



# FreeForm® Modeling Plus™ Solution Guide

## AutoSurfacing Complex Models

### INTRODUCTION

The AutoSurfacer utility can be used to export the NURBS and patches data that some vendors require for post-processing in NURBS-based surface modeling packages. To export a model through the AutoSurfacer and save it to the STEP or IGES file formats, select the **Export Model** feature from the **File** menu and choose **AutoSurfacer** from the **Save as Type** menu. This will launch the AutoSurfacer window, through which you can apply patches and automatically surface the model for compatibility in NURBS packages.

### ISSUE

Some geometric qualities in a part can be difficult for the AutoSurfacer to process. These include pieces with thin or sharp edges, and large, detailed pieces that require many patches. When these pieces are AutoSurfaced, the output may contain areas where patches are distorted or missing altogether. When this occurs, the output either needs to be reprocessed in the AutoSurfacer with modified settings, or manually repaired with the patch tools in FreeForm.



*Example of a model before auto surfacing*



*Incomplete auto surface result due to problem areas*

### SOLUTION

In the event a model does not autosurface completely, or bad patches result, there are steps you can take to repair or replace the surfaces and export usable NURBS data to 3rd party NURBS modeling packages. These steps, beginning on the following page, involve several manual surfacing methods that utilize a variety of FreeForm Modeling tools.

In the example used for this guide, an eye wear model is exported through the AutoSurfacer but the result is not complete due to areas on the model that did not surface completely or accurately. To correct this, the exported IGES surfaces are imported back into the FreeForm file that contains the original clay model. The bad patches are then deleted, and areas that were not surfaced completely are repaired with new patches that are manually created. Once this is completed, all of the surfaces are stitched into a solid for export to 3rd party Parasolid or NURBS-based modeling software.

## STEP 1: EXPORT TO AUTOSURFACER

Using the Export Model feature, available from the File menu, launch the FreeForm AutoSurfacer (available in FreeForm Modeling Plus only) and auto surface the model. This example, and all subsequent steps to follow, uses a sunglasses model.

**TIP: When preparing to auto surface a large piece (over 100 mb), you may need to decimate the piece to reduce its size (to under 100 mb).**

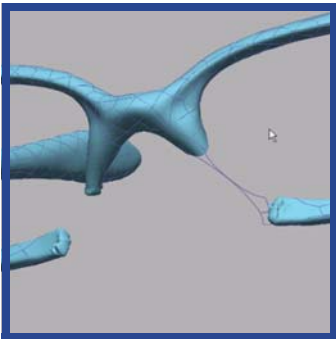


- 1 In the **File** menu, click **Export Model**.
- 2 Under **Save as type**, select **AutoSurfacer**.
- 3 Click **Save**. The model appears in the **AutoSurfacer** window. You can rotate the model in this window using the mouse.
- 4 Set the available auto surfacing options. For complete descriptions of these options, see the FreeForm Help system.

In this example, the following changes are made:

- **Patches** - Changed from 400 to 1000. Increasing the number of patches can improve the auto surface result for larger pieces. Note that the maximum patch number is 10,000. 1 to 5,000 is typically effective.
- **Control Points** - Changed from 20 to 25. Increasing the number of control points will increase the UV grid for each patch, providing greater fit capability when surfacing parts that include complex surface details.

- 5 Click **AutoSurface**. The model is auto surfaced. When it is finished, patches will appear on the model. Note that this step may take 30 minutes or more, depending on the size and complexity of the model and on the performance of your computer.



- 6 Rotate the model in the AutoSurfacer window and inspect the result for problem areas.

In this example, you can see that the part of the frame beneath the bridge was not auto surfaced completely. The autosurfacer failed to create patches in these areas. In other cases, patches that are created could be warped or jagged, or may not fit correctly to the surface. Problem areas like those found in this example can be manually repaired in FreeForm.

- 7 Click **Save** to save the AutoSurfacer result to either **STEP** or **IGES**. This file will later be imported into the original clay file in FreeForm.
- 8 Close the **AutoSurfacer** window.

## STEP 2: IMPORT THE STEP/IGES FILE OVER THE ORIGINAL

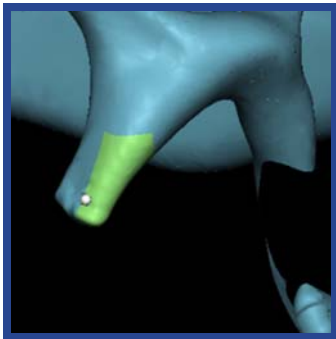
In this step, the STEP/IGES file saved in Step 1 is imported into the original clay file, so we can tell precisely where the problem areas are by comparing them with the original clay model.



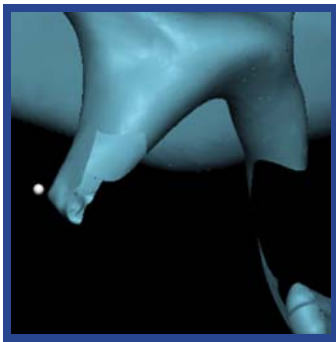
- 1 In the **File** menu, click **Import Model**. The **Import Model** dialog appears.
- 2 Browse for and select the file you saved in **Step 1**. Once the file has been selected, click **Import**.
- 3 The IGES model (blue) is imported into the original clay model (beige). In this example, the clay of the original model is visible where surfaces could not be created in the AutoSurfacer.

## STEP 3: DELETE THE BAD PATCHES

Once the STEP/IGES file has been imported, delete the bad patches, or areas where patches do not end cleanly, from the imported model. Be sure to rotate the model as needed to provide the best view of these areas.



- 1 In the **Patches/Solids** palette, click **Select**.
- 2 Using the PHANTOM stylus, touch the modeling (selection) tool to the patch you want to delete, then click the stylus button. When selected, the patch will turn green.



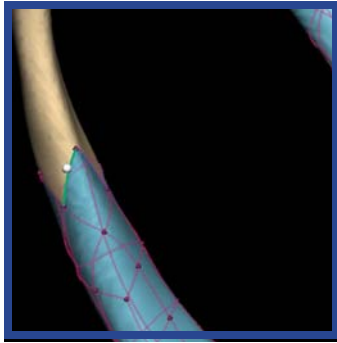
- 3 Press the **Delete** key on your keyboard. The selected patch is removed.  
**TIP: To select multiple patches, use box select. Click the stylus button, drag the selection box, then click the stylus again to define the box.**
- 4 Repeat Steps 2-3 until all bad patches have been deleted.

## STEP 4: DRAW CURVES ON THE ORIGINAL CLAY PIECE

In this step, curves are drawn on the original clay piece by extracting a curve from the edge of an adjacent patch. The new curves will be used to define new patch boundaries on the original clay piece, allowing for the creation of new patches in the problem areas.

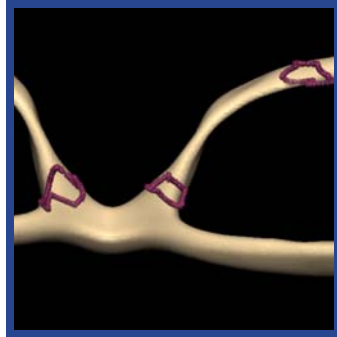
**NOTE: It is important to extract curves from every edge along the patch boundaries. Each patch will require a closed boundary.**

**IMPORTANT: Do not fit the curves to clay once they are created. Doing so may result in a gap between the edges of adjacent patches.**



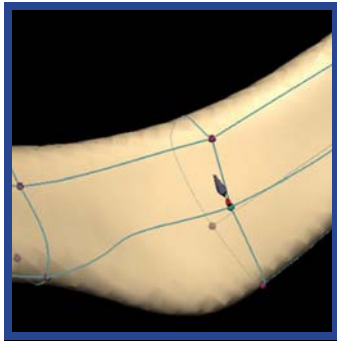
- 1 In the **Curves** palette, click **Copy from Edge**.
- 2 Using the PHANTOM modeling (selection) tool, touch the edge you want to extract from, then click the stylus button.
- 3 Repeat **Step 2** for each patch edge along the boundary. Each time an edge is selected, a new curve is added to the **Object List**. If you were to turn off the display of the patches on the model, leaving only the beige clay piece, you will see each selected curve. This will allow you to easily identify missing boundary curves that may still need to be extracted in the boundary.

*Optional:* Once you have finished creating (extracting) curves, open the **Object List** (**O** key), and hide the imported patches. Only the original clay piece (beige) and the new curves should be visible.



- 4 In the **Curves** palette, click **Select**.
- 5 Rotate the model so that all new curves can be easily selected using box-select. To box-select the new curves, click the stylus button where you want the first corner (top-left) of the selection box, drag the cursor to the end position (bottom-right), then click the stylus button a second time. When selected, the edit points in each curve will highlight (purple) as shown, and new options will appear in the dynabar.

Now that curves have been extracted from all patch edges tangent to the repair zone, the interior curve network needs to be created. This will completely identify the patches in the repair area.



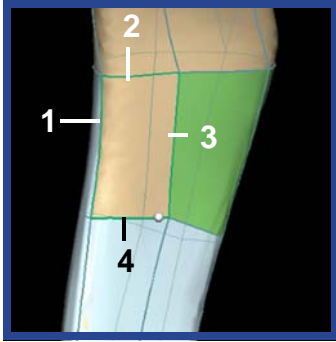
- 6 In the **Curves** palette, click **Draw Curve** and select the **Fit to Clay** option on the dynabar. Using the PHANTOM stylus, draw new curves connecting the new (copied) curves to one another, creating well-defined, connected curve boundaries. These boundaries will later be used to define new patches. Continue creating new patch boundaries using this method, placing each curve individually, until new curve boundaries are connected throughout the problem area - in this example, the part of the eyeglasses beneath and to either side of the bridge, as shown. This may take several minutes, depending on the size of the area.

**NOTE: Make sure to connect all curves. There should not be any stray or disconnected curves when you are finished.**

## STEP 5: CREATE THE NEW PATCHES

In this step, the Create Patch command is used to create new patches from the curve boundaries created in the previous step.

- 1 In the **Patches/Solids** menu, click **Create Patch**.
- 2 In the dynabar, click the **Fit to Clay** option, then select **Manual Boundary Select**. This will allow you to select each patch boundary one segment at a time.



- 3 Select each patch boundary. To do this, touch the PHANTOM stylus to each curve segment in the boundary, one at a time, and click the stylus button. A patch boundary is simply an area enclosed by three or four individual curves, as created in Step 4:6 above. Once a patch has been selected, the area it encloses turns green.

In this example, four individual curves are selected to define a four-sided patch boundary.

**NOTE: This may take several minutes, depending on the number of patch boundaries, and individual curves, in the model.**

- 4 You may find it helpful to organize all new patches in a folder. This will help you to differentiate the patches you manually create from the patches that were generated by the AutoSurfacer. To do this, click on a selected patch in the **Object List** and select **Collect Into Folder** from the menu that appears. You can then specify a name for the new folder. If creating patches on two or more distinct sides or areas of a model, like in this example where patches are being create on either side of the bridge in an eyeglasses model, you may want to organize your new patches by side (such as *Left Side Patches*, for example).



- 5 Continue selecting the patch boundaries until all of the new boundaries created in Step 4:6 have been selected.

## STEP 6: STITCH THE NEW PATCHES

Once all of the new patches have been created from the patch boundary curves, you need to stitch the new patches with the original patches. To do this, follow the steps below.



- 1 In the **Patches/Solids** palette, click **Stitch**.
- 2 In the dynabar, click **All**.
- 3 Set the **Tolerance** accordingly. In this example, the tolerance is changed from .1 to .05.
- 4 Click **Stitch**.

**NOTE: When the patch color changes from blue to grey, it indicates that a closed solid has been created, which is desired, assuming the model is closed. If the model remains blue, it indicates that the NURBS model consists of individual patches and that there is a gap somewhere in adjacencies of the patches that will not allow a closed solid to be created. The gap may be a result of fitting edge-extracted curves to clay, which can create a gap between adjacent patches.**

## STEP 7: EXPORT THE REPAIRED SURFACES

The final step in this process is to export the stitched model.

- 1** In the **File** menu, click **Export Model**. The **Export Model** dialog appears.
- 2** Choose the appropriate format under **Save as type**.
- 3** Click **Save** and rename the file. *Do not* overwrite the initial AutoSurfacer output.



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