
Introduction to Surfaces

In this exercise, we will introduce you to surfacing techniques that we'll use to model a biscuit container. We will also take advantage of some of thinkdesign solid modeling capabilities to complete the model. Let's get started!

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1. Step 1: Curves and Surfaces upper shell

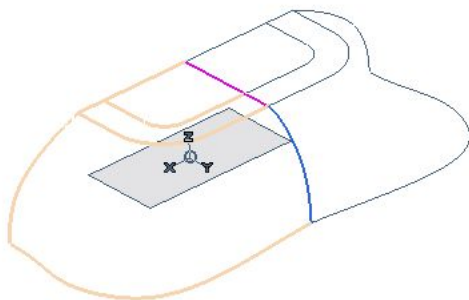
As mentioned, we intend to make one half and then mirror it to make the whole. So now let's mirror our entities in one quadrant to make the first half.

NOTE:

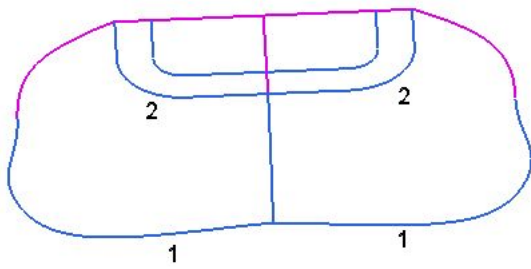
With a double click on the exe file you can run the webtraining session. ThinkDesign will be open with the right model to start.

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

- Hide Layer 40.
- Use **Mirror Entities** to reflect, as shown in the below image, the planar sections take as reference the plane perpendicular to X axis and through **Work Plane Origin**.

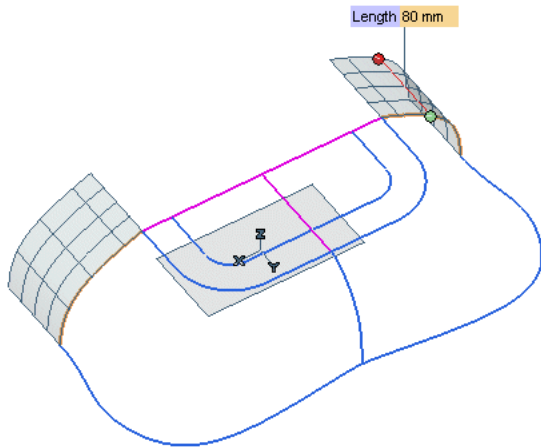


Use **Join Curves** to make 2 unique curves, one each as marked below.





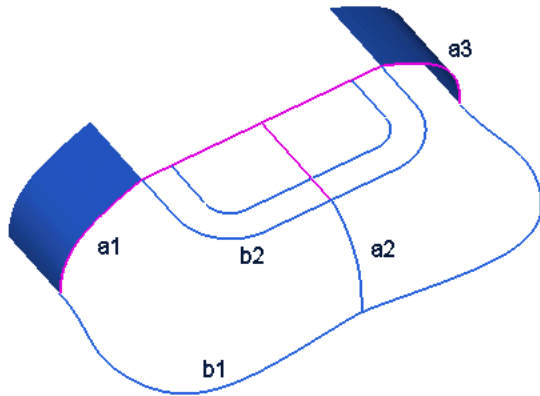
Now we are ready to define some 3D shape. Our goal will be to keep the tangency between the surfaces on the original and the part that will be mirrored later. To achieve this we will need some reference surfaces that can ensure this.


- Start **Linear Surface** and select the two curves that are situated on XZ plane.
- Choose Y as direction and assign to the minidialog a measure..



The surface that we are going to make will be defined through five curves..

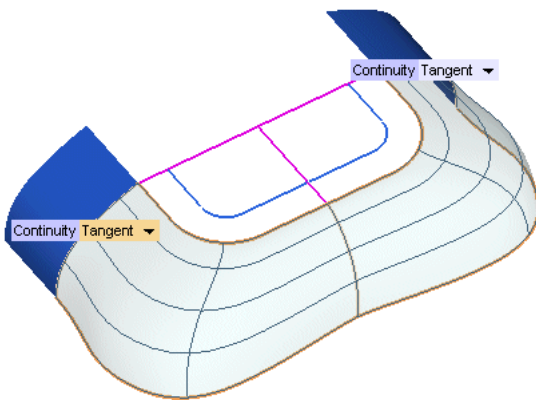
- Start the **Lofted Surface** command.
- Select a1 - a2 - a3 as  Boundary Set A. a1 and a3 aren't curves but you have to select the boundaries of the linear surfaces. It is important to remember this.
- Select b1 - b2 as  Boundary Set B



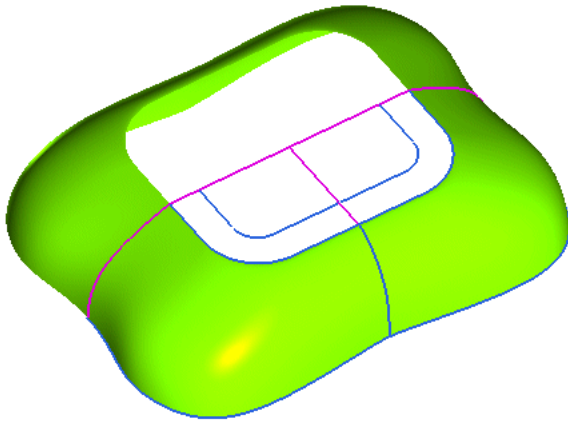
- Under  More Options you see the Grid mode.
- If a1 and a3 boundaries selection are correct you'll see two minialog with the possibility to impose the continuity constraints pop-up. choose Tangent as the option in both the dialog box.

Hint:

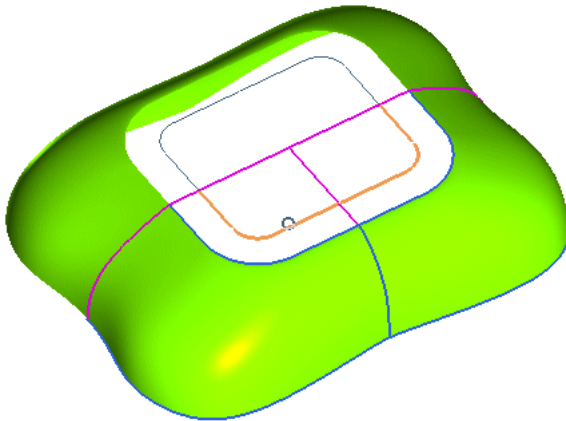
If you do not see the minialogs at both ends it means your selection is not correct. To help you make the correct selection, you are advised to **Hide Entities** the construction curves that were used for the two linear surfaces. Use appropriate selection filter to get the correct result.



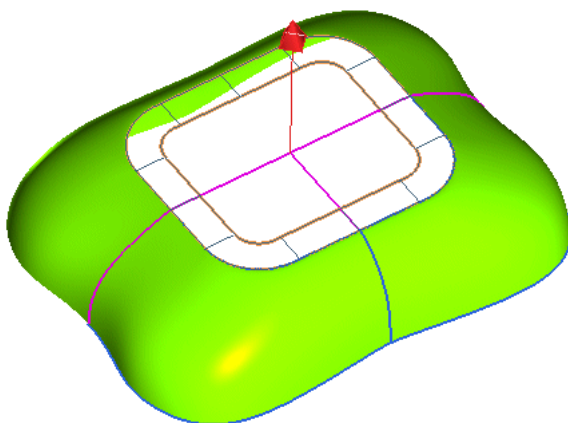
- **Hide Entities** the two linear surfaces.
- Reflect the Lofted surface with **Mirror Entities**.



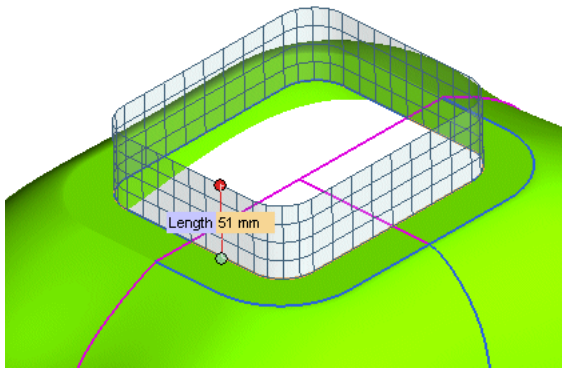
Same Mirror for the neck profile. Use  to recover the last data imposed.



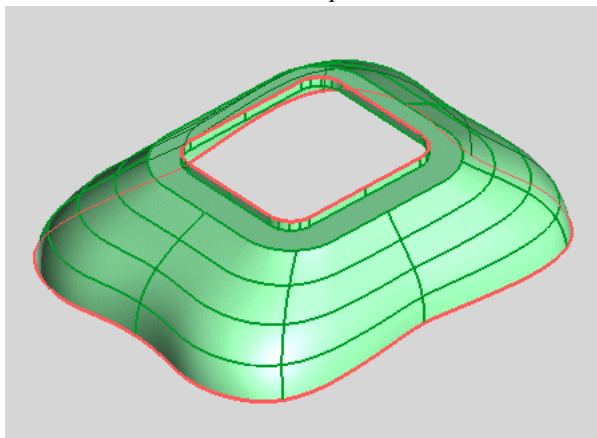
Now let's create planar base surface for the neck. Use the **Plane Surface** command. You have to select the two top boundaries in the surface and the internal loop to make the slot.



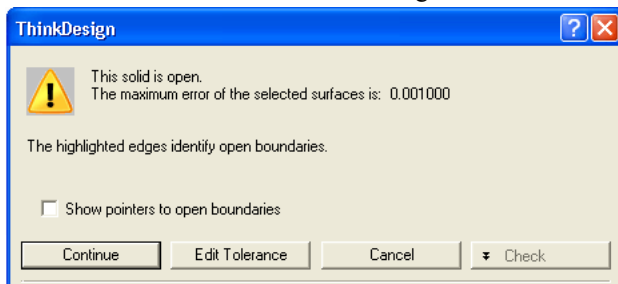
- To define the neck's shape we'll use the **Linear Surface** command.
- Select the neck curves and give the direction as Z axis.
- Assign 10 mm as length.



- Choose **Insert** → **Solid** → **Make Solid** and select all surfaces.
- Press OK to make an open Skin Solid.

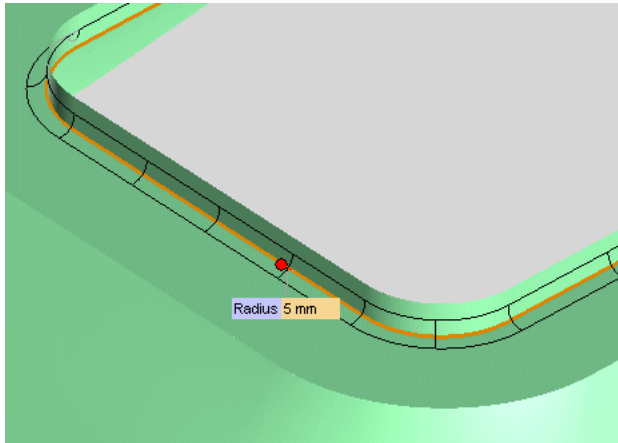


- Obviously the selected entities do not make a solid as we are working only on the skin which has no thickness.
- Hit Continue button for the warning and we have a solid.

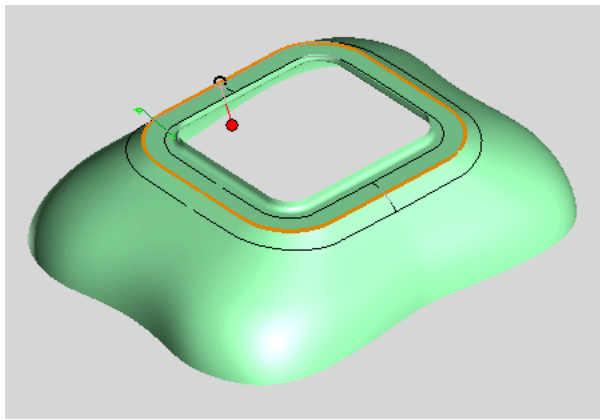


Irrespective of whether we are working on a closed solid or just the skin, as long we are able to create a solid we have the possibility to work with solid modeling tools like fillet, chamfer, hole, shell and others.

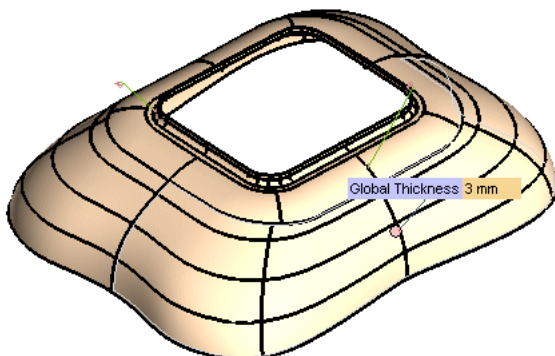
- Make a **Fillet Edges** with a radius of 5 mm on the bottom neck edge. Use the constant radius as mode.



- Make a **Fillet Edges** with a radius of 40 mm on the edge shown below. Use the Constant arc length as mode.



- Start the **Solid Shell** command.
- Select the open solid. thinkdesign alerts you with a warning that it isn't possible to remove material but you can only add. Press Yes in any case.
- Assign 3 mm as Global Thickness. Ensure that the thickness is oriented to inside. Toggle to wire frame mode and if required zoom in to the solid to ensure the correct direction of thickness.

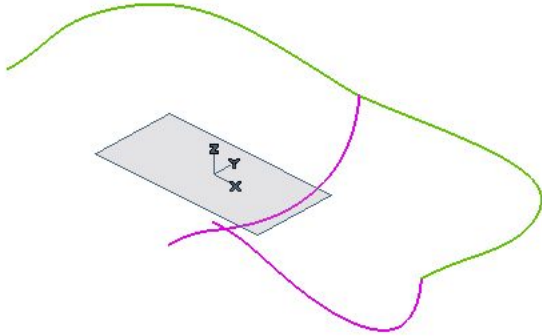


Fantastic! You have made the upper manifold solid starting with sketching curves on an image and using surface modeling commands.

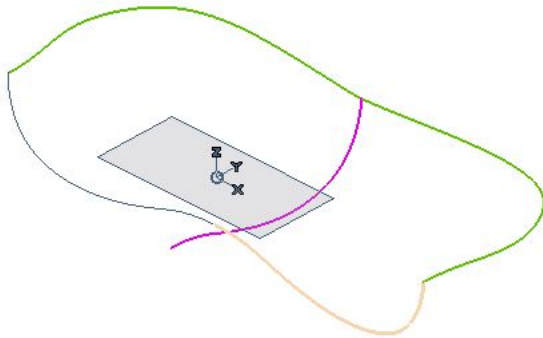
2. Step 2: Curves and Surfaces lower shell

In this step we will create the lower shell of the Biscuit holder using wireframe and surfaces modeling. At the end we will introduce the solid shell with same thickness as the upper. Our emphasis will be to make the lower shell tangent with the upper.

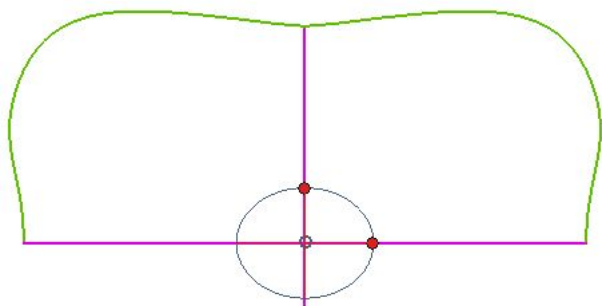
- **Hide Entities** all 3D entities, and show an set current Layer 40. Transfer in it the up joined green curve.



- Reflect the XZ curve with **Mirror Entities**. Below the result.



Press **F8** in your keyboard to orient the view to the work plane and make an ellipse with **Conic Curve** command (major axis length 100 mm and minor axis 80 mm) and point set to the **Work Plane Origin**.



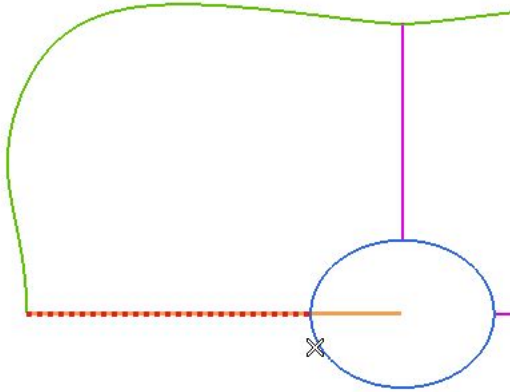
Let's trim the curves using **Edit** \rightarrow **Trim/Extend Curves**.

Note:

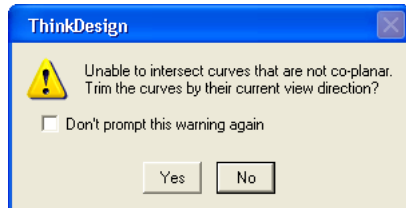
The improved **Trim/Extend Curves** command permits you to trim curves that don't have real intersection

points but seems interesting in the current view projection.

- Start the **Trim/Extend Curves** command.
- Set Mode to First.

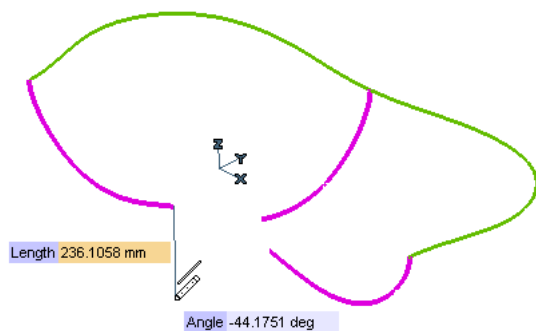


- Hit the Yes button in the alert message to remove all extended lines.



While the **Trim/Extend Curves** helped us to trim the three curves on projection, we still have to have one 3D curve that passes through these three end points. We also need to keep in mind that the curve we intend to create would eventually be mirrored and also a tangent continuity with the next mirrored parts would be necessary. Therefore we will have to provide start and end continuity and also the tangent vector should be parallel to Y axis.

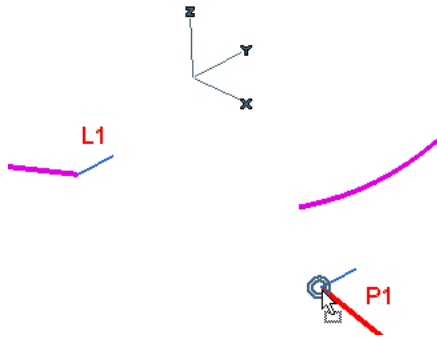
- Make a line that start at the end of internal section curve as shown below.



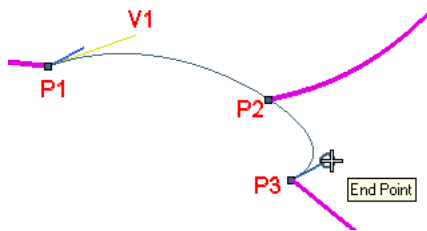
- For end point use Point Coordinates under snap toolbar and assign PX 0 - PY 15 - PZ 0.
- Hit OK button.



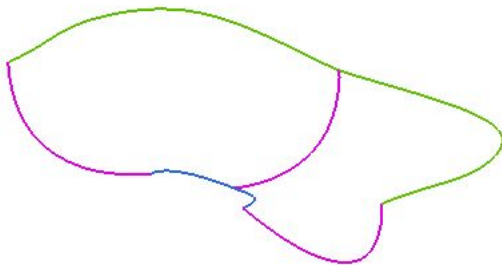
Copy the line L1 in the mirrored part using Drag/Drop until P1 point. You can obtain the same effect with **Move Entities** or **Mirror Entities** command.



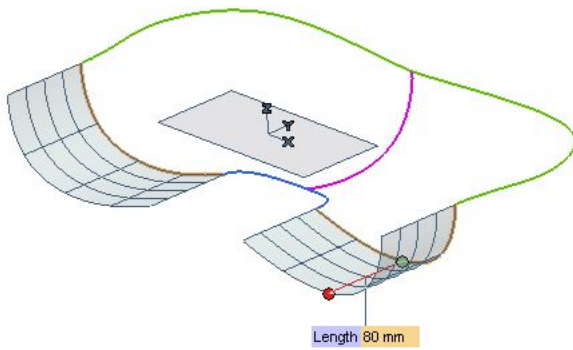
- Start **Insert Curve through Interpolation Points**.
- Select three end points P1 - P2 - P3. A generic curve is generated as shown in the image below.





- Select vector V1 and move until the end line. Repeat the same for the other vector.
- Hit OK to confirm.

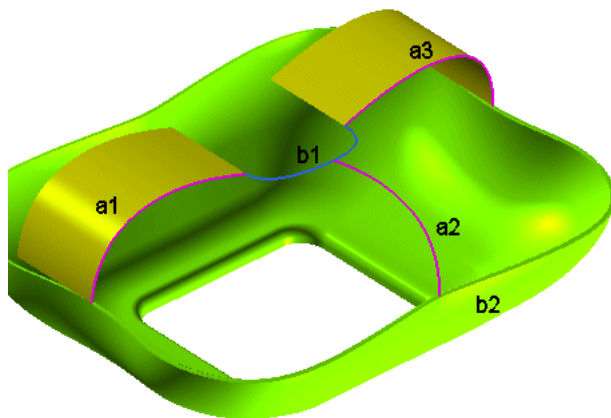


As before, we will create two linear surfaces that will be used to enforce tangency between the original and mirrored half. Create the **Linear Surface** with Direction set to Y and Length 80 mm.

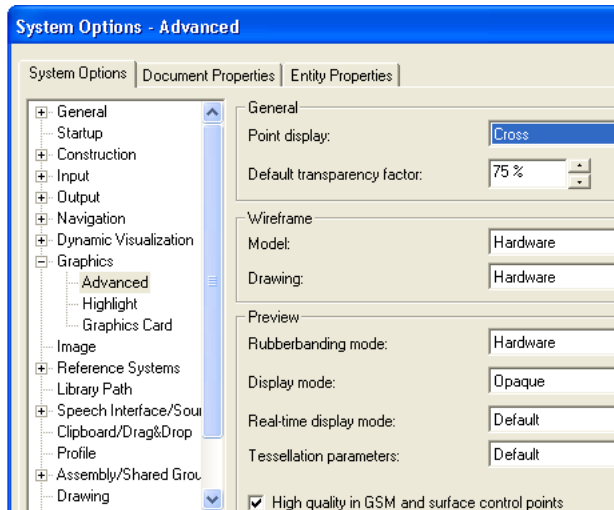


Unhide Entities on the previously made upper solid. We will use this to define another tangent condition for the **Grid Lofted Surface**.

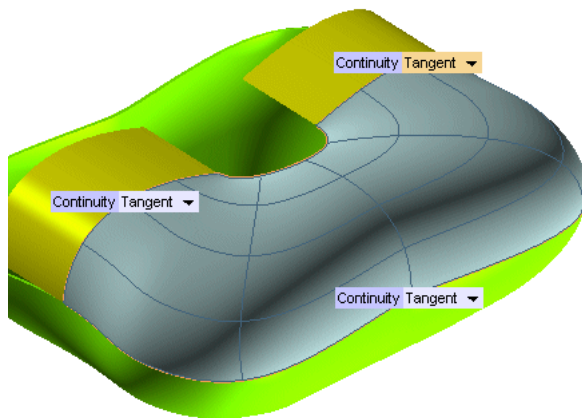
- Start **Grid Lofted Surface** .
- Select a1 - a2 - a3 as  Boundary Set A. A1 and A3 aren't curves but you have to select the boundaries of the linear surfaces.
- Select b1 - b2 as  Boundary Set B. Here, B2 label indicates the boundary of the external face of the upper solid.



If you want to change the graphics of the preview mode, open the Options window with right button on the mouse and indicate your preferred mode.





If A1, A3 and B2 boundaries selection are correct you'll see three minialogs with the possibility to impose the continuity constraints. Choose Tangent as the option in all of them.

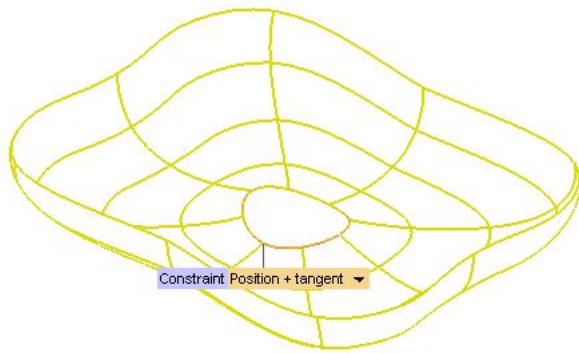




Hide Entities the upper biscuit holder solid and the two linear surfaces.

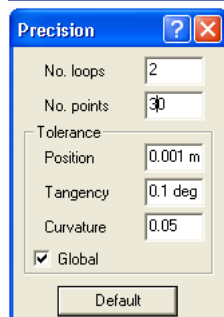
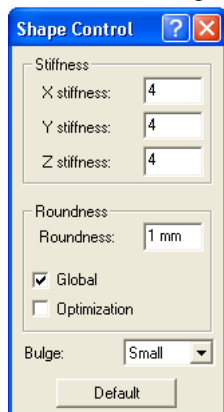
Using **Edit** → **Mirror** command, mirror the Bi-rail surface that you have just created.

Our next goal will be to close the slot at the center using the **Capping** command..

- Start the **Capping** surface command.
- Select the slot boundaries curves as Constraint boundary curves. Ensure that all these Boundary curves are in  Group 1
- Assign Position + tangent as constraint. If you cannot find it, have you got selected surface boundaries?.
- Click on  Preview icon to see preview of the operation.

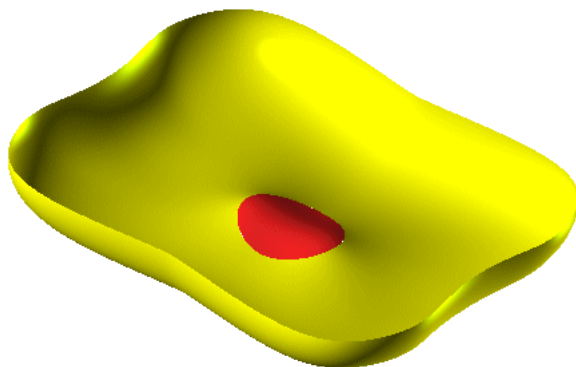


Under  More Options adjust the Shape Control and Precision parameters and hit on  Preview.



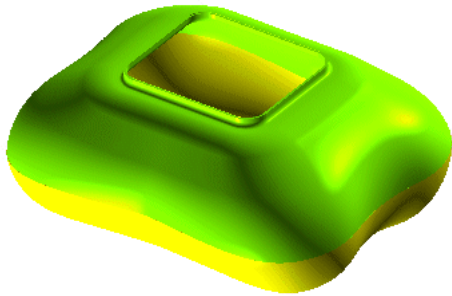
- Click  OK to continue.

Look at the result, which is shown in the red color in the image below.



To complete the Lower solid, repeat the same steps of **Make Solid** and **Solid Shell**, that we did for the upper solid.

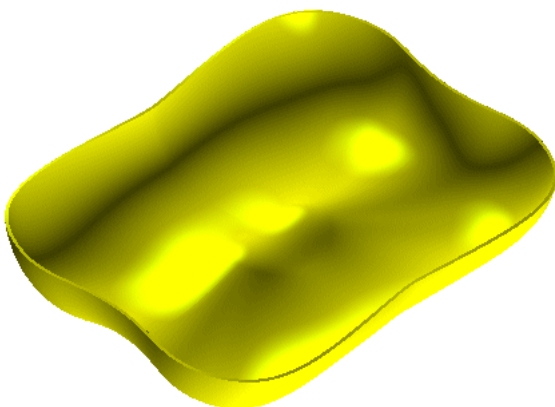
Unhide the image and now we have both the upper and lower solids of the Biscuit holder.




Great job!!.

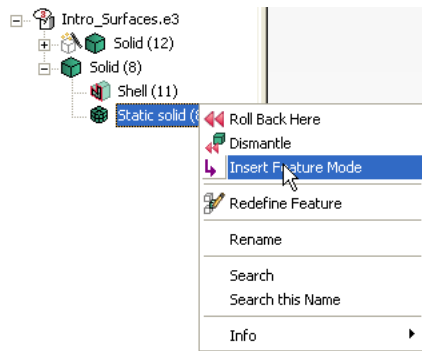
3. Step 3: Sample modes to change the shape

In the previous steps, we have used standard surface modeling methods to create our biscuit holder. But, you know boss is always right! He wants you to modify the shape. The neck is too straight to close, the body bulge is too pronounced, how about a dimple in the capping surface..., oh ! it never ends. We can feel your heart sink but hold it right there..., thinkdesign has advanced tools like **Zone Modeling**, **Global Bend** and **Global Radial Bend** that can change the shape of the solid (be it parametric or static), surfaces, curve and points and in next to no time. While you can study in depth these arguments in other focused web training tasks or e-seminars we will give you a flavor of these advanced techniques here with one example of adding a dimple to the Capping surface. Other changes are shown without explanation at the end of the task.



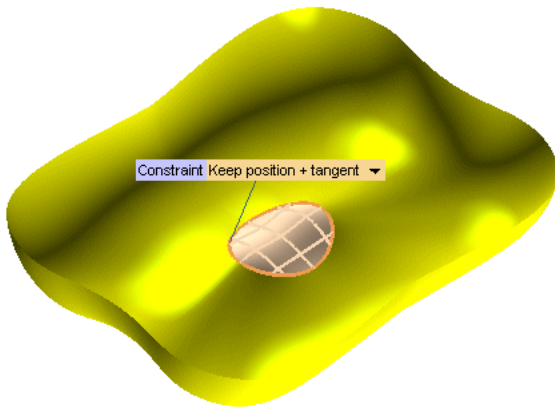
Let's try to dimple the Capping surface in the bottom solid using **Zone Modeling**. Clear up the graphics area by hiding the upper solid.

- In the history tree branch of the lower solid select Static Solid and right click on the mouse to invoke the context menu.
- Choose  **Insert Feature Mode**.

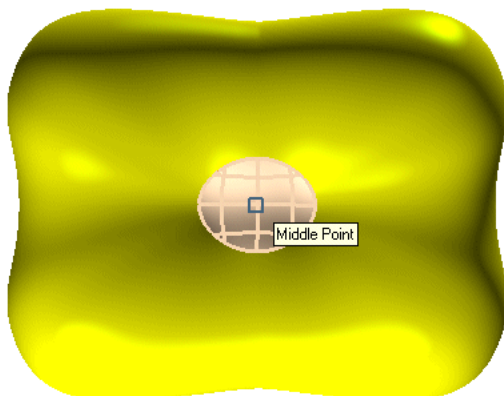


As you do that, the shell feature gets deactivated and you are now ready to change the shape of capping surface although it is well integrated into the solid..

- Start the **Zone Modeling** command and select capping surface as Faces.
- Select AutoPreserving. The command open Preserving parameters. Select Curve (Group 1) and as constraint choose Keep position + tangent




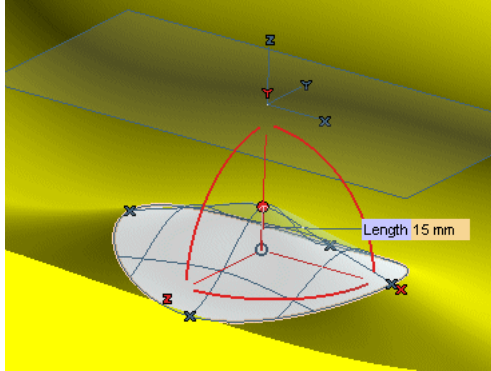
- Hit in your keyboard.
- Under Matching select Interactive and indicate a point on the same face .





A red handle appears on the same position.

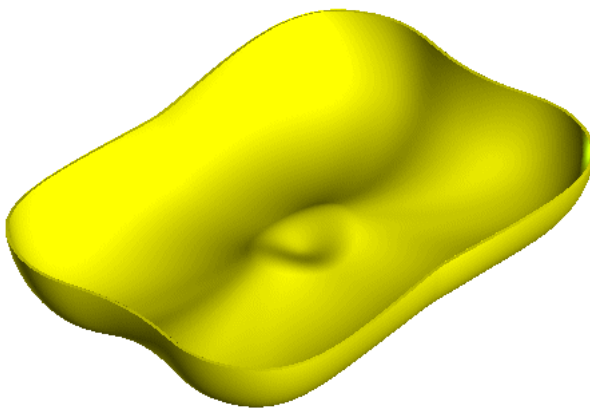
- Hit to show the work plane.

- Select Z as  Interactive.
- Assign positive or negative value to the minidialog. The command will always show a preview.

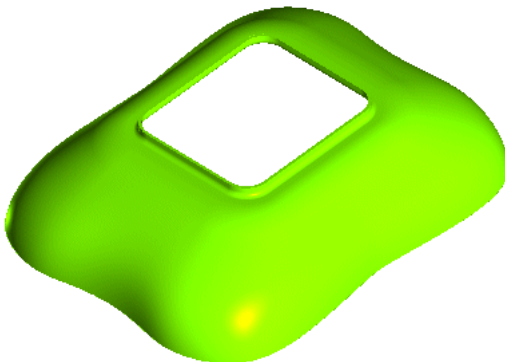


- Hit  OK once you have the dimple direction as in the image below.
- Go back to the history tree and right click on Zone modeling and select  **Insert Feature Mode** to exit the command.
- **Rebuild All** and you are done with inserting a dimple on the bottom solid of the biscuit holder.

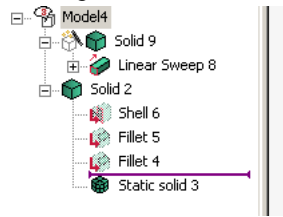
We hope you appreciate the benefits from this powerful tool. We have used with extreme ease an external dimension to modify shape and behavior of an existing geometry. The beauty is that the changes are precise and controlled.



There are more examples of what you can do with **Advanced Modeling** and **Zone Modeling**.

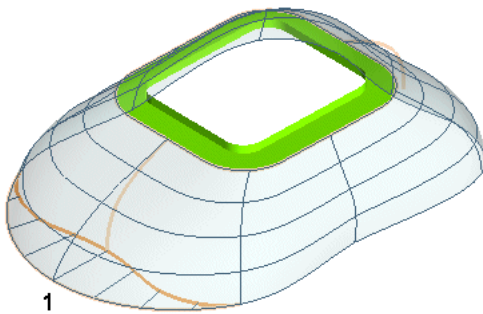


Depending on your needs always use **Insert Feature Mode** command at appropriate place in the history tree. The above inserted feature will also apply to the new feature that you insert and this should dictate the selection of the position for **Insert Feature Mode** command.

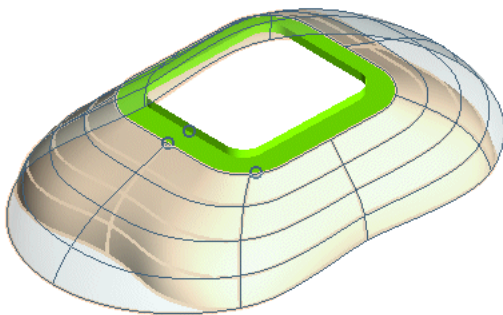


Just check out many things you can do with **Advanced Modeling** and **Zone Modeling**.

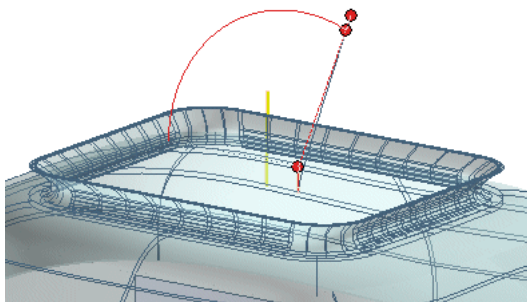
Zone Modeling permits you to make changes on a unique part and use Symmetry option to simultaneously change mirrored entities.



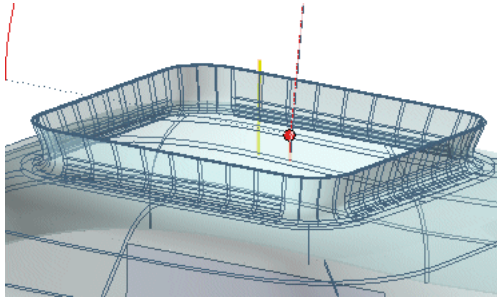
With Symmetry option (under More Options) present, both in **Advanced Modeling** and **Zone Modeling**, it is possible to reduce modeling time. For instance in the image below we have applied changes on one set of features. With Symmetry option set the changes are replicated on the mirrored part avoiding duplication of the same constraints all over again.



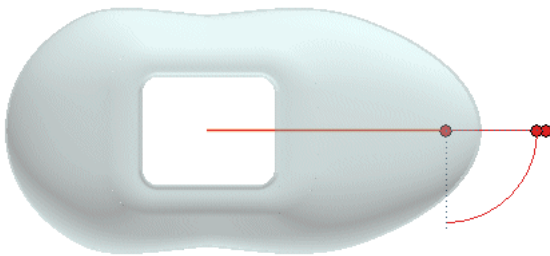
Using **Global Radial Bend** it is possible to change the behavior of the neck as shown in the image below.



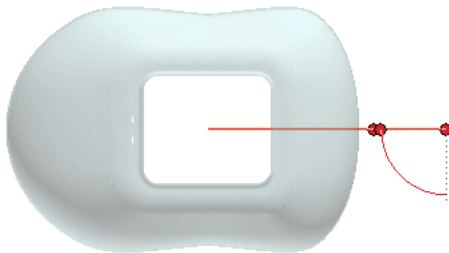
You can also stretch the neck with compounded changes by changing precise linear and angular values.



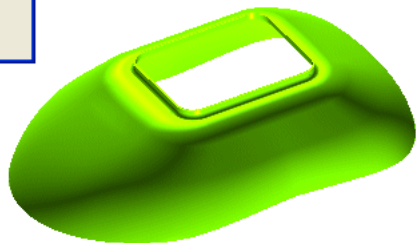
Using **Global Bend** we have the possibility to bend or to extend the faces as shown below.



...or compress the same.



Mind you, we are working with parametric and static solids and they remain manifold after all these operations.



Congratulations !! on completing this task. Hope you now have a taste of things to come in other web training tasks on **Advanced Modeling** and **Zone Modeling**.