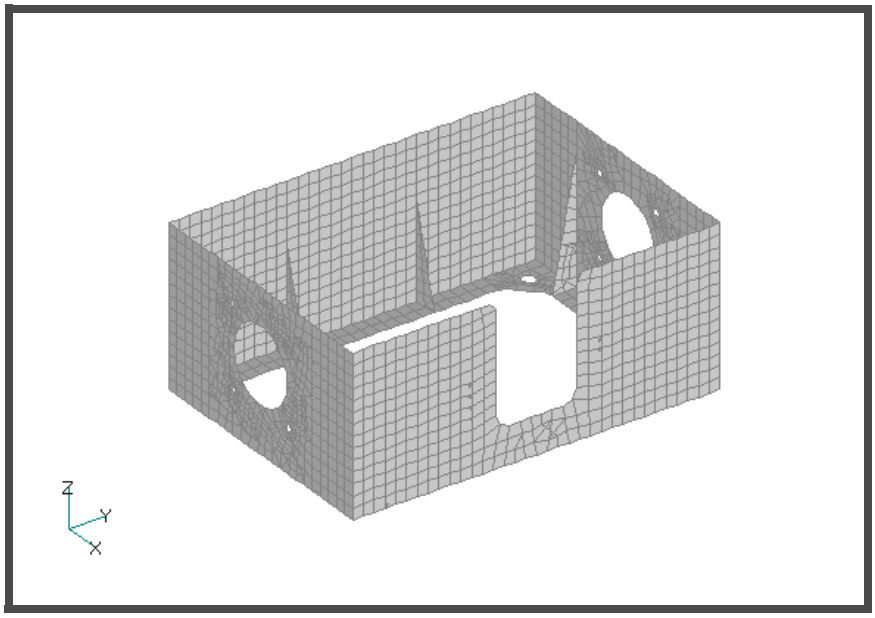
APPENDIX B

Mid-Plane Surface Trimming, (Part II)



Objectives:

- Generate midplane surfaces.
- Edit surface intersections.
- Mesh midplane surfaces.

Model Description:

This workshop is similar to the previous exercise but will demonstrate how to manually generate, edit and cleanup midsurfaces using the various menu options.

The parasolid model below can be solid meshed and surface meshed; however, in order to obtain a surface mesh we must extract surface geometry at the midplane of the solids. Using 2D elements for analysis is advantageous whenever it is possible as opposed to using 3D elements. It decreases the analysis run time as well as conserves system resources.

The following workshop will demonstrate how to extract midsurfaces from a solid model using Midsurface/Generate, edit the surface intersections with Midsurface/Intersect, and subsequently cleanup the unwanted surfaces using Midsurface/Cleanup. Then you will be able to obtain a 2D mesh which idealizes the solid model.

Figure B.1

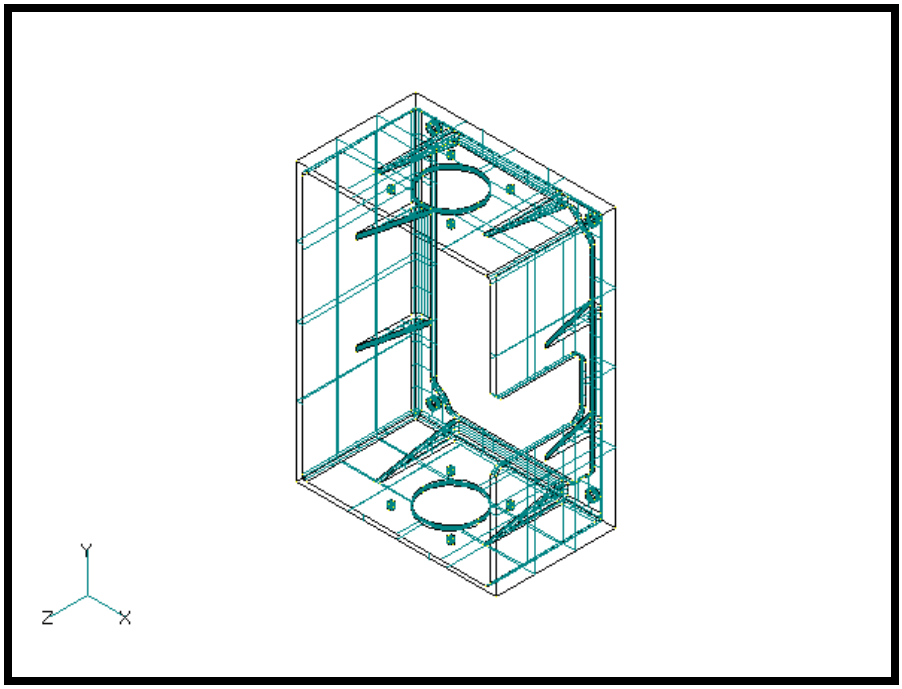


Table B.1- Model Properties

Youngs Modulus:	**10E+06 lbs/in^2**
Poisson's Ratio:	**0.3**

Suggested Exercise Steps:

- Import the parasolid file **MPexam.x_t**.
- Check the thickness of the part using the **Tools/Distance** command.
- Create a material, **mat_1**.
- Create a new property called **plate**.
- Extract midplane surfaces from the solid using the **Generate** command.
- Delete extra surfaces created at the corners.
- Delete extra surfaces created above each wedge.
- Specify a mesh size on the surfaces by accepting the default element size.
- Mesh the midplane surfaces.
- In **View/Options** turn off all entities except for Element.
- Change View Style to Solid.

Exercise Procedure:

1. Start up MSC.Nastran for Windows V4.0 and begin to create a new model.

   Double click on the icon labeled **MSC.Nastran for Windows V4.0**.

   On the *Open Model File* form, select **New Model**.

   Open Model File: **New Model**

2. This exercise should be performed with the **Advanced Geometry-Parasolid Engine** turned on.

   Tools/Advanced Geometry...

   ● **Advanced Geometry-Parasolid**

   OK

3. First import the parasolid file.

   File/Import/Geometry...

   Go to the following: c:\Mscn4w40\Examples

   File name: **MPexam.x_t**

   Open

   OK

4. Rotate to an isometric view by selecting **View/Rotate** or **F8**.

   View/Rotate... <F8>

   Isometric

   OK

   Turn off the workplane.

   Tools/Workplane... <F2>

   ☐ **Draw Workplane**

Done

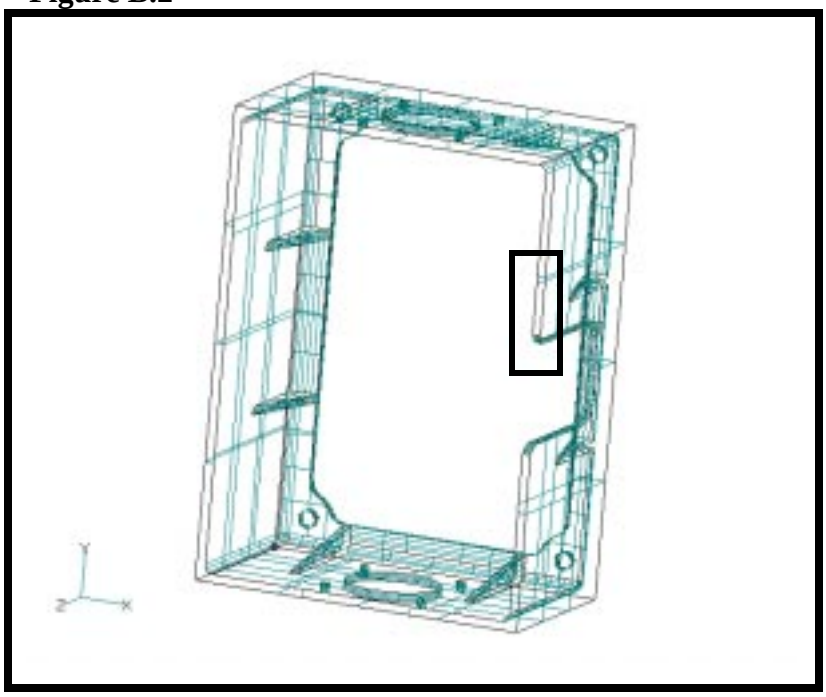
View/Regenerate... <Ctrl+G>

5. Check the thickness of the part.

   Zoom into a corner section of the model. First rotate the part in order to get a better view of one of its edges. Select the **Dynamic Rotate** button for this.

   Now use the Zoom button to zoom into area shown below.

Figure B.2



Tools/Distance...

Methods^ **On Point**

Click from point 5 to 7 (refer to the following diagram).

Point ID: **5**

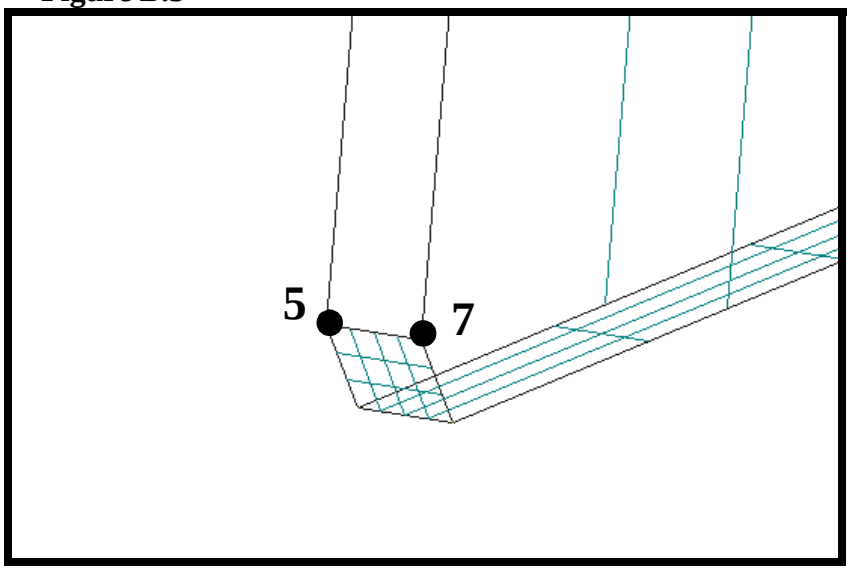
OK

Point ID: **7**

OK

A window will appear indicating that the thickness of the model is 4.92125.

Figure B.3



OK

Cancel

6. Create a material called **mat_1**.

   From the pulldown menu, select **Model/Material**.

   Model/Material...

ID:	**1**
Title:	**mat_1**
Youngs Modulus:	**10E6**
Poisson's Ratio:	**0.3**

   OK

   Cancel

7. Create a new property called **plate**.

From the pulldown menu, select **Model/Property**.

Model/Property...

ID:	**1**
Title:	**plate**
Elem/Property Type...	
Plane Elements:	● **Plate**

OK

To select the material, click on the List icon next to the databox and select **mat_1**.

Material:	**1..mat_1**
Thicknesses, Tavg or T1:	**4.92125**

OK

Cancel

Make the geometry fit within the window.

View/Autoscale <Ctrl+A>

8. Create a 2D model from the 3D geometry.

   At this point, you can mesh the solid geometry with tetrahedral solid elements. However, to save time and disk space this model can be better idealized by a 2D mesh. To do this, extract midplane surfaces from the solid.

   First, create a group to put the new midsurface into.

   Group/Set...

Title:	**midsurface**

OK

Now, set the **Automatic Add** to the **Active** group to automatically add all entities created from this point on to the active group (midsurface).

Group/Operations/Automatic Add...

● **Active**

OK

Next, extract the midsurfaces from the solid model.

Geometry/Midsurface/Generate...

Select All

OK

Enter Offset Value: **5**

OK

Finally, view the extracted midplane surfaces by posting the Active Group (midsurface).

View/Select... **<F5>**

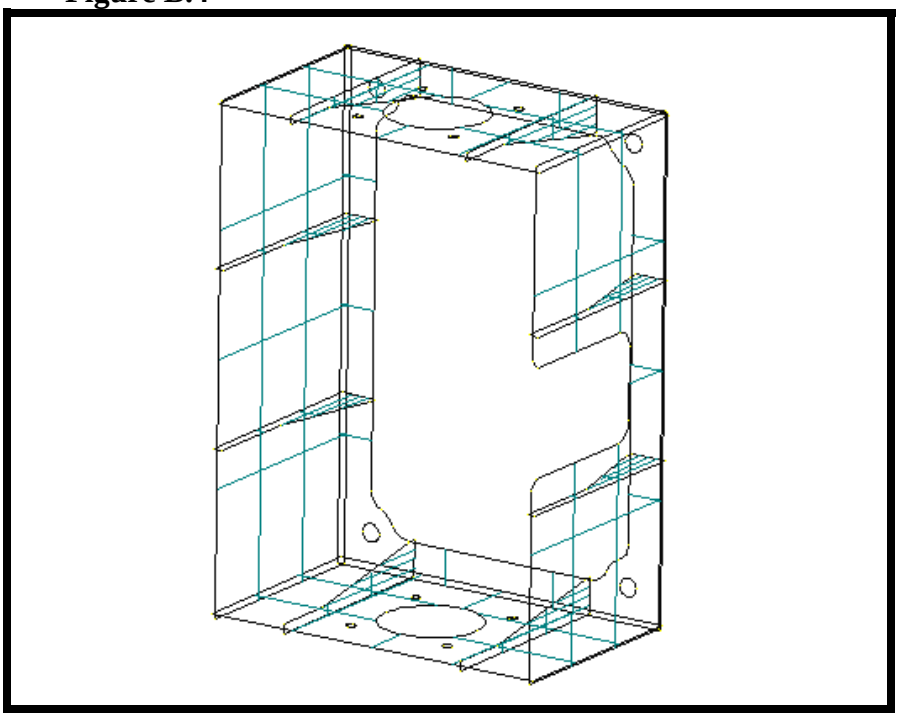
Model Data...

Group: ● **Active**

OK

OK

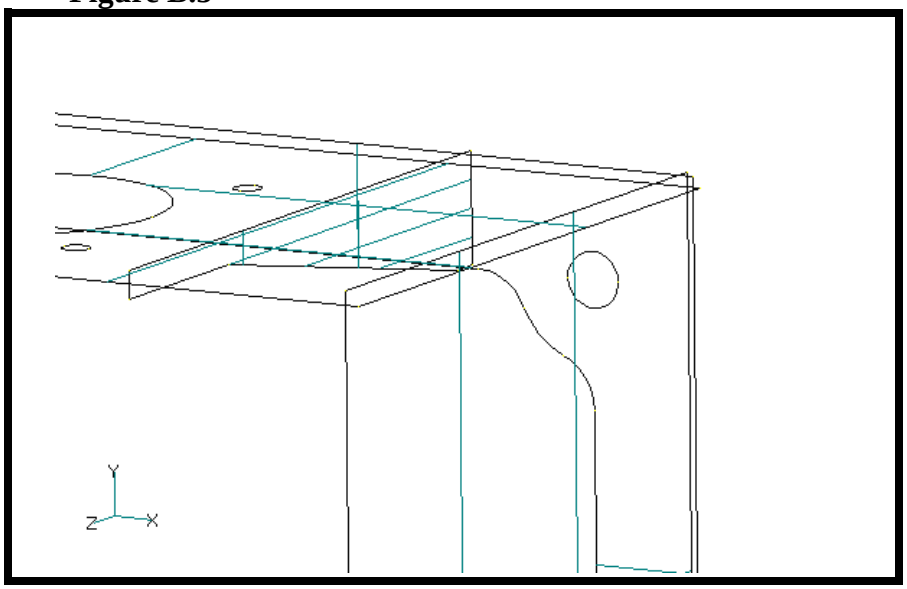
Figure B.4



9. Delete extra surfaces created at the corners.

   Notice that the **Geometry/Midsurface/Generate...** command created the midsurfaces but did not automatically edit out the extra surfaces created by the surface intersections at the corners. Edit out these extra surfaces.

Figure B.5



Geometry/Midsurface/Intersect...

*Box select the entire geometry by holding down the **SHIFT** button and the right mouse button.*

OK

NOTE: The **intersect** command will break the surfaces where they intersect.

Next use the **cleanup** command to select the surfaces to be extracted.

Geometry/Midsurface/Cleanup...

*Box select the entire geometry by holding down the **SHIFT** button and the right mouse button.*

OK

The *Messages and Lists* window will show "Removable surfaces being moved to Layer 2". View this layer.

View/Layers...

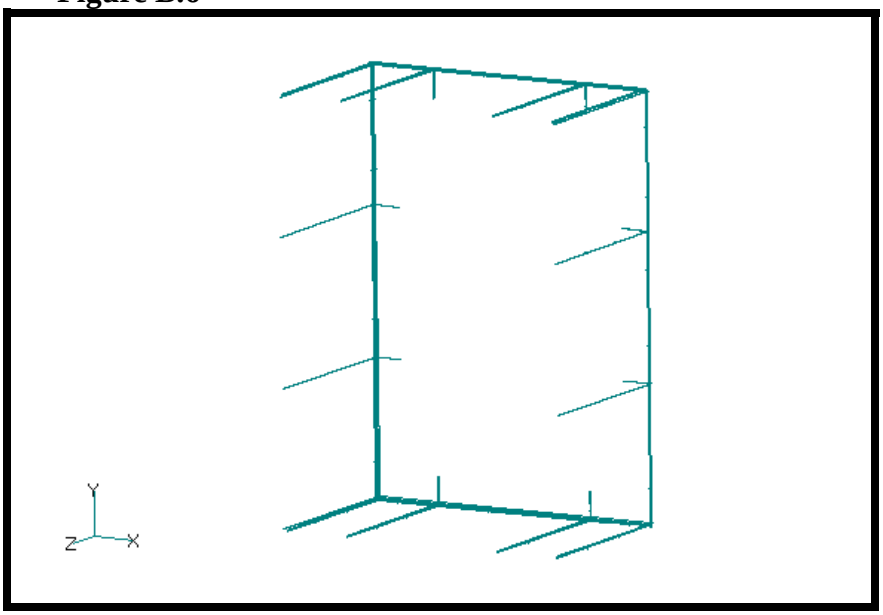
● **Show Visible Layers Only**

Hidden Layers: **2..Mid-Surfaces to Delete**

Show ->

OK

Figure B.6



Layer 2 is the group of selected extra surfaces that will be removed from the main geometry.

Delete/Geometry/Surface...

Shift and drag Left Mouse button to box select all the surfaces on the screen.

OK

When asked, "OK to Delete 68 Selected Surfaces?," select **Yes**.

Yes

Now change the view option back to the main geometry.

View/Layers...

● **Show All Layers**

OK

10. Reposition the model.

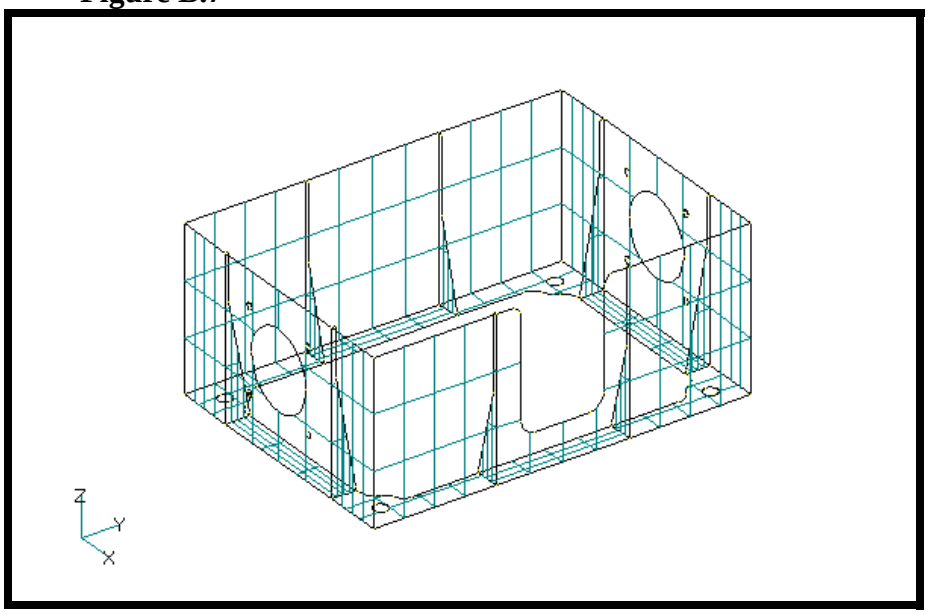
View/Autoscale... **<Ctrl+A>**

View/Rotate... **<F8>**

Dimetric

OK

Figure B.7



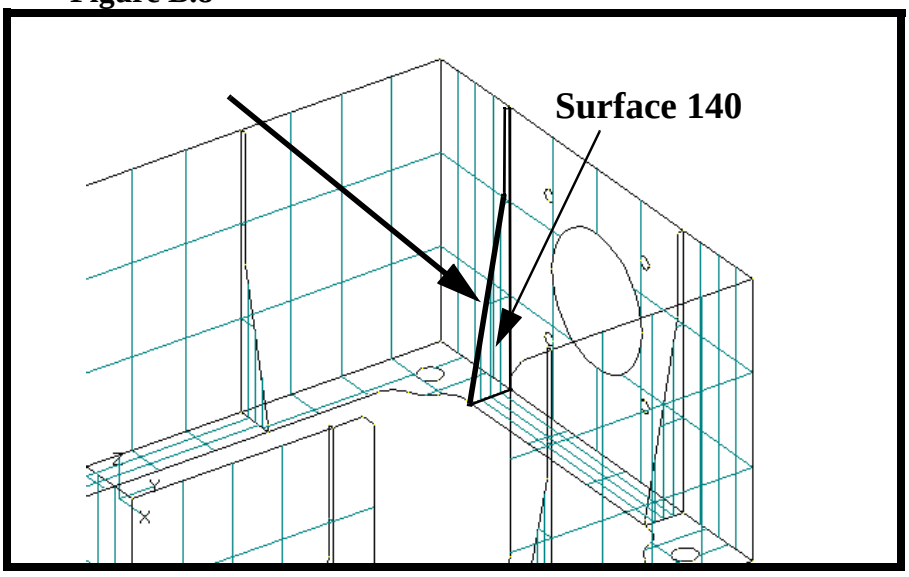
11. Delete the extra slivers that were created above each wedge.

    Notice the extra surfaces located above each wedge. These slivers were created by the midplane extraction since the distance between the vertical surface of the wedge and the outer face of the box was within the *Offset Value*. We must edit some of these features from the surface model.

    Geometry/Midsurface/Trim with Curve...

    Select, one at a time, the 8 surfaces that currently represent the support wedges. For example, select the surface below (**Surface 140**).

Figure B.8



ID: **140**

OK

Select on the surface's diagonal curve (**Curve 400**).

OK

Repeat the process for the other 7 surfaces (wedges).

Surface	Curve
209	412
205	406
193	386
189	380
197	413
201	420
137	394

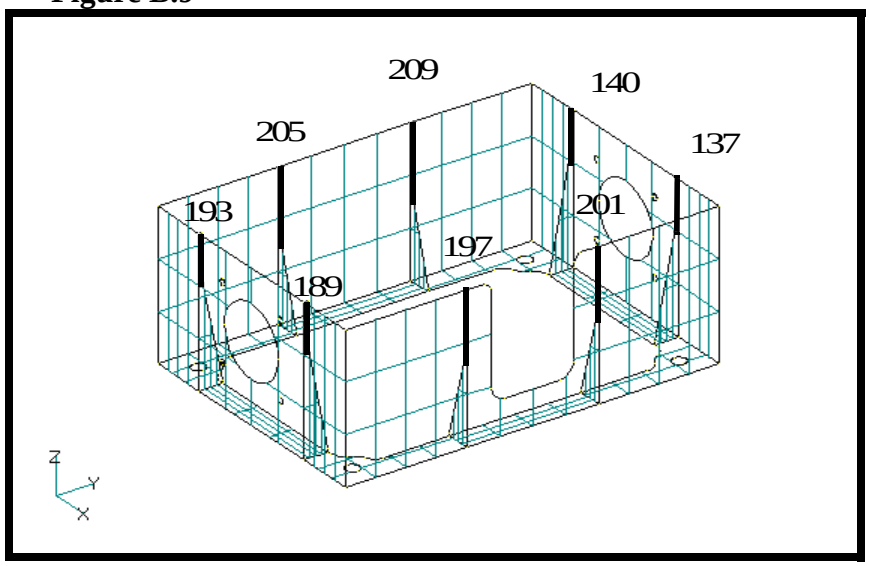
Cancel

Delete the small sliver surfaces that are left above the wedges after you make the edits.

Delete/Geometry/Surface...

Select the small surfaces.

Figure B.9



OK

When asked, "OK to Delete 8 Selected Surface(s)?," select Yes.

Yes

12. Break the surfaces at the intersection between the wall and the support wedges so that the mesh will match.

Geometry/Midsurface/Intersect...

Group: **1..midsurface**

OK

13. Specify mesh seeding.

Mesh/Mesh Control/Size On Surface...

Group: **1..midsurface**

OK

Accept the default values.

OK

Cancel

14. Mesh the surfaces in the midsurface group.

Mesh/Geometry/Surface...

Group: **1..midsurface**

OK

Property: **1..plate**

Element Shape: ● **Quads**

OK

Either select the **Quick Options** button or **CTRL+Q**:

Quick Options... <Ctrl+Q>

All Entities Off

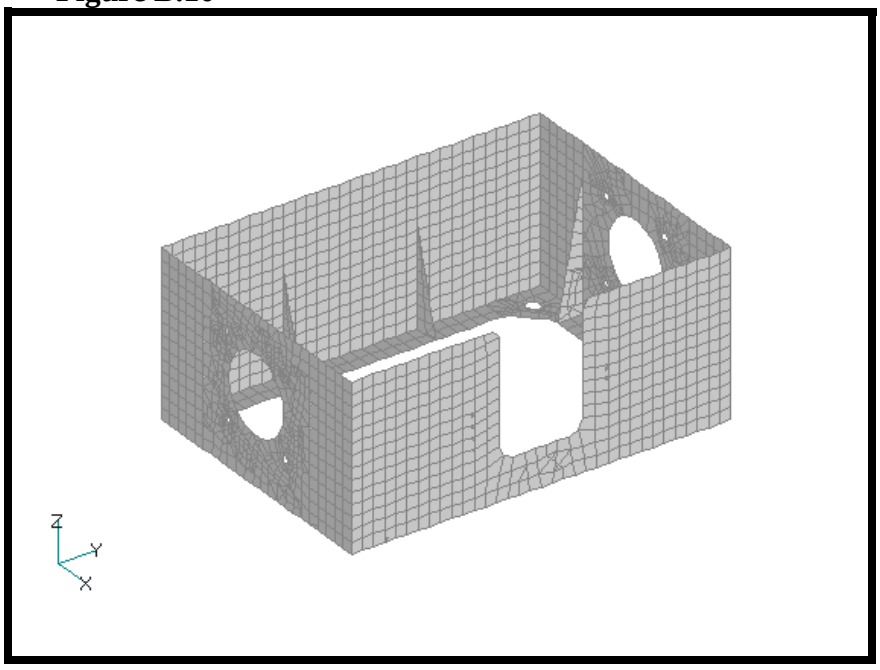
Draw: ☒ **Element**

Done

Select the View Style icon:

(highlight) **Solid**

Figure B.10



15. Finally, save the file.

File/Save As...

File name: **Midsurface2.mod**

This concludes the exercise.

File/Save

File/Exit