Midsurface generation in HyperMesh

- Generate new geometry representing the mid-plane of complex “thin-solid” type parts.
  - Formed sheet metal parts
  - Molded plastic parts
- Original geometry remains unchanged
- Ideally, parts have inner/outer face surfaces that correspond to each other
  - Thickness should be clearly smaller than length/width dimensions
  - Suppressing/removing/deleting unnecessary features and details can improve results
- Thickness information is stored with the generated midsurface
Midsurface generation process flowchart

Use the **auto midsurface** sub-panel

Success?

**no**

Use **surface pair**
Sub-panel to make Midsurfaces for Failed parts

Success?

**no**

Use the **quick edit sub-panel** to fix issues with mid-surfaces

Use **assign target** sub-panel to modify target information

Use **replace edge** sub-panel to close small gaps or slivers

Use **extend Surfaces** sub-panel to connect surfus That are too short

Use **view thickness** sub-panel To view or Modify midsurface thickness

Keep successful midsurfaces

Keep successful midsurfaces
Automatic midsurface generation

- Selecting source geometry:
  - Closed solid (surfaces or solid geometry)
Automatic midsurface generation

- Selecting source geometry:
  - Partial or incomplete solid
    - unconnected inner/outer surface faces
  - Surface normal directions must be defined correctly
Auto midsurface extraction options

• **Step and base surface options:**
  • Apply to molded or machined parts with discrete thickness changes

• **Thickness bounds, max thickness ratio:**
  • Restrict midsurface operations to improve performance for large complex models

• **Radius/Thicknes (R/T) ratio**
  • Helps identify and process complex junctions (where 3 or more plates meet) using the fillet radius

• **Thickness based stitch tolerance (11-120)**
  • Automatically set local stitching tolerance based on thickness; otherwise use global cleanup tolerance
Auto midsurface extraction options

- Extract by component / cross components
  - By component: each original part is its own component; extract midsurface one part at a time
  - Cross components: original part geometry consists of multiple components

- Result in Middle Surface component / current component

- Sorting options:
  - Specifies how to organize middle surfaces when using the sort function:
    - <~original name> comp
    - <Midsurface #nn> comp
    - original comp

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<thead>
<tr>
<th>$</th>
<th>align steps</th>
<th>$</th>
<th>no thickness bounds</th>
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<tbody>
<tr>
<td>$</td>
<td>auto mid position</td>
<td>max thicknesses ratio</td>
<td>1 0 0 0</td>
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<td>result in current comp</td>
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sort Middle Surface comp into:

- <~original name> comp
Midsurface Base Surfaces

• Useful for cases where the "align steps" option is not applicable, such as when plates are not connected, or when the step does not consist of a single large surface on one side.

• Allows the user to specify the distance at which the mid-surfaces will be positioned relative to the user selected sides of the plates.

• The proper thickness and offset data are assigned to each mid-surface generated.
Midsurface Rerun

- Useful for cases where the auto mid-surface algorithm has trouble recognizing certain features, or to manually specify which lines should be collapsed for complex models.

- Allows a user to see the collapsed lines found by the auto mid-surface algorithm, edit the set of the collapsed lines, and rerun the auto mid-surface algorithm with the user-edited collapsed lines.
Midsurfacing: Tools

- Once a midsurface has been created, it can be modified using tools on the midsurface panel
  - **Quick Edit** – Repair a midsurface by correcting where the vertices of the surface were placed
  - **Assign Target** – An extension to quick edit, and functions in a similar fashion
  - **Replace Edge** – Fill in gaps and slivers by combining one surface edge with another – works the same as in the edge edit panel
  - **Extend Surface** – Extends two surfaces (e.g., ribs) until they intersect
  - **View Thickness** – Review of the thickness of a midsurface using white lines (probes) extending from each vertex of the surface
Midsurface Edit: Quick Edit

- **Repair midsurfaces by modifying “targets”**
  - Targets represent a link between a fixed point on the original source geometry (point to offset) and the corresponding fixed point of on the midsurface (pilot point)

1. Select the midsurface to edit.
2. Select the target by selecting its entity (point or edge) to offset.
3. Select the new pilot entity (point or edge).
4. Confirm the operation clicking on the update button.
**Midsurface Edit: Assign Target**

- **Combined target:**
  This option allows the user to combine multiple targets.
  It is very useful when the virtual intersection planes of the midsurface are not easy to find. New entities are displayed when the user clicks the point to offset.

  The new entities are put in temporary components.

  HyperMesh automatically gives a new combination of targets that can be changed.

  The point to combine is like the point to offset. HyperMesh will create the resultant of all the combined target. When the target is accepted it changes from green to red.

- **Remove a target:**
  1. Select the point to offset on the target
  2. Select the target to remove
  3. Click remove target
Midsurface Edit: Replace Edge

Allows the cleanup tolerance to be changed locally for the two surfaces to be stitched on the retained edge.
Midsurface Edit: Surface Trim/Extend

- Improved automatic bulk extension of surfaces.
- Speed and robustness improvements.
- Addition of new extension methods for automatic max extension by thickness multiplier and manual extension over edges by distance.
- Many new options to control resulting surface extension, including creating new surfaces from the extension.
Midsurface Edit: Surface Trim/Extend

Allows surfaces to extend by selecting the surface edges which must be extended to meet.
Midsurface Edit: Extend Surface

This option is used to specify which surfaces are to be considered for extension.

- **max extension**: It represents the maximum distance between a surface edge and neighbor surfaces for the edge to still be processed by the tool (it can also be chosen as thickness multiplier).
- **surf to extend**: If it is checked, any surface that is selected may be extended or truncated.
- **surf to target**: If it is checked, any surface that is selected may be extended or truncated.

Selected surfaces...
**Midsurface Edit: View Thickness**

Allows you to:

- to display thickness of selected surfaces (White)
- to change the value of surface thickness

A temp component will be created named **Surface thickness**
Midmesh Thickness mapping (new in HM 11-120)

Allows you to:

- Map thickness information from geometry to elements
  - As property cards
  - As nodal thickness on element cards
- Offset elements from outer face to midplane
- Review thickness by color or 3D element representation
Midsurfacing: Process & Strategy

1. Obtain a closed volume of surfaces or solids
   - *Midsurface : auto midsurface* requires an enclosed volume
   - Use topology repair techniques if needed

2. For complex parts, try defeaturing the surface defining the volume
   - This simplifies the part and may give better results with *create : solid*

3. Generate the midsurface using *midsurface : auto midsurface*
   - Use *surface pair* for areas that need more control
   - Use *midsurface : editing tools* for midsurfaces that need fine tuning

4. View the midsurface and correct errors using the midsurface editing functionalities
   - Can generally use *quick edit*