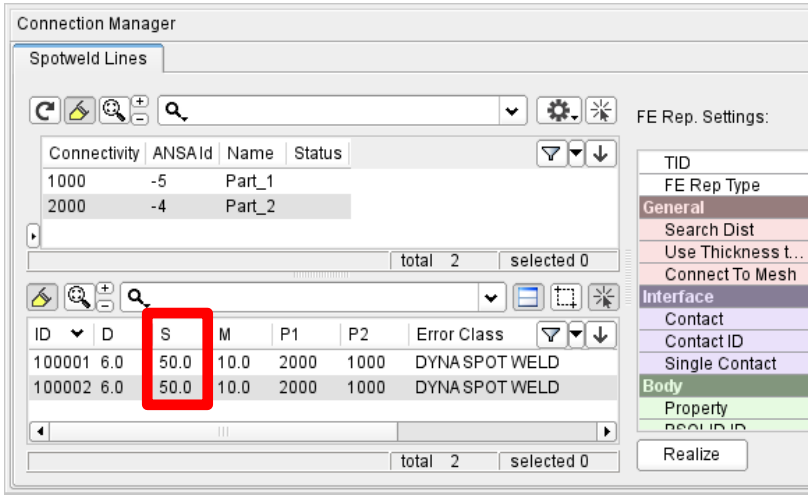
- For parameterization of connection properties, e.g.:

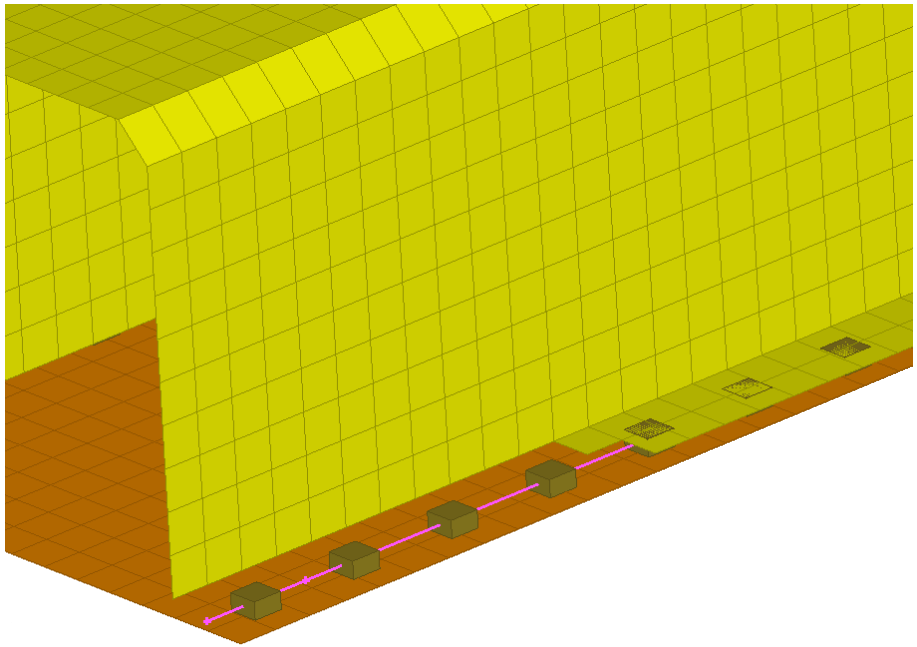




ANSA Parameter

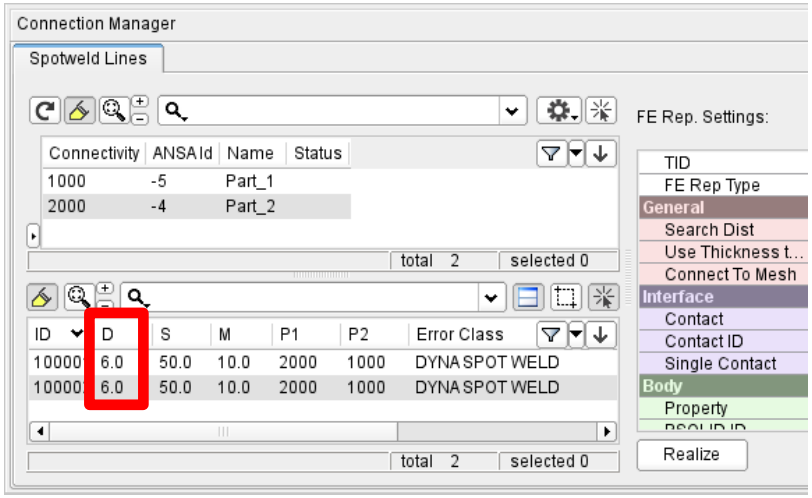
- For parameterization of connection properties, e.g.:
  - distance between weld spots

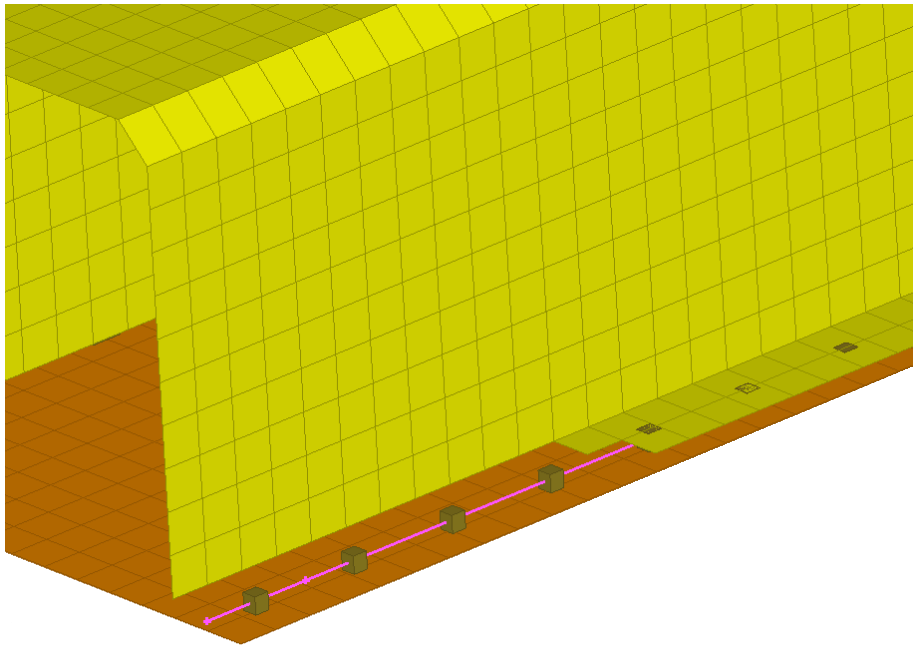




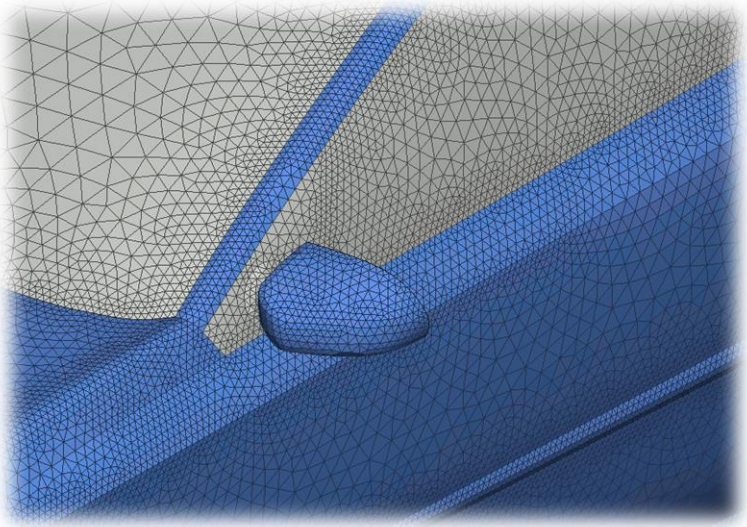
ANSA Parameter

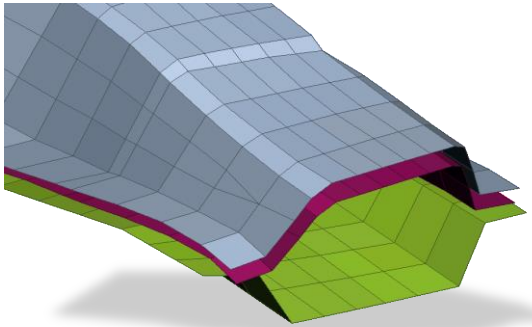
- For parameterization of connection properties, e.g.:
  - distance between weld spots
  - diameter of weld spots

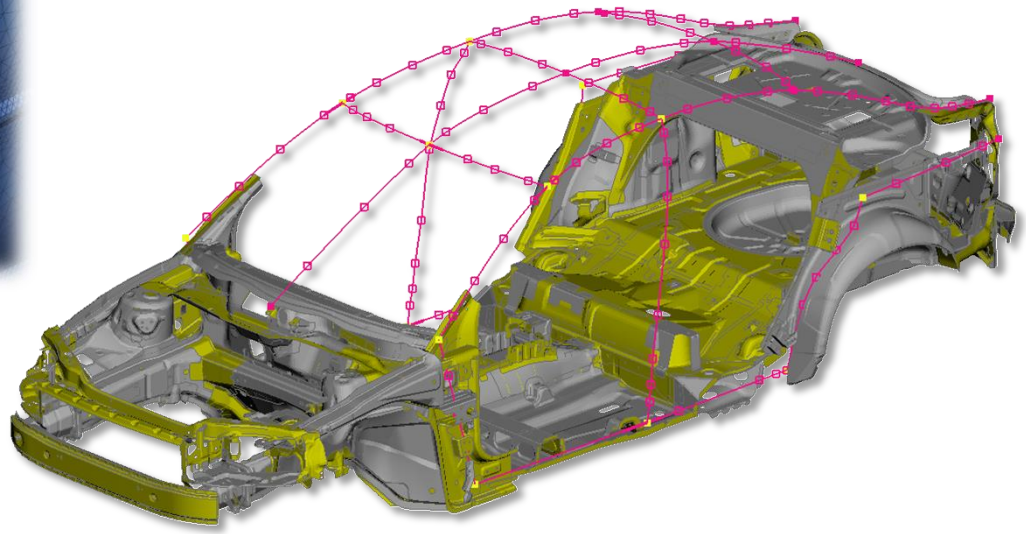




Ευχαριστώ πολύ







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