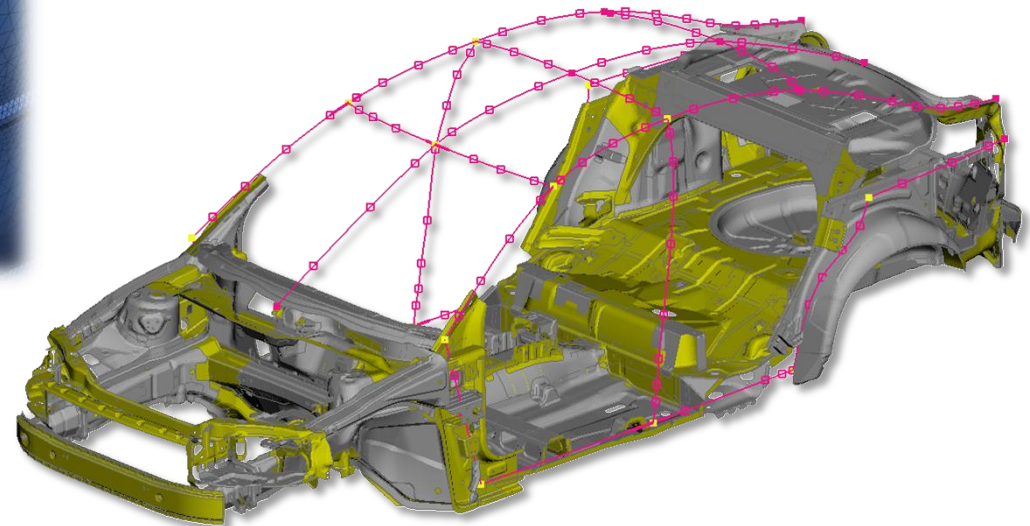
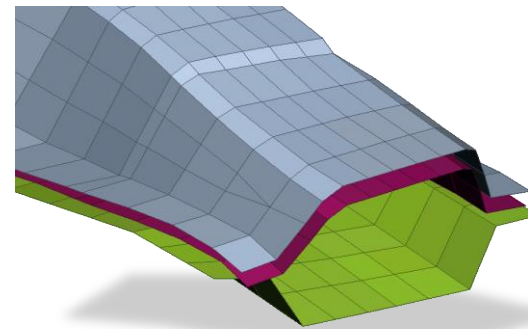
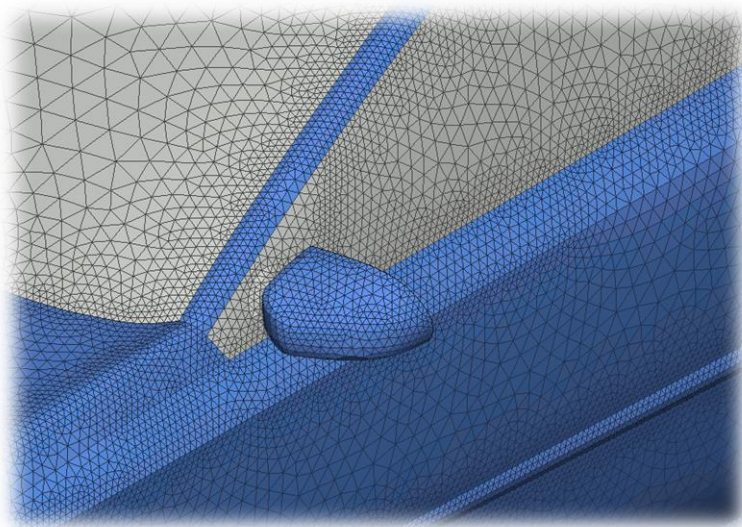


# Model Parameterization in ANSA

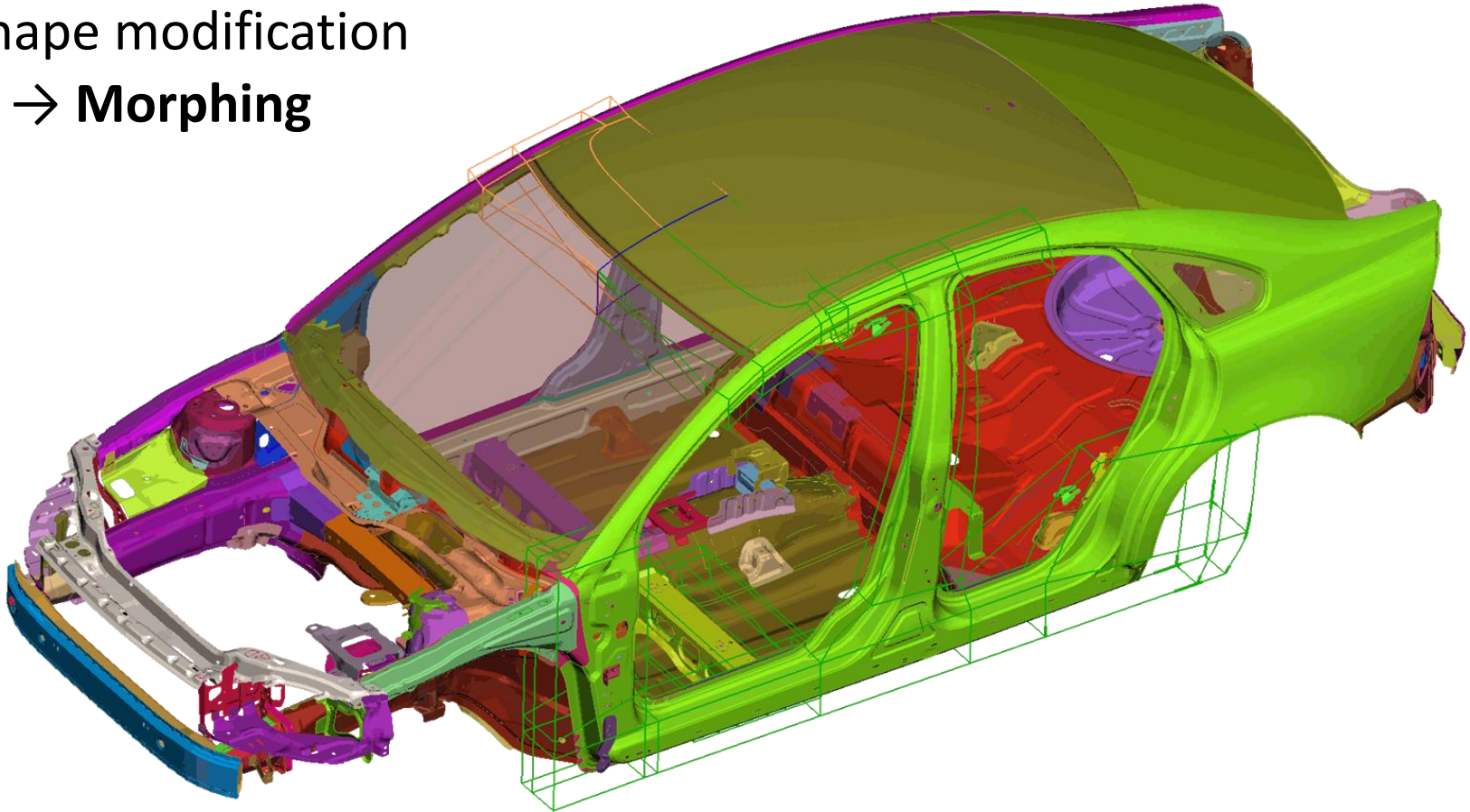


Dirk Dreißig  
Mail: [ansa@lasso.de](mailto:ansa@lasso.de)

# Types of Parameterization

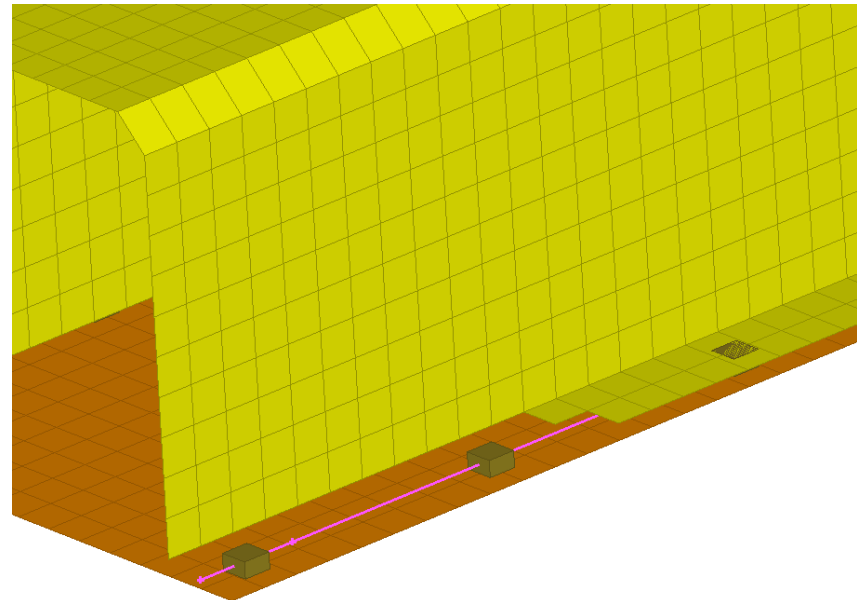
## Types of Parameterization

- Shape modification  
→ **Morphing**



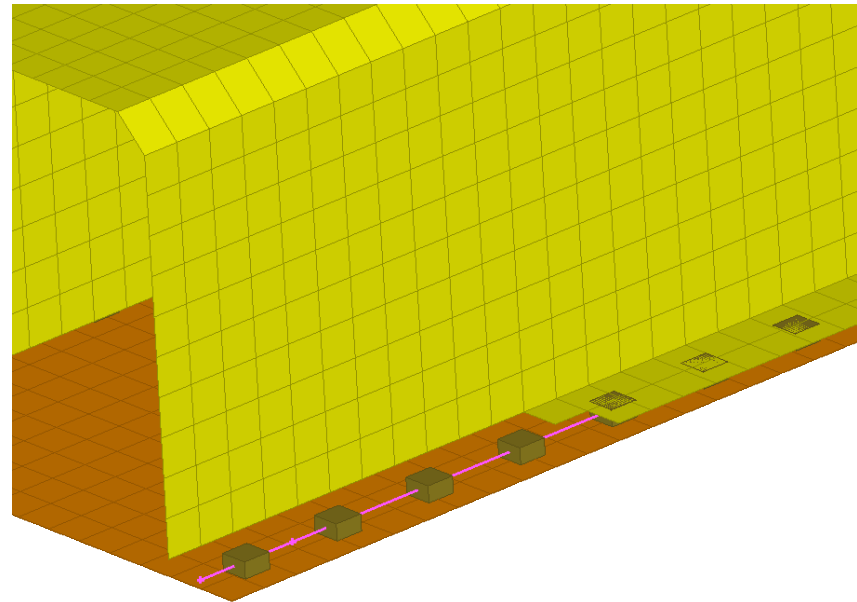
# Types of Parameterization

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



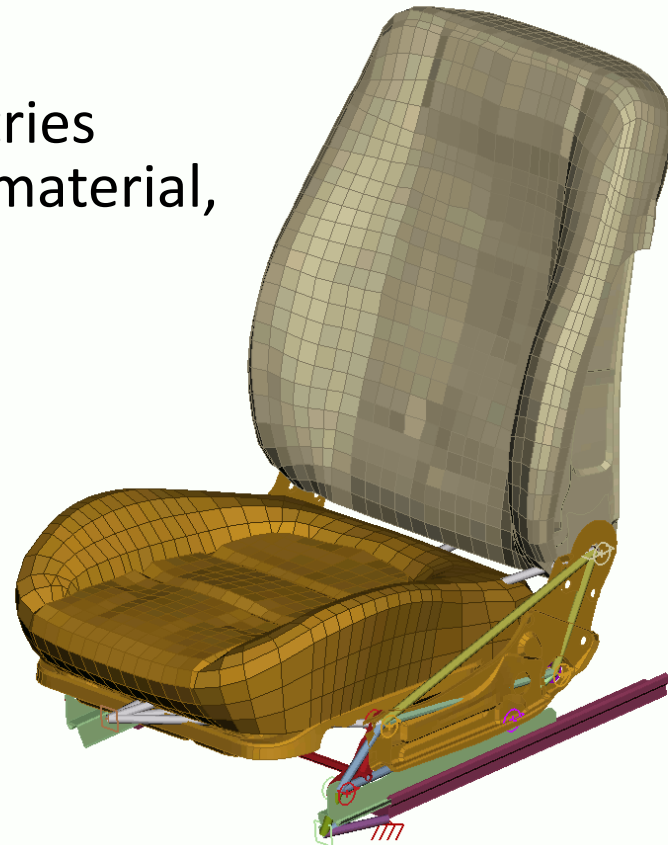
# Types of Parameterization

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



# Types of Parameterization

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



# Morphing

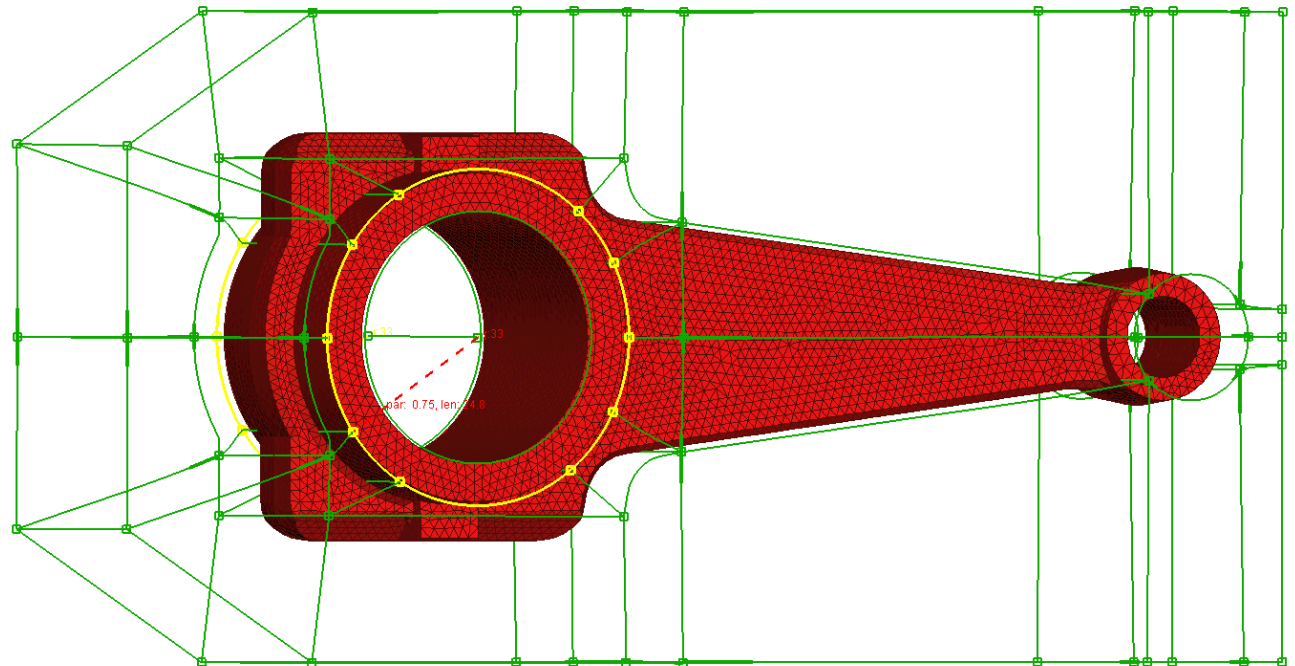
# Morphing

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



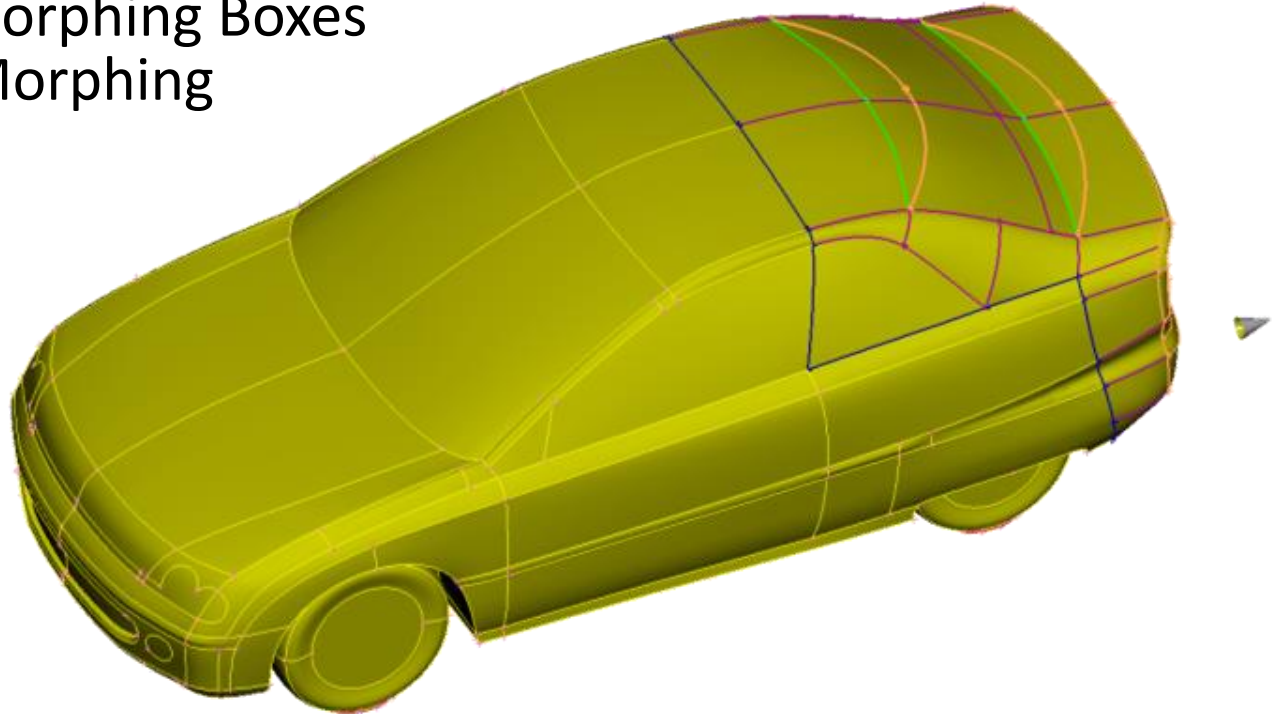
# Morphing

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



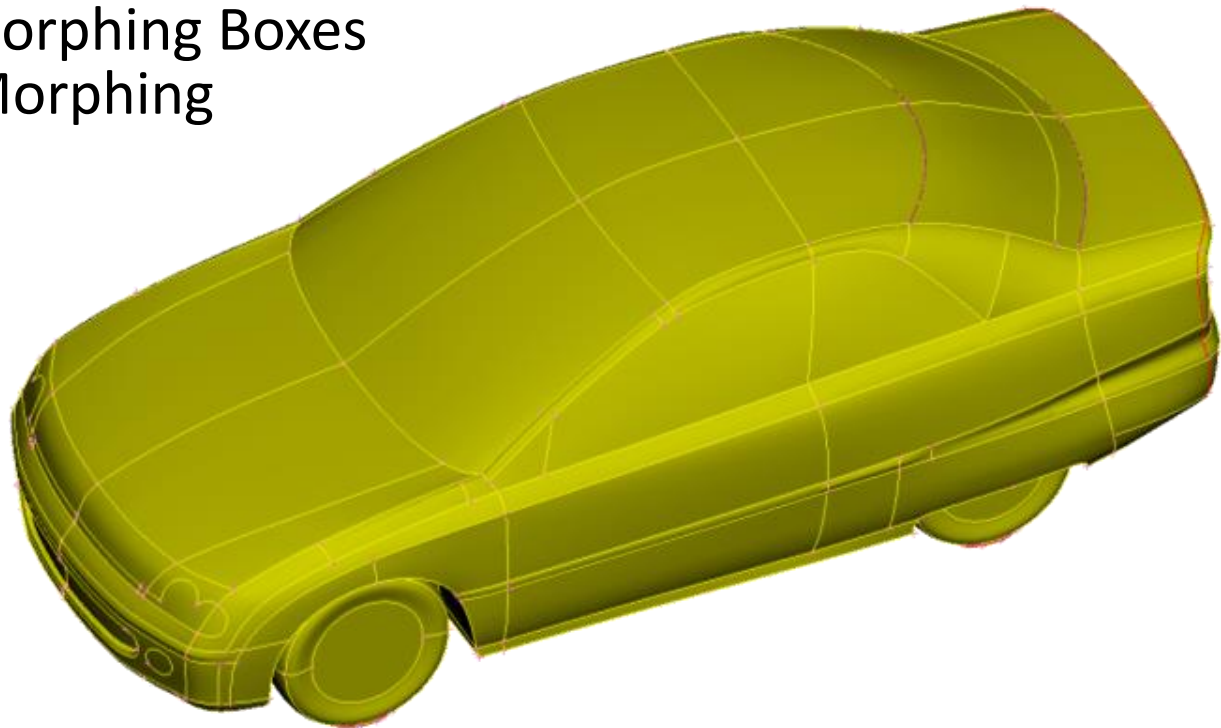
# Morphing

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



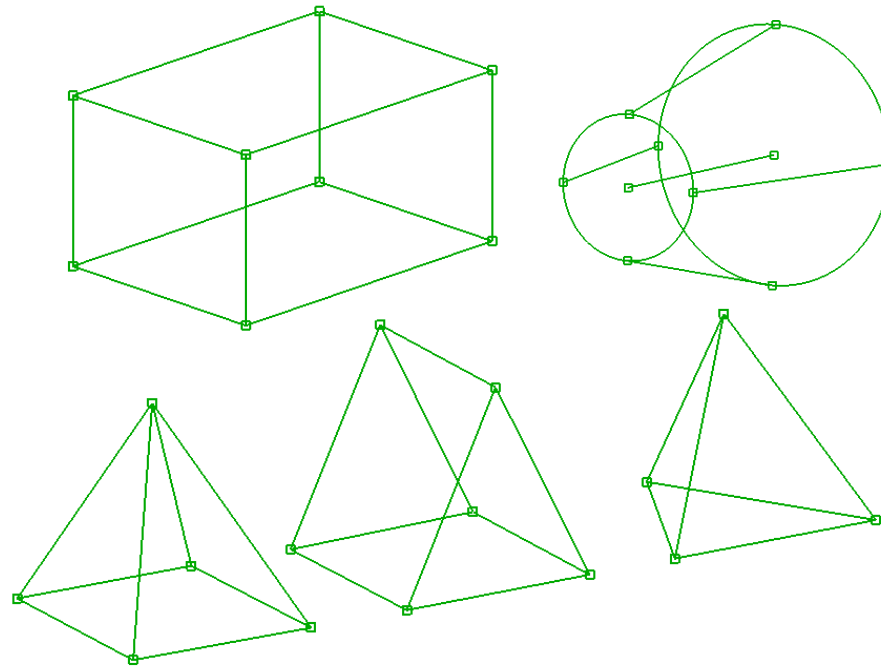
# Morphing

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



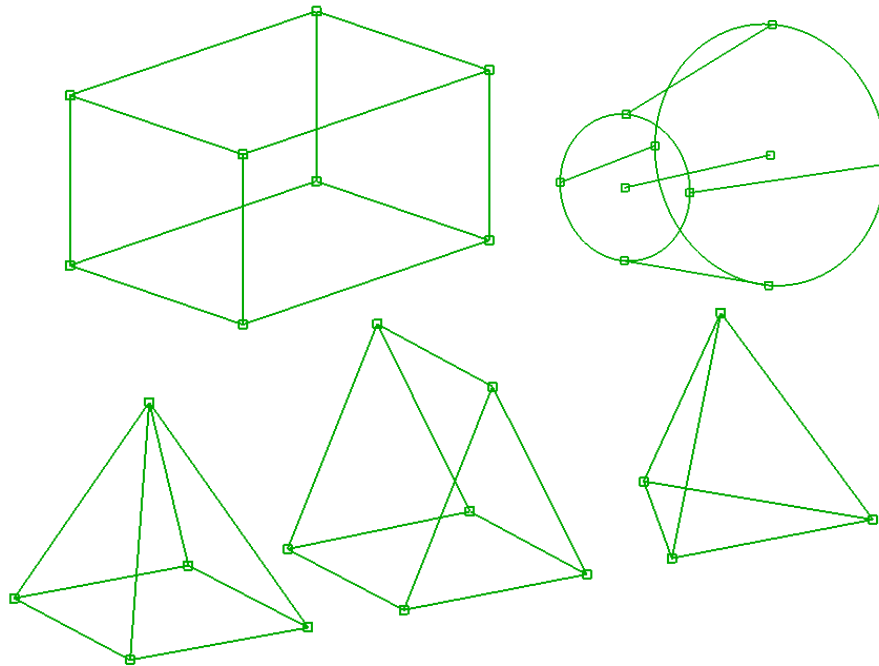
# Box Morphing

## Types of boxes



# Box Morphing

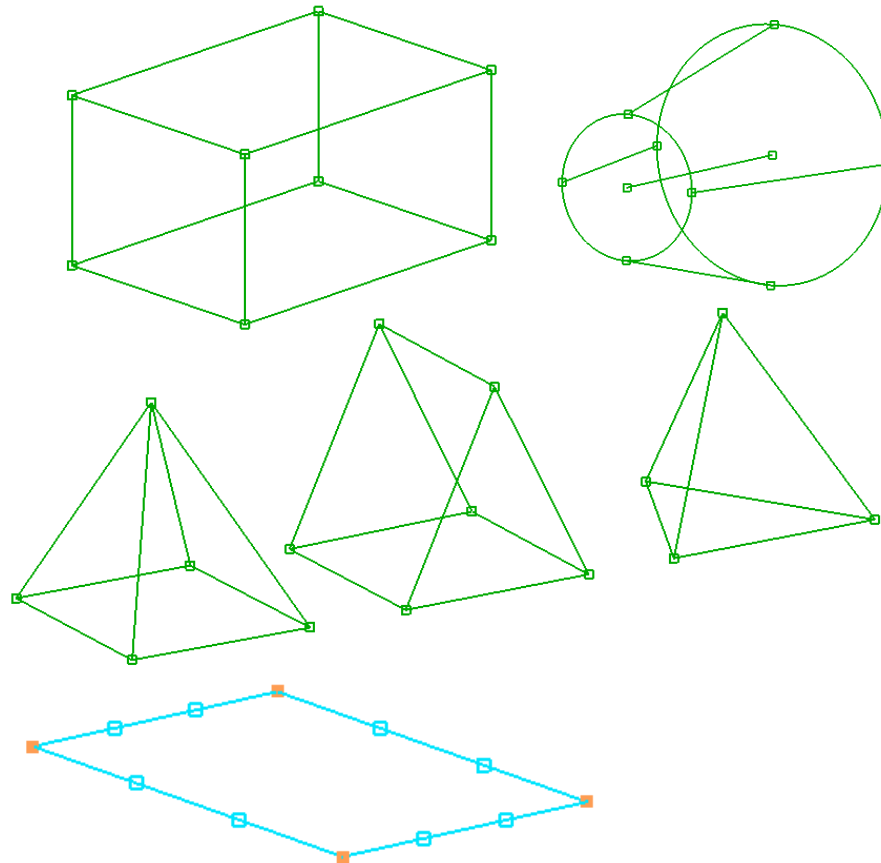
## Types of boxes



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

# Box Morphing

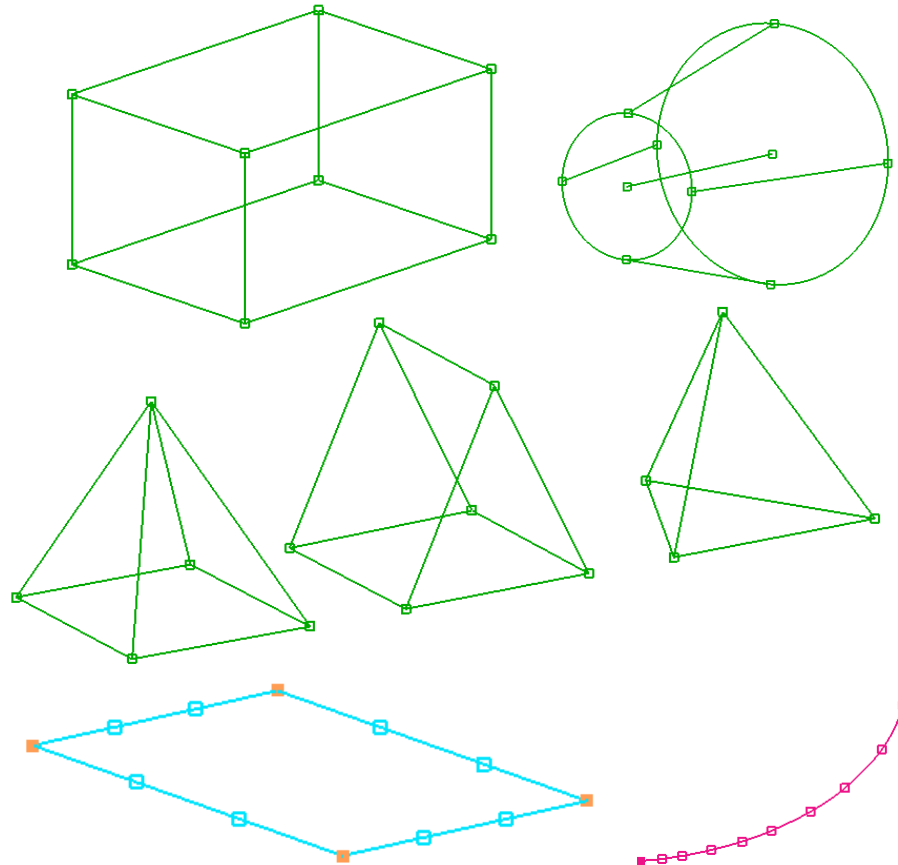
## Types of boxes



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

# Box Morphing

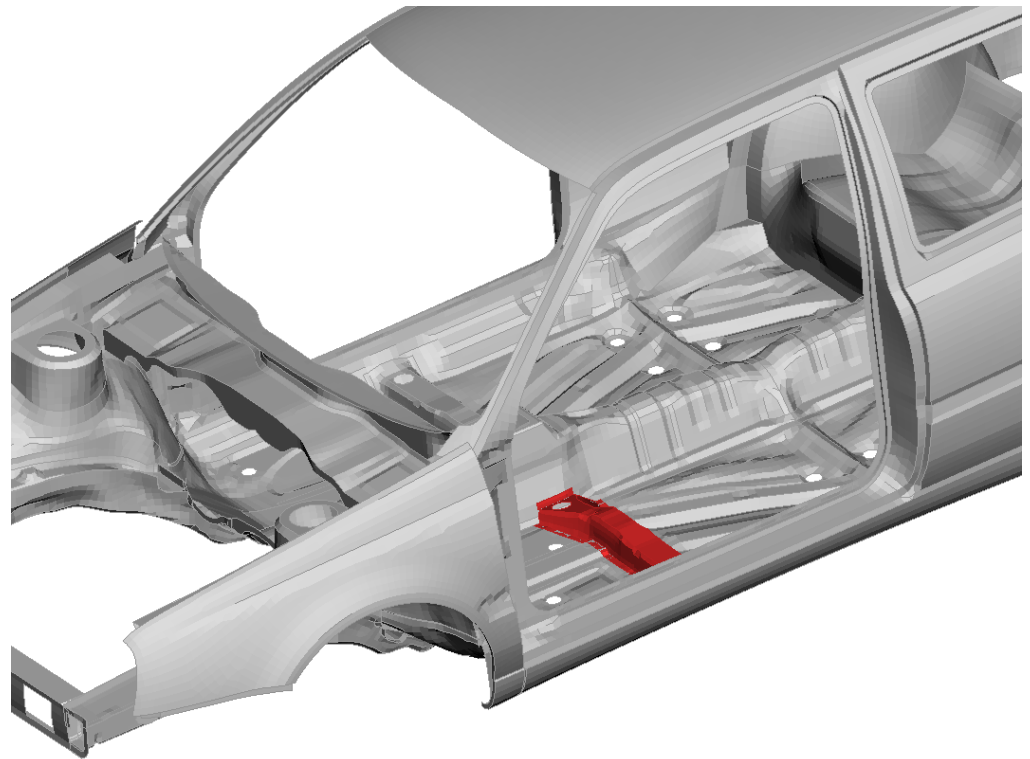
## Types of boxes



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

# Box Morphing

## Creation of Boxes

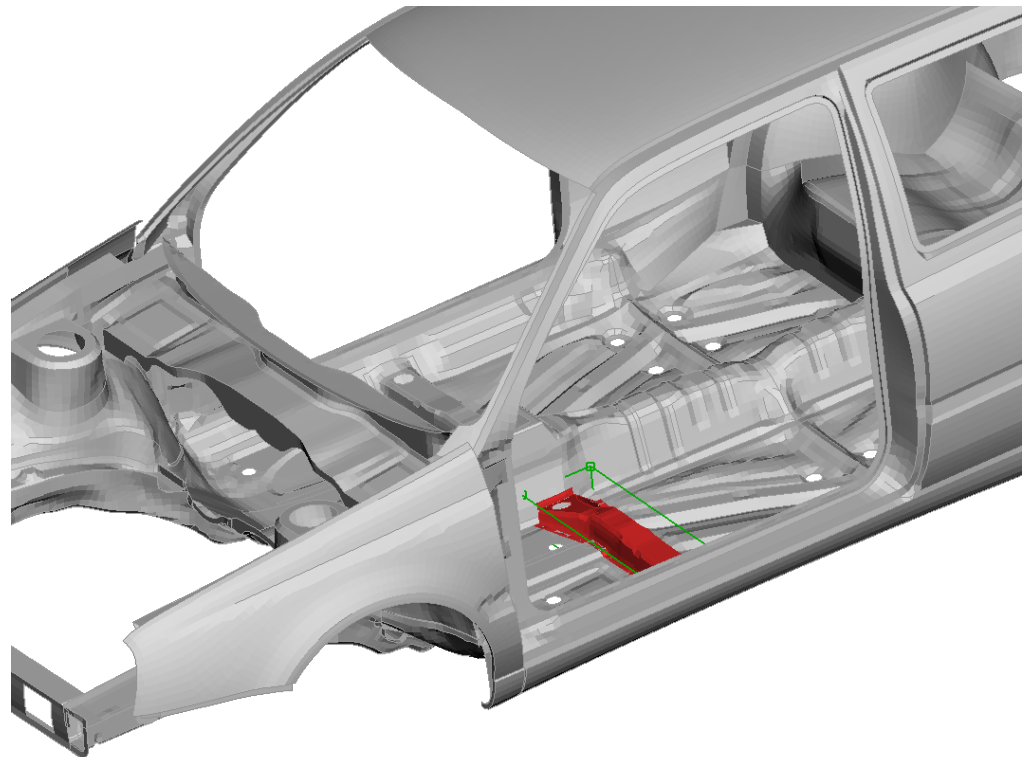




# Box Morphing

## Creation of Boxes

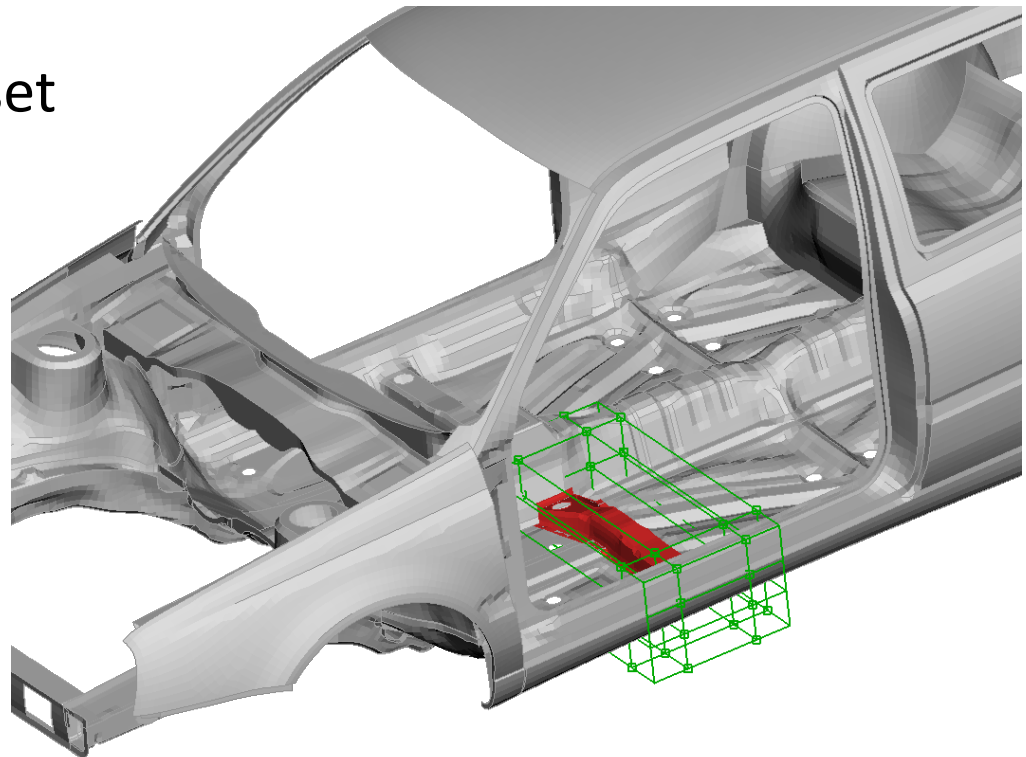
- Around Entities



# Box Morphing

## Creation of Boxes

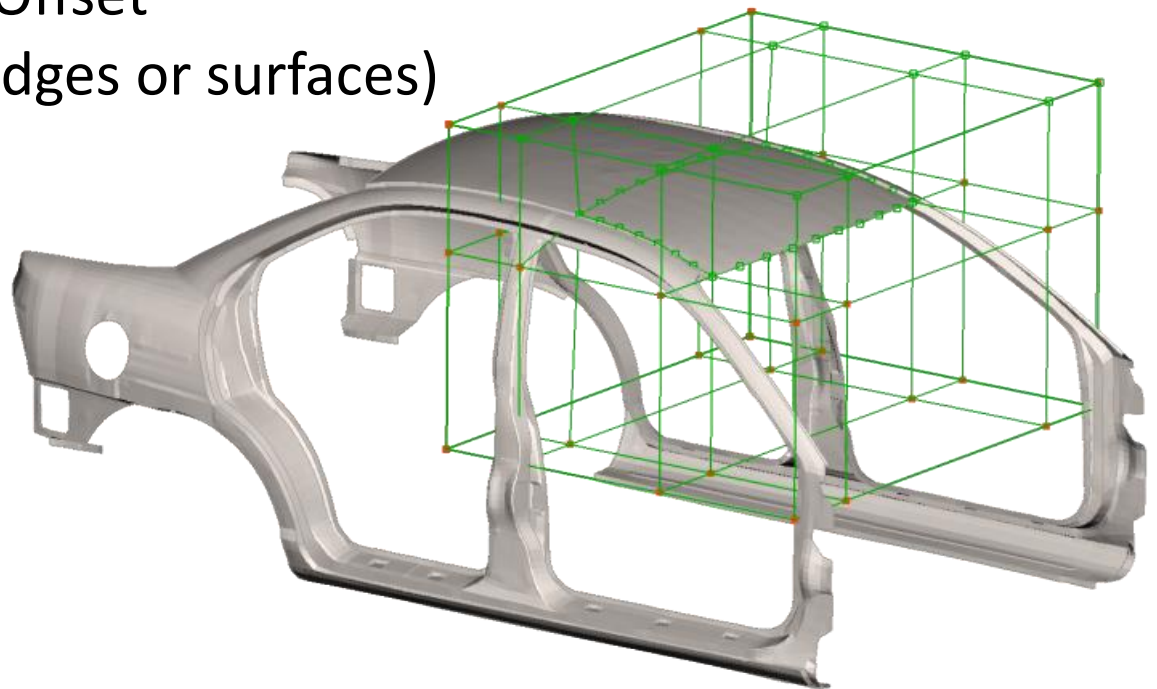
- Around Entities
- Buffer Zones via Offset



# Box Morphing

## Creation of Boxes

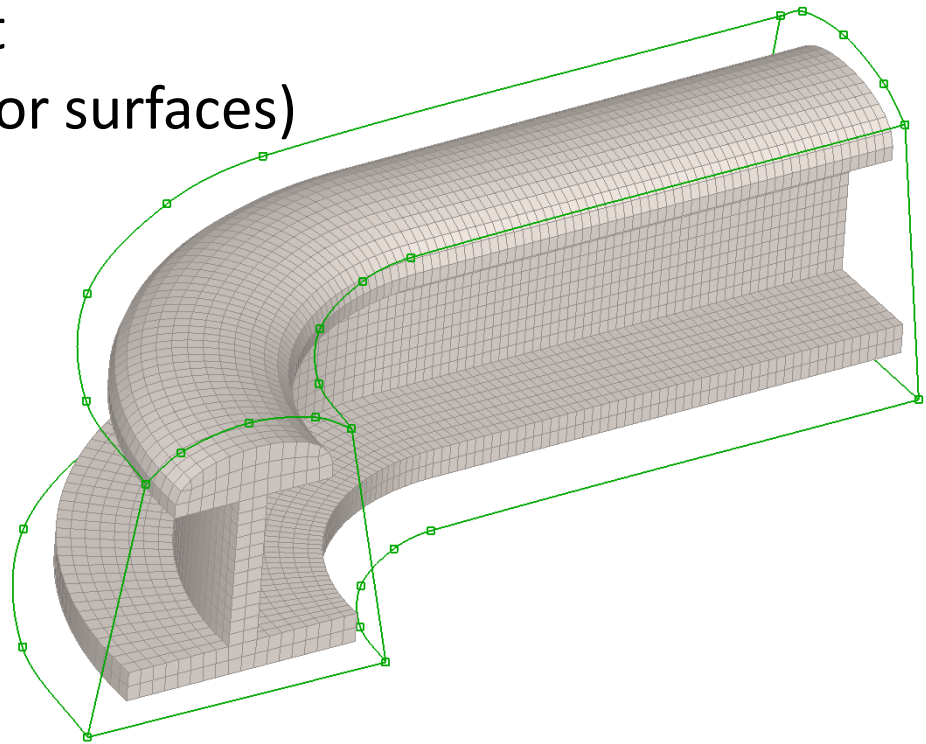
- Around Entities
- Buffer Zones via Offset
- Split + Fit (onto edges or surfaces)



# Box Morphing

## Creation of Boxes

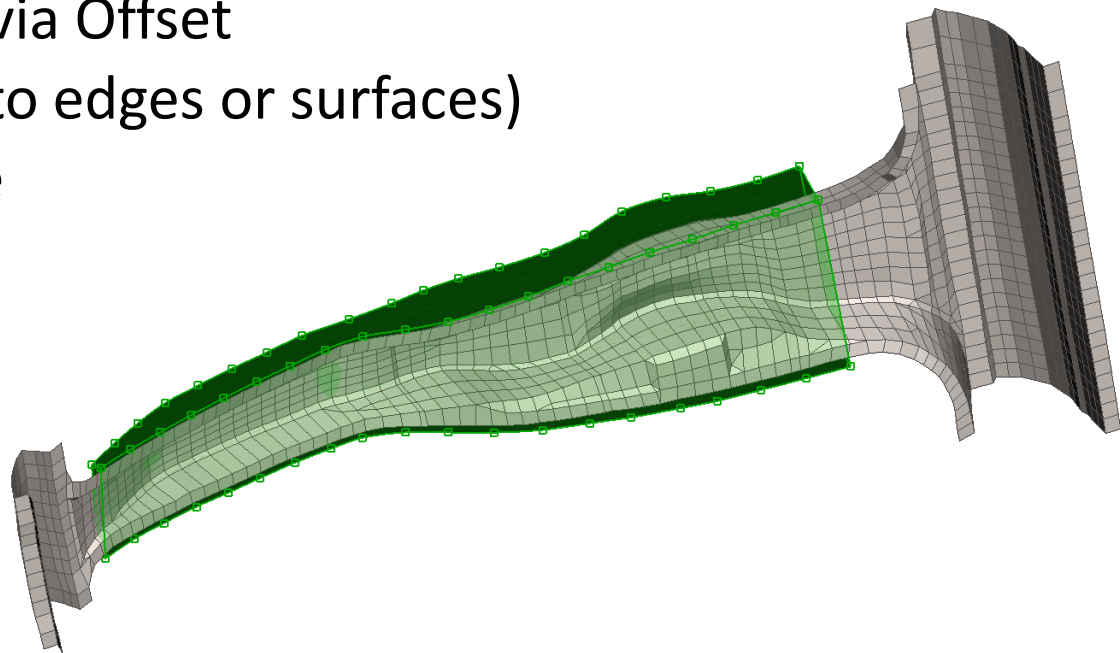
- Around Entities
- Buffer Zones via Offset
- Split + Fit (onto edges or surfaces)
- Sweep / Glide



# Box Morphing

## Creation of Boxes

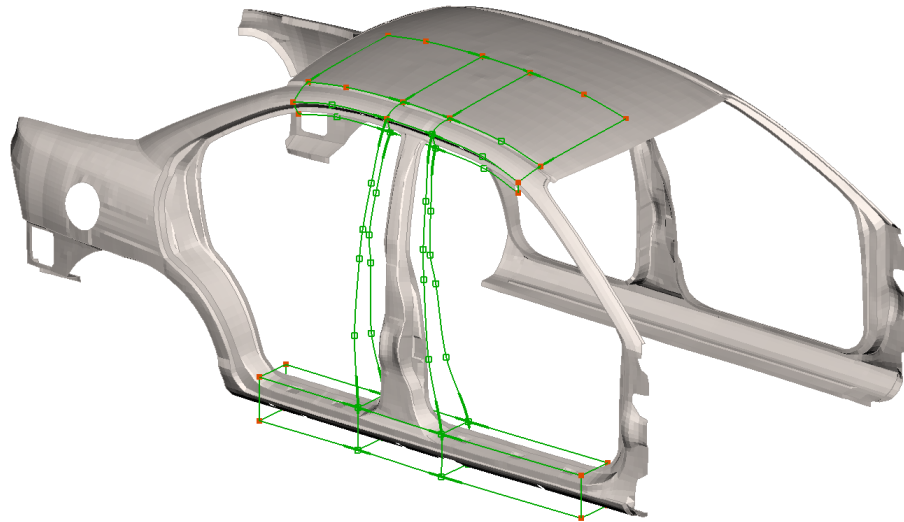
- Around Entities
- Buffer Zones via Offset
- Split + Fit (onto edges or surfaces)
- Sweep / Glide
- Adapt
- etc.



# Box Morphing

## Linked Morphing Boxes

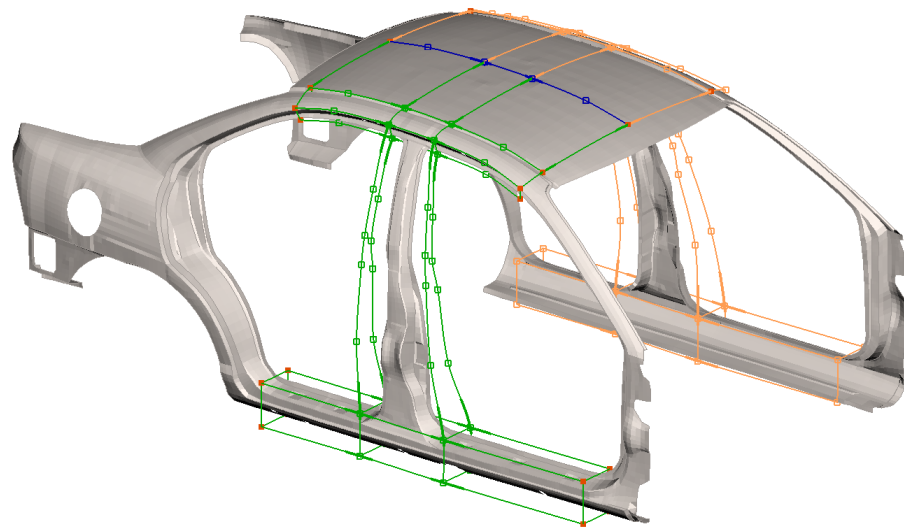
- Taking advantage of model symmetry
- Link according symmetry-/mirror plane, rotation axis or translation vector



# Box Morphing

## Linked Morphing Boxes

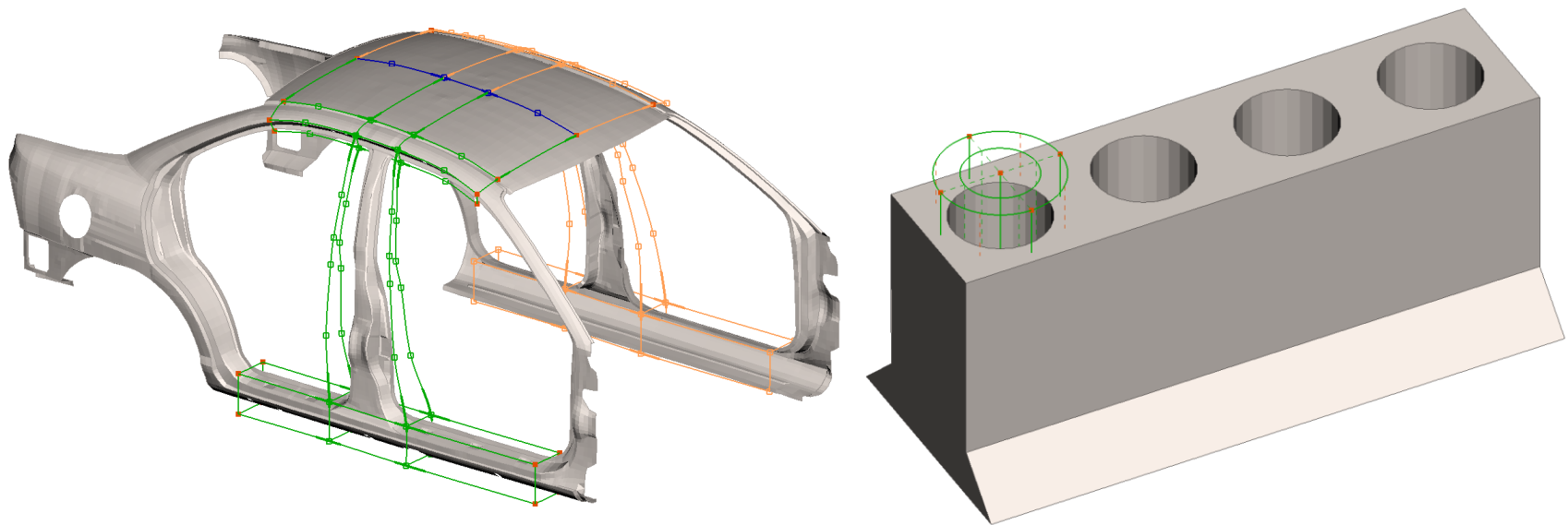
- Taking advantage of model symmetry
- Link according symmetry-/mirror plane, rotation axis or translation vector



# Box Morphing

## Linked Morphing Boxes

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

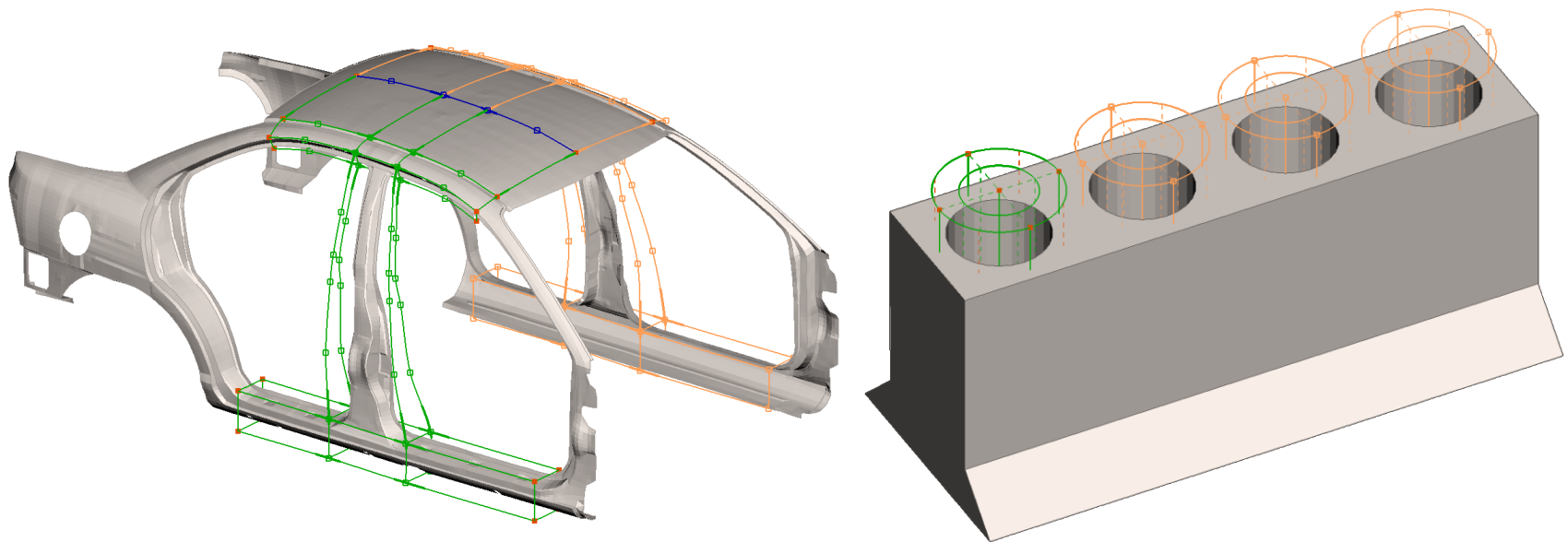




# Box Morphing

## Linked Morphing Boxes

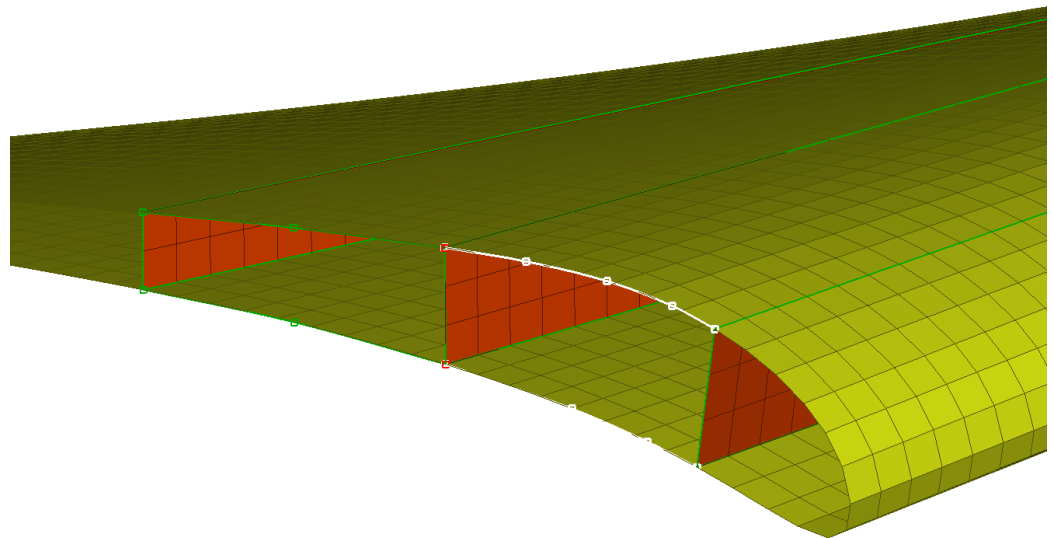
- Taking advantage of model symmetry
- Link according symmetry-/mirror plane, rotation axis or translation vector



# Box Morphing

## Modification of Boxes

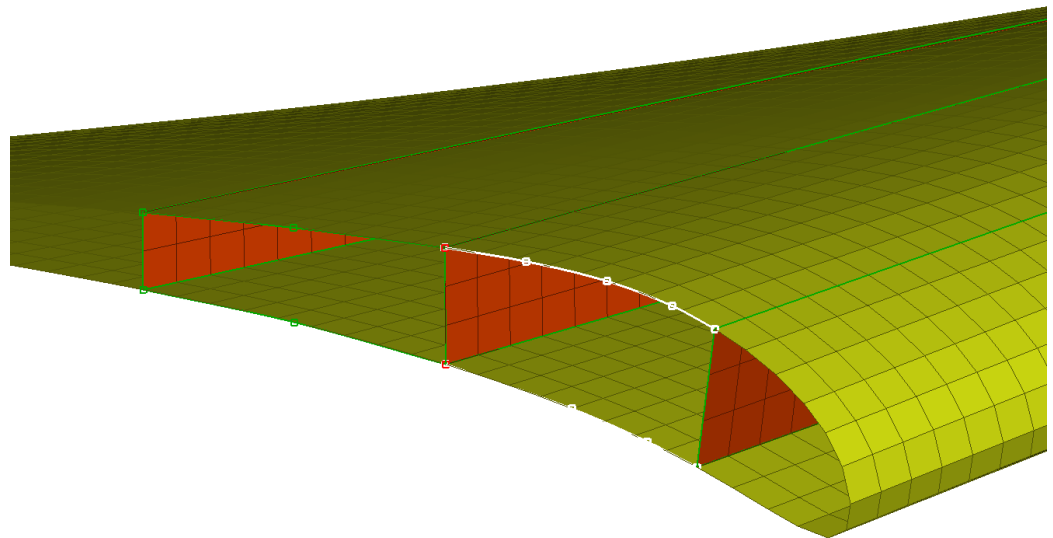
- Move (Translate, Rotate)
- Slide / Extend



# Box Morphing

## Modification of Boxes

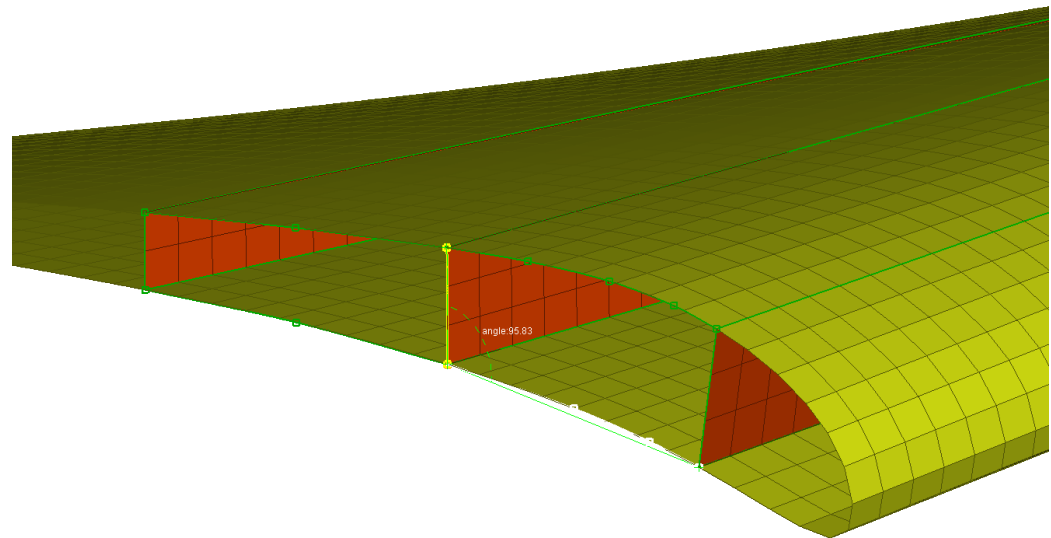
- Move (Translate, Rotate)
- Slide / Extend



# Box Morphing

## Modification of Boxes

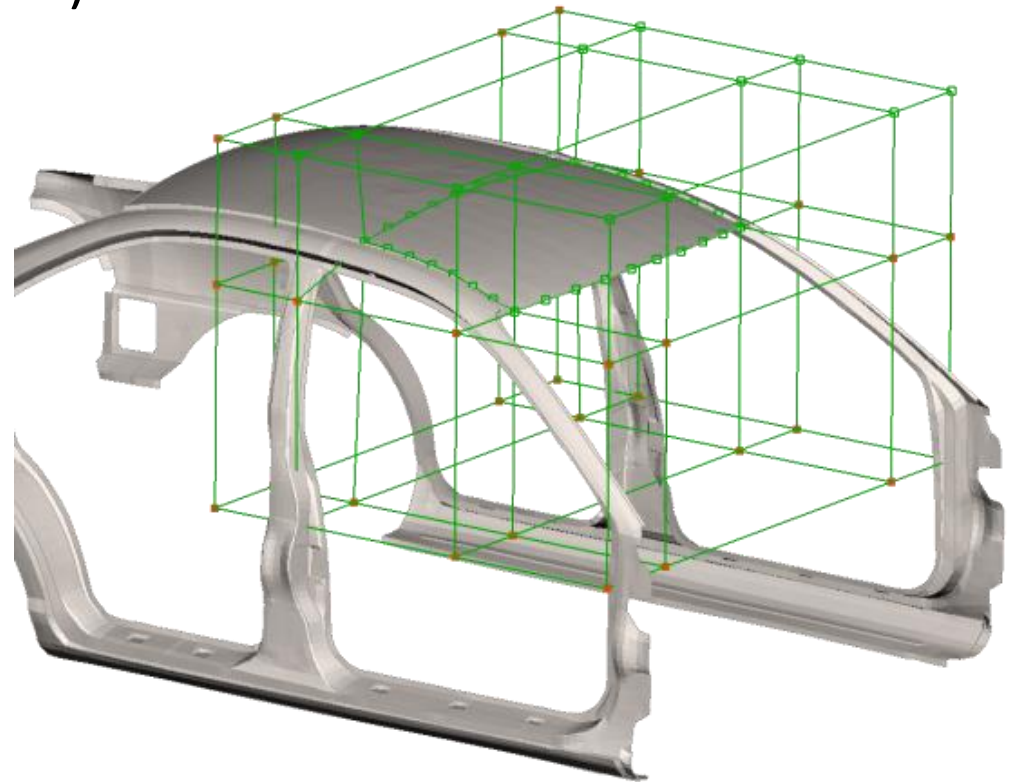
- Move (Translate, Rotate)
- Slide / Extend
- Angle



# Box Morphing

## Modification of Boxes

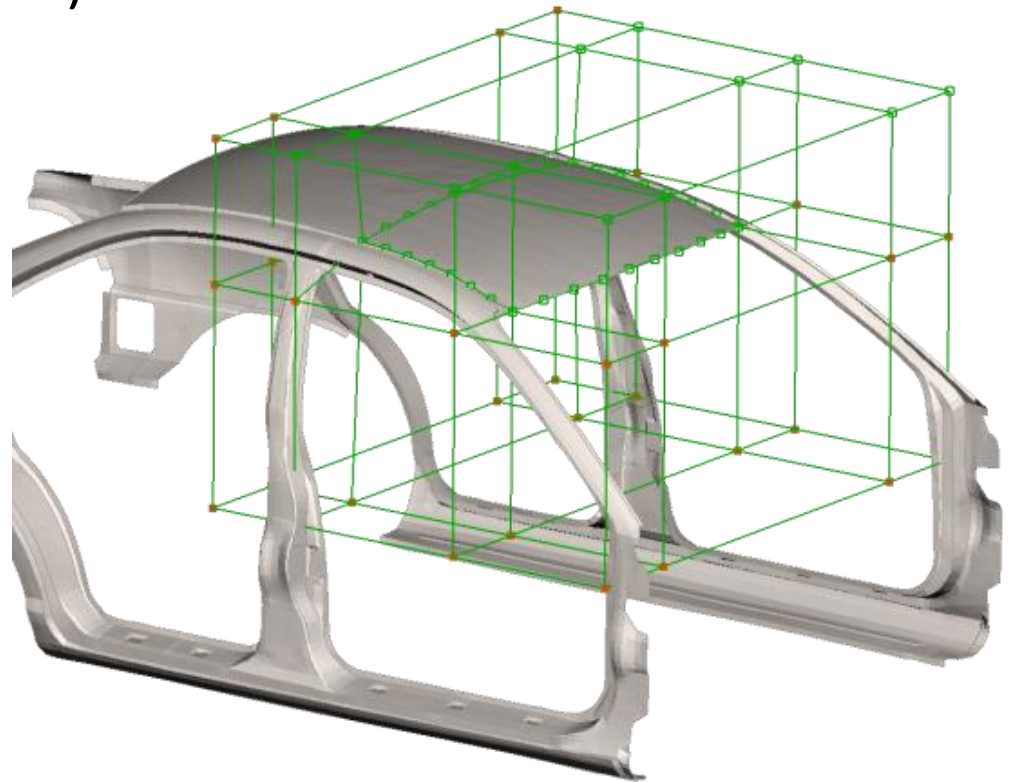
- Move (Translate, Rotate)
- Slide / Extend
- Angle
- Fit (edges, surfaces)



# Box Morphing

## Modification of Boxes

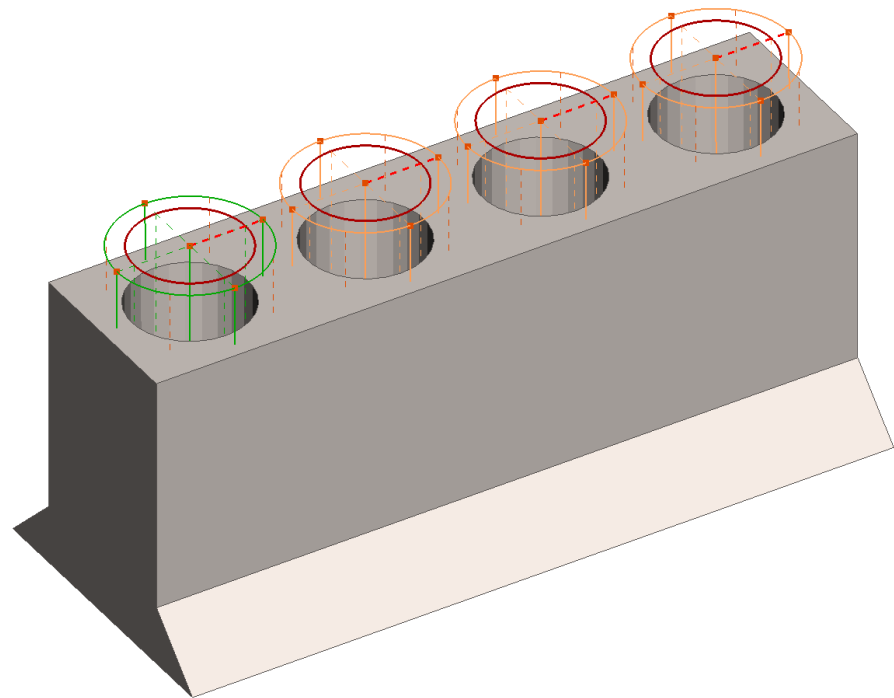
- Move (Translate, Rotate)
- Slide / Extend
- Angle
- Fit (edges, surfaces)



# Box Morphing

## Modification of Boxes

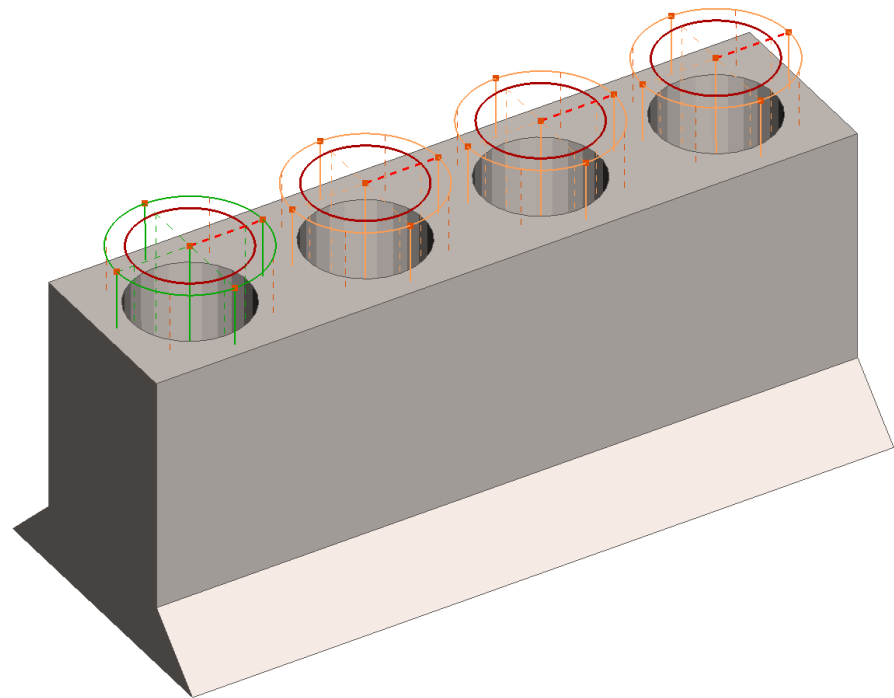
- Move (Translate, Rotate)
- Slide / Extend
- Angle
- Fit (edges, surfaces)
- Radius



# Box Morphing

## Modification of Boxes

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





# Box Morphing

## Box in Box

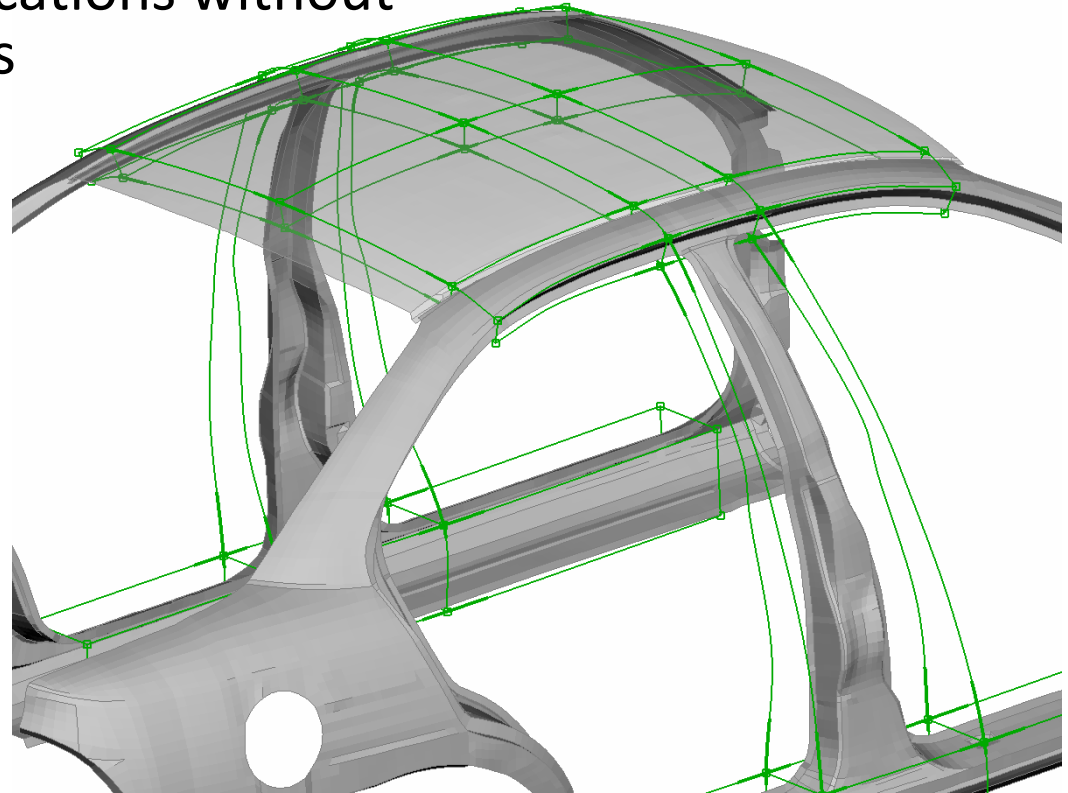
- Separate groups of boxes handle different features
- Global and local modifications without excessive splits of boxes



# Box Morphing

## Box in Box

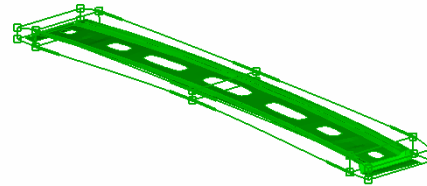
- Separate groups of boxes handle different features
- Global and local modifications without excessive splits of boxes
- Global: B-pillar position



# Box Morphing

## Box in Box

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



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

# Box Morphing

## Box in Box

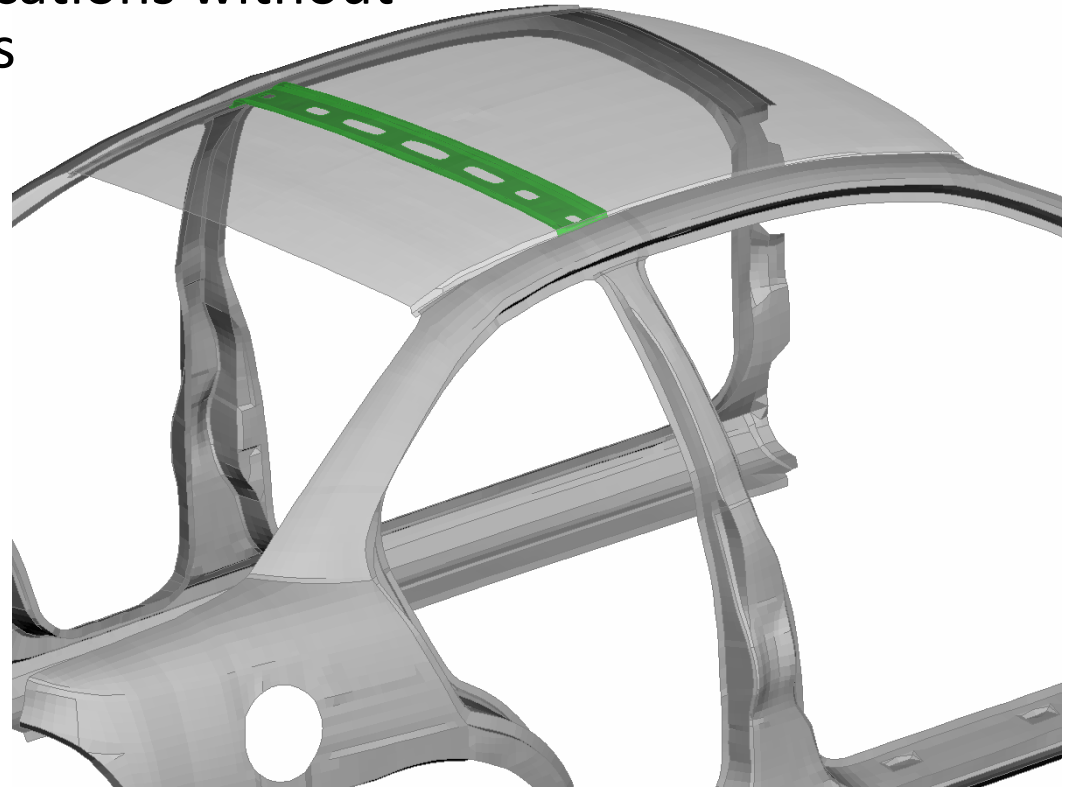
- Separate groups of boxes handle different features
- Global and local modifications without excessive splits of boxes



# Box Morphing

## Box in Box

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

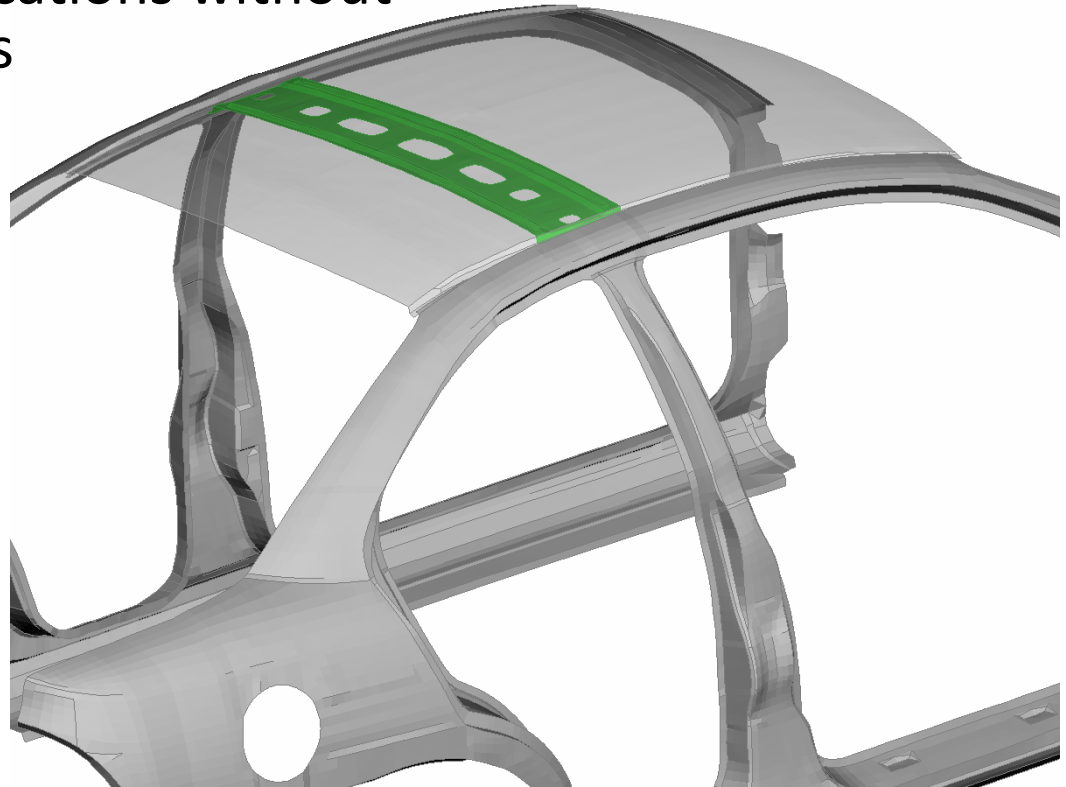


# Box Morphing

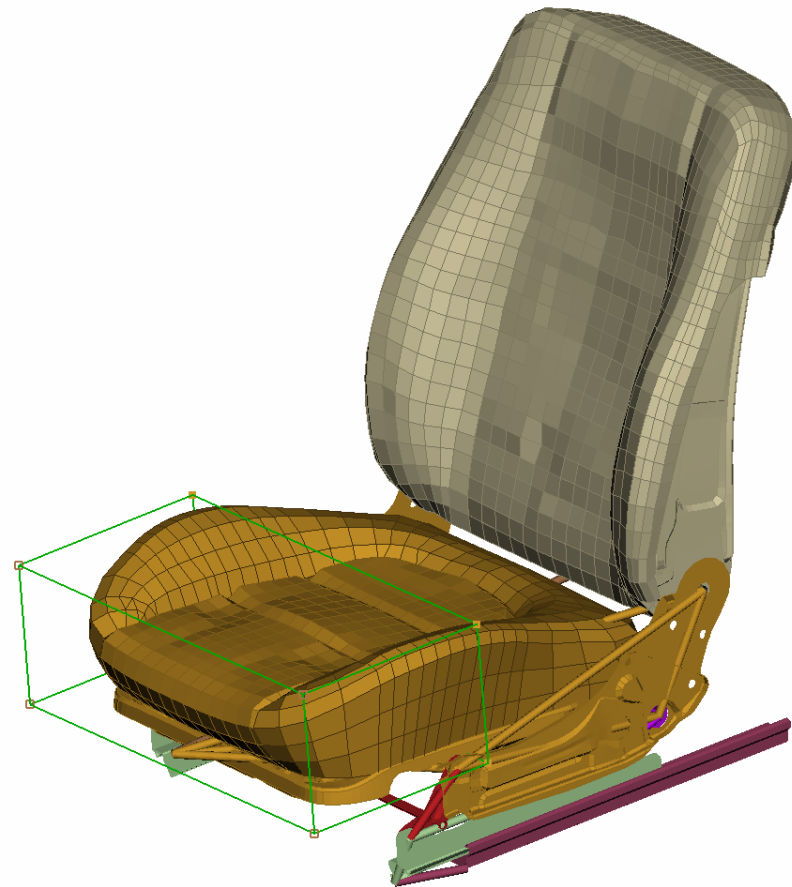
## Box in Box

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

- Global morphing
- Local morphing



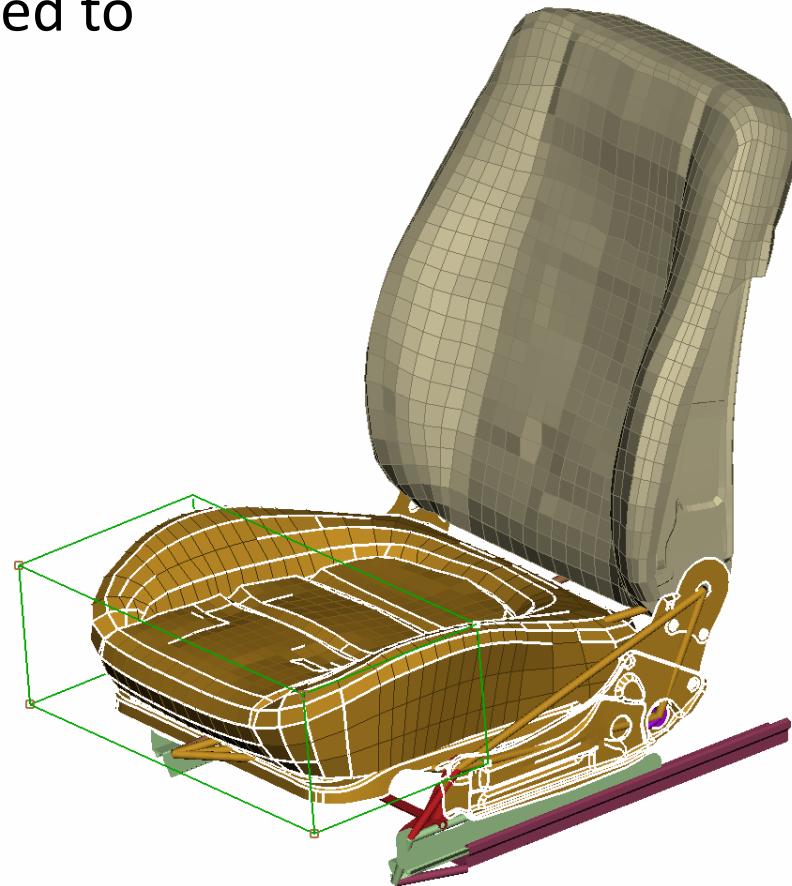
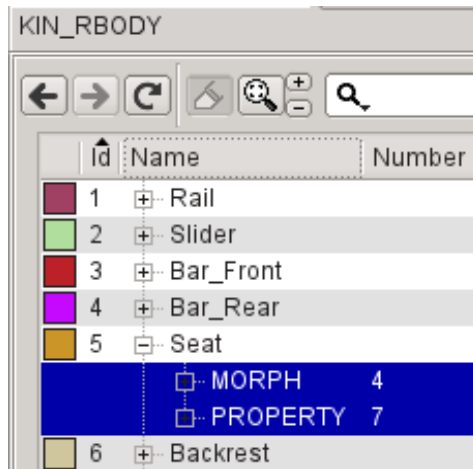
# Box Morphing Coupled with Kinetics



# Box Morphing

## Coupled with Kinetics

- Morph Control Points added to Kinetic Rigid Bodies

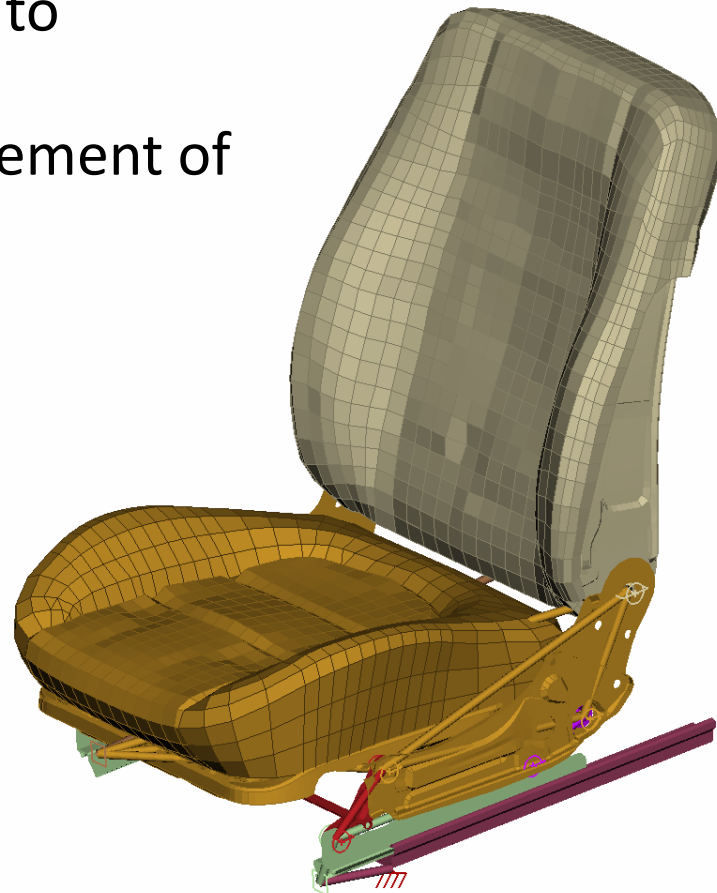
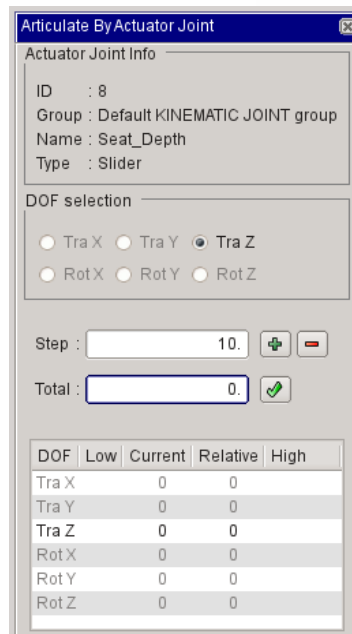




# Box Morphing

## Coupled with Kinetics

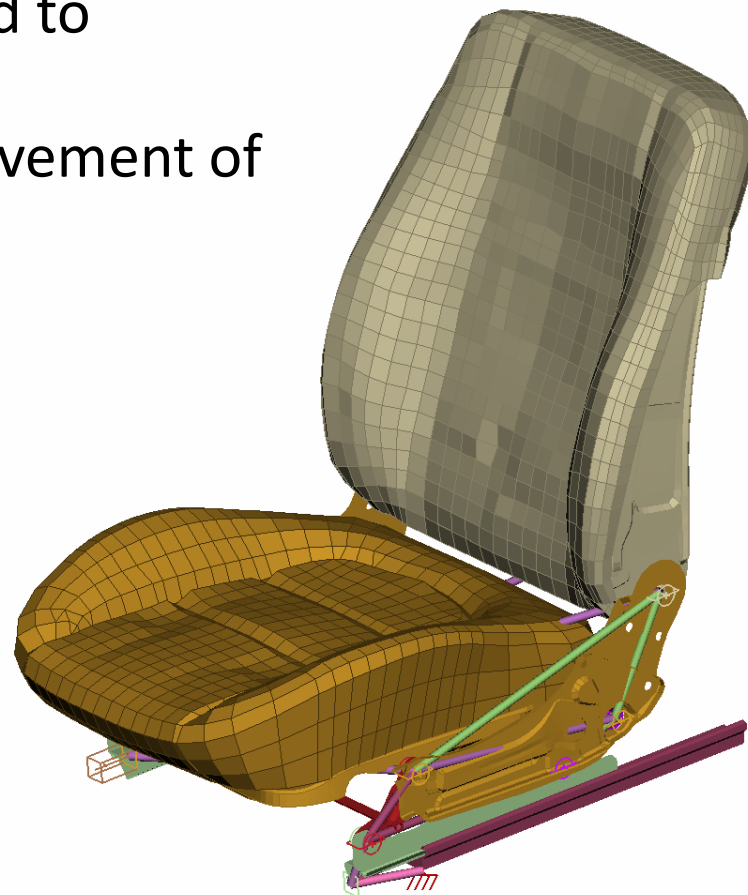
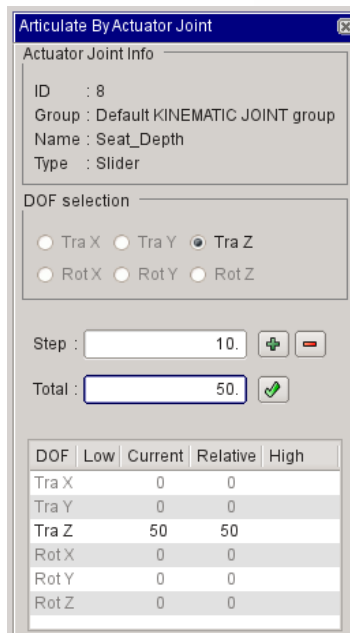
- Morph Control Points added to Kinetic Rigid Bodies
- Morphing controlled by movement of Rigid Bodies



# Box Morphing

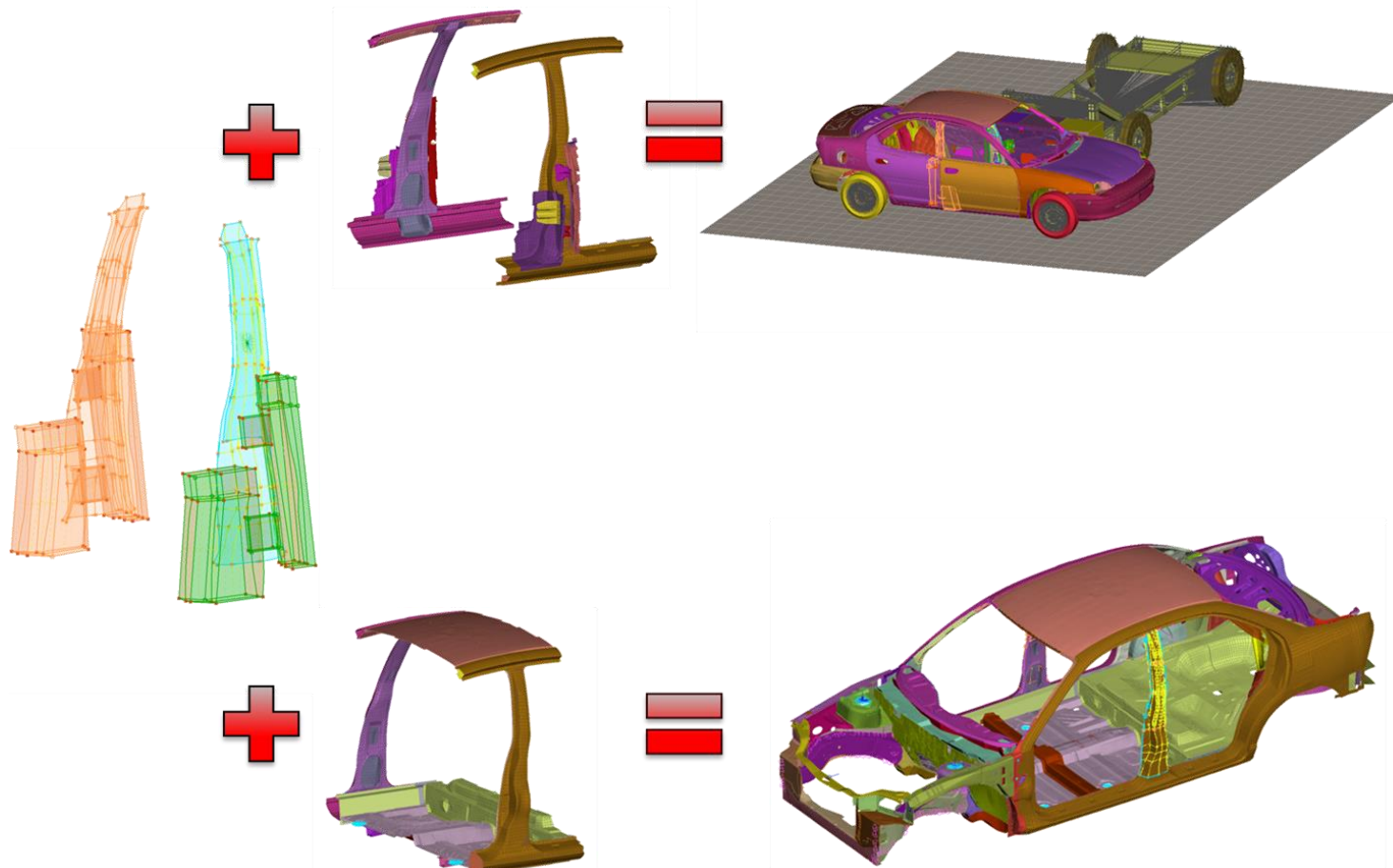
## Coupled with Kinetics

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



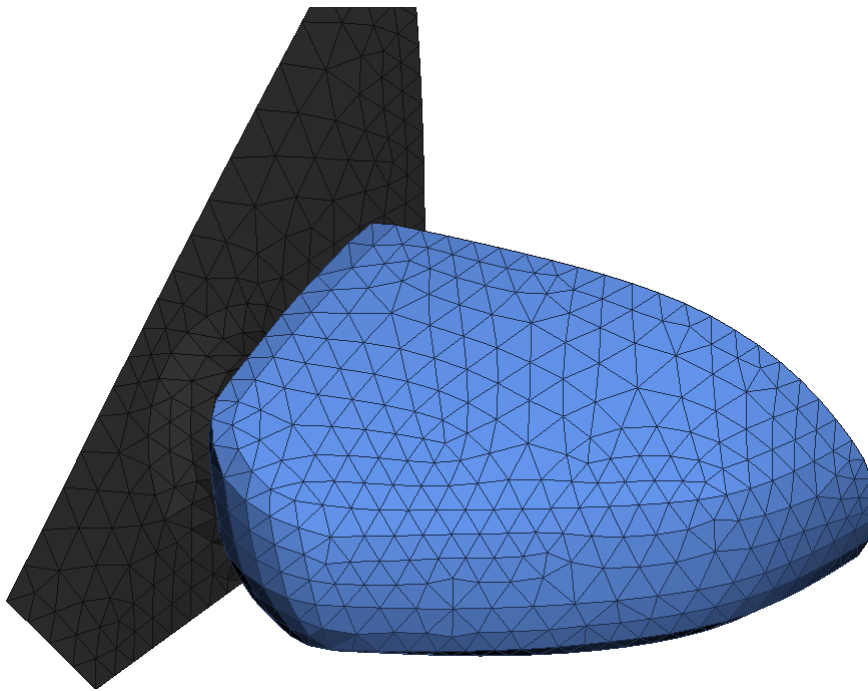
# Box Morphing

Re-use of boxes and parameters for multiple models



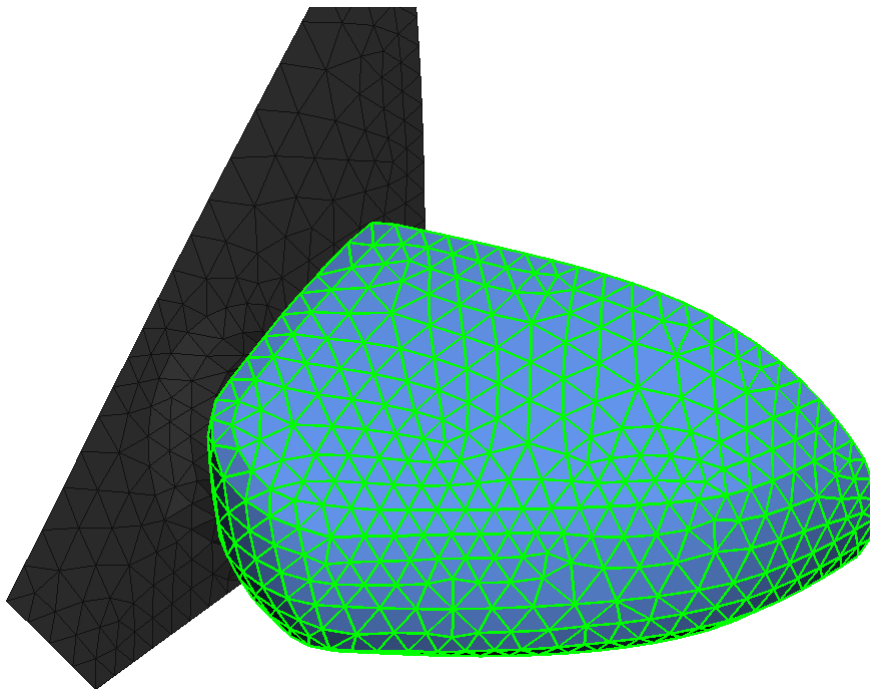
# Direct Morphing

Translate, rotate or scale FE-mesh or Geometry entities



# Direct Morphing

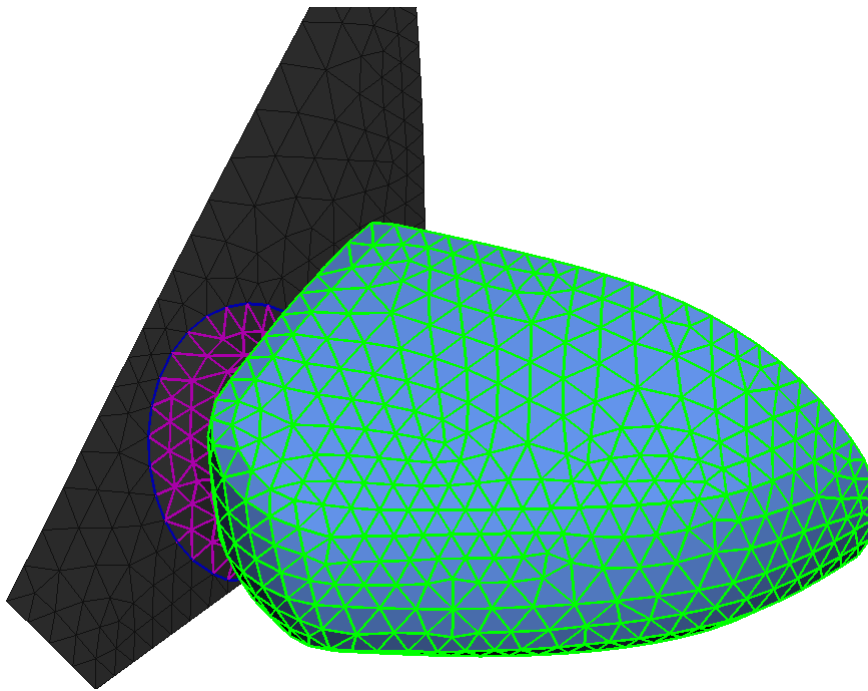
Translate, rotate or scale FE-mesh or Geometry entities



- Control Entities

# Direct Morphing

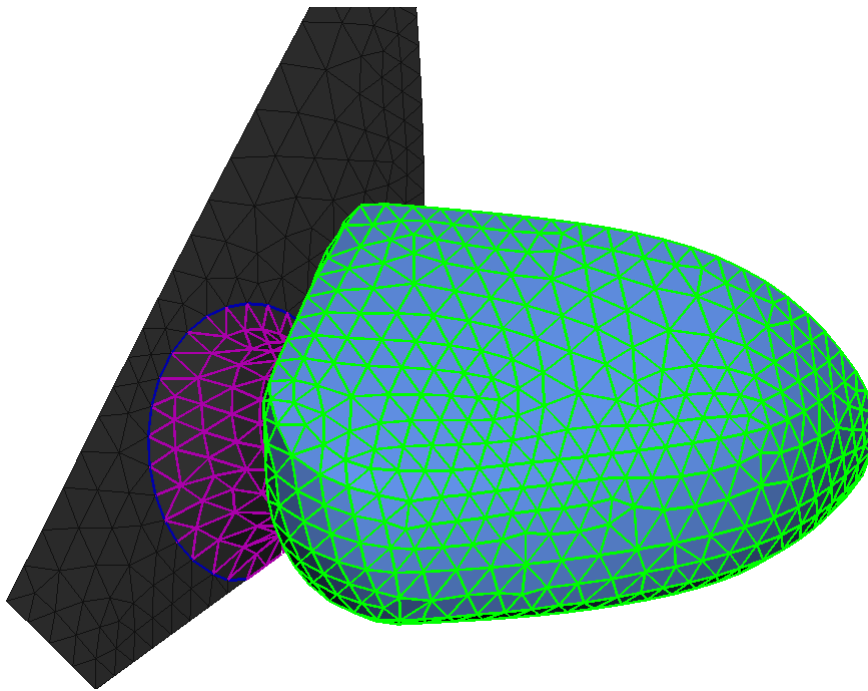
Translate, rotate or scale FE-mesh or Geometry entities



- Control Entities
- Morphed Entities
- Boundary

# Direct Morphing

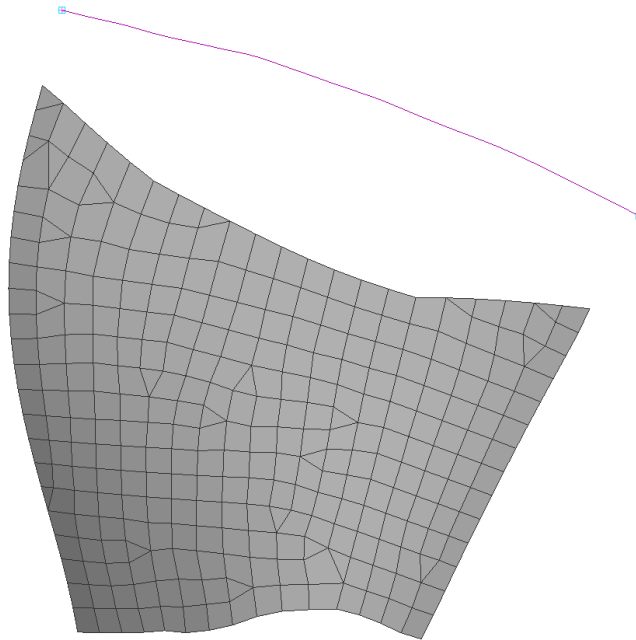
Translate, rotate or scale FE-mesh or Geometry entities



- Control Entities
- Morphed Entities
- Boundary
- Morphing

# Direct Morphing

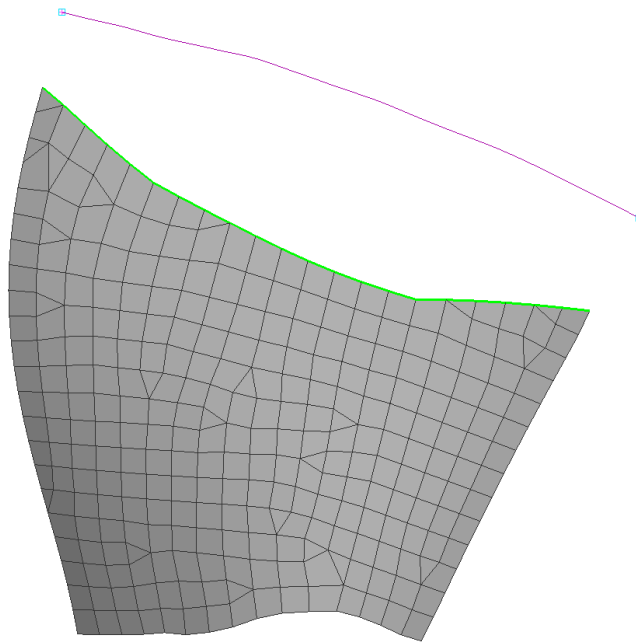
Snap **FE** or geometry edges to **single** or multiple target curves





# Direct Morphing

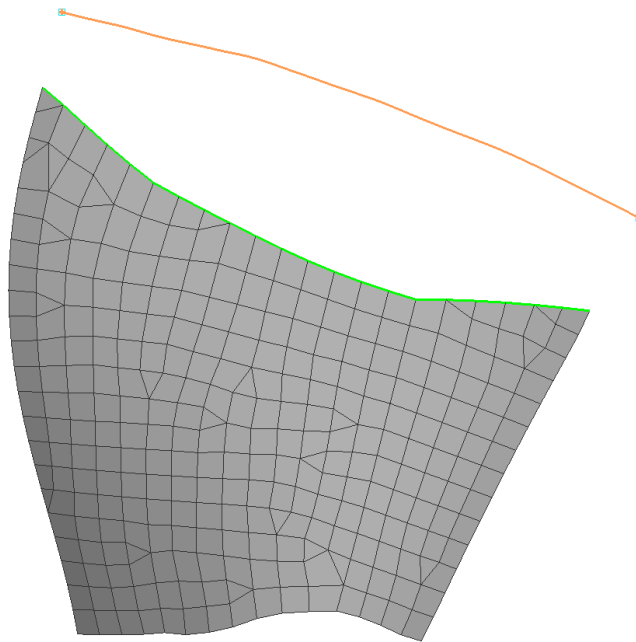
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin

# Direct Morphing

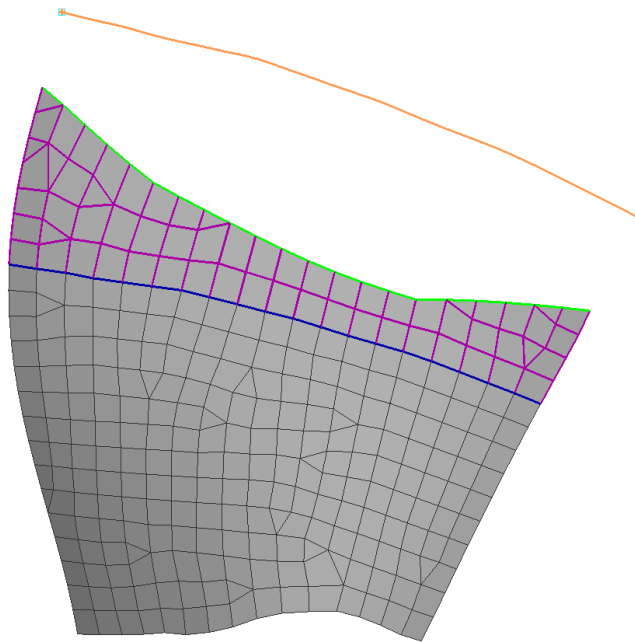
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target

# Direct Morphing

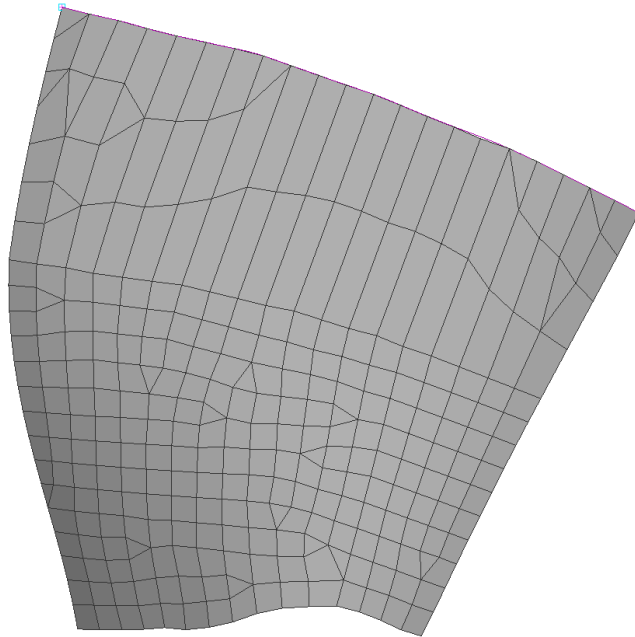
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target
- Morphed Entities
- Boundary

# Direct Morphing

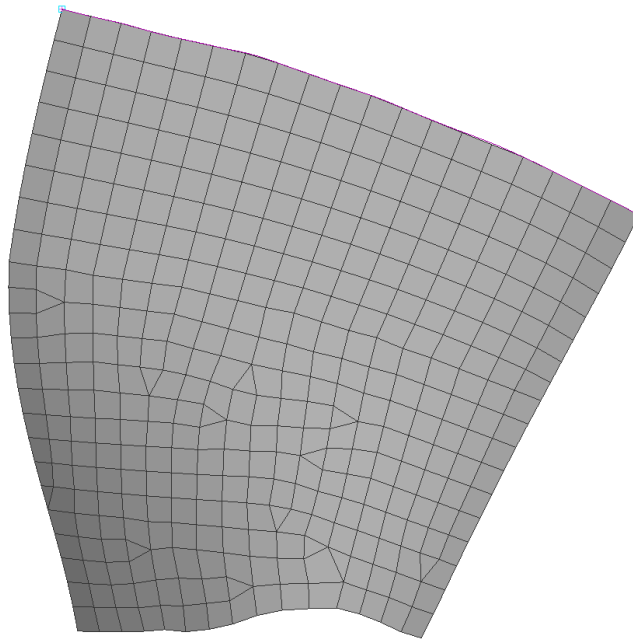
Snap **FE** or geometry edges to **single** or multiple target curves



- Origin
- Target
- Morphed Entities
- Boundary
- Morphing

# Direct Morphing

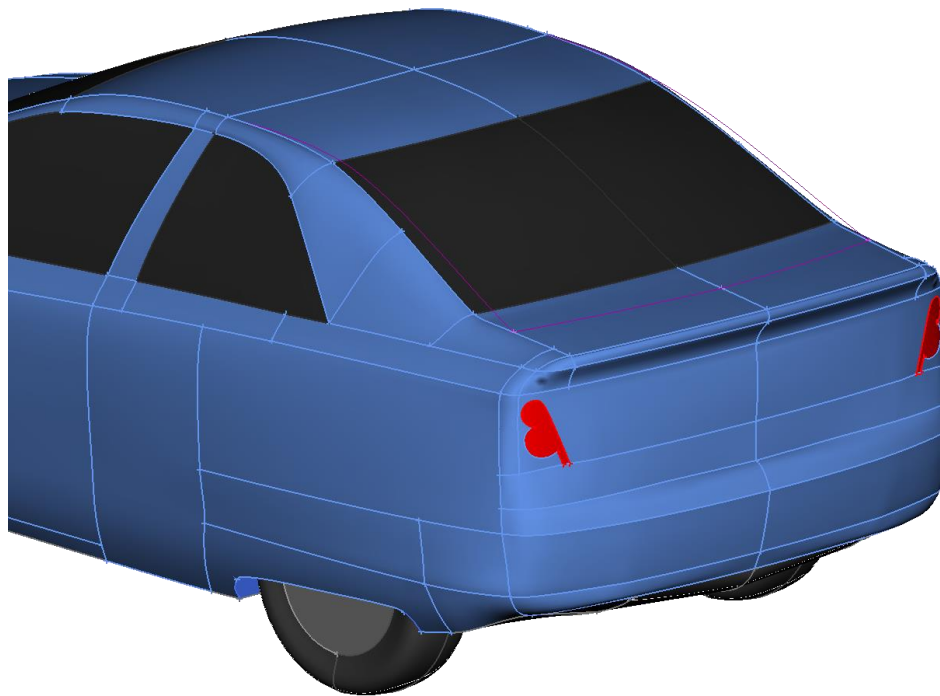
Snap **FE** or geometry edges to **single** or multiple target curves



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

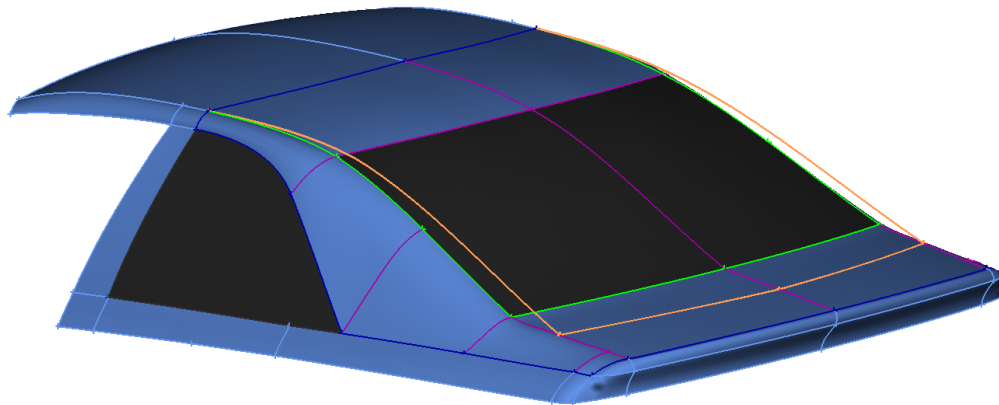
# Direct Morphing

Snap FE or geometry edges to single or multiple target curves



# Direct Morphing

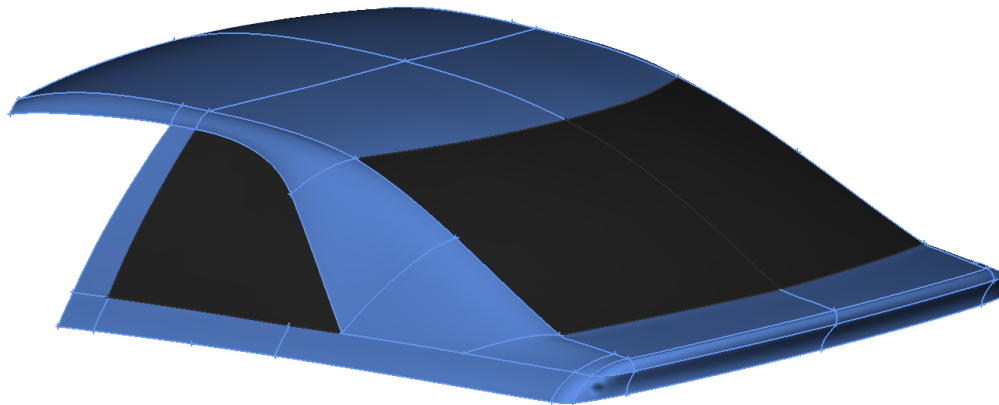
Snap FE or **geometry** edges to single or **multiple** target curves



- Origin
- Target
- Morphed Entities
- Boundary

# Direct Morphing

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

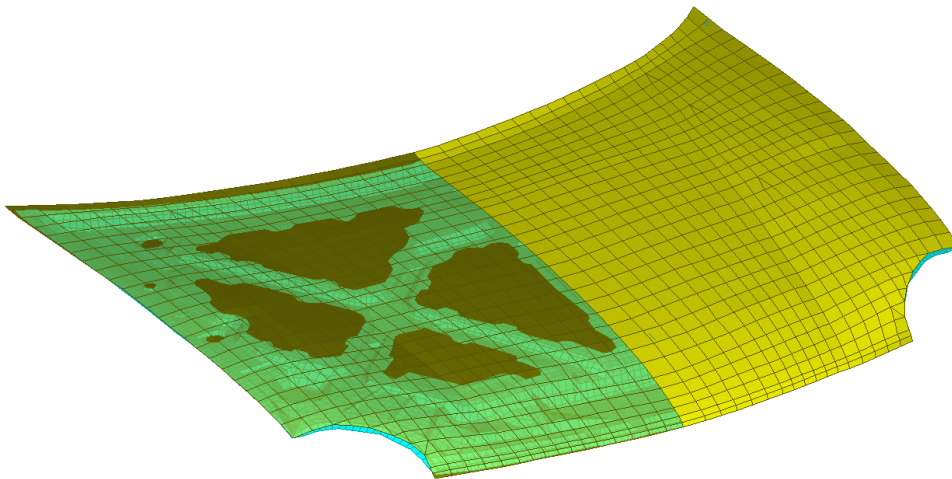


- Origin
- Target
- Morphed Entities
- Boundary
- Morphing



# Direct Morphing

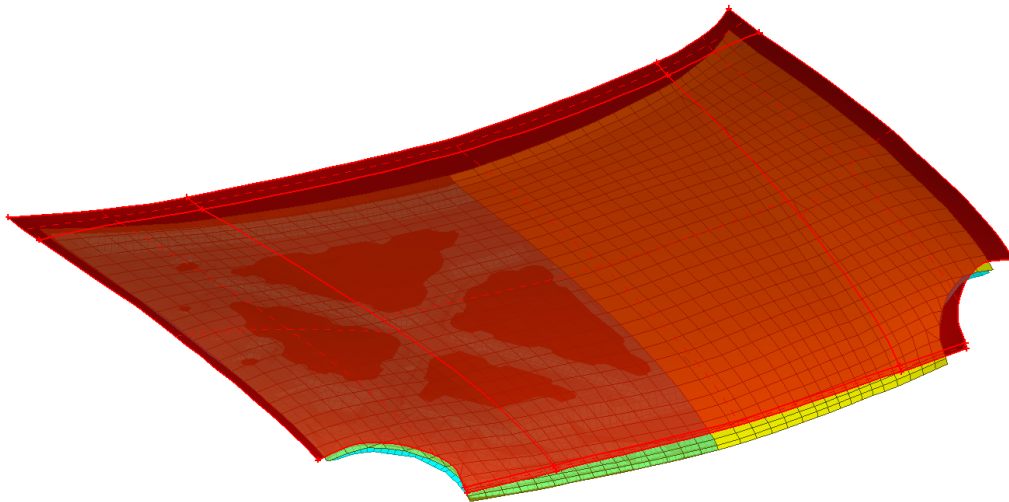
Fit surfaces – e.g. fit existing FE-mesh onto new CAD-geometry



- Original FE-surface (with additional underlying parts)

# Direct Morphing

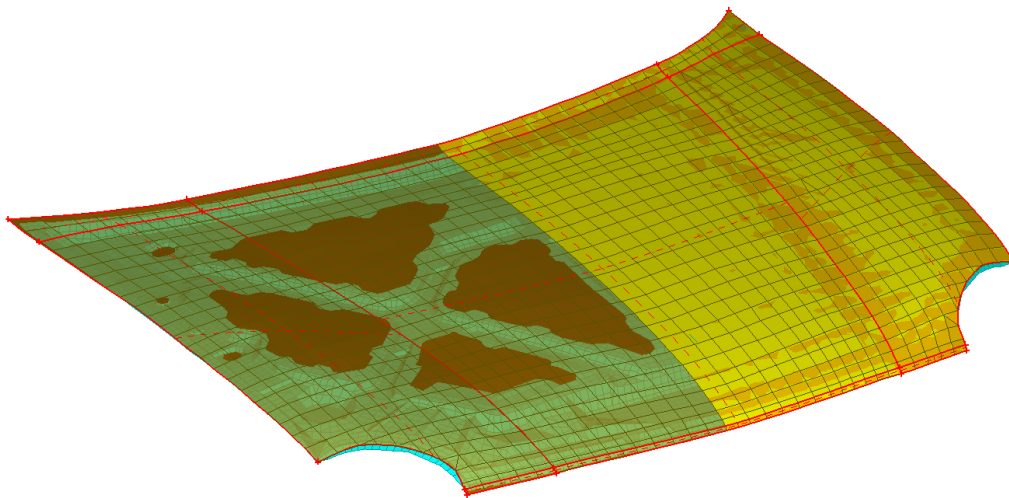
Fit surfaces – e.g. fit existing FE-mesh onto new CAD-geometry



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

# Direct Morphing

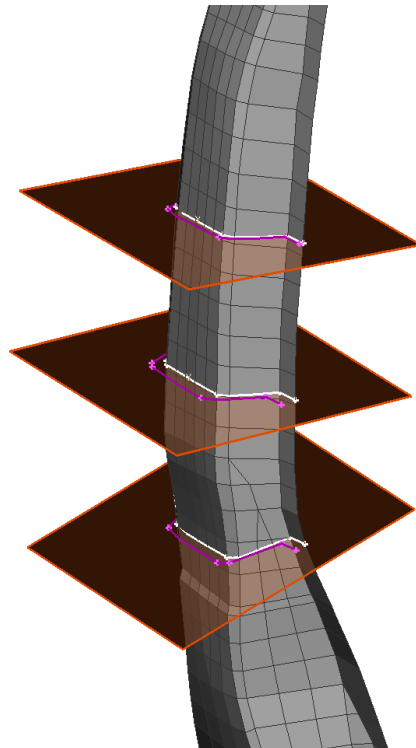
Fit surfaces – e.g. fit existing FE-mesh onto new CAD-geometry



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

# Direct Morphing

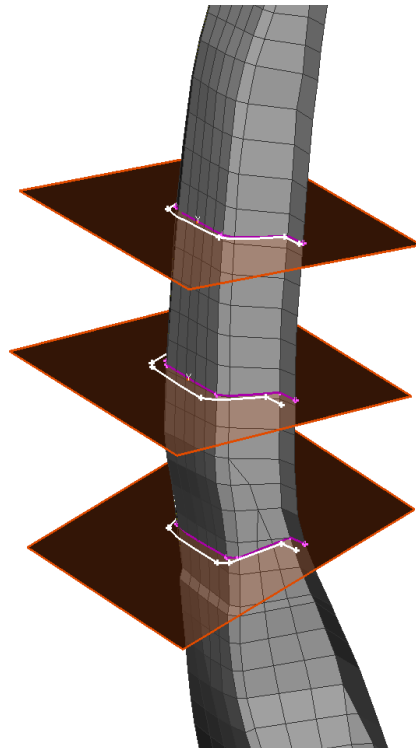
Fit cross sections (applicable on FE-mesh and geometry)



- Original cross section

# Direct Morphing

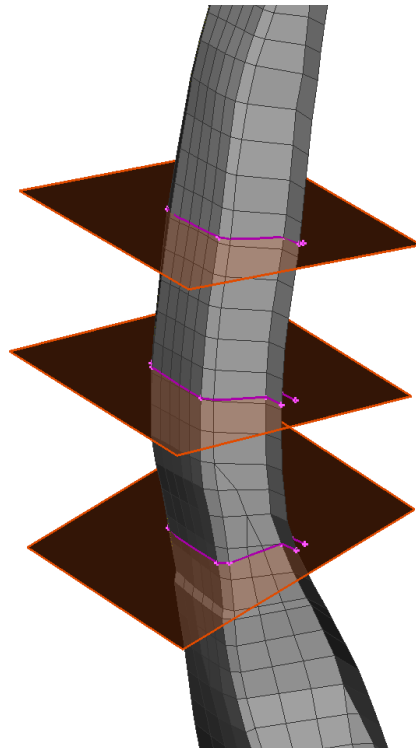
Fit cross sections (applicable on FE-mesh and geometry)



- Original cross section
- Target cross section

# Direct Morphing

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



- Original cross section
- Target cross section
- Morphing

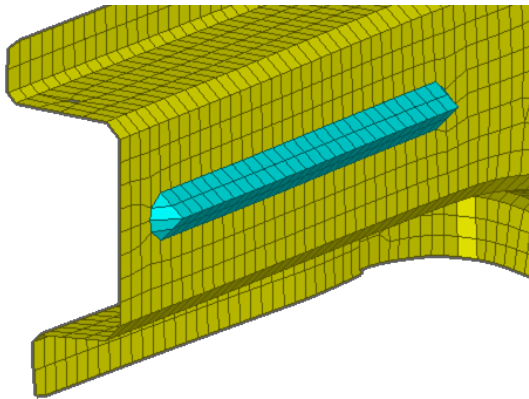
# Direct Morphing

Generation & modification of beads and embosses

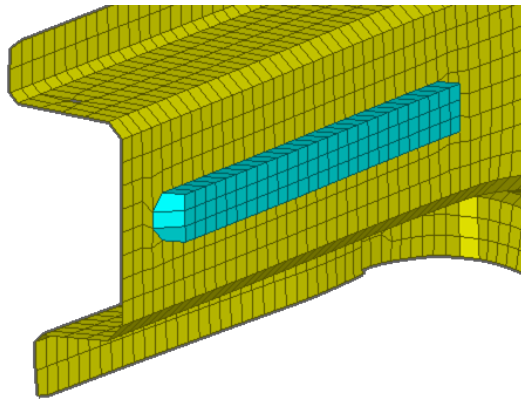
# Direct Morphing

## Generation & modification of beads and embosses

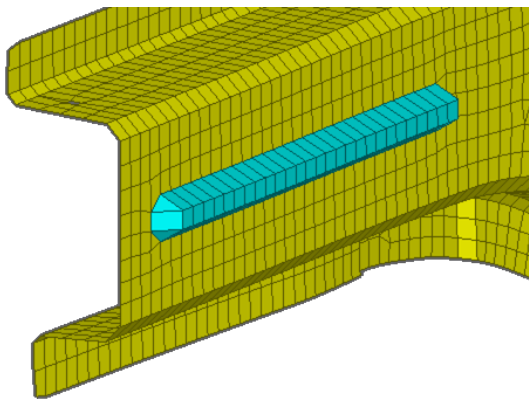
Triangular-shape



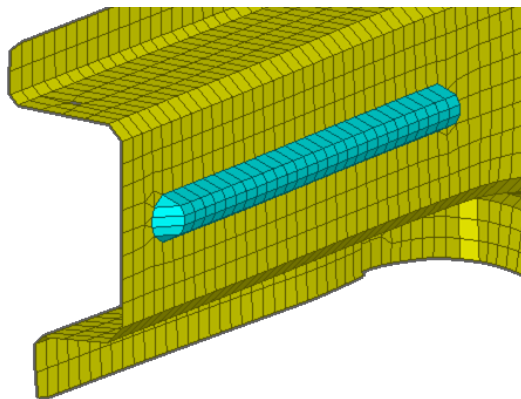
Box-shape



Trapezoidal-shape



Ellipse-shape



Depress ✕

Width:

Height:

Rows:

Offset mode:

Element length

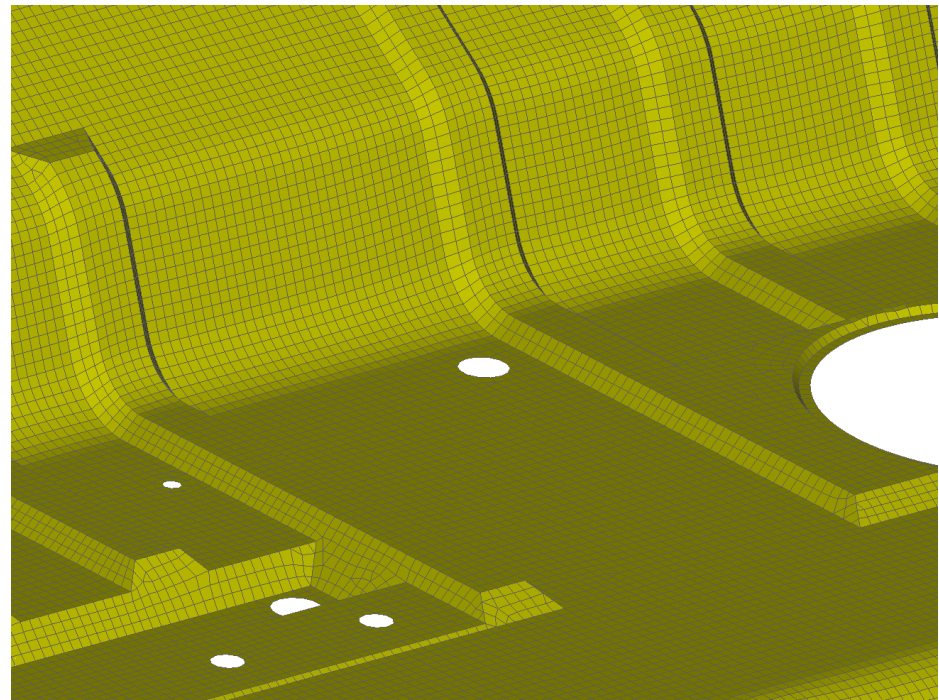
Type:

Flat width:



# Direct Morphing

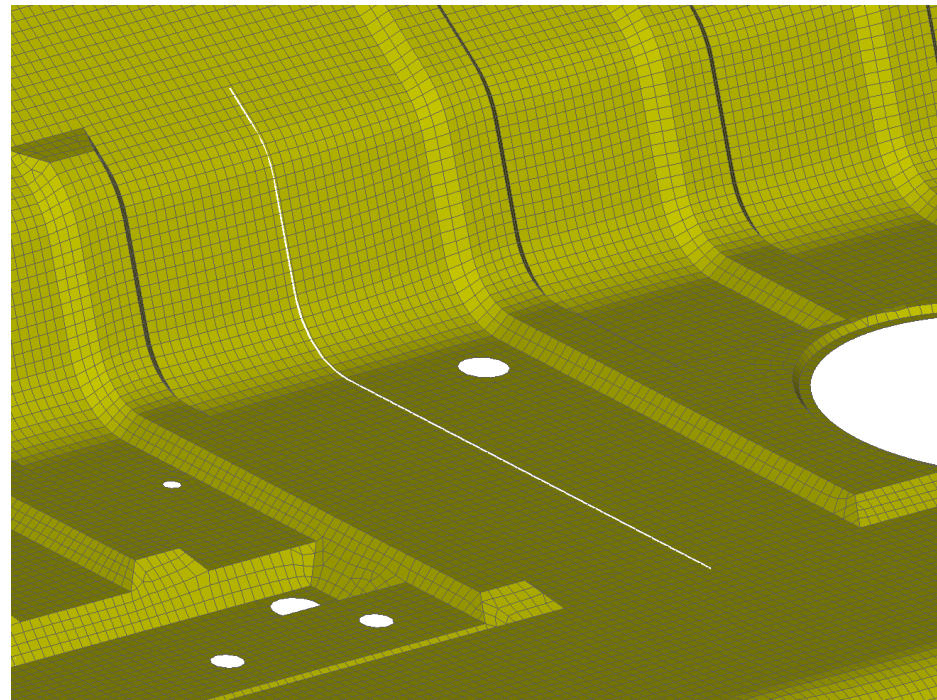
Generation & modification of beads and embosses



# Direct Morphing

Generation & modification of beads and embosses

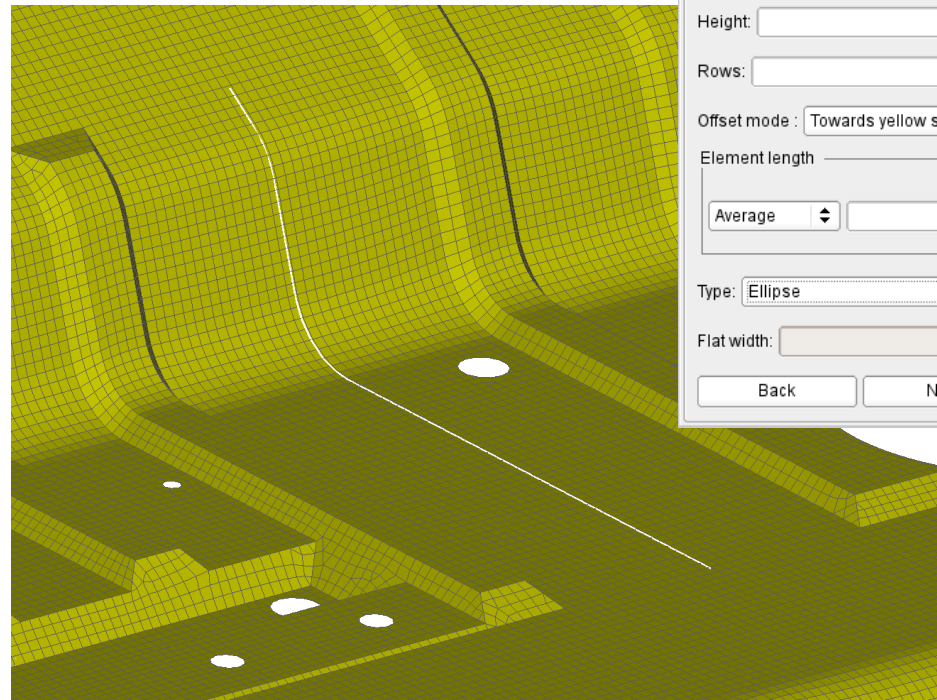
Curves



# Direct Morphing

Generation & modification of beads and embosses

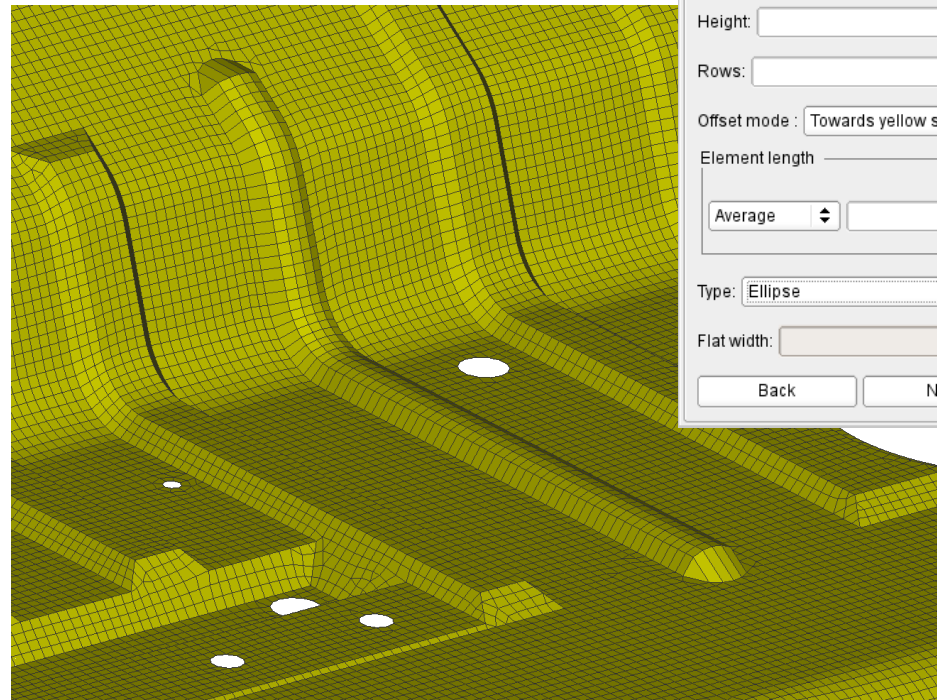
Curves  
↓  
Depress Parameter



# Direct Morphing

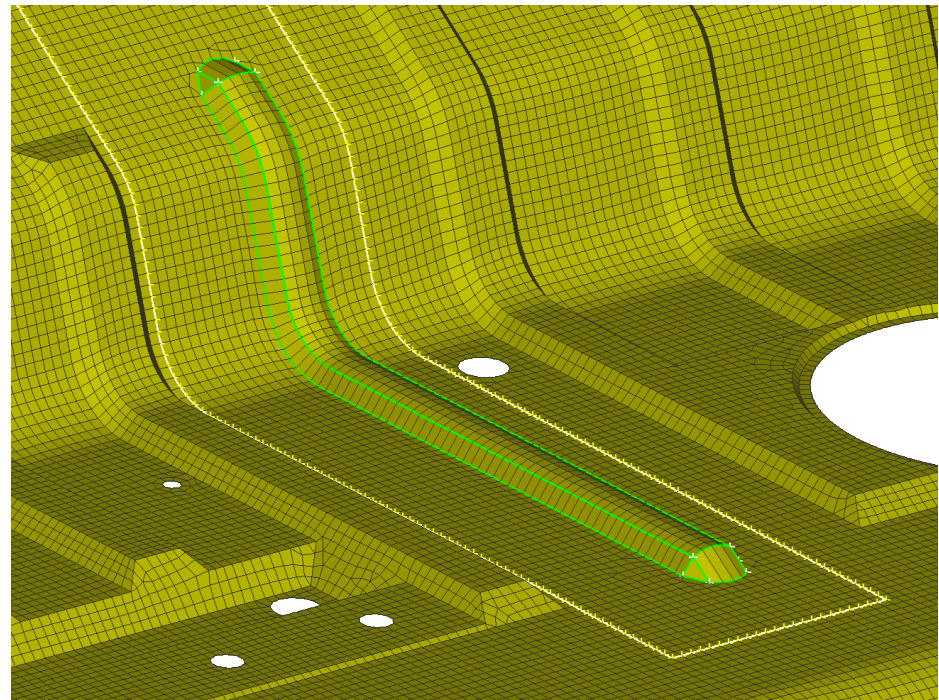
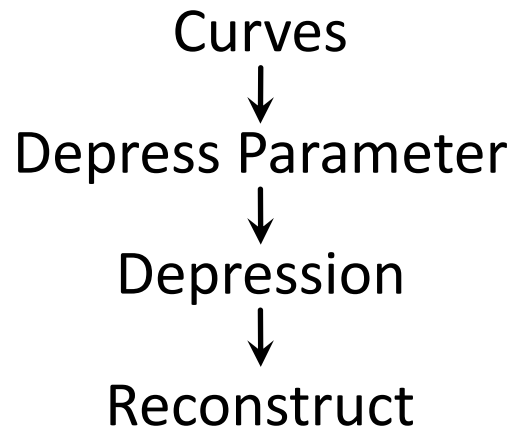
Generation & modification of beads and embosses

Curves  
↓  
Depress Parameter  
↓  
Depression



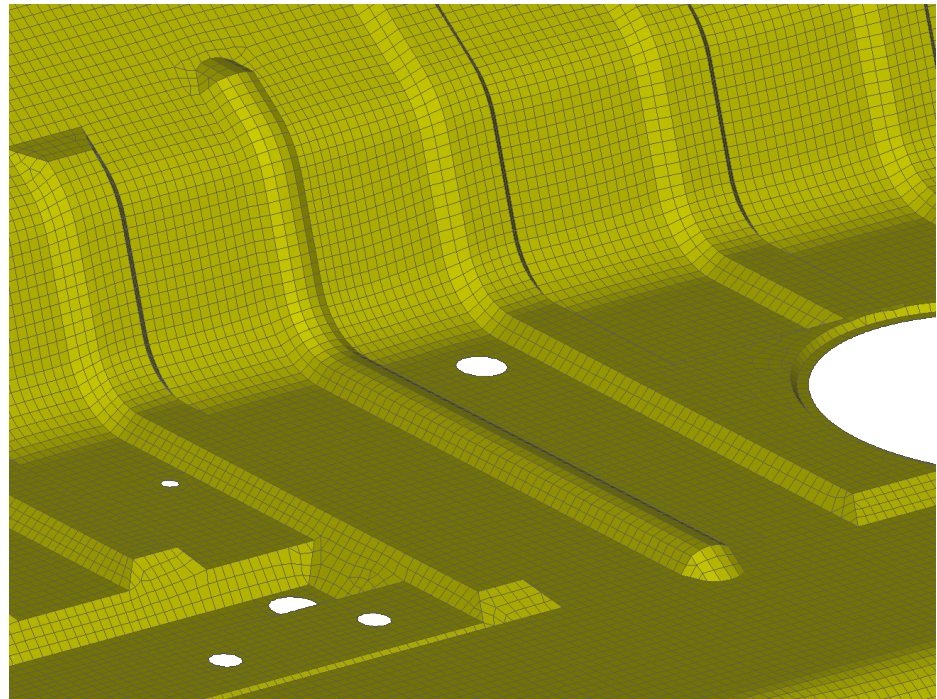
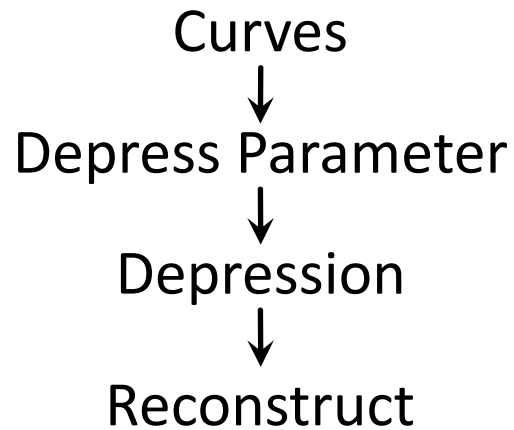
# Direct Morphing

Generation & modification of beads and embosses



# Direct Morphing

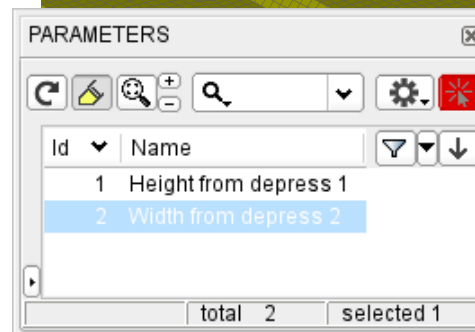
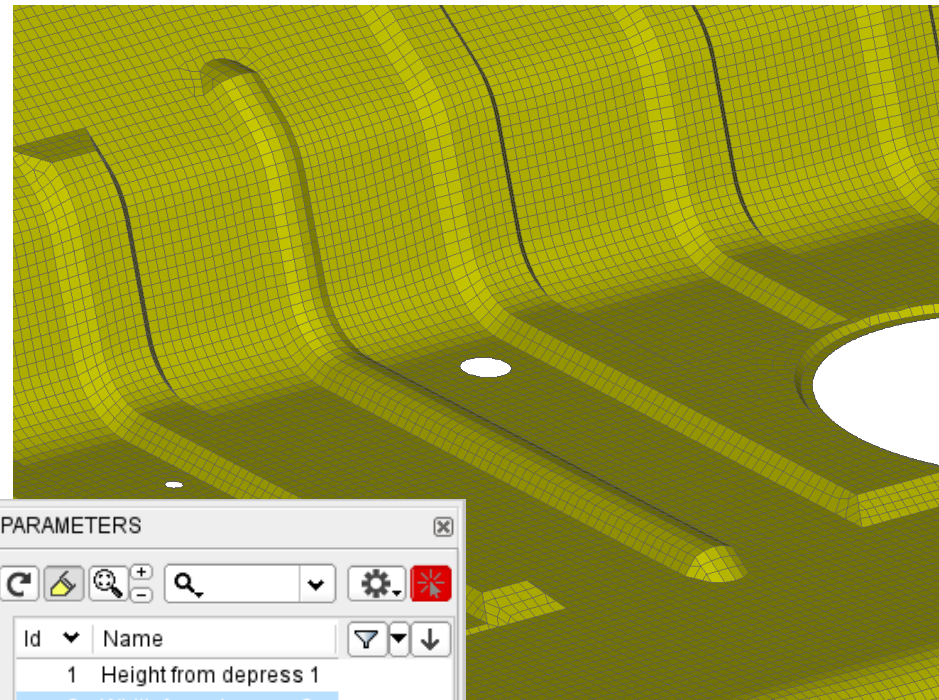
Generation & modification of beads and embosses



# Direct Morphing

Generation & modification of beads and embosses

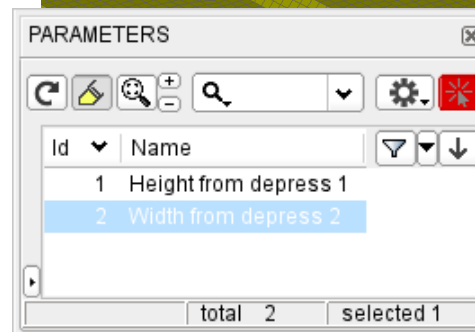
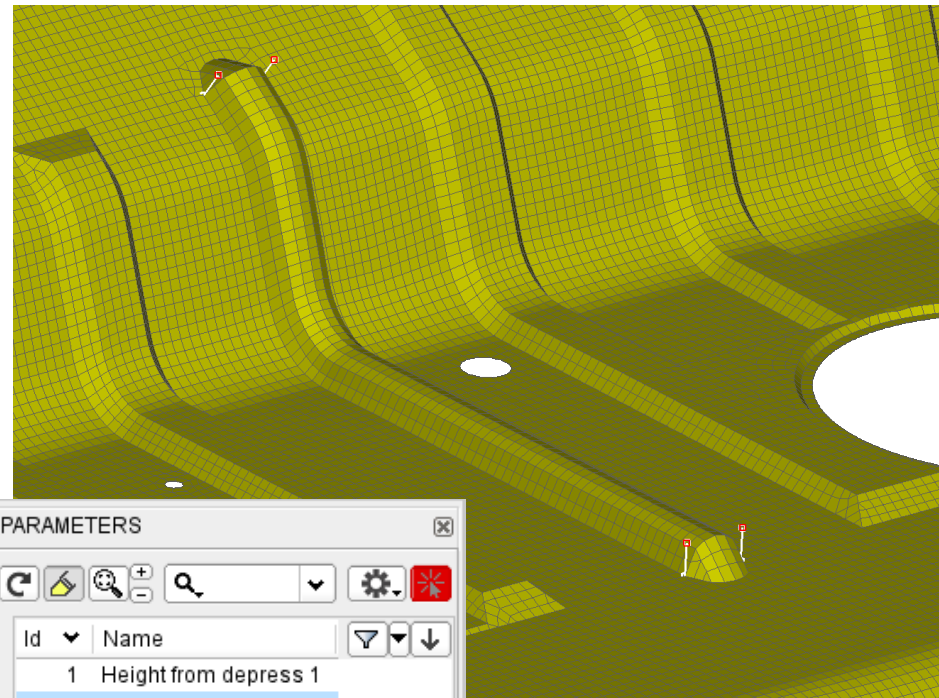
Curves  
↓  
Depress Parameter  
↓  
Depression  
↓  
Reconstruct  
↓  
Auto-created morph  
boxes and parameters



# Direct Morphing

Generation & modification of beads and embosses

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

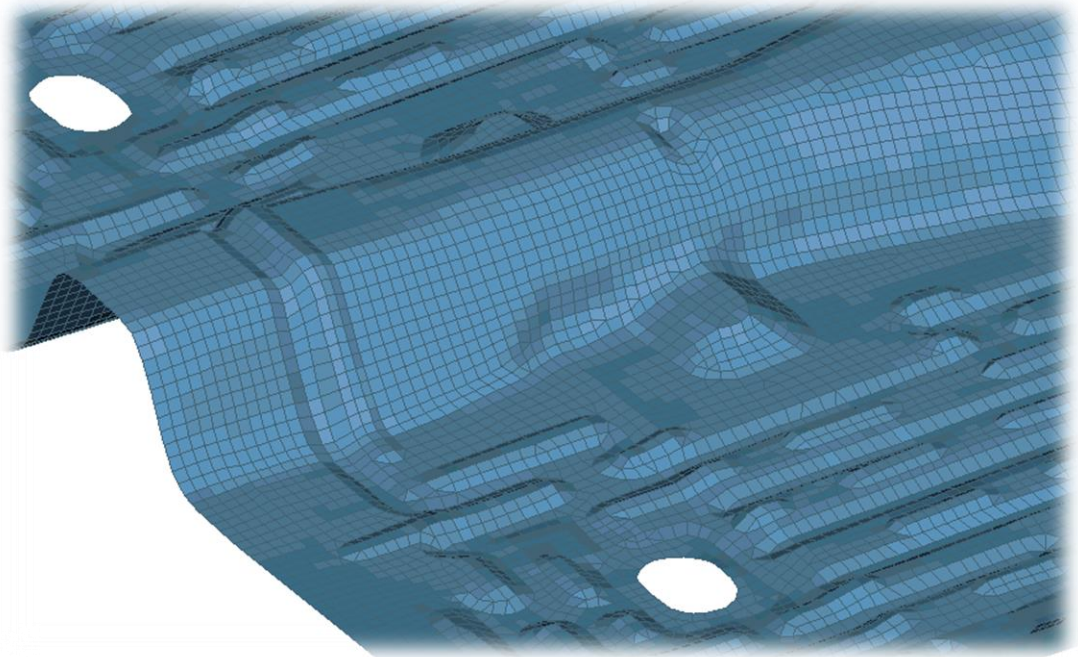




# Direct Morphing

## Slide Feature

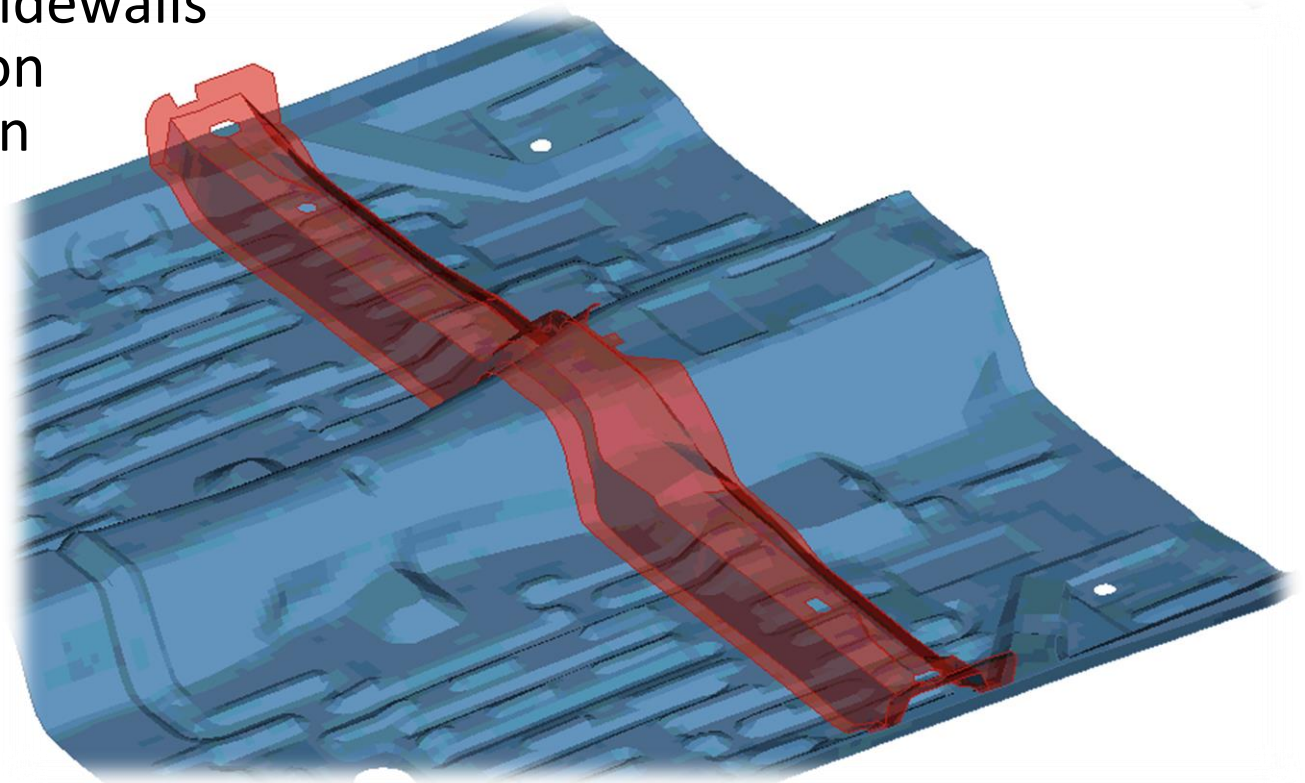
- Features of any shape (e.g. holes, beads, ribs) slide on underlying surface
- Mesh of origin and target areas is reconstructed
- Features are moved or copied



# Direct Morphing

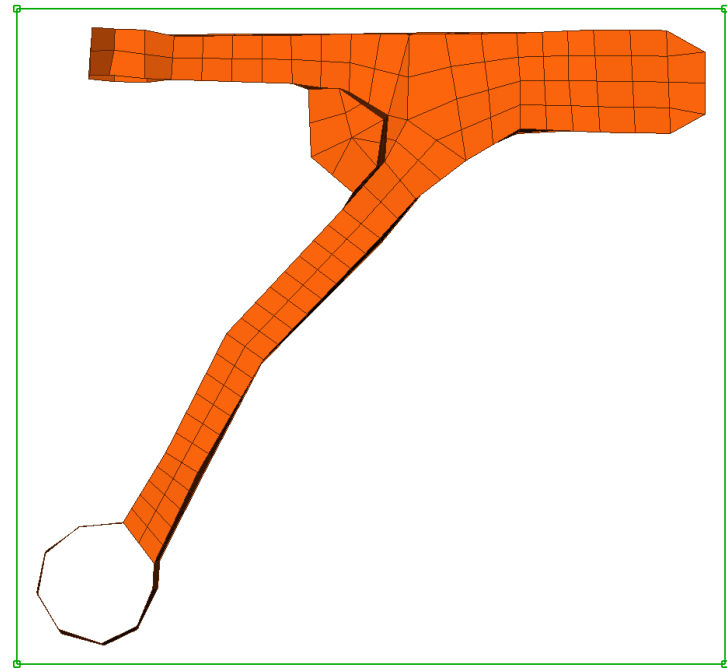
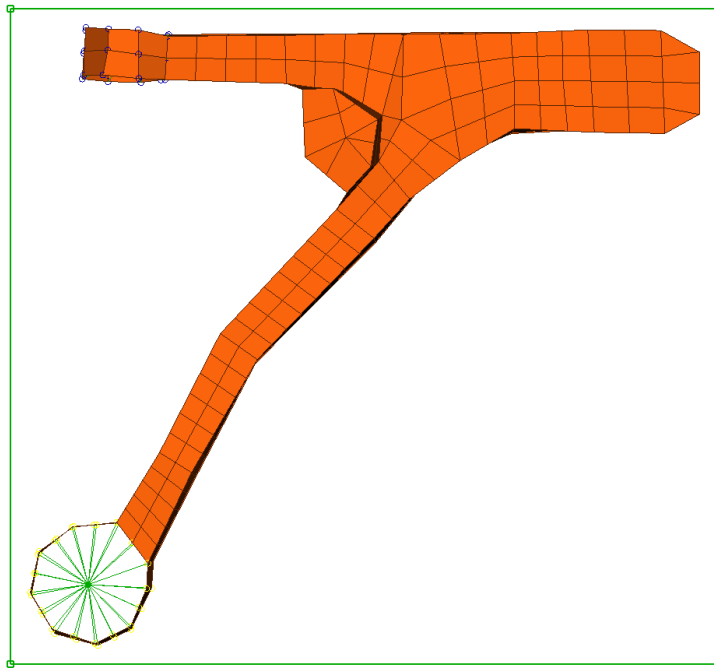
## Slide Member

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



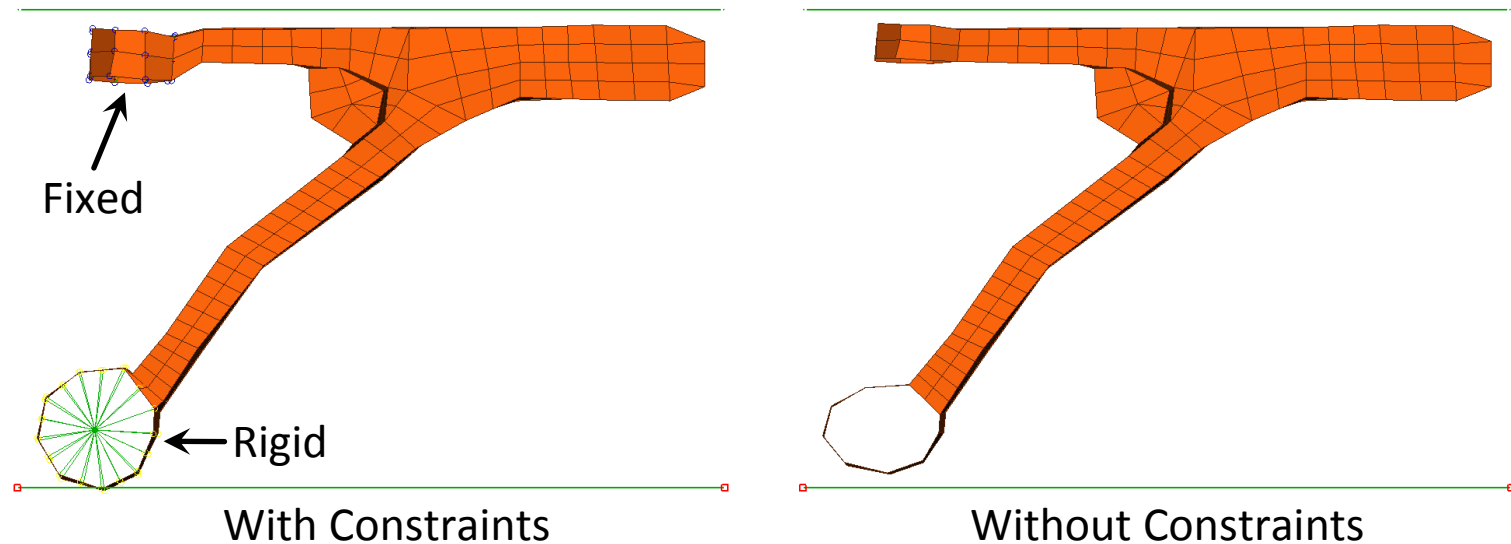
# Morphing Constraints

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



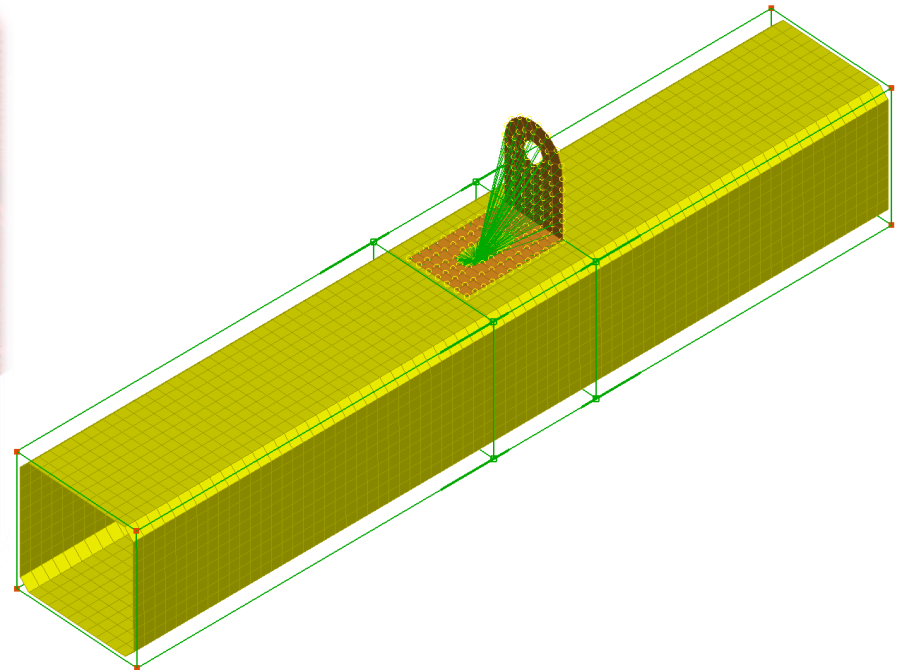
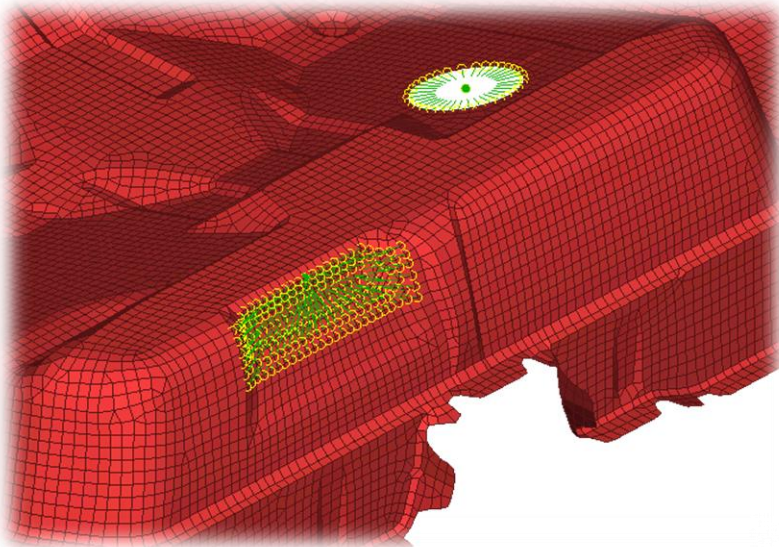
# Morphing Constraints

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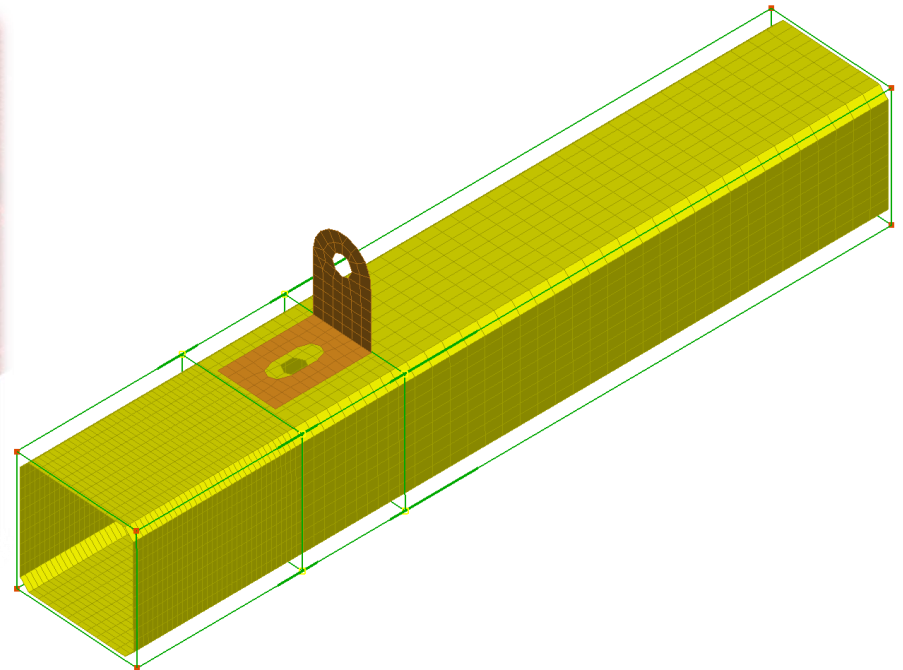
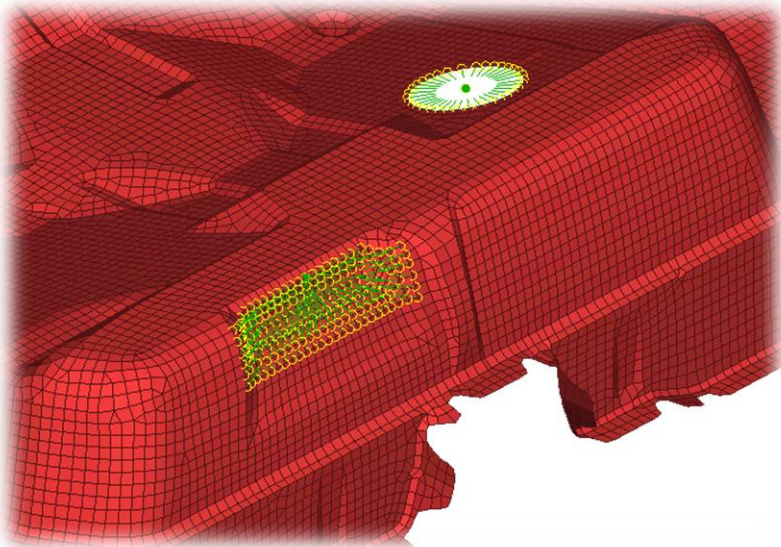
# Morphing Constraints

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# 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



# Record Morphing Actions

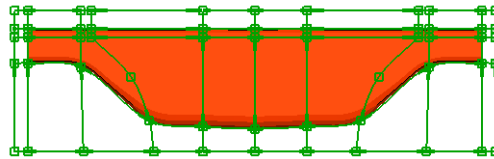
## Deformation Parameter

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

# Record Morphing Actions

## Deformation Parameter

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



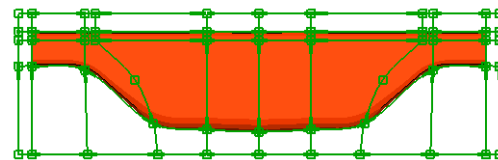
Initial shape – start recording



# Record Morphing Actions

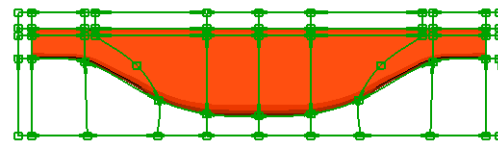
## Deformation Parameter

- Records any Box or Direct Morphing action
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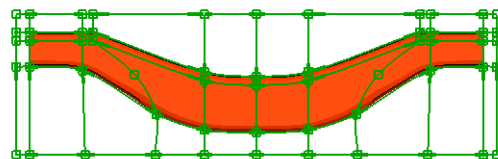


Initial shape – start recording

Edge Fit



Move Free

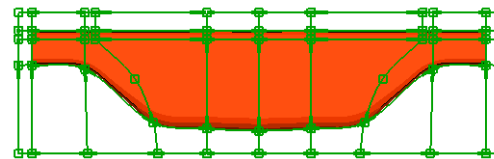


Deformed shape – stop recording

# Record Morphing Actions

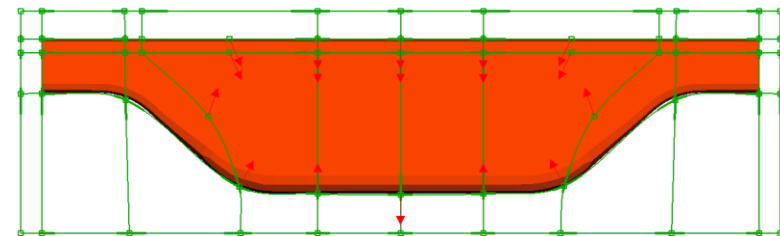
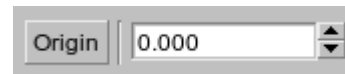
## Deformation Parameter

- Records any Box or Direct Morphing action
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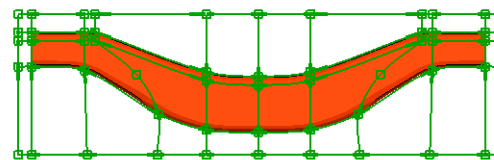


Initial shape – start recording

**Deformation  
Parameter**



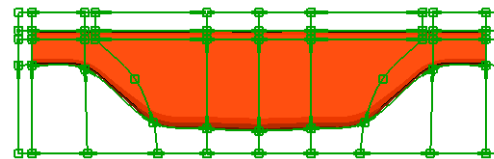
Deformed shape – stop recording



# Record Morphing Actions

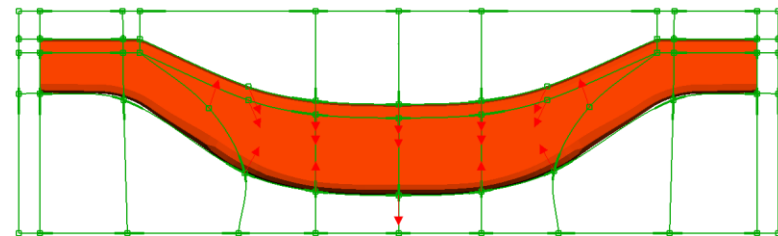
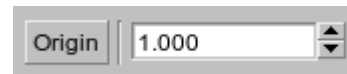
## Deformation Parameter

- Records any Box or Direct Morphing action
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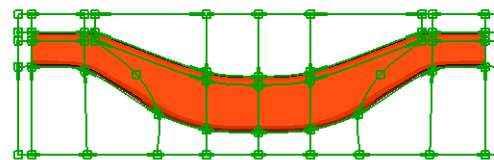


Initial shape – start recording

**Deformation  
Parameter**



Deformed shape – stop recording



# Mapping of Deformations

# Mapping of Deformations

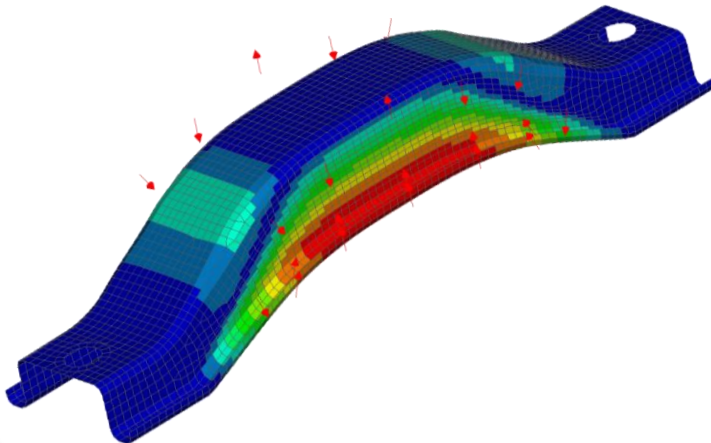
- Morph according existing deformation field:
  - Deformation Parameter
  - History States
  - DESVAR of Nastran SOL 200
  - Text file

# 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

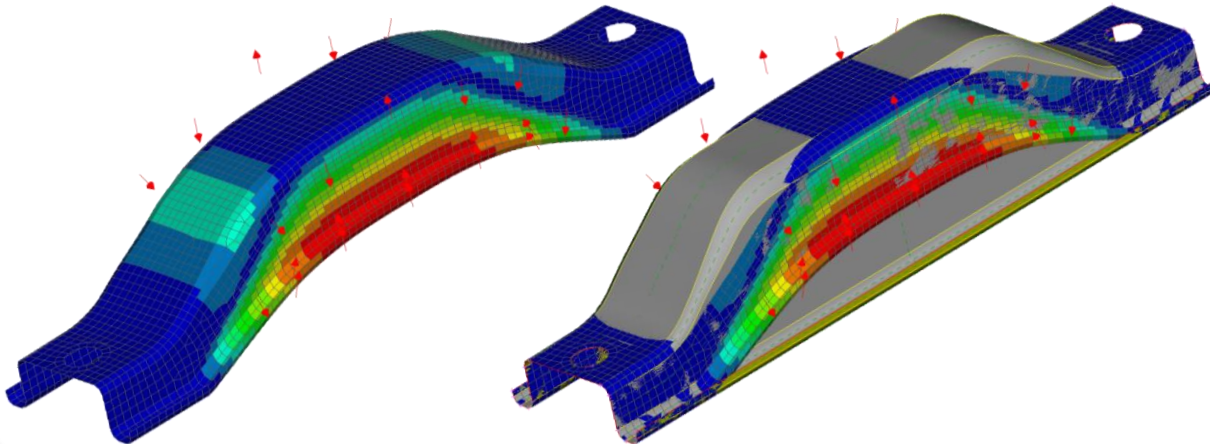
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  - Deformation Parameter
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  - DESVAR of Nastran SOL 200
  - Text file
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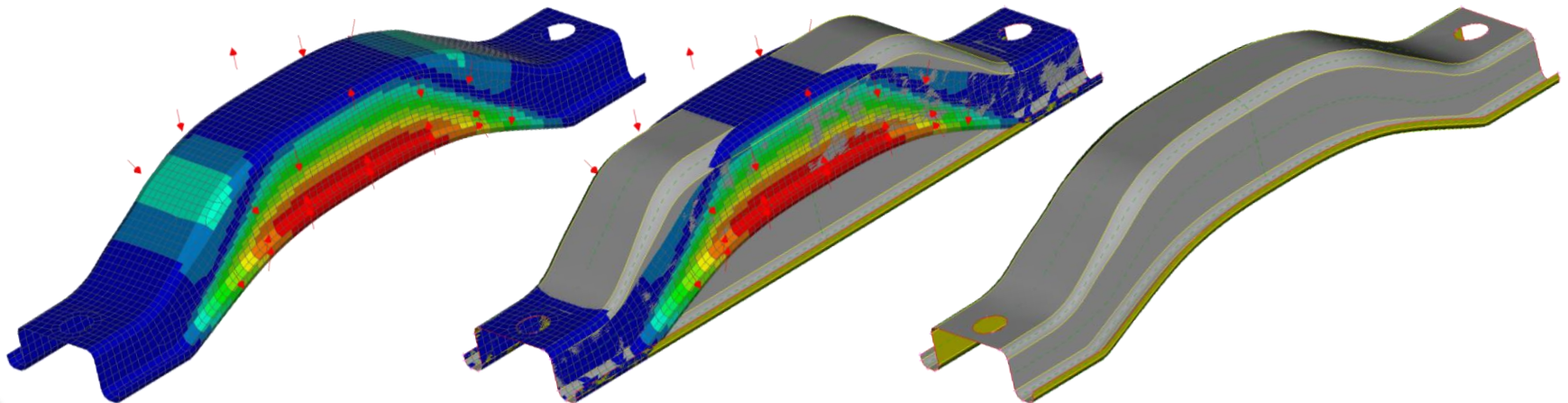
- Morph according existing deformation field:
  - Deformation Parameter
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  - DESVAR of Nastran SOL 200
  - Text file
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## Mapping of Deformations

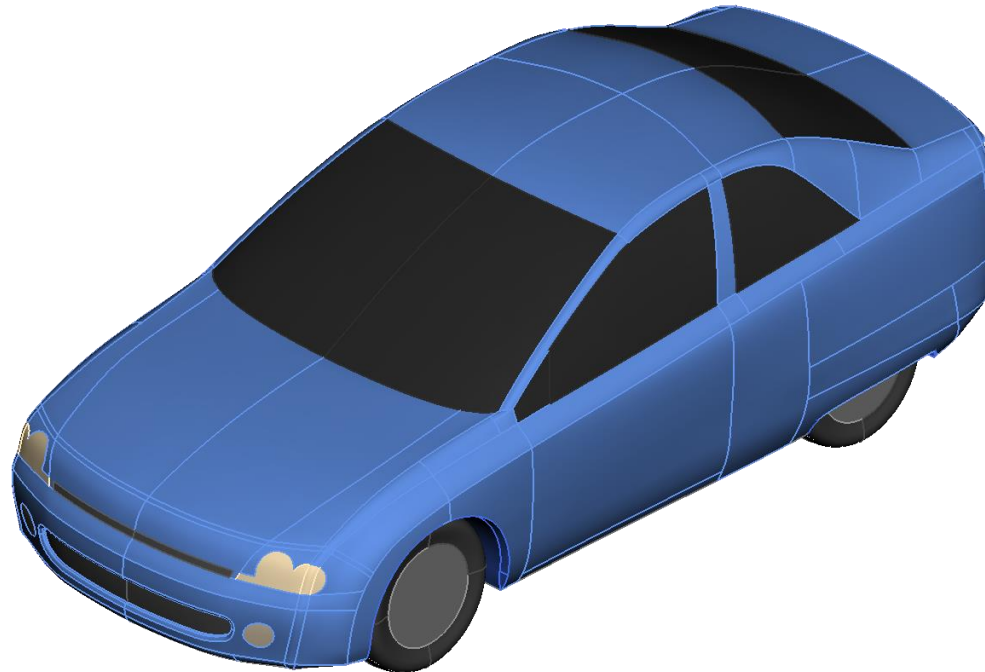
- Morph according existing deformation field:
  - Deformation Parameter
  - History States
  - DESVAR of Nastran SOL 200
  - Text file
- E.g. Modify geometry according optimized FE-model



# Functionalities assisting Morphing

## 3D Points and Curves

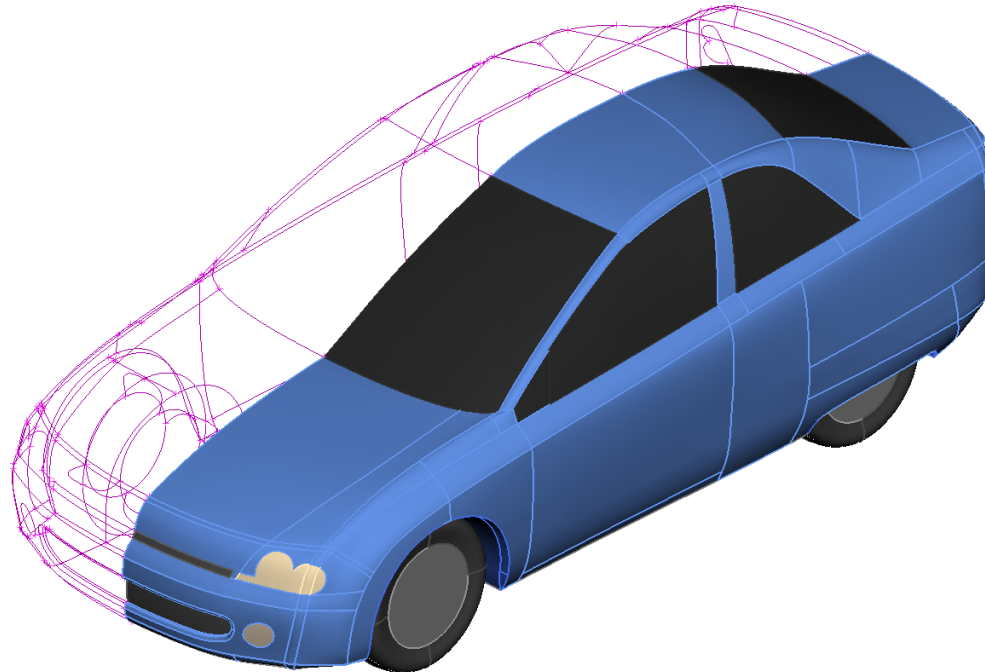
- Act as initial or target positions for fittings
- Suitable for Box and Direct Morphing
- Obtained from FE mesh or CAD geometry



# Functionalities assisting Morphing

## 3D Points and Curves

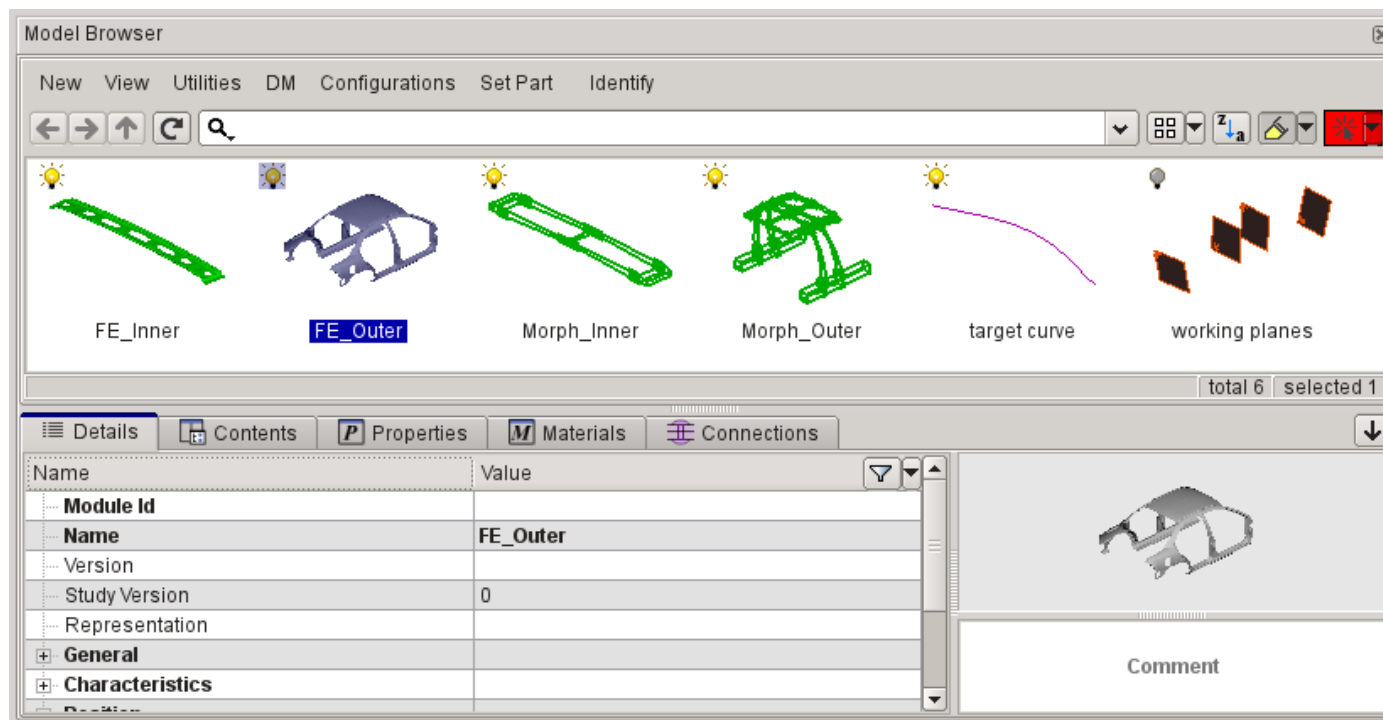
- Act as initial or target positions for fittings
- Suitable for Box and Direct Morphing
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# Functionalities assisting Morphing

## Model Browser

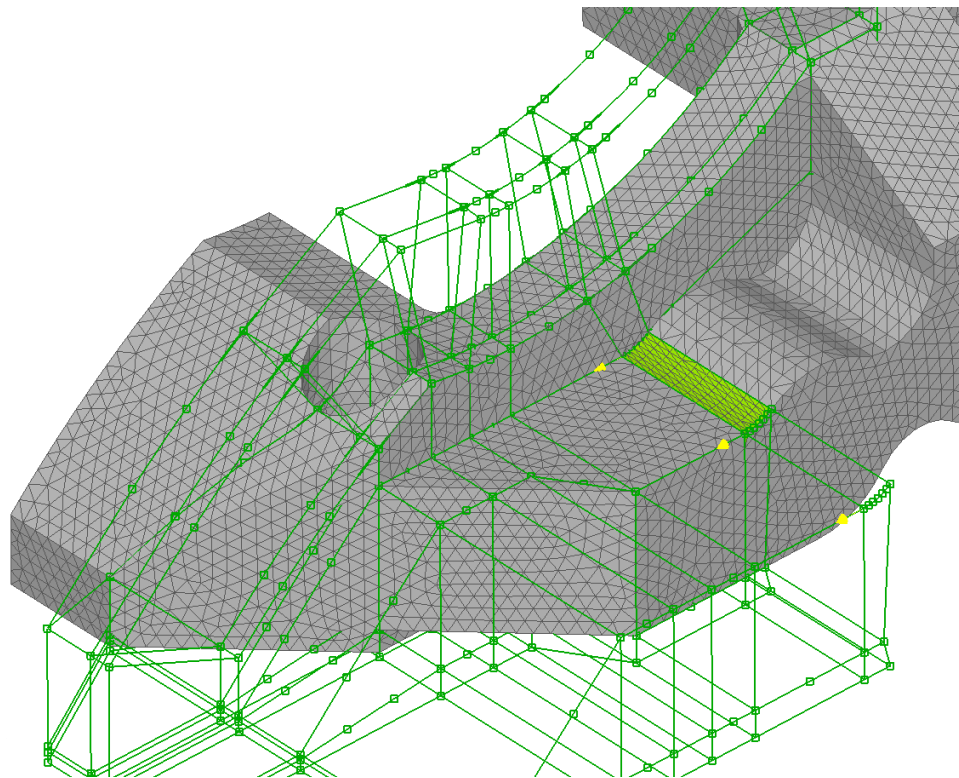
- Useful for Box Morphing (esp. complex configurations)
- To organize morph contents



# Functionalities assisting Morphing

## Reconstruct / Smooth morphed mesh

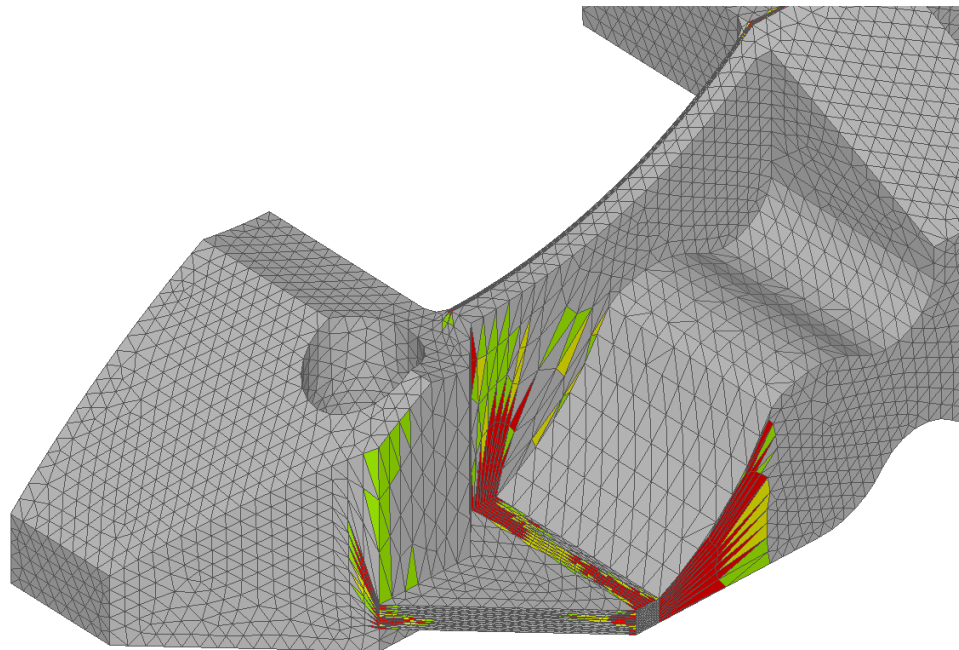
- Suitable for Box and Direct Morphing
- Improve mesh after morphing with large deformations



# Functionalities assisting Morphing

## Reconstruct / Smooth morphed mesh

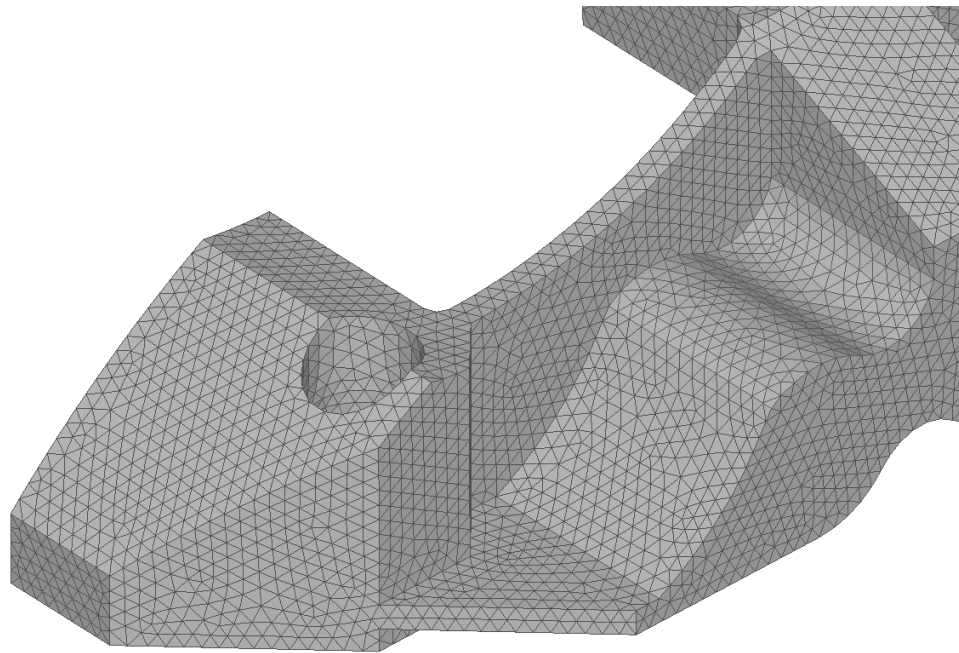
- Suitable for Box and Direct Morphing
- Improve mesh after morphing with large deformations



# Functionalities assisting Morphing

## Reconstruct / Smooth morphed mesh

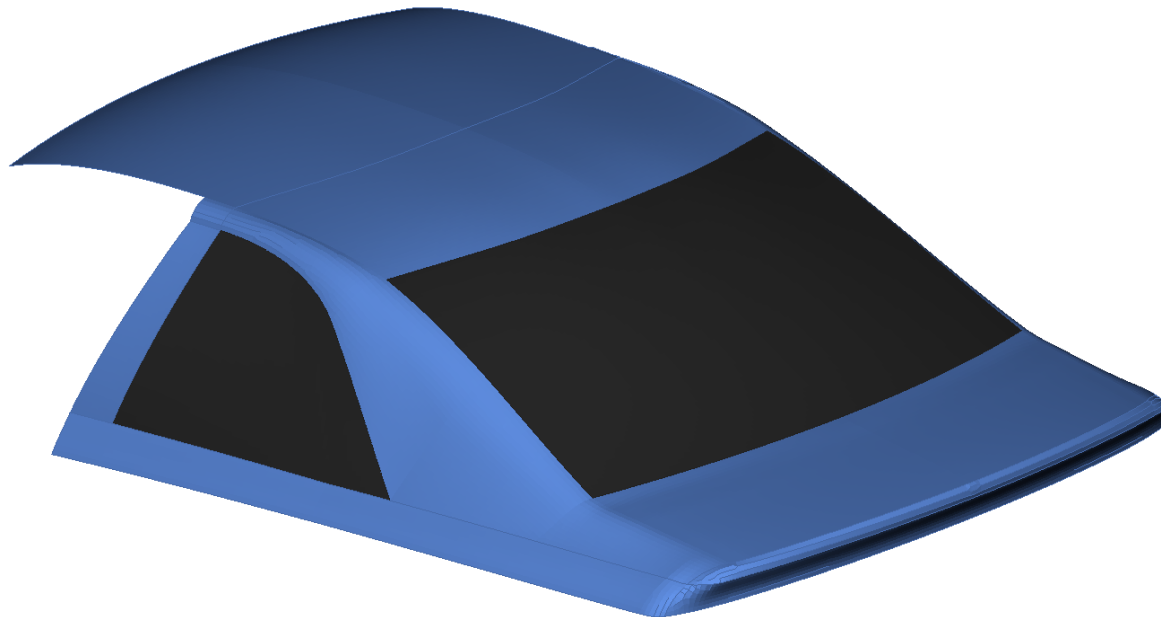
- Suitable for Box and Direct Morphing
- Improve mesh after morphing with large deformations



# Functionalities assisting Morphing

## Visualize Morphing Deviations

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

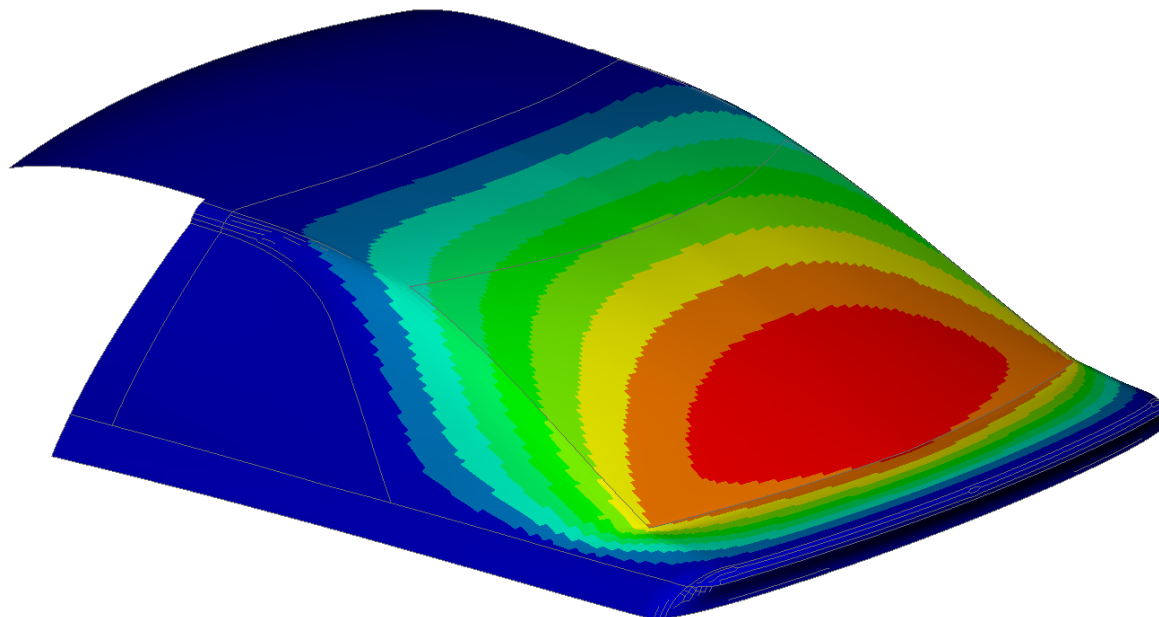




# Functionalities assisting Morphing

## Visualize Morphing Deviations

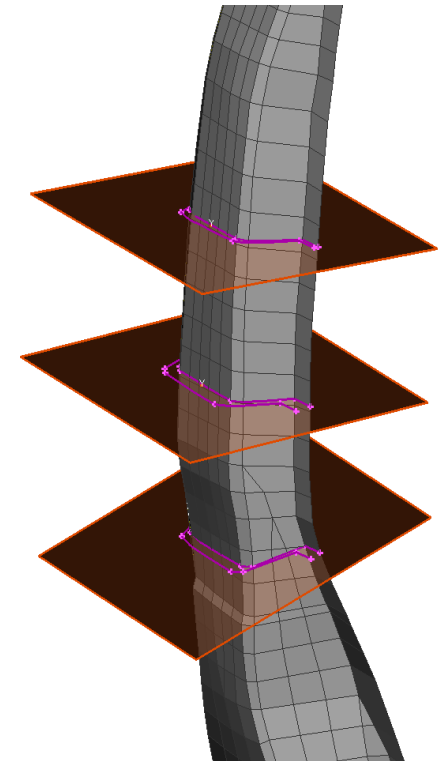
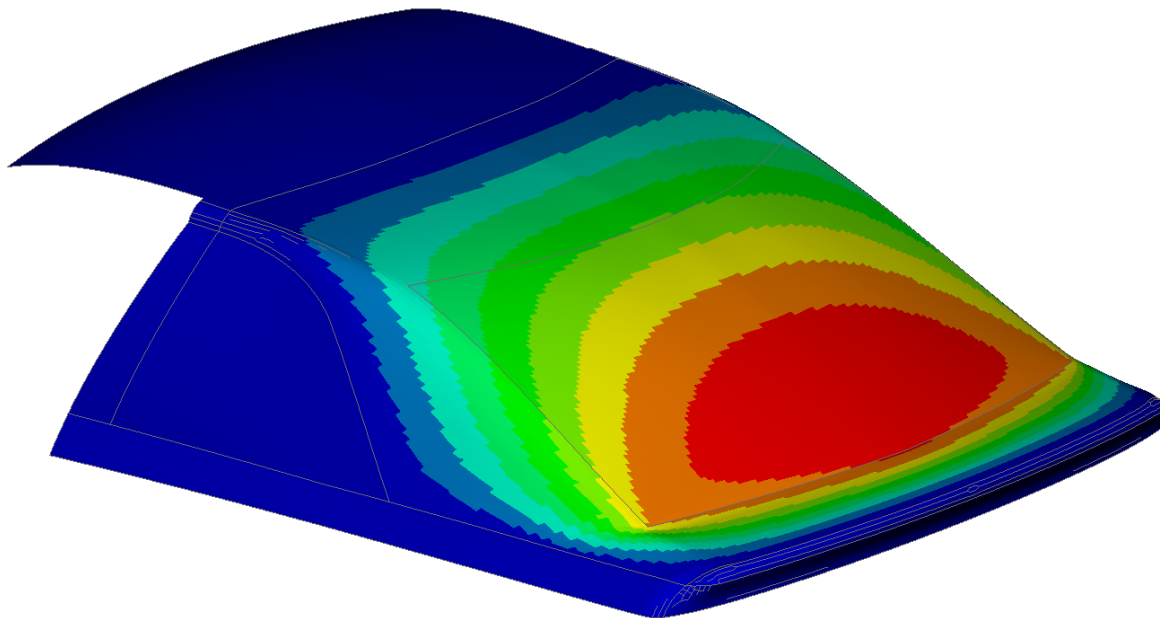
- Suitable for Box and Direct Morphing
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# Functionalities assisting Morphing

## Visualize Morphing Deviations

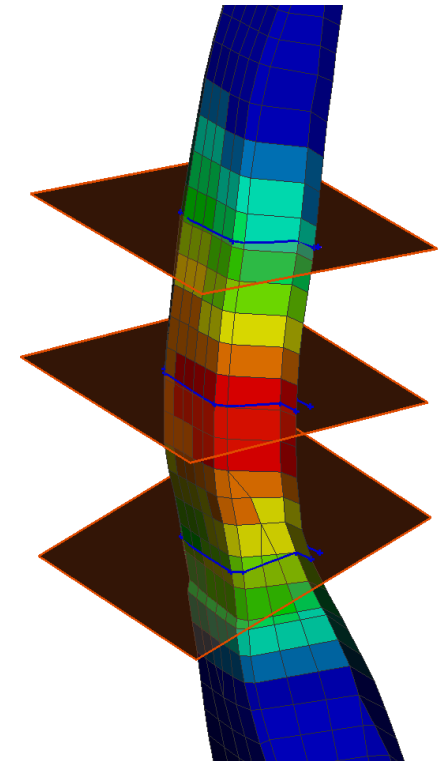
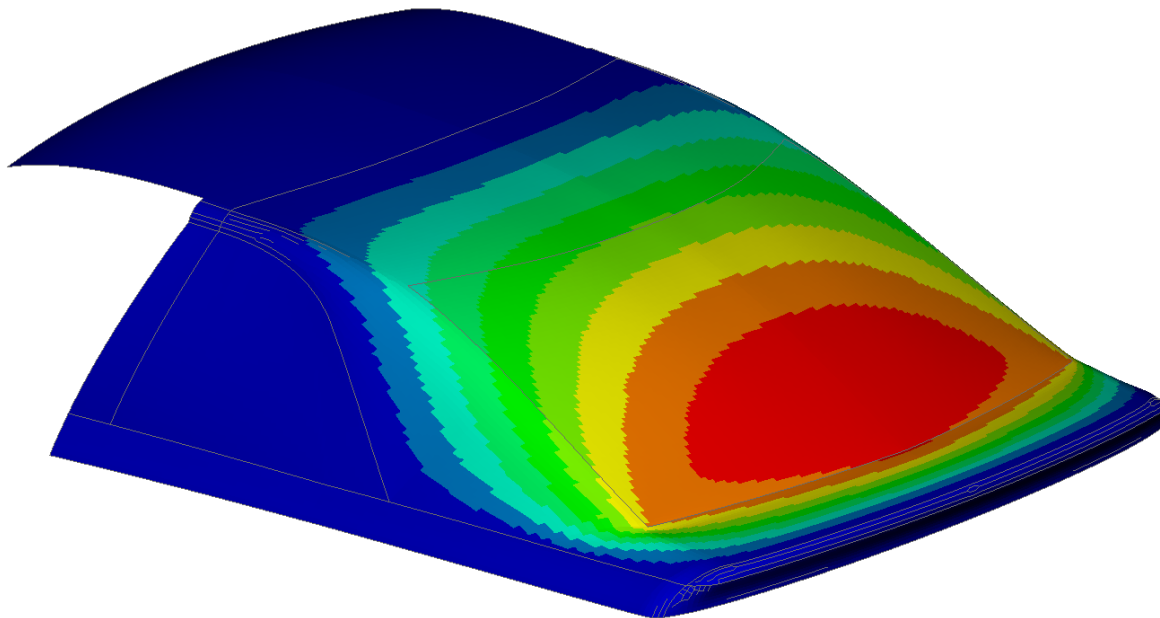
- Suitable for Box and Direct Morphing
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# Functionalities assisting Morphing

## Visualize Morphing Deviations

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



# ANSA Parameter

- For parameterization of solver card entries

\*DLOAD [DLOAD]

Name

FROZEN\_DELETE  
NO

STEP	OP	AMPLITUDE	STEADY STATE LOADING
1	NEW		

by ELSET LOAD TYPE magn(EID)  
set 3 P

Comment

OK Cancel

# ANSA Parameter

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

\*DLOAD [DLOAD]

Name

FROZEN\_DELETE  
NO

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

Comment

OK Cancel

A\_PARAMETER

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

total 3 selected 0

# ANSA Parameter

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

\*DLOAD [DLOAD]

Name

FROZEN\_DELETE  
NO

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

by  ELSET  LOAD TYPE  magn(EID)

set  3  P  =ignite1

Comment

=ignite1

OK Cancel

A\_PARAMETER

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

total 3 selected 1

# ANSA Parameter

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

\*DLOAD [DLOAD]

Name

FROZEN\_DELETE  
NO

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

by  set  3  P  =ignite1

Comment

=ignite1

OK Cancel

A\_PARAMETER

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

total 3 selected 1

```

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

```

# ANSA Parameter

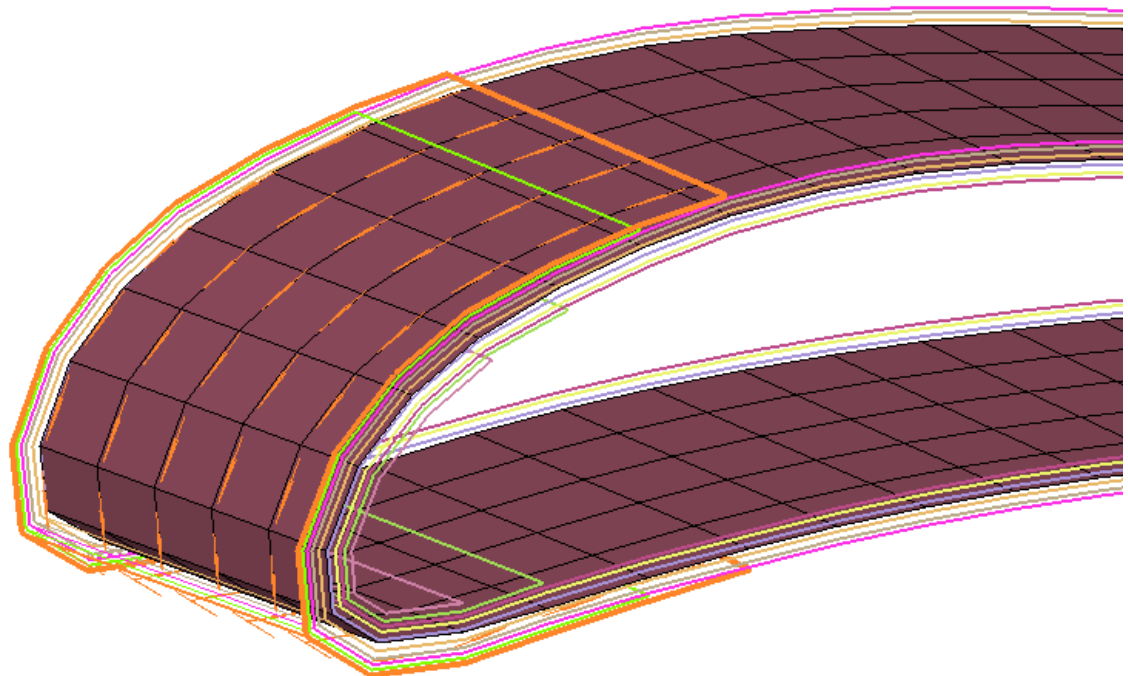
- For parameterization of composite properties, e.g.:

Layers

PID	Z0	NSM	S
1			

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

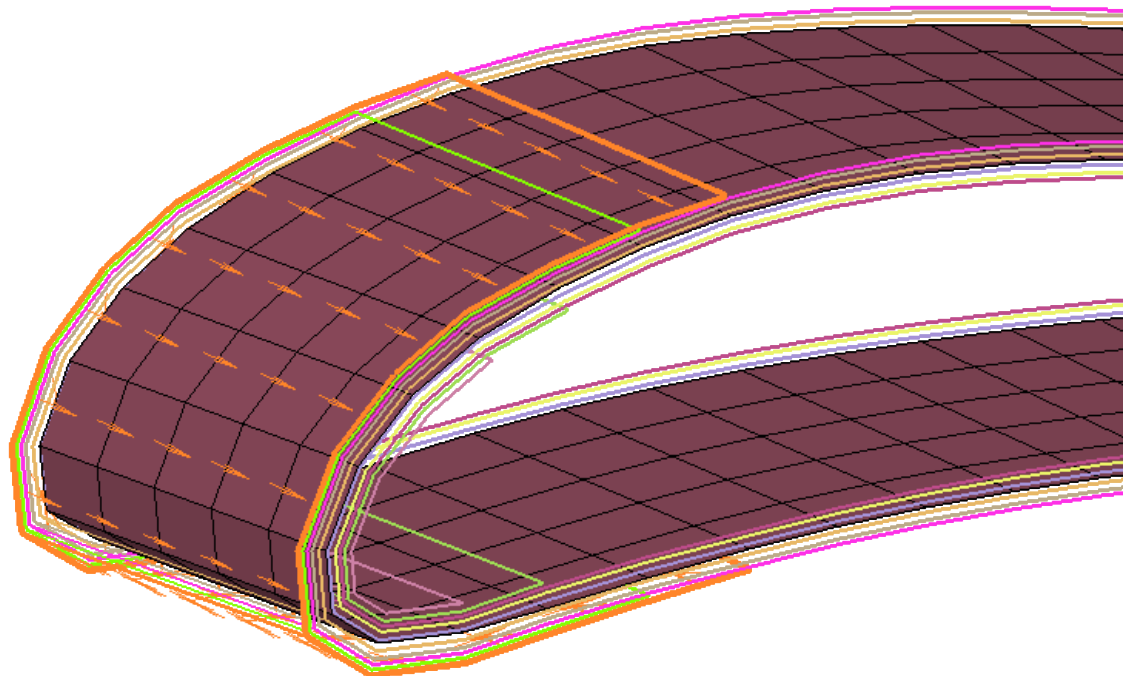




# ANSA Parameter

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

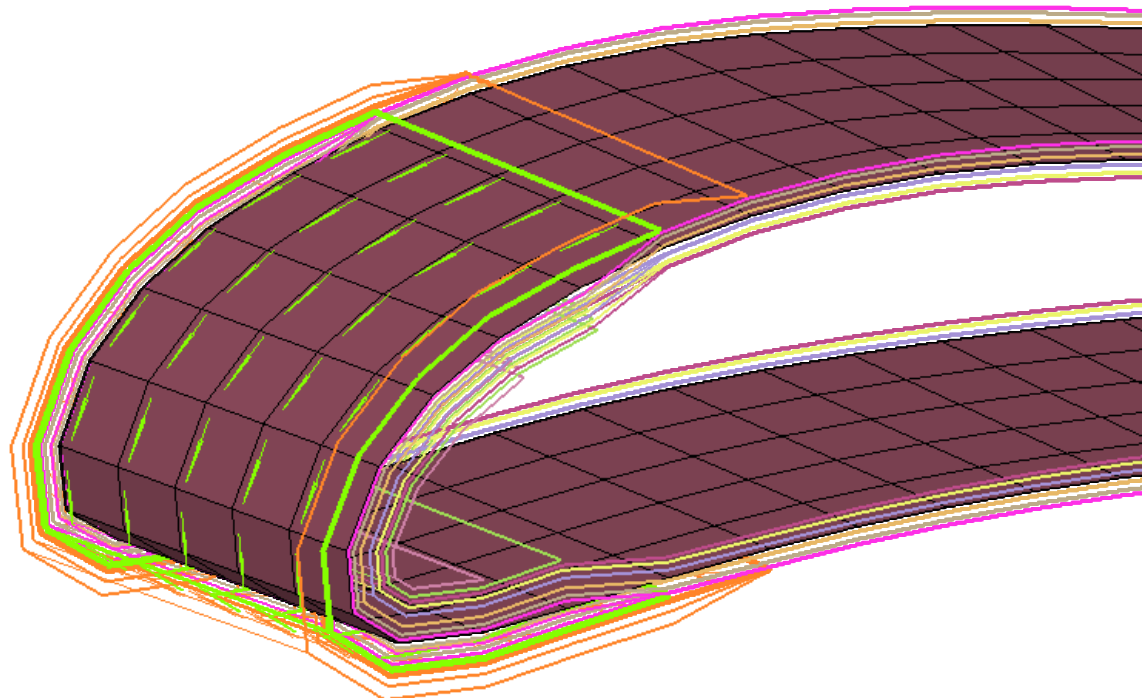
Layers				
PID	Z0	NSM	S	
1				
AVA	Type	T	THETA	m:
1	Sequence			
1	Layer	0.2	90.	
2	Layer	0.1	-45.	
3	Layer	0.1	45.	
4	Layer	0.2	0.	
5	Layer	0.2	0.	
6	Layer	0.1	45.	
7	Layer	0.1	-45.	
8	Layer	0.2	90.	



## ANSA Parameter

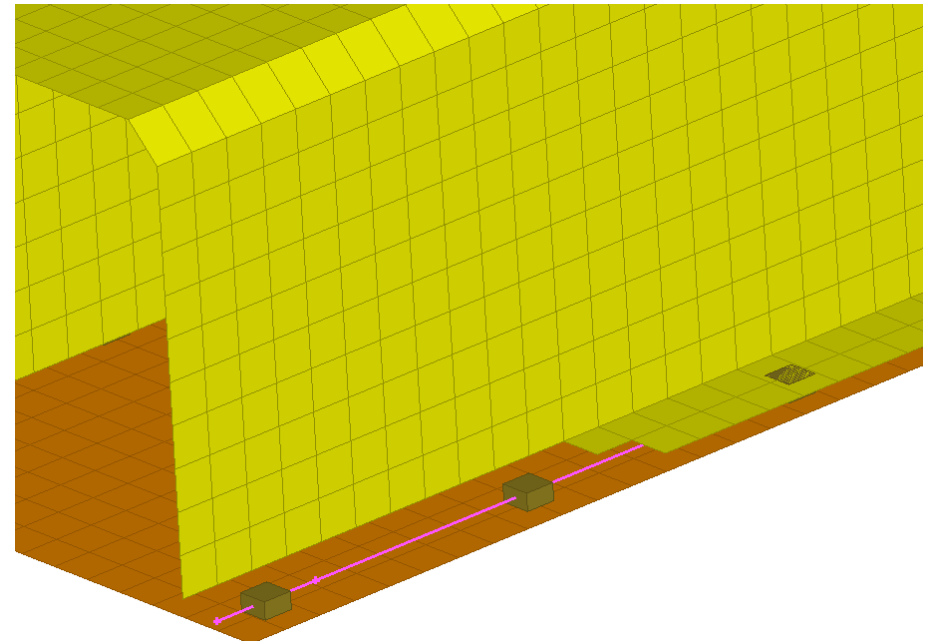
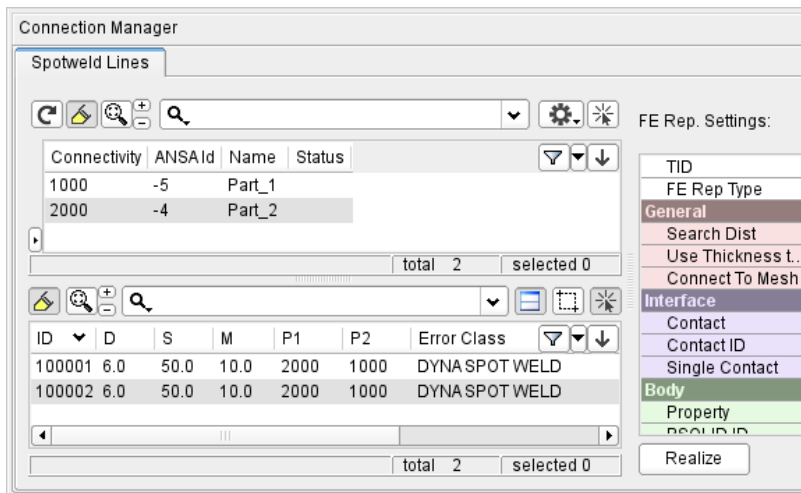
- For parameterization of composite properties, e.g.:
  - fabric orientation
  - layer thickness

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



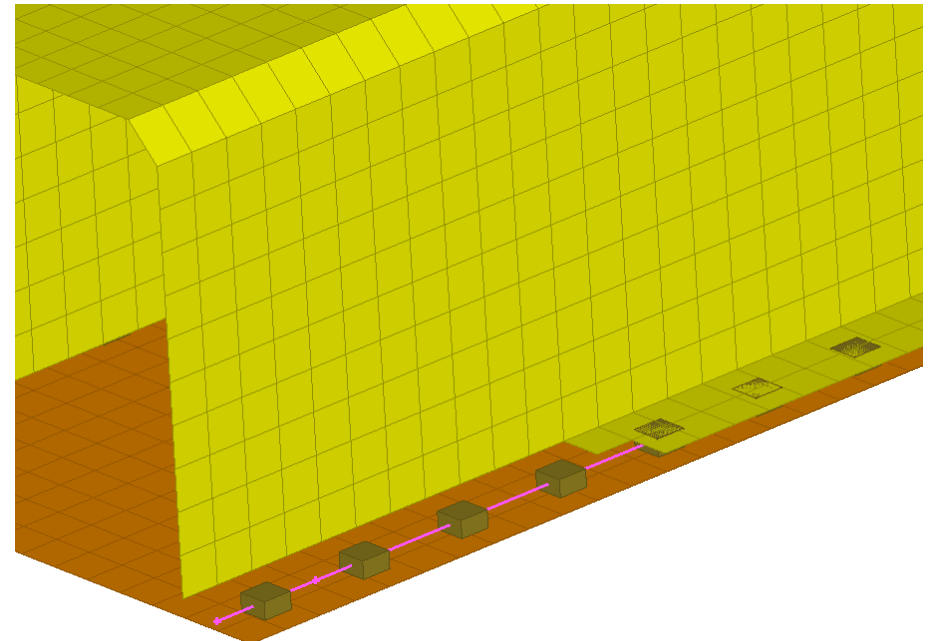
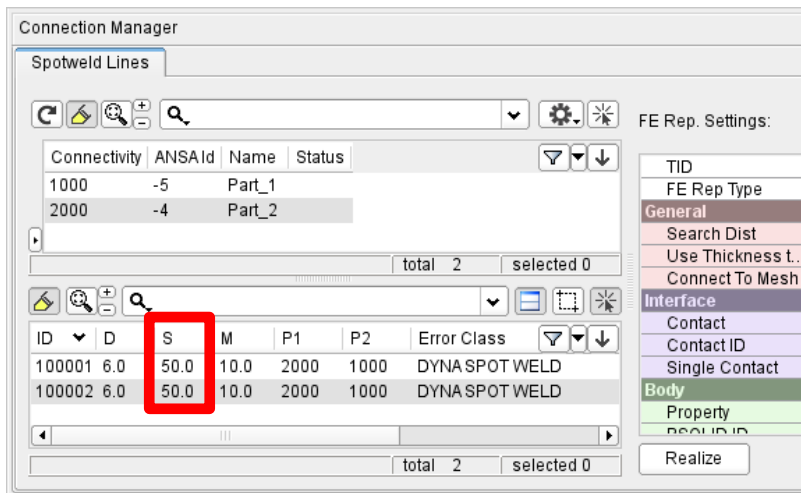
# ANSA Parameter

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



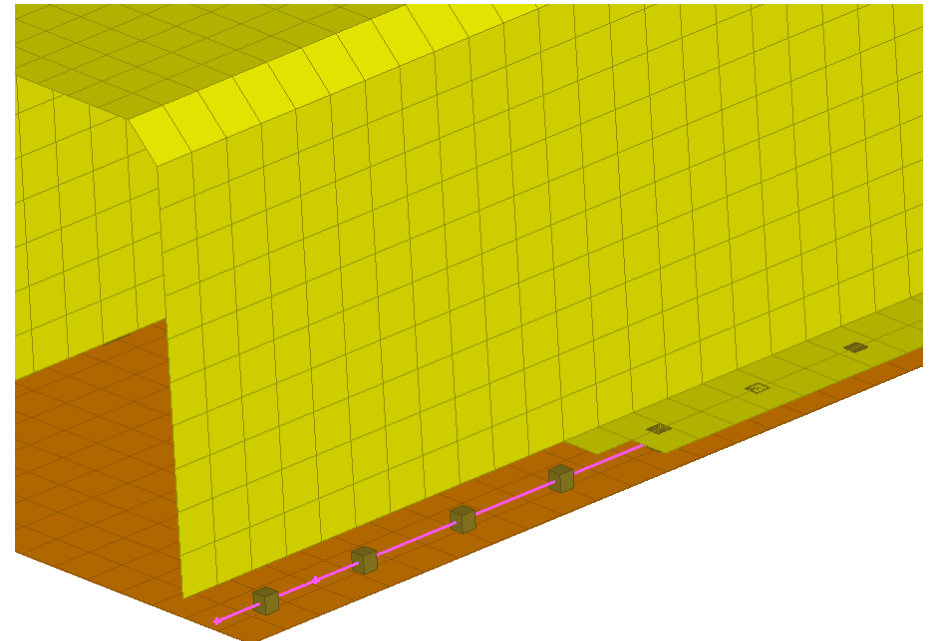
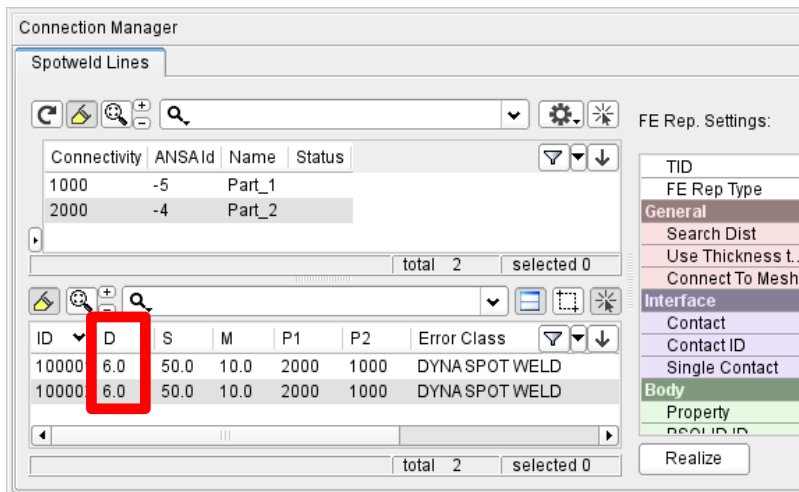
# ANSA Parameter

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

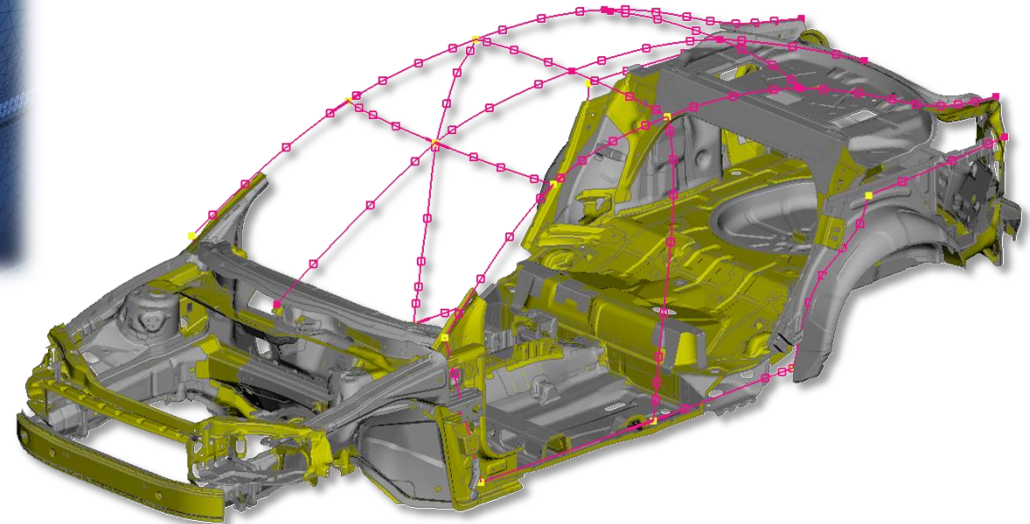
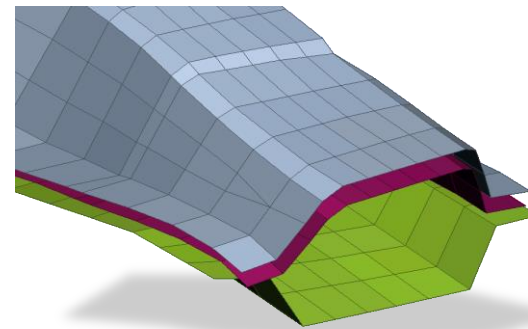
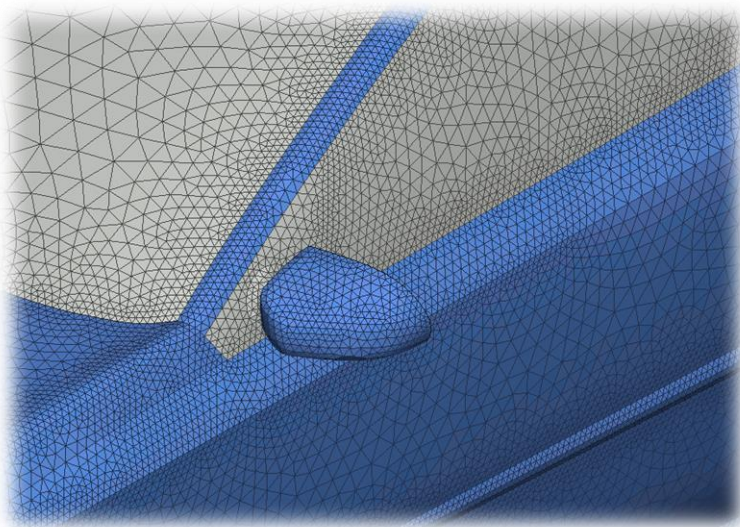


# ANSA Parameter

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



# Ευχαριστώ πολύ



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Mail: [ansa@lasso.de](mailto:ansa@lasso.de)