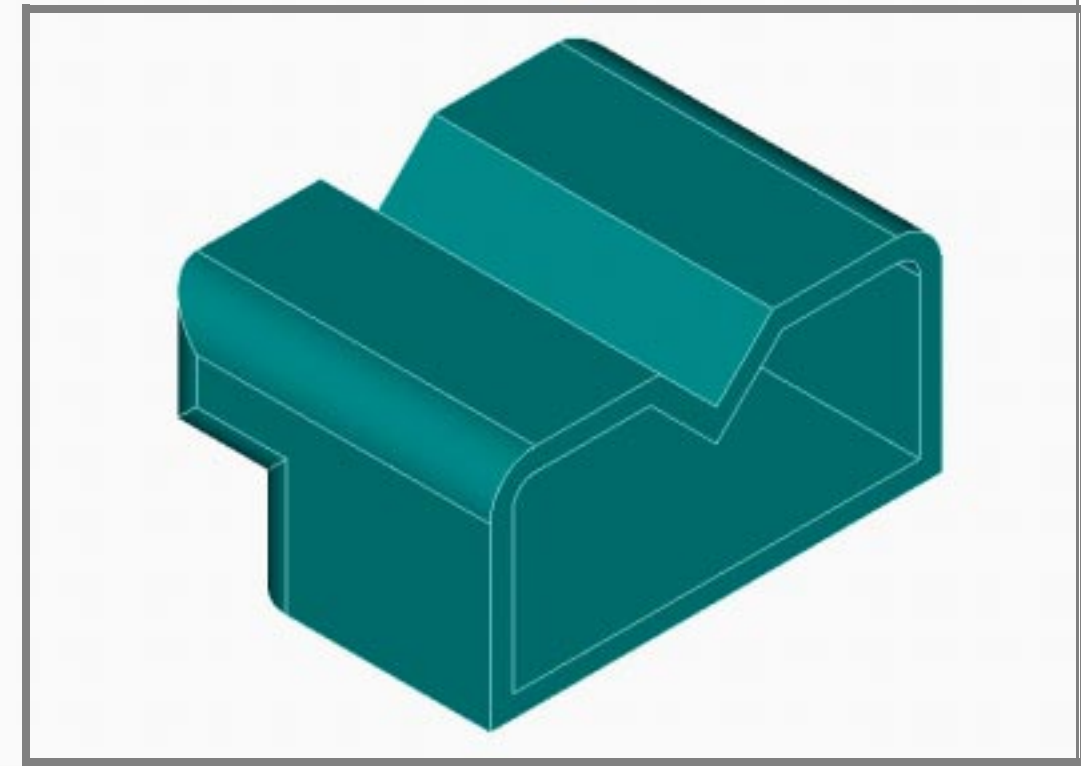


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## WORKSHOP 6

# *Solid Modeling (Part II)*



### **Objectives:**

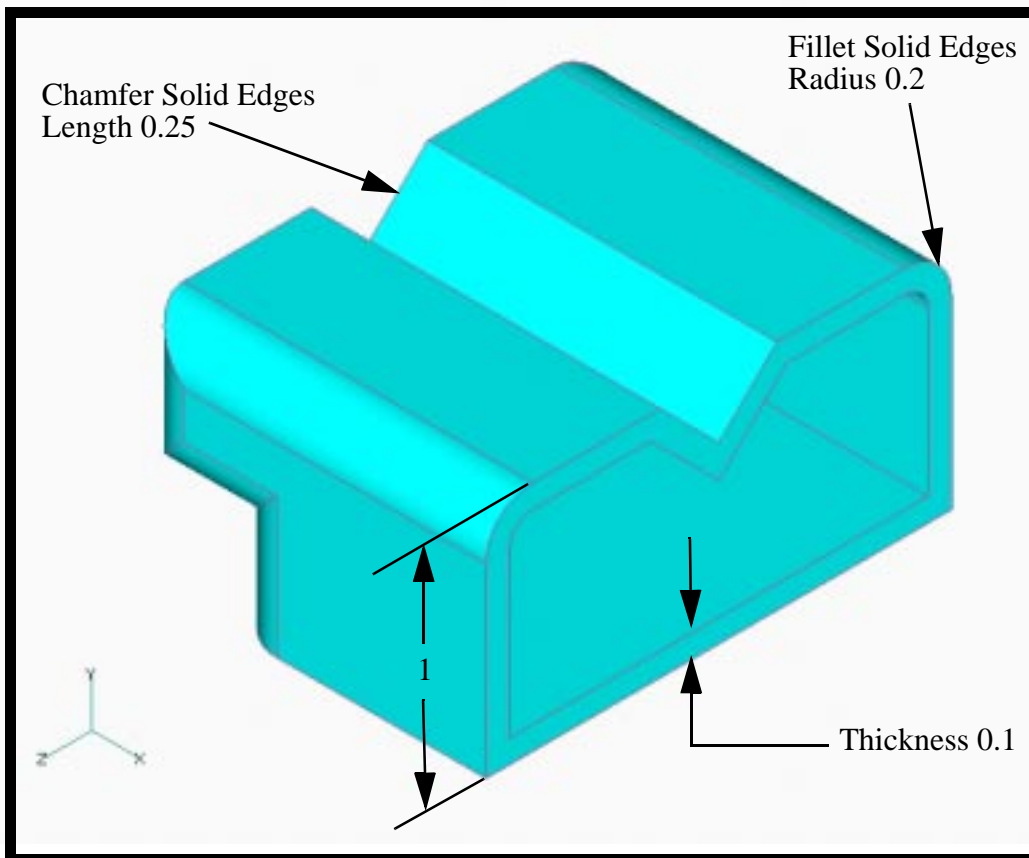
- Create a solid model
- Explore solid modeling features such as chamfering, filleting, and shelling.



## Model Description:

The objective of this exercise is to explore solid modeling in MSC.Nastran for Windows. Such features as chamfering, filleting, shelling, and slicing will be utilized to create the part below from a simple 3 x 1 x 1 solid block. You will also familiarize yourself with working and changing the workplane. The dimensions of the completed part are shown below.

**Figure 6.1 - Geometry Model**



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## Suggested Exercise Steps:

- Create a 3 x 1 x 1 box.
- Remove two 1 x 0.4 x 0.4 sections from the block.
- Chamfer the top edge of the box to a length of 0.25.
- Fillet the edges of the solid with a radius of 0.2.
- Hollow out the solid with the shell command to a thickness of 0.1.
- Cut the model in half.
- Rotate on the halves 180°.
- Add the two solids together to create the new 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. Create a 3 x 1 x 1 rectangular box.

**Geometry/Solid/Primitives...**

*Title:*

**solid\_test**

*Material:*

**New Solid**

*Direction:*

**Positive**

*Origin:*

X:

**0**

Y:

**0**

*Primitive:*

**Block - Center**

X:

**3**

Y:

**1**

Z:

**1**

**OK**

3. Change to an Isometric View.

**View/Rotate...**

<F8>

**Isometric**

**OK**

4. Move the workplane to make it easier to edit the existing geometry.

*Right Click Mouse* button anywhere on your screen to invoke the pop up menu. Select **Workplane**.

**Workplane...**

**On Surface...**

*On Surface:*

**3**

*At Point:*

**2**

*Axis Point:*

**5**

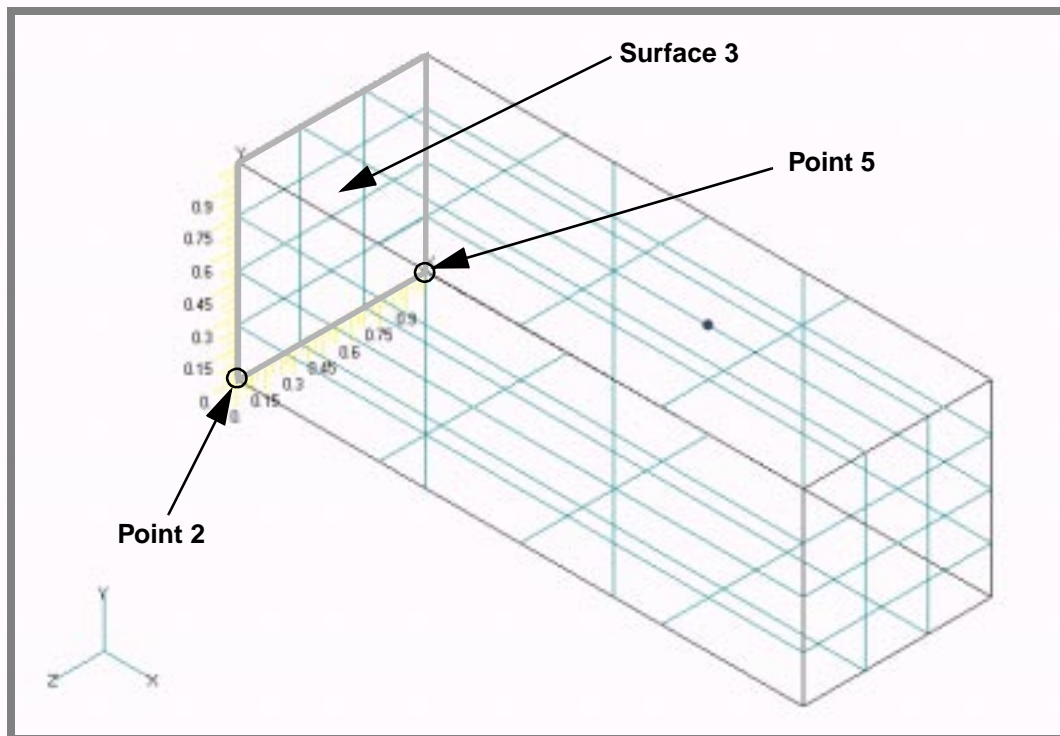
**First Quadrant**

**OK**

**View/Regenerate**

**<Ctrl+G>**

**Figure 6.2 - Workplane on Surface 3**



5. Remove a 1 x 0.4 x 0.4 notch from either side of the original solid.

**Geometry/Solid/Primitives...**

*Material:*  **Remove**

*Direction:*  **Positive**

*Origin:* X:  Y:

*Primitive:*  **Block - Corner**

X:  Y:  Z:

*Right Click Mouse* button anywhere on your screen to invoke the pop up menu. Select **Workplane**.

**Workplane...**

*On Surface:*

*At Point:*

*Axis Point:*

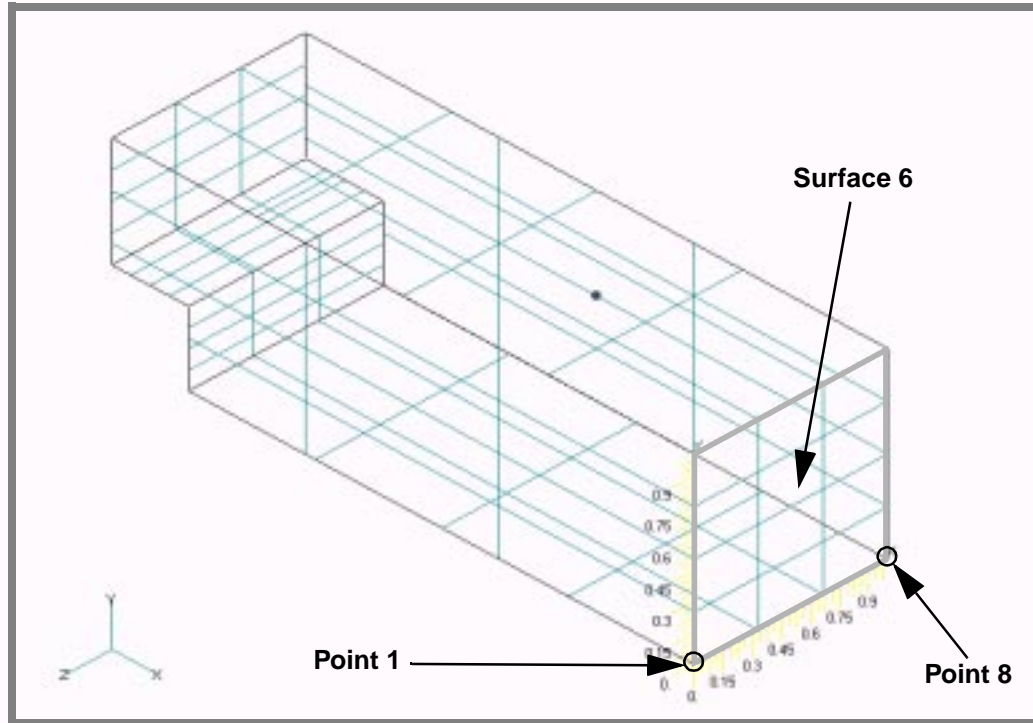
**First Quadrant**

(Note: See Figure 6.3 for entity ids)

**View/Regenerate**

<Ctrl+G>

**Figure 6.3 - Workplane on Surface 6**



**Geometry/Solid/Primitives...**

*Material:*

Remove

*Direction:*

Negative

*Origin:*

X:

Y:

*Primitive:*

Block - Corner

X:

Y:

Z:

*Right Click Mouse* button anywhere on your screen to invoke the pop up menu. Select **Workplane**. Then uncheck *Draw Workplane* box and click *Cancel*.

**Workplane...**

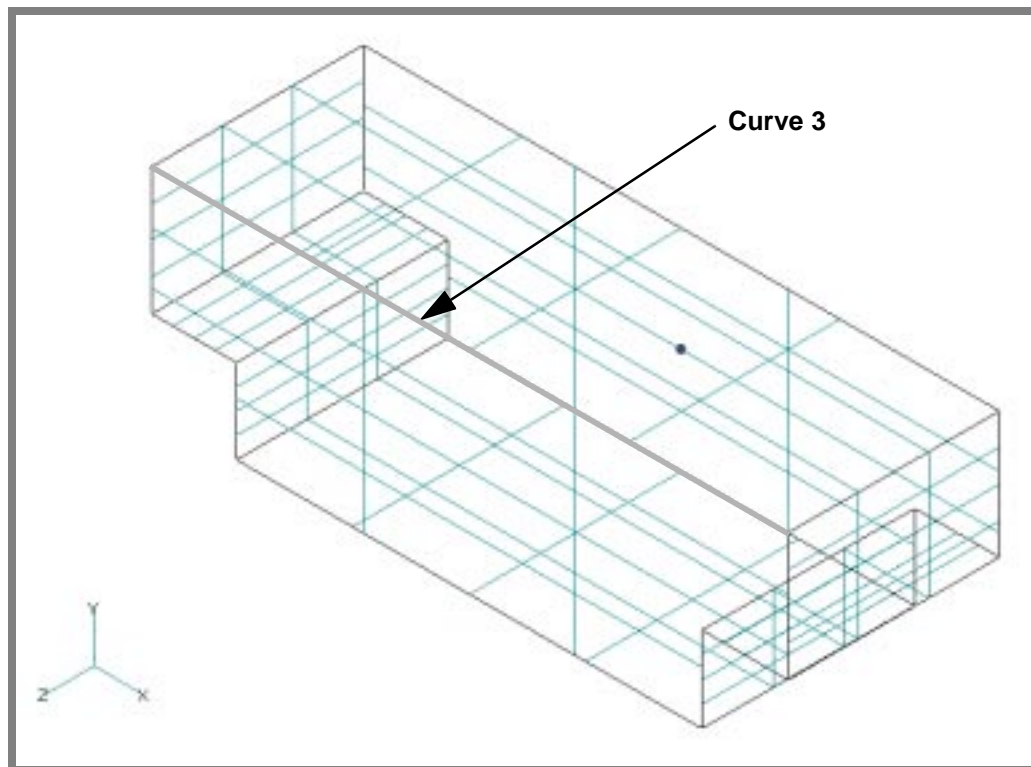
**Draw Workplane**

**Done**

**View/Autoscale**

**<Ctrl+A>**

**Figure 6.4 - Geometry Model**



6. Chamfer the top edge.

**Geometry/Solid/Chamfer...**

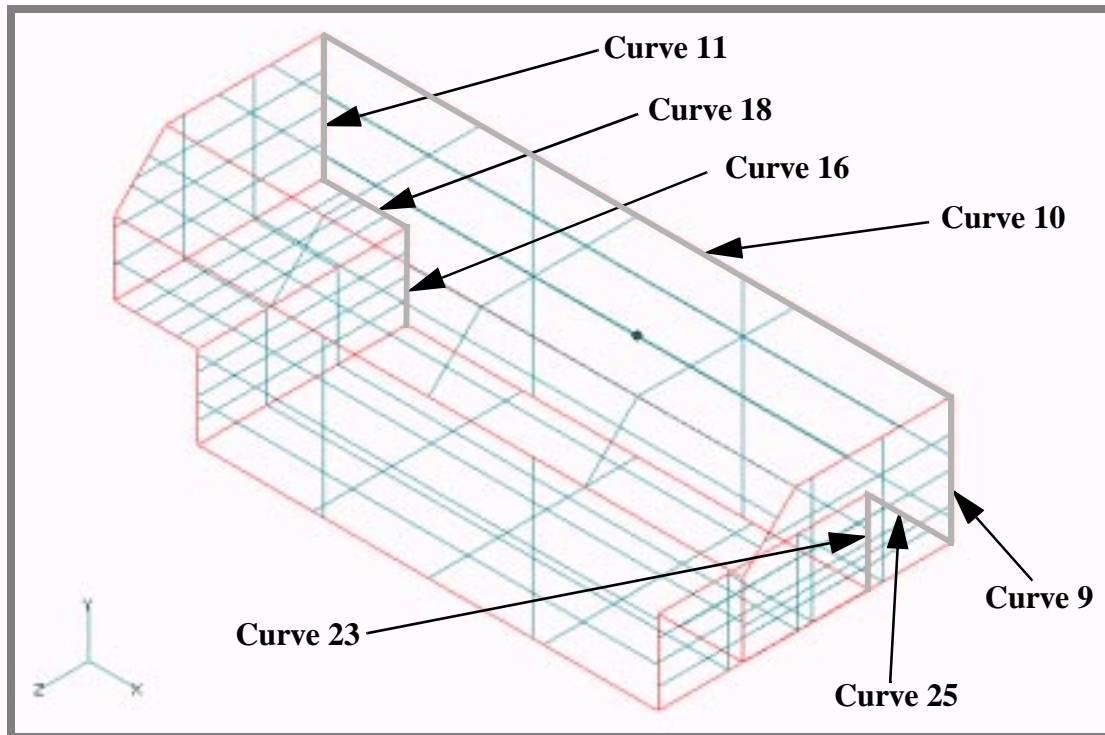
Select **Curve 3** as shown in Figure 6.4 above.

**OK**

Under the *Chamfer Solid Edges* window input the following:

*Length:*

**Figure 6.5 - Chamfer Model**



7. Fillet the solid.

**Geometry/Solid/Fillet...**

Select **Curves 9, 10, 11, 16, 18, 23, 25** as shown in Figure 6.5 above.

Under the *Fillet Solid Edges* window input the following:

*Radius:*

8. Switch to solid render model.

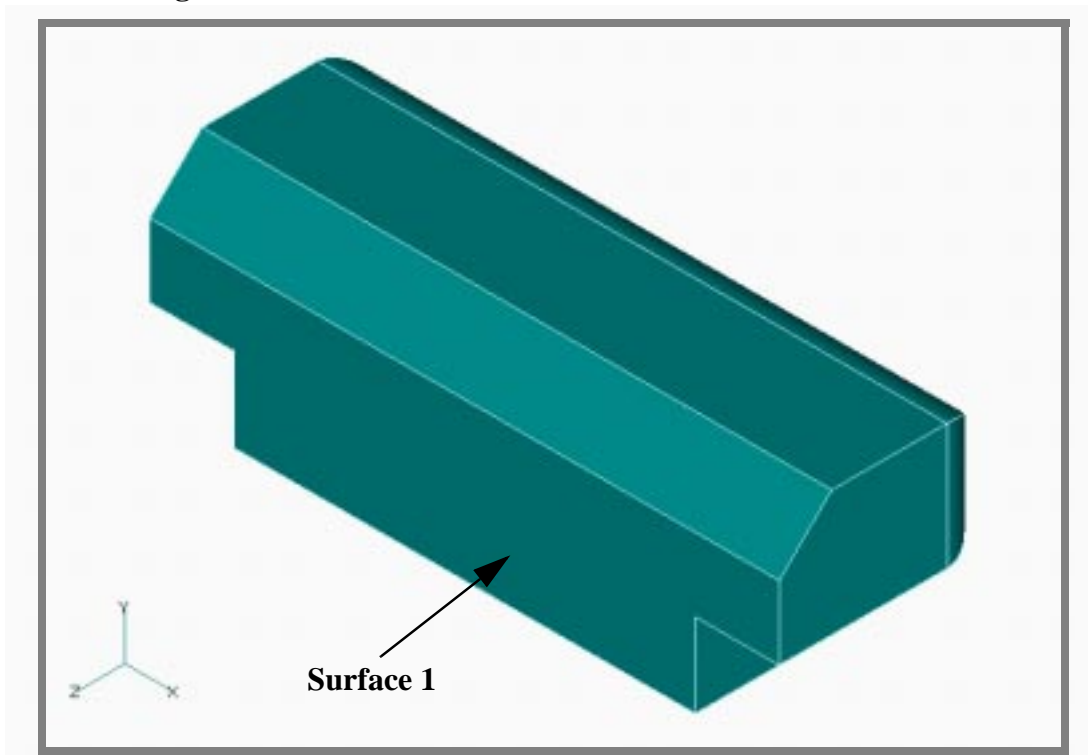
Click the *View Style* icon.



Select **Rendered Solid**.

At this point, the model should look like Figure 6.6

**Figure 6.6 - Fillet Model**



9. Shell the surface. Use a wall thickness of 0.1 units.

**Geometry/Solid/Shell...**

*Entity ID:*

**1..solid\_test**

**OK**

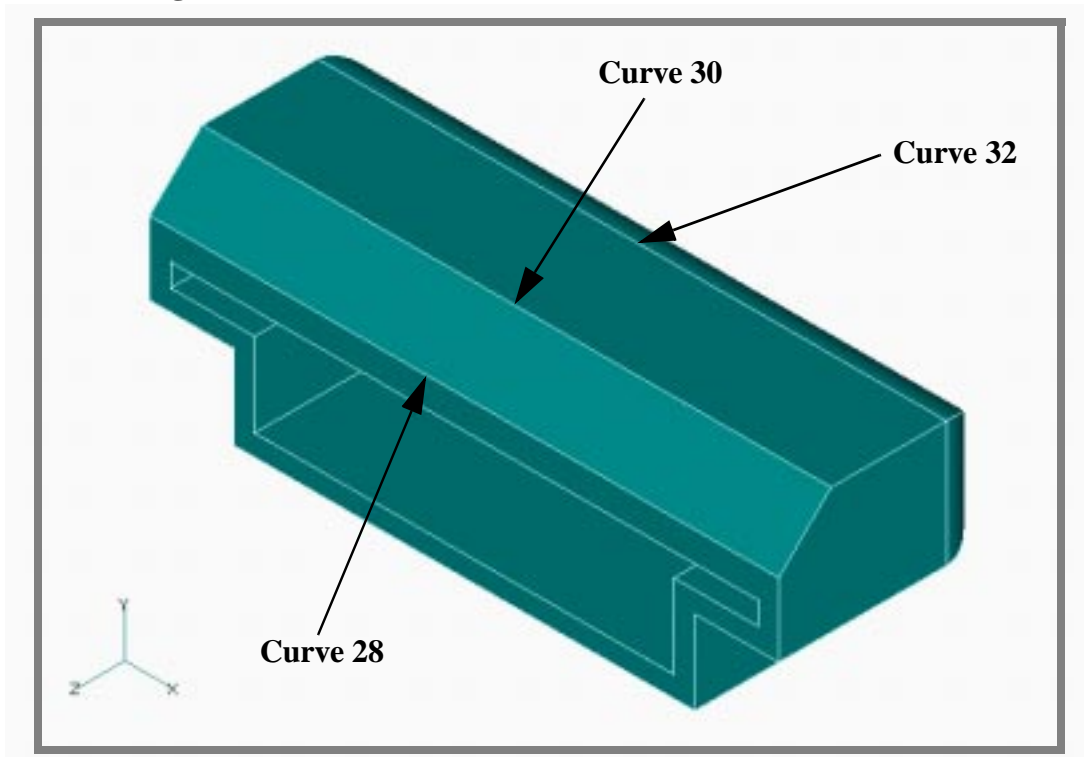
Select **Surface 1** as shown in Figure 6.6 above.

**OK**

Under the *Solid Shelling* window input the following:

*Thickness:*

**Figure 6.7** - *Shell Model*



10. Create the points to define cutting plane.

**Geometry/Point...**

Select **Curve 28** as shown in Figure 6.7 above.

*Curve ID:*

Select **Curve 30** as shown in Figure 6.7 above.

*Curve ID:*

Select **Curve 32** as shown in Figure 6.7 above.

*Curve ID:*

**32**

**OK**

**Cancel**

Note: By double-clicking when selecting the curves, the **OK button** will automatically be selected. The **OK button** mouse pick can be avoided with the method.

11. Slice the solid in half.

**Geometry/Solid/Slice...**

*ID:*

**1**

**OK**

Under the *Specify Plane for Intersection* window select the following:

**Method^**

**Points**

Select the midpoints you have just created in the previous step.

*Base Point ID:*

**67**

*Plane Point 1:*

**68**

*Plane Point 2:*

**69**

Note: Once the three points are selected, click on

**Preview**

to inspect the cutting plane.

When finished, select

**OK**

- 
12. After slicing, we now have two independent solids. Now rotate one of the solids.

**Modify/Rotate By/Solid...**

Select Solid(s) to Rotate to (Select **Solid 2**)  
Coordinates:

**OK**

Under the *Select Axis of Rotation* window select the following:

**Method^**

*Direction:*

**Axis**

**Positive**

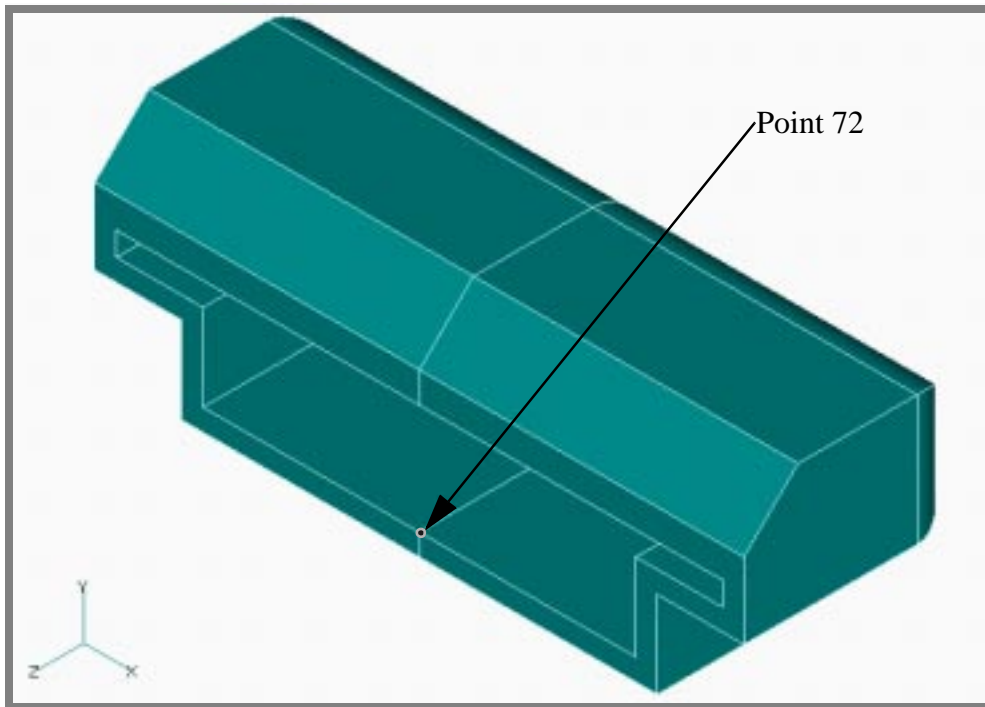
**Y Axis**

*Right Click* anywhere on your screen to invoke the pop up menu and click **Snap to Point**. Select **Point 72** as shown in Figure 6.8.

Note: You may have to left mouse click in the coordinate entry box before you select Point 72.

	X:	Y:	Z:
<i>Base:</i>	<b>XPT(72)</b>	<b>YPT(72)</b>	<b>ZPT(72)</b>

Figure 6.8 - Point 72



**OK**

Under the *Rotation and Translation* window input the following:

*Rotation Angle:*

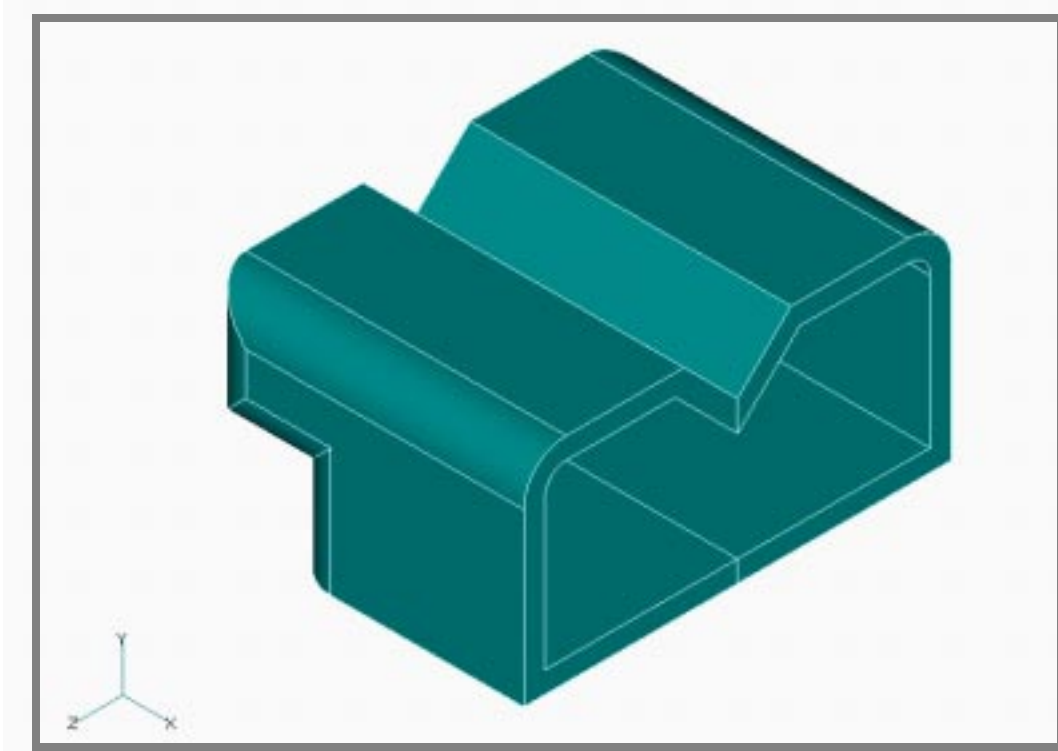
**180**

**OK**

**View/Regenerate**

**<Ctrl+G>**

**Figure 6.9 - Rotated Model**



13. Merge the two solids.

**Geometry/Solid/Add...**

**Select All**

**OK**

This concludes the exercise.

**File/Save**

**File/Exit**