WORKSHOP 6
MID-SURFACE EXTRACTION
WING SECTION

3D Parasolid Solids

2D Surfaces
Problem Description

- The design department has produced a solid model of an aircraft wing section.
- The task is to extract mid-surfaces from the solid model, preparing for shell meshing.
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- The solid model consists of five individual solids as shown in the exploded view.
The model of the wing section is shown without the upper wing skin.
Idealization

- Replace the solid geometry with surface geometry. Mesh the surfaces to create plate elements. Mesh the edges of surfaces to create bar elements.

Wing skins and ribs are modeled using plate elements

Rib stiffeners and rib caps are modeled using bar elements
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General outline of workshop steps

- Import the Parasolid model file wing_section.xmt_txt
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- General outline of workshop steps (continued)
- Five parasolid solids
General outline of workshop steps (continued)

- Create rib surfaces
  - They will be the length (X-direction) of the ribs

<table>
<thead>
<tr>
<th>Rib</th>
<th>Solid Face List</th>
<th>Offset Solid Face List</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Solid 1.5</td>
<td>Solid 1.7</td>
</tr>
<tr>
<td>2</td>
<td>Solid 2.5</td>
<td>Solid 2.7</td>
</tr>
<tr>
<td>3</td>
<td>Solid 3.5</td>
<td>Solid 3.7</td>
</tr>
</tbody>
</table>
General outline of workshop steps (continued)

- Create rib stiffener surfaces
  - They will be the width (Z-direction) of the ribs

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solid Face</td>
<td>Solid 1.32</td>
<td>Solid 1.36</td>
<td>Solid 1.40</td>
<td>Solid 2.32</td>
<td>Solid 2.36</td>
<td>Solid 2.40</td>
<td>Solid 3.32</td>
<td>Solid 3.36</td>
<td>Solid 3.40</td>
</tr>
<tr>
<td>Offset Solid Face</td>
<td>Solid 1.33</td>
<td>Solid 1.37</td>
<td>Solid 1.41</td>
<td>Solid 2.33</td>
<td>Solid 2.37</td>
<td>Solid 2.41</td>
<td>Solid 3.33</td>
<td>Solid 3.37</td>
<td>Solid 3.41</td>
</tr>
</tbody>
</table>
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- General outline of workshop steps (continued)
  - Created rib and rib stiffener surfaces
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General outline of workshop steps (continued)

- Use the manual or automatic mode to extract mid-surfaces from the wing skin solids.
  - Solid Face List: Solid 4.6 5.6
  - Offset Solid Face List: Solid 4.1 5.1
General outline of workshop steps (continued)

- There is a gap between the top or bottom of the rib/rib stiffener surfaces and the wing skin surfaces. It is 0.050 inch which is half of the wing skin thickness.
General outline of workshop steps (continued)

- Only simple (green) surfaces can be extended. MSC.Patran will automatically attempt to convert complex (magenta) surfaces into green surfaces before performing the surface extend operation.
- In cases where the automatic conversion fails, a manual surface refit may be required using Geometry: Edit/Surface/Refit.
General outline of workshop steps (continued)

- Extend the rib stiffener surfaces to the wing skin surfaces to eliminate those gaps. Do not break the wing skin surfaces during the extend operation.
General outline of workshop steps (continued)

- Extend the rib surfaces to the wing skin surfaces to eliminate those gaps. Do not break the wing skin surfaces during the extend operation.
General outline of workshop steps (continued)

- Use the rib stiffener surfaces to break the rib surfaces. The rib surface edges resulting from this operation can be meshed with bar elements to represent the stiffeners.
- Delete the rib stiffener surfaces.
General outline of workshop steps (continued)

- Extend the wing skin surfaces 4.5 inches in the span direction.
  - Notice that MSC.Patran automatically refits the magenta surfaces to green surfaces.
  - Note that the surface extension retains the contour of the surface.
For a further demonstration of the Surface Extend tool, use the extend by percentage to lengthen the cord of the wing skin by 10% in anticipation of front and rear spars.
General outline of workshop steps (continued)

- Finally associate the upper and lower rib surface edges with the wing skin surfaces. This will enforce congruent meshes between the ribs and wing skins.
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