
Plastic Part Modeling 1

In this task, we will show how to create a plastic coffee maker housing using solid modeling, surfaces modeling, Boolean and Zone Modeling techniques.

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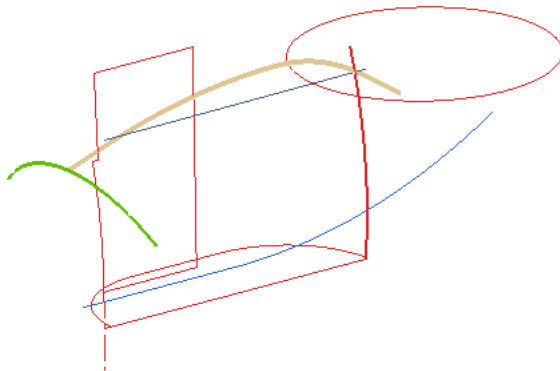
1. Step 1 : The Basic Plastic Part

Open the model, if it is not already open. The model file is located in the your customize task folder. You will notice that all entities will be active but stacked in different layers.

NOTE:

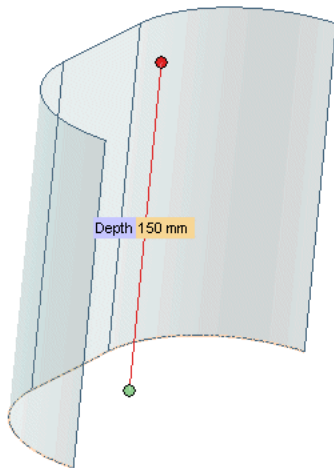
With a double click on the exe file you can run the webtraining session. ThinkDesign will be open with the right model to start.

If request to open a file, you can find it in the C:\MyTraining path.



Use the **Output Layers** icon to activate only the Layer 0. This layer has a profile on it.

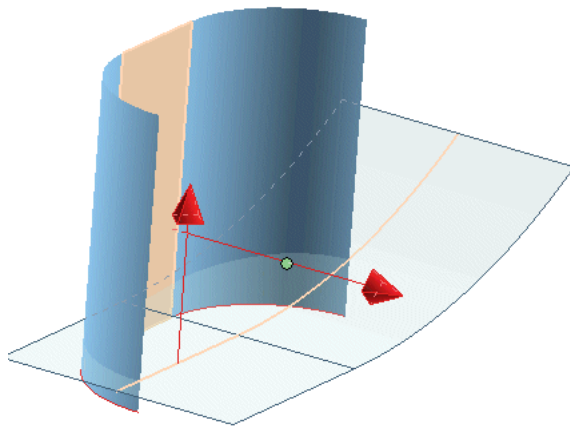
- Create a **Linear Surface** from the Profile 1.
- Make the Depth150.
- Direction Y.
- Draft None and Extend Length.
- Check the Associative option.
- Click OK.



Use the **Output Layers** icon to activate also the Layer1. This layer has a second profile on it.

Now we are going to make a cut using it.

- Activate the **Linear Slot** command.
- Select profile and the face of the solid that we want to cut.
- Use the Both Sides. To activate the Both Sides option, right click in the graphics area after the Linear Slot command has been activated.



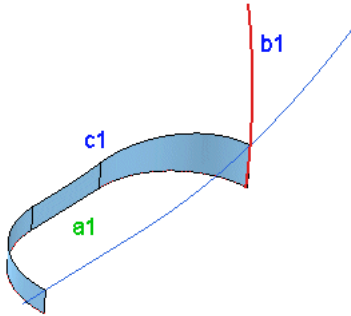
If necessary invert the Cut Side with double click on red arrow that start on cut profile. Use the image shown below as reference to indicate that the arrow is pointing in the right direction to cut the top side.

Click OK

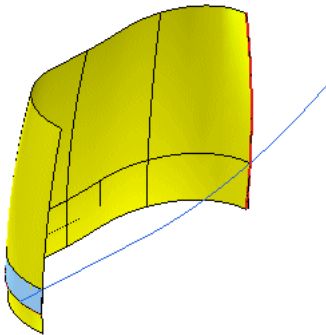
Turn on Layer2.

Now, we are going to create an Associative**Spined Surface**.

- Select **Insert** \rightarrow **Surface** \rightarrow **Spined**.
- Check the Associative option in the selection list.

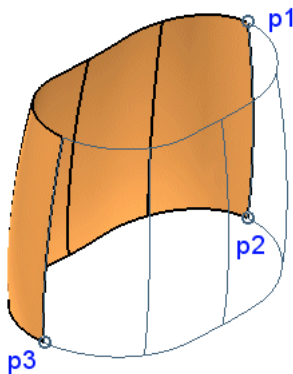


- Select original profile (a1) as Spine and the thick red curve (b1) as Boundary.
- For 1st Drive, select upper boundaries (c1) of the splitted face.
- Click OK.



We are now going to mirror this new surface using the **Mirror Entities** command and the 3 points option.

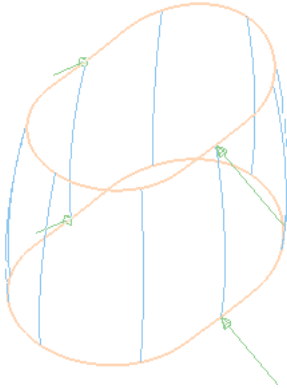
- Activate **Mirror Entities**.
- Set the Symmetry plane to 3 Points.
- Select the 3 vertices of the Spined surface as shown below.
- Check the Copy option.
- Pick More Options and check the Linked Copies option.
- Click OK.




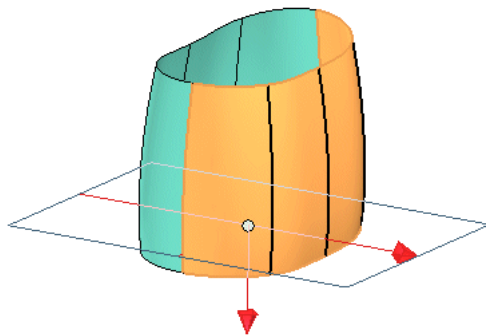
We now need to make these 2 surfaces into an associative solid. We will do this using the **Make Solid** com-

mand with the Associative option checked.

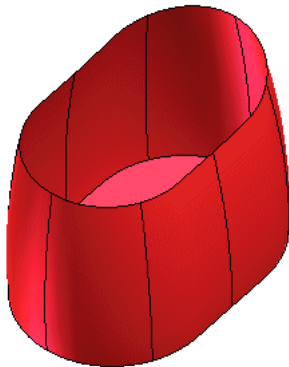
Select Continue for create an open solid.



- Use  **Hide Entities** to hide the first linear skin solid.
- Turn on Layer3
- Create a **Linear Slot** using this red profile.
- Extension Thru all and use the Symmetric direction.
- Invert the vector to define the side to cut, if necessary.
- Click OK.



Without using the Boolean operations, we have obtained the bottom side of this model.

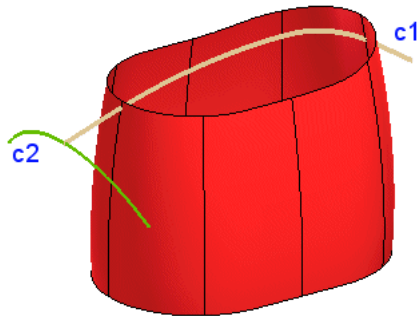


Normals on open solids.

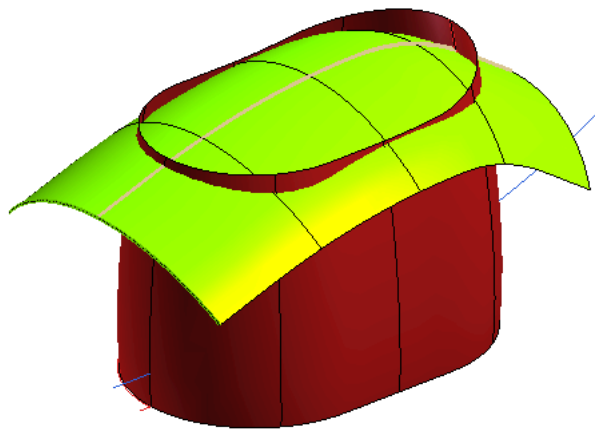
If the results are not as intended, you have to check the normals of the solid using **Utilities** and invert them when necessary using the command **Modify** → **Solid** → **Invert Normals**.

Activate **Output Layers** and turn on Layer4

We are now going to create a new associative **Spined Surface** using these 2 curves.

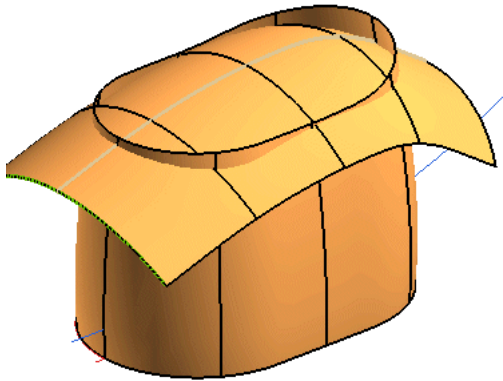


- Activate **Spined Surface**.
- Select Brown curve (c1) for Spine and Green curve (c2) for Boundary and
- Check the Associative option from the selection list.
- Click OK.



We are now going to make a cut using the boolean operation **Intersect Solid** using the brown and red solids and to obtain a closed manifold solid.

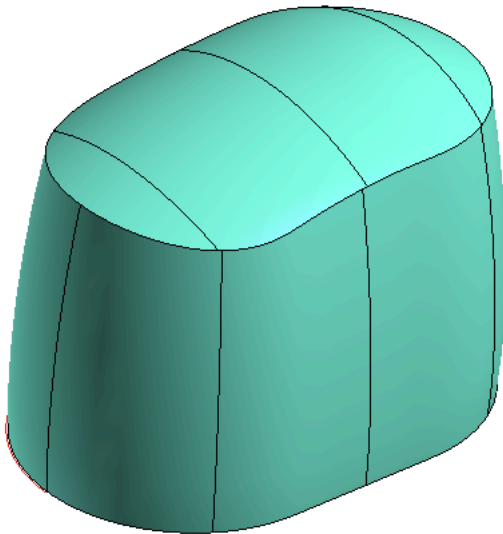
- Activate the **Intersect Solid** command
- Select both solids.



- Click OK

Note: wrong result?

If applying the Intersect Solid you obtain a wrong result, the solid, both open, need to be analyzed in the their normals.

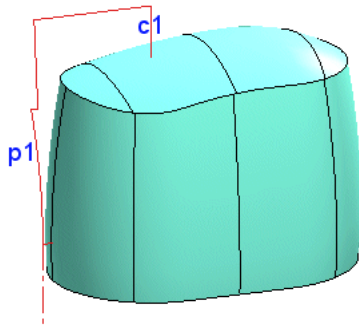


2. Step 2 : More features

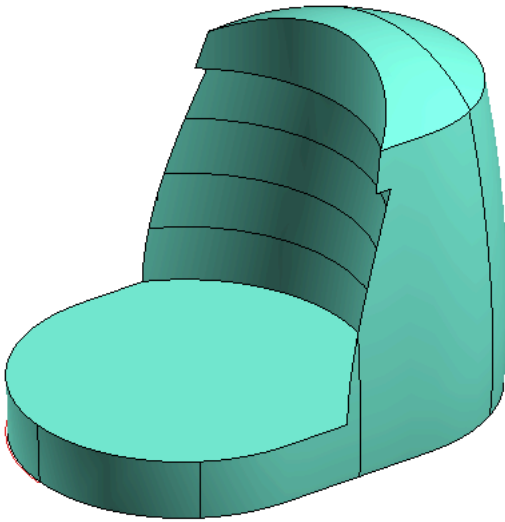
Activate **Output Layers**. Turn off Layers1 – 2 – 3 – 4 and turn on Layer5.

We are now going to use the Red profile to make a **Rotational Slot**.

- Activate the **Rotational Slot** command.
- Select the red profile (p1).
- Select the vertical line (c1) on the same red profile as the axis and the model as the solid.

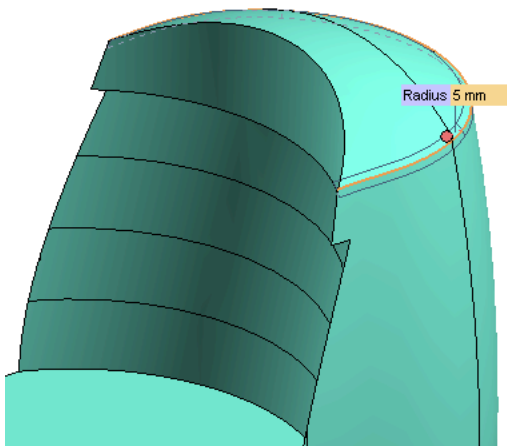


- Set the angle to Angle360.
- Click OK.




We are now going to round some of the edges using our **Fillet Edges** tool.

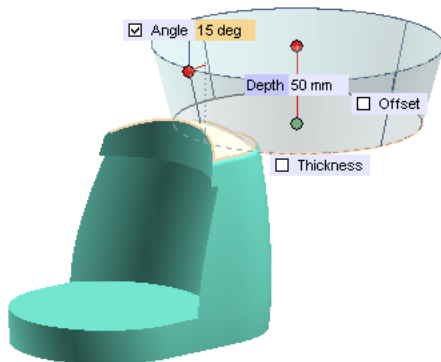
- Activate the **Fillet Edges** command.
- Select the upper round edge of the model as shown below.
- Set the value at Radius5
- Click OK




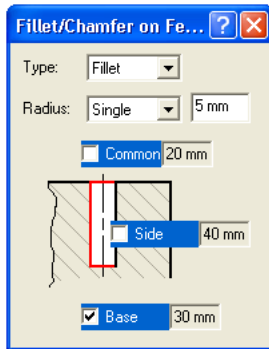
Turn off Layer 5 and turn on Layer 6.

We are now going to make a cut in the top of the model by making another temporary solid and subtracting it from the existing solid.

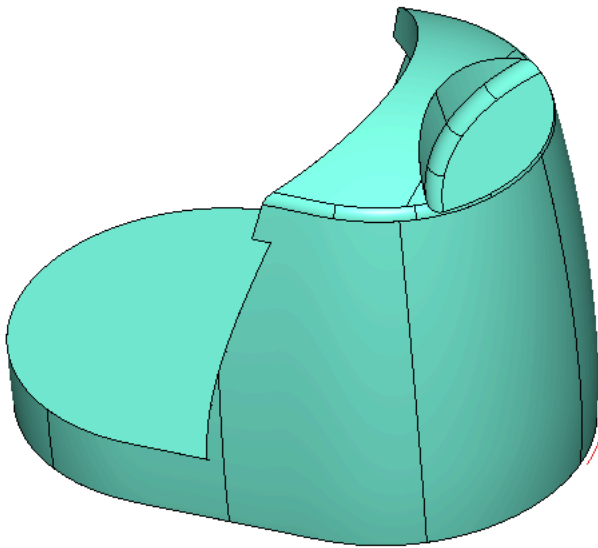
- Activate the **Linear Slot** command.
- Select the circle profile.
- Set Depth 50 and pick  More Option to set Angle 15 outwards.



- Under  Fillet/Chamfer keep the below data.
Fillet as Type.
Single as Radius.
Keep checked only Base and assigning 5 as value.

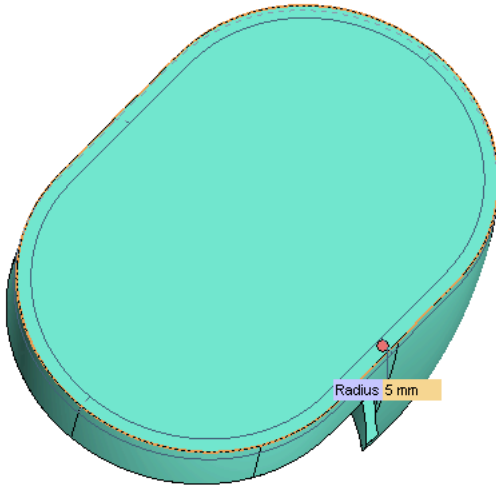


- Click OK.



Add some other additional fillets.

- Activate the **Fillet Edges** command
- Select the bottom edge of the model as shown below
- Set the value as Radius5
- Click OK



Turn off Layer6.

Using **Hide Entities**, hide all, except plastic model.

Quick tips on How to Hide All

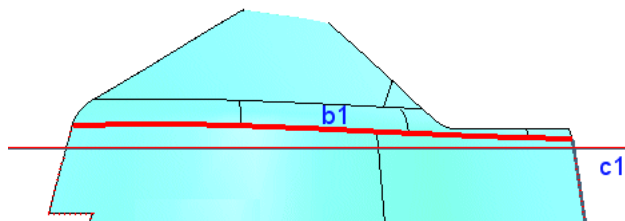
To hide everything, you can use the CTRL + A basic windows command to Select All. You can then click you **Hide Entities** command.

3. Step 3 : Setting up Zone Modeling

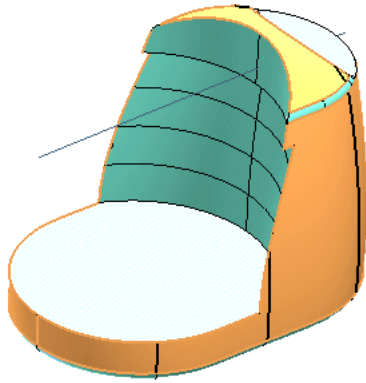
We are now going to show you how to setup the model to use advanced Zone Modeling to achieve our desired design intent.

Turn on Layer 7.

If you look at this model from the side view, you will notice that the top filleted edge isn't planar (b1). In this case, our design intent tells us that we want to have a planar edge (c1) around the top rather than a 3D edge that we have now. See the image below to understand better what we intend to get on the model.

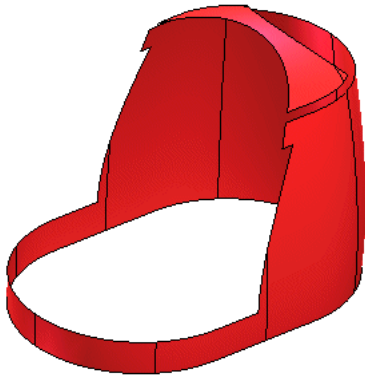




- Activate the **Solid from Faces** command
- Select the three highlighted faces shown below.
- Pick the Linked copies option.
- Click OK







In the history tree now appears a new solid that contains the three selected faces.

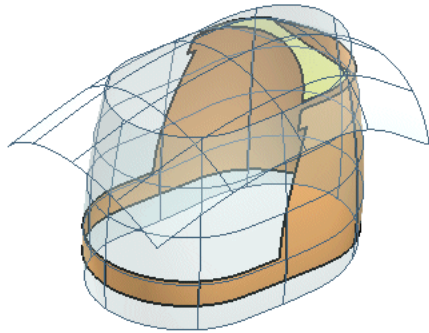
- Activate the **Hide Entities** command and select main solid.



- Activate **Break Solid**
- Set the  Mode to Local.
- Check the Associative option.
- Select all three faces.
- Click  OK

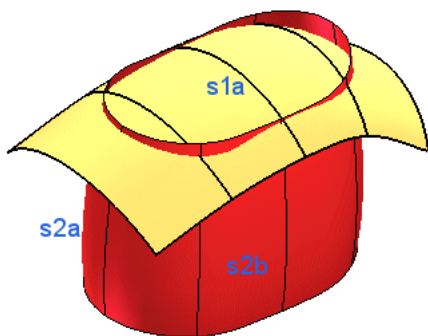
We need to untrim all surfaces so we can generate our new planar edge..

- Activate **Modify**  **Surface**  **Untrim**.
- Select all the broken skins.
- Set the  Mode to Global.
- Check the Associative option.
- Click  OK



We are now going to create some curves at the intersection of these new surfaces. Perhaps, for better visibility, change current color and line width.

- Activate the **Intersect Curve** command.
- Check the Associative option.
- Select upper entity (s1a) as Surface A.
- Select upper entity (s2a and s2b) as Surface B.
- Click OK.

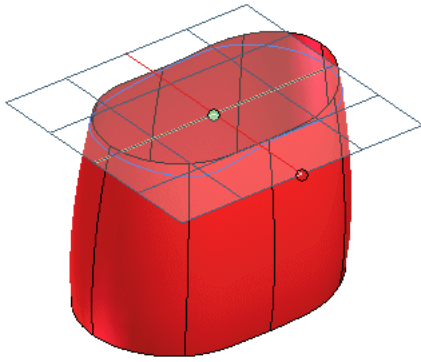


Right Click on the upper surface and click Hide Entities.

Turn on Layer7.

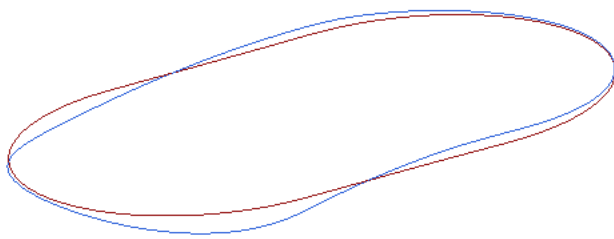
- Create a **Linear Surface** from the line the was displayed on Layer 7.
- Make the Depth a value that exceed, in Symmetric mode, the untrimmed surfaces
- Check the Associative option.
- Click OK.

Similarly, create an **Intersect Curve** between spined and linear surfaces using the same method as above.

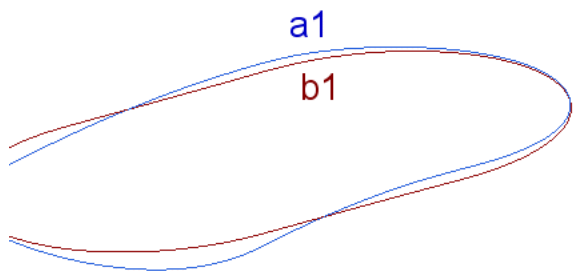




Use the **Hide Entities** to hide all surfaces.

Turn off Layer7. The only thing that should be visible are the new intersect curves as shown below.

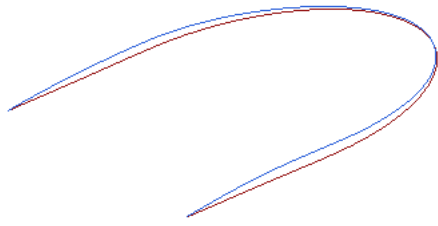


- Use the **Trim/Extend Curves with Limits** command to cut off some pieces of curves.

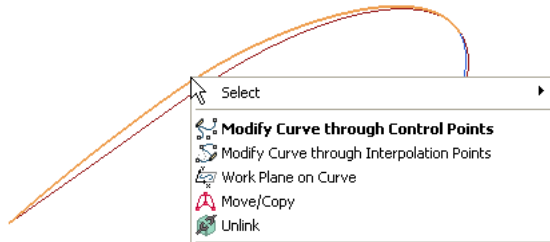


- Pick on **Trim/Extend Curves with Limits**.
- Select Blue curve (a1) for  Boundaries Entities and Brown curve (b1) for  Curves. The pick in b1 curve indicates the side that you want keep.
- Check the Associative option.
- Click OK.

Use again the **Trim/Extend Curves with Limits** command to cut off other and keep only the rear parts.

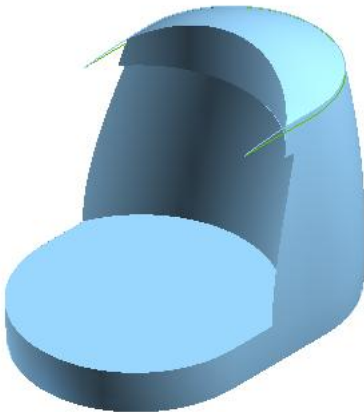


Now, by right button of the mouse on each curve, unlink all them. It is necessary to remove the linked references respect different steps in the history of the hybrid modeling.

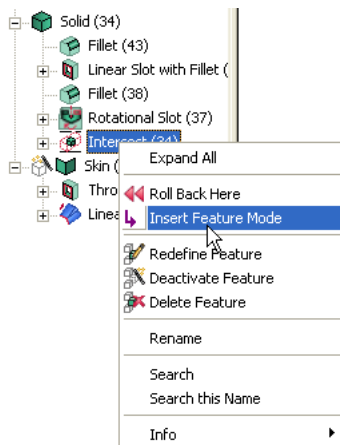


4. Step 4 : Zone Modeling

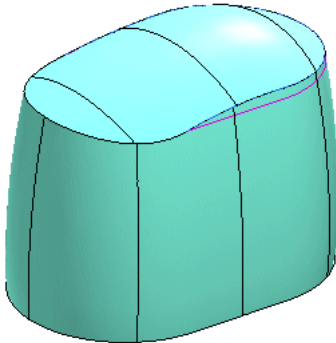
Now use the **Unhide Entities** to see the main solid.




- Now we want to insert a **Zone Modeling** feature inside the solid to change the shape.

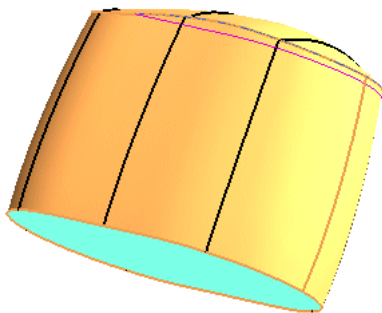


- In the History Tree select the last **Intersect Solid** feature with right mouse button and choose Insert Feature Mode.







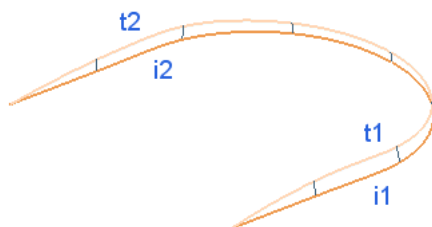
Let's start **Zone Modeling** in order to modify these faces.





- Pick  Face and select three faces like shown below (all without bottom plane).
- Select Auto Preserving, to find automatically the constrains to keep.

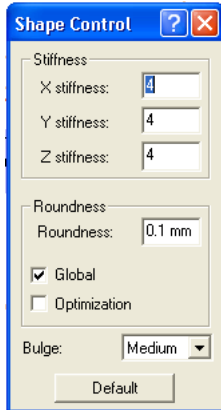
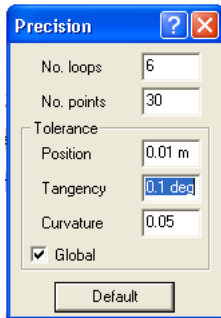


We are going to select our initial and target conditions so we can modify the surface. We'll use the intersection curve created earlier.

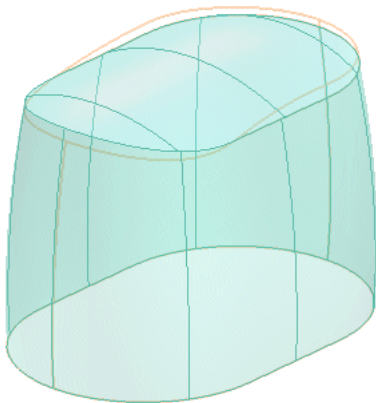
- Pick  Matching.
- Select two boundaries curves (t1 and t2) as  Initial Curves for  Group 1.
- Next, select the other two planar curves (i1 and i2) as  Target Curves.



- If necessary in  More Options use Invert to correct the temporary line.
- In  More Options active  Precision and  Shape Control to set the following parameters.



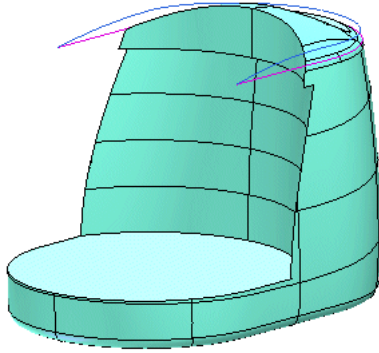
Click on  Preview.



- Click  OK.


Now you have just inserted a ZM feature inside the solid topology to give a new shape to the model.

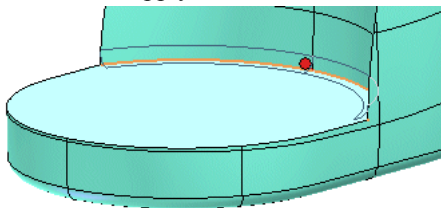
- Right click on new Zone Modeling feature in the History Tree and say Insert Feature Mode.
- **Rebuild Model** .
- Use **Hide Entities** to hide all curves.




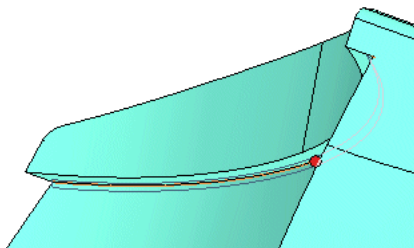
5. Step 5 : Fillets and adding thickness.


Now let's insert some fillets to eliminate all the sharp edges using the **Fillet Edges** command.

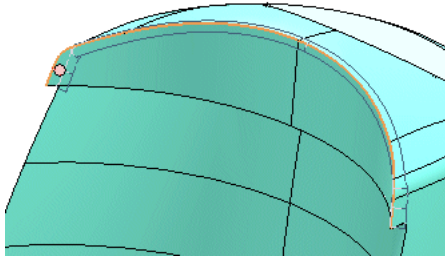
- Activate the **Fillet Edges** command
- Select the edge shown below.
- Set the fillet value as Radius3
- Click  Apply




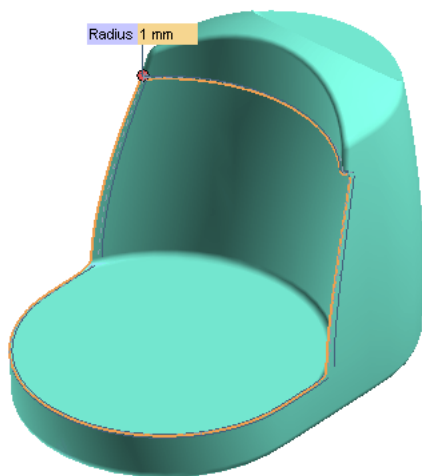
- Select the edge shown below.
- Set the fillet value as Radius1
- Click  Apply




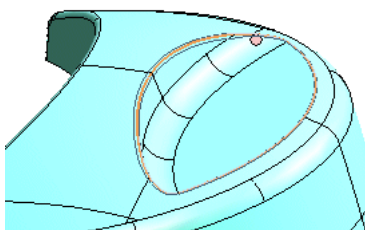
- Select the edges shown below.
- Set the fillet value as Radius2
- Click  Apply





- Select the edges shown below
- Set the fillet value as Radius1
- Click  Apply



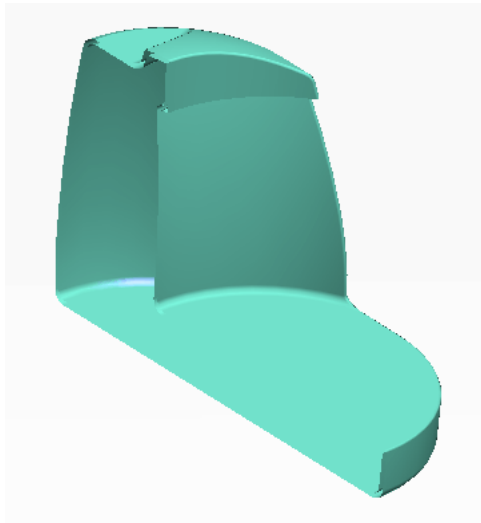
- Select the edges shown below
- Set the fillet value as Radius1
- Click  OK



Now let's add thickness to the solid.

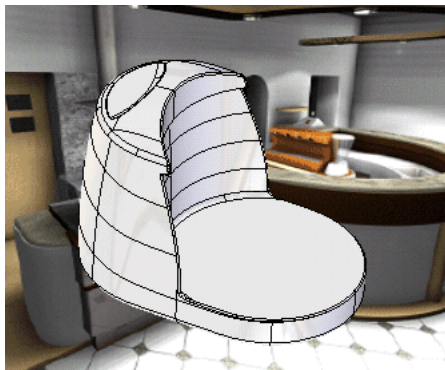
- Activate command **Solid Shell**.
- Change the  Mode to Add Thickness.
- Select the solid.
- Set the Global Thickness2 and direct the arrow inside the body.
- Click  OK.

Use **View** → **Modify** → **Define View Section** command for a graphic split of the object and check the internal side.



Finally, it's time to save our coffee maker model.

- **Save As** the model as mymodel.e3.



Excellent job! We'll use some additional functions like **File** → **New...** → **Model Derived from Current** in the Plastic Part Modeling 2.