

Tutorial 5 Inserting a Freeform Face

Overview

In this tutorial, we'll insert a freeform face from SurfaceWorks into a SolidWorks part. The new face will be tangent to the planar SolidWorks face that surrounds it, and durably attached to the SolidWorks edges. The part will end up being a drop-in tub (Fig. 1).

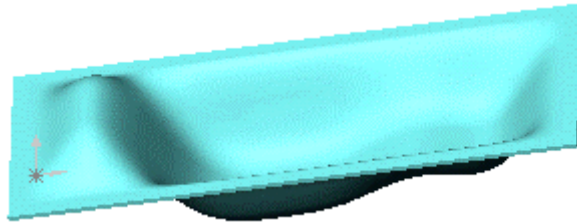



Fig. 1

Entity introductions:

- Tangent Boundary Surface

Concept and Function introductions:

-  cursor shape
- Select boundaries bottom, right, top, left to match TBS spreadsheet
- Shaping a Tangent Boundary Surface via its control sliders, and via the Control Values spreadsheet
- SurfaceWorks>Add SurfaceWorks Parents
- SurfaceWorks>Manage SurfaceWorks Parents

Here are the basic steps we'll follow:



- Select a planar face from a model in SolidWorks to take with us into SurfaceWorks.
- From the inner edges of this face, create a Tangent Boundary Surface in SurfaceWorks with G1 continuity along all its edges.
- Shape the surface before heading back to SolidWorks.
- Cut the part with the new surface, thus making the new face.
- Lengthen the tub, then shell the part.

- Edit the Tangent Boundary Surface in SurfaceWorks and bring the changes back into SolidWorks.

Again, since some of you may be rather new to SolidWorks as well as to SurfaceWorks, we include step-by-step instructions for both the SurfaceWorks and the SolidWorks parts of the tutorial modeling. (If you are an old hand at SolidWorks, please bear with the details for newer users. Thanks!)

Base Extrude and Boss Extrude

We will start this tutorial by finishing a sketch started in SolidWorks:

- 1 In **SolidWorks**, **File>Open TubStart.sldprt** from the \Integrated Tutorials folder.
- 2 **Select 'Sketch2'** from the FeatureManager.
- 3 **Choose**  or **Extruded Boss/Base** from the Features toolbar and click above the surface.
Type = Blind
Dimension = 50 in
- 4 **Select 'Sketch1'** from the FeatureManager.
- 5 **Choose**  again and again click above the surface.
Type = Blind
Dimension = 26 in

Add SurfaceWorks Parents

The geometry we will take into SurfaceWorks is the narrow upper face of Boss-Extrude1, which surrounds the Base-Extrude. In SurfaceWorks, we will make a freeform surface that spans the area inside the inner edges of this narrow face, then we'll bring that surface into SolidWorks and cut with it, thus creating the new freeform face.

- 1 **Right-click on the narrow upper ledge-like face of the Boss-Extrude** (it surrounds the Base-Extrude), then from the shortcut menu (right click) choose **Add SurfaceWorks Parent**. If you have difficulty selecting the face, you may have to rotate and/or zoom the model.
- 2 From the menu bar, choose **SurfaceWorks>Manage SurfaceWorks Parents**. This dialog shows you a list of all the SolidWorks geometry that has been assigned as SurfaceWorks parents. **Notice** that besides the face we selected, 8 edges are listed. When you add a face as a parent, you automatically get all its edges as parents as well.
- 3 **Close the dialog**.

- 4 Choose **SurfaceWorks>Modeler**.

Check program settings

Let's check those program settings and make sure we're all starting with the same ones (the initial program defaults). This is what you should have:

On the **View** menu:

Status Bar should be **ON** (preceded by a checkmark; to turn an option on, simply click on the menu item or if it has a box next to it click on the box).

All **Toolbars** should be **ON**. To check this, click on **Toolbars**. The resulting list should have all of its boxes checked.

On the **Tools>Options, General**, tab:

Rotation Constraint should be set to **Free tumble**

On the **Tools>Options, Dragging** tab:

All the **snaps** should be **ON**


Prompt after drag should be **OFF** (no checkmark)

Create the Surface

You see the imported SolidWorks geometry. The face is represented by a Trimmed Surface, and its edges by Projected Snakes (a "snake" is a curve constrained to lie on a surface). We'll use a Tangent Boundary Surface to make a freeform surface inside the SolidWorks face. We chose this kind of entity because it allows us to:


- Make a surface tangent to adjacent surface(s) — the key here is that the bounding curves need to be snakes along the edges of the adjacent surfaces
- Shape the interior of the surface using numerous control points

We want to select all four lines (Projected Snake entities) around the inside of the model. You could start with any of them and go in either direction around the loop, but for the tutorial, so we're all looking at the same model, do it this way:

- 1 **Click on the upper of the long inner edges to select it.**
- 2 **Ctrl+click, in order, going clockwise** (right, lower, left), **to select the other three inner lines**. All four Projected Snakes should now be displayed wider and also listed in the selection set.
- 3 On the Insert toolbar, click  (with the all-blue boundary), then choose **Tangent Boundary Surface** from the drop-down menu (alternatively, you could choose **Insert>Surface>Tangent Boundary Surface**). In the dialog box, the four lines you selected should be listed as the "Bounding Curves".
- 4 Make **Number of u control values = 8** and **Number of v control values = 6**.

- 5 We want the surface we are making to be tangent to the surface rimming it, so **click each of the four radio buttons in the G1 column**. Since the bounding curves are snakes on the adjacent surface, the G1 and G2 options are available.
- 6 Click **Apply** (not OK; we want the dialog to stay open — we haven't finished shaping this surface yet). A "basis" surface with 8 x 6 control "points" appears inside the bounding curves. Each of the inner 6 x 4 controls displays as a slider point on a line that is normal to the basis surface — you can use these to shape the interior of the surface. The outer row of controls has no sliders; these controls are fixed at zero because we specified G1 continuity for the edges. The slider controls display only for shaping the surface (they aren't real points and they will disappear when you OK the dialog).

Tangent Boundary Surface Control Values

- 1 The dialog box is still open.  or **View>Modify>Pan the graphic image** and **drag the dialog** to show as much as possible of the entire surface and the entire dialog.
- 2 In the dialog, switch to the **Control Values tab**, to see the model's spreadsheet control, which is synchronized with the sliders in the graphic image.
- 3 **Notice:**
 - In the dialog, the outer row of values is grayed out and, in the graphic image, the outer row of control points has no slider to slide on — the points are fixed at zero. This is because we specified G1 continuity along all the Tangent Boundary Surface's edges. (If we had specified G2 continuity, two rows of controls would be grayed out and sliderless; if we had specified G0, none would be grayed out, and all would have slider lines.)
 - The corner values in the spreadsheet and the corner controls in the graphic image are color coded, so you can keep track of which values correspond to which sliders. The control nearest the $u=0, v=0$ corner of the surface is always red. This value always is at the lower left of the spreadsheet. So in this case, you can see that to map the surface onto the spreadsheet, we'd need to flip the surface top to bottom.


Instead, we'll show you a little trick about selecting Tangent Boundary Surface edges: if you select them in the order bottom, right, top, left, the surface automatically will be oriented similarly to the spreadsheet. Let's do it:

- 4 Switch back to the **General tab** and **click in the "Bounding Curves" data field**.
- 5 In the graphic window, reselect the curves: **click the bottom inner edge**, then **Ctrl+click in order, the inner edge on the right, the top, and the left**. (When you change bounding curves, continuity for the first and third edges is set back to G0 — the curves in these positions are different from before. The curves in the second and fourth positions happen to be the same ones as before, so they keep their G1 continuity assignment.)

- 6 **Set continuity to G1** for all the edges.
- 7 Click **Apply**, then return to the **Control Values tab**. Now it's easy to see which cell in the spreadsheet corresponds to which slider in the graphic window.

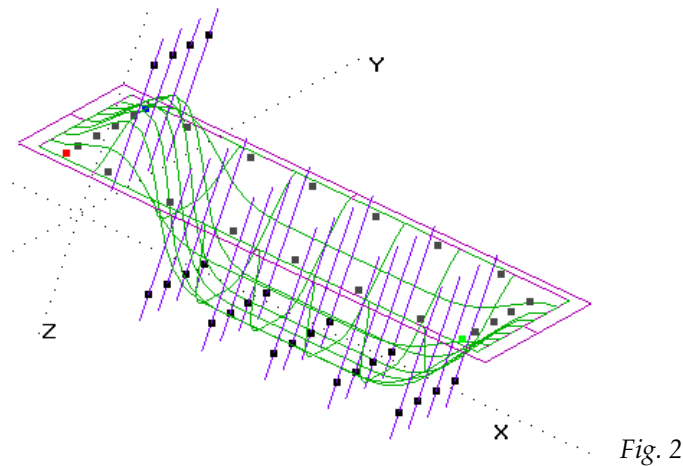
Shape the Surface

You can shape the interior of a Tangent Boundary Surface in two ways: by sliding the sliders in the graphic view or by typing in values on the Control Values tab of the dialog. We'll demonstrate both methods. We want to shape the surface so that some of it is above the original plane of the surface, and some of it is below:

- 1 In the drawing, **find the slider nearest the blue color coded point** (at upper left, in this view). **Aim the cursor arrow at the point on the slider line** — the  icon will appear. **Drag the slider point up a little** and see how the surface responds.
- 2 **Notice** in the dialog that the value for the slider you just dragged is no longer zero.
- 3 Back in the graphic display, **drag the upper-left slider up to approximately 20** (watch the value in the spreadsheet as you drag — you may need to pause during the drag to force the value to update).
- 4 **Drag the slider next below it** (in the same column) **to approximately 20**.

Since we want the whole first column to be 20 and the rest of the cells to be -20 let's work with the spreadsheet.

- 5 In the **Control Values** spreadsheet, click in the top left editable cell. This value should already be around 20 from being dragged.
- 6 Type 20 and press the down arrow, 20, down arrow etc.
- 7 **Repeat this for the next column using -20 for the cell value.** To speed the process for the rest of the columns, select the four -20 cells, copy (Ctrl+C), click the top editable cell in the next column, and paste (Ctrl+V), etc. (You won't see any change in the graphic until you click Apply or OK).
- 8 Now click **Apply** (Fig. 2).



- 9 Click **OK** and rotate  to see what you have.

Insert the Face

- 1 **File>Exit & Return to SolidWorks, saving changes.**

The surface we've made is hidden inside the part, but imagine it there — it goes both above and below the plane of the narrow face we brought in from SolidWorks. That's why we made the Base-Extrude taller than Boss-Extrude1.

- 2 Before we use the imported surface, go again to **SurfaceWorks, Manage SurfaceWorks Parents**. The Import column now shows that Surface-Imported1 is the import based on four of the edges (2, 3, 4, 5) listed in the Export column.
- 3 **Expanding any of the Surface-Imported1 listings** shows that the imported surface comes from the SurfaceWorks entity 'surface1'.
- 4 **Expanding any of the features in the Export column** shows the name of the SurfaceWorks entity that the SolidWorks entity was translated into.
- 5 **Close the Manage SurfaceWorks Parents dialog.**

Now, we'll cut the part with the surface.

- 6 In the FeatureManager, **select Surface-Imported1.**
- 7 **Insert>Cut>With Surface:**

The outlined arrow in the graphic image should be pointing toward the top of the part. If it isn't, click the "Flip the side to cut away" box.

- 8 **OK** (Fig. 3).

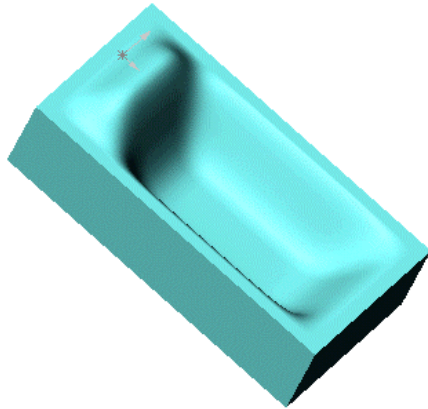




Fig. 3

Lengthen the Tub

Ah, but what if we now decide that we want the tub to be longer? Well, we'll just make it longer:

- 1 Click  to **expand Boss-Extrude1**.
- 2 **Double-click Sketch1**.
- 3 In the graphic display, **double-click the 96 dimension**, then **change it to 120** in the dialog; click on the green check mark.
- 4 **Rebuild** ( or **Edit>Rebuild**) the part (Fig. 4).

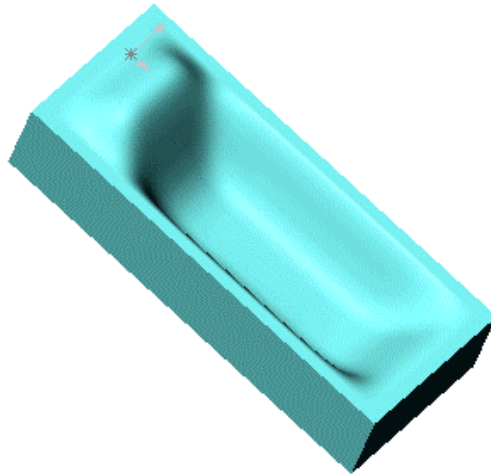





Fig. 4

Shell the Part

Now, let's shell this part. We'll make it a drop-in tub:

- 1 Select the five big faces of Boss-Extrude1**, i.e. the "sides" and "bottom" of the model (yes, you'll need to rotate to get the ones that aren't visible now). Be sure you get the face icon  before you Ctrl+click — you have to point where the imported surface does not interfere with the face selection. Toggle the Rotate button  on and off on the toolbar in order to switch back and forth to the Select tool without losing any faces from the Selection Set.
- 2 Shell**  the part:
Thickness = 1 in.
Make sure 5 faces are listed (Face <1>, Face <2>, etc.; if there aren't five, go back and reselect them.)
OK (Fig. 5).

Ready to cut a drain hole and install in your new bathroom?

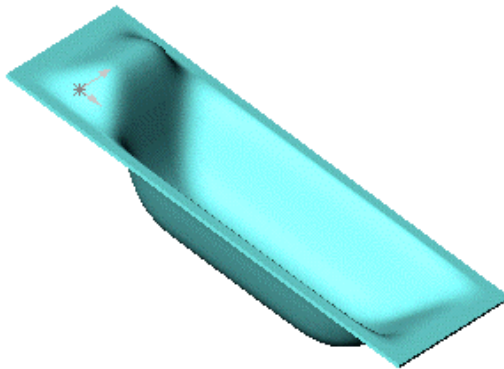



Fig. 5

Final Modification in SurfaceWorks

Before leaving this model, let's go back to SurfaceWorks and change the shape of the Tangent Boundary Surface — maybe you'd like to lounge in the tub with your feet up?

- 1** Choose **SurfaceWorks>Modeler**.
- 2** **Double-click the Tangent Boundary Surface** to edit it.
- 3** Go to the **Control Values** tab and **change all the values in the next-to-last column of control values to -10**; **OK**.
- 4** **File, Exit & Return to SolidWorks, saving changes.**

- 5 Rotate  to see what you have (Fig. 6).

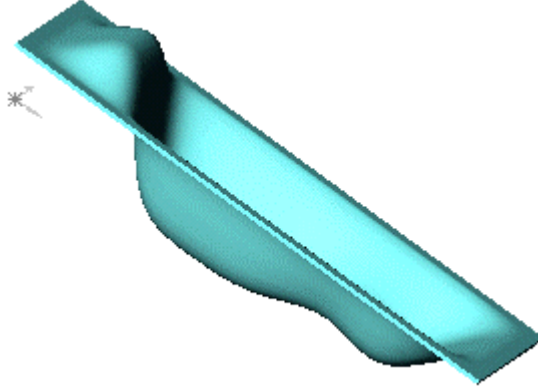


Fig. 6

- 6 That's all for Tutorial 2, so **File, Exit SolidWorks**.

