

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)
 - \rightarrow Morphing
- Modification of solver card entries (e.g. property thickness, used material, connection properties)

 \rightarrow ANSA Parameter





Types of Parameterization

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





Translate, rotate or scale FE-mesh or Geometry entities



- Control Entities
- Morphed Entities
- Boundary
- Morphing



Snap <u>FE</u> or geometry edges to <u>single</u> or multiple target curves



- Origin
- Target
- Morphed Entities
- Boundary



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Snap <u>FE</u> or geometry edges to <u>single</u> or multiple target curves



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



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



- Origin
- Target
- Morphed Entities
- Boundary



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



- Origin
- Target
- Morphed Entities
- Boundary
- Morphing



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



 Original FE-surface (with additional underlying parts)



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



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



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



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



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



• Original cross section



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



- Original cross section
- Target cross section



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



- Original cross section
- Target cross section
- Morphing



Generation & modification of beads and embosses

Triangular-shape



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Direct Morphing Generation & modification of beads and embosses





Direct Morphing Generation & modification of beads and embosses

Curves





X

Depress

Direct Morphing Generation & modification of beads and embosses









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 Depress Parameter Depression Reconstruct Auto-created morph boxes and parameters





Box Morphing Types of boxes



• 3D

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



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





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





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





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









• Around Entities





- Around Entities
- Buffer Zones





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



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



- 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.





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







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





With Nested Elements

Without Nested Elements



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





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





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





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



Initial shape – start recording



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





- Records any direct or box morphing action
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- Records any direct or box morphing action
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Mapping of Deformations

- Morph according existing deformation field:
 - Deformation Parameter

 - History StatesDESVAR 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





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Functionalities assisting Morphing Reconstruct / Smooth morphed mesh

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Functionalities assisting Morphing Visualize Morphing Deviations

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



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

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





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







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

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

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