Parametric Technology Corporation

Getting Started with Pro/ENGINEER® Wildfire® 4.0 Import DataDoctor™

A Tutorial-based Guide to Workflow

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Introduction

Getting Started with Pro/ENGINEER Wildfire 4.0 Import DataDoctor is a tutorial-based introduction that shows you how to repair the geometry of models imported into Pro/ENGINEER from external sources. If you follow the complete series of procedures, you will learn how IDD handles the imported geometry and best practices for fast and efficient repair.

These procedures introduce the basic techniques for using IDD tools. After you are familiar with these procedures, you will be able to quickly repair, modify, and featurize legacy and external models. The final result will fit seamlessly with whatever Pro/ENGINEER design you are working on.

Intended Audience

This guide is intended for designers with some experience in the use of Pro/ENGINEER.

Scope and Purpose

This guide is not intended to be a complete summary of IDD techniques. The goal of the exercises is to familiarize you with the repair process so that you can use it to streamline model repair. Many intermediate and advanced techniques are not mentioned. Some basic techniques have been bypassed in favor of presenting the whole workflow to a new user in a manageable way.

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Import DataDoctor Concepts

After you have imported a part model (or a part from an imported assembly model) into your Pro/ENGINEER session, use Import DataDoctor to correct geometry, ensure surface consistency, add constraints, close unwanted gaps, and adjust tangencies in the imported parts.

This guide introduces you to some commonly used IDD techniques required to repair an imported model and convert it into a Pro/ENGINEER model. After you have completed the exercises, you should be able to repair, modify, and use external models in your own designs.

Note: Proficiency in Pro/ENGINEER is assumed. Only procedures unique to IDD are covered by this guide.

Before You Begin

If you have not already done so, download the `IDD_Models.zip` file and extract the models. The link to the zip file and this guide are on the same page.

Learning the User Interface

Import DataDoctor is only available when a previously imported Pro/ENGINEER part is in session and is the active model.

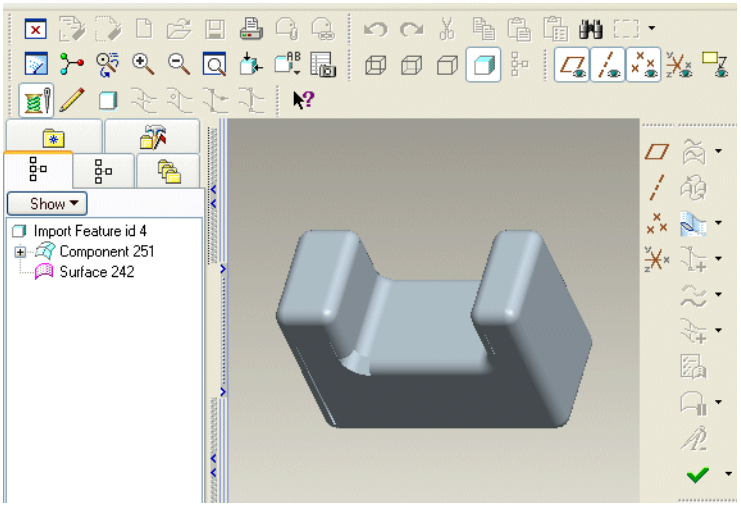
To access the IDD environment:

1. Right-click the Import Feature in the Model Tree and choose **Edit Definition** from the shortcut menu.
2. Click **Geometry** > **Import DataDoctor** to enter the IDD environment.

The following changes occur:

- The Geometry/Topology Structure Tree (GTS) replaces the regular Pro/ENGINEER Model Tree
- The IDD Edit and the IDD menus are added to the menu bar.
- The IDD Mode toolbar appears in the icon area above the graphics window
- The IDD Tools (Repair, Modify and Featurize) toolbar appears on the right side of the graphics window

The IDD user interface



The Geometry/Topology Structure Tree

The Geometry/Topology Structure Tree is similar to the regular Pro/ENGINEER Model Tree. The imported model's geometry (surfaces, datums, and other IDD geometry types) are grouped as logical collections of member nodes. Each node is identified by an icon. Consult the IDD online help for information about performing many common IDD operations directly on each member node of the GTS Tree, including Hide, Activate, Merge, Exclude, Cut, Copy, Paste, and Rename.

Import DataDoctor Modes

There are three Import DataDoctor modes. Each mode is, essentially, a set of tools that perform increasingly complex analysis, conversion, and manipulation processes on imported external data. The modes are:

- Repair mode—Finds and removes gaps and sliver surfaces, adds UV curves, allows wireframe editing as well automatic repairs based on user-defined wireframe models.
- Modify mode—Modifies individual curves and surfaces, and replaces one-sided edges.
- Featurize mode—Converts static geometry to explicit procedural geometries with modifiable properties. Featurize mode tools convert existing geometry types in the imported model to IDD pseudo-features such as Cylinder, Plane, Extrude, or Revolve. Featurize mode also allows you to change pseudo features sketch or direction, and allows you to trim or extend, merge or intersect, close, or remove surfaces. Transformation by constraint or by dragging is also possible..

The Mode Toolbar

Use the Mode toolbar to access modes and set display options available for viewing the Repair wireframe:

-  —Enter Repair mode
-  —Enter Modify mode
-  —Enter Featurize mode
-  —Display tangency (Repair mode only)
-  —Display frozen elements (Repair mode only)
-  —Display vertices (Repair mode only)
-  —Display wireframe (Repair mode only)

The Repair Toolbar

Use the Repair toolbar to access specific repair tools:

-  —Add curve by projection/intersection surface
-  —Replace
-  —Define gap or sliver
-  —Add or remove from wireframe display
-  —Combine or split curves
-  —Add or remove tangency
-  —Edit surface properties
-  —Freeze or unfreeze
-  —Repair

The Modify Toolbar

Use the Modify toolbar to access specific surface and curve modification tools:

-  —Sketched curve
-  —Merge or Split wireframe
-  —Extrapolate
-  —Math properties
-  —Modify
-  —Move vertex
-  —Align
-  —Transform
-  —Replace

The Featurize Toolbar

Use the Featurize toolbar to access specific repair tools:

-  —Sketch curve
-  —Curve Through Points
-  —Boundary Blend
-  —Define Gap
-  ,  ,  ,  —Convert to (Plane, Cylinder, Revolve, Extrude)
-  —Close
-  —Trim
-  —Extend
-  —Merge
-  —Detach

2

Using Repair Mode: Basic Repairs

In this chapter, you will import a model and learn how to use Import DataDoctor perform basic repairs and save the model as a normal solid boundary representation Pro/ENGINEER model.

In this exercise, you will:

- Import and save a foreign or legacy model (from a STEP file).
- Find and repair any gaps using the Search tool and the Define Gap tool.
- Add a boundary blend to close an opening or a missing surface.

Note:

When doing the exercises in chapters 2 and 3, use a copy of the original model file (`basic_probs_w_slvr.stp`) for each chapter. After you have used one method to repair a gap, it cannot be repaired again using another method.

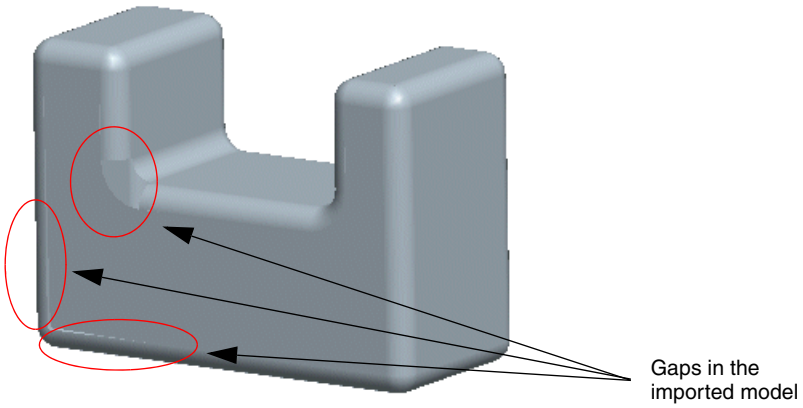
Import the Model

1. Click **File** > **Open**. The **File Open** dialog box opens.
2. Browse to the directory containing the models.
3. At the bottom right of the dialog box, select **All Files (*)** from the **Type** list. The `basic_probs_w_slvr.stp` file appears in the list of files.
4. Double-click the file or select it and click **Open**. The **Import New Model** dialog box opens.
5. Select **Part** as the **Type** and accept the default name or enter a new one.
6. Click **OK**. The Information window opens and the model appears in the graphics window.

   Note

   To disable the Information window, set the `intf3d_show_import_log` configuration option to *no*.
7. Close the Information window.

Basic Repair Model



Set the Model Display

1. Show or hide datum planes, datum axes, datum points, datum coordinate system, and annotation elements as needed to unclutter the model during repair.
2. Set the model display to Wireframe to make geometric entity errors easier to see.

Start Import DataDoctor

1. In the Model Tree, right-click the import feature of the model (the default name is `Import Feature id xx`) and choose **Edit Definition** from the shortcut menu. The **Geometry** menu appears on the menu bar.
2. Click **Geometry** > **Import DataDoctor**. You are now in the IDD environment. The GTS Tree and the IDD menus and toolbars appear.

Using the GTS Tree

In the example below, the import feature contains a logical grouping of surfaces under `Component 251`. This grouping is called a component and corresponds to a quilt.

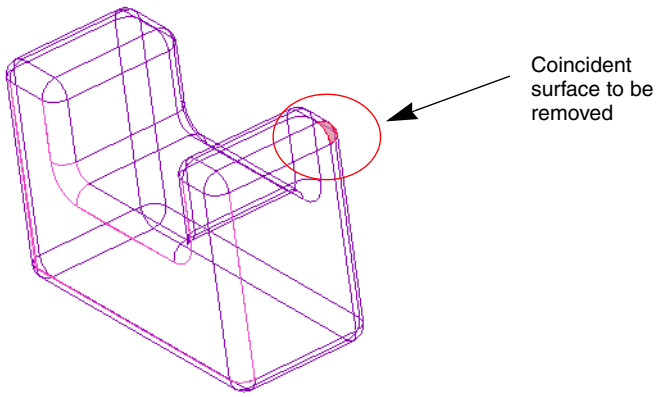
Note

Each independent quilt in the import feature appears as a separate component in the GTS Tree.

Next on the tree is `surface 242`, which has not been grouped. This is surface is not part of the main quilt. In this example, the single surface in the GTS Tree is a coincident surface—a duplicate surface that lies on top of another surface. Since it is coincident, it is not used in the model and must be removed.

Remove Coincident Surfaces

Use the Hide/Unhide technique described in steps 1 through 4 to quickly examine the geometry of individual nodes in the GTS Tree. Follow steps 5 and 6 to remove the coincident surface.



1. Right-click `component 251` on the GTS Tree and choose **Hide** from the shortcut menu. `Component 251` and its grouped surfaces are temporarily hidden.
2. Right-click `surface 242` and choose **Hide** from the shortcut menu. Nothing is now visible in the graphics window.
3. Select `component 251` and `surface 242` on the GTS Tree. The model appears in the graphics window as a red mesh, indicating that these surfaces are hidden.
4. Select `component 251` on the GTS Tree and spin the model to see the surface beneath `surface 242`. Since you have verified that there is an actual surface on the feature, you can now remove `surface 242`.
5. Rght-click `surface 242` on the GTS Tree and choose **Delete** from the shortcut menu.
6. Right-click `component 251` on the GTS Tree and choose **UnHide** from the shortcut menu. The model appears in the graphics window, without the extra surface.

Find, Define, and Repair Gaps

There are two ways to repair gaps. You can search for them automatically and select them using the Search tool, or you can select them manually from the model. However you determine gaps for repair, you must add selected gaps to the wireframe to close them.

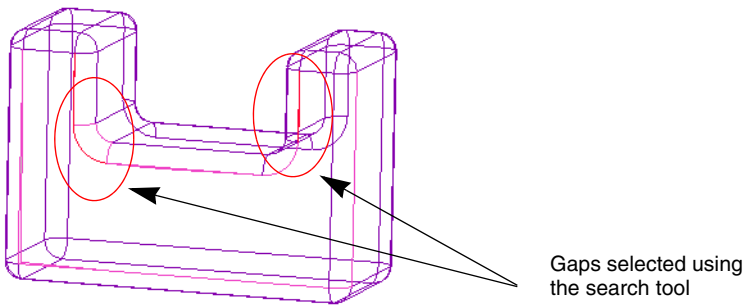
Note

Use the Repair Mode Display icons to set the display to Wireframe for the section of model being repaired.

Find Gaps by Automatic Search

When you use the Search tool to find and select gaps in the model you do not have to select them individually in the graphics window. Use the gap size attribute value to set search rules:

1. Select  on the Display toolbar to enter Repair mode.
2. Click  on the Edit toolbar. The **Search Tool** dialog box opens.
3. Select **Gaps** in the **Look for** list.
4. Leave the **Value** at the default of `0.099129` and click **Find Now**. Both the **Found Items** list and the **Selected Items** list are empty because the model does not contain gaps with the default value.
5. Set **Value** to `1` and click **Find Now**. `GAP0001` and `GAP0002` appear in the **Found Items** list. These gaps have a value of `1`.
6. Select both these items and click the arrow button to move them into the **Selected Items** list.
7. Close the **Search Tool** dialog box. The selected edges appear in red in the graphics window as shown in the following figure:



Note

Make sure to turn on the Wireframe display so you can see which Wireframe gaps are satisfied (shown in green) and which gaps have been defined but not satisfied (shown in black).

Close the Gaps

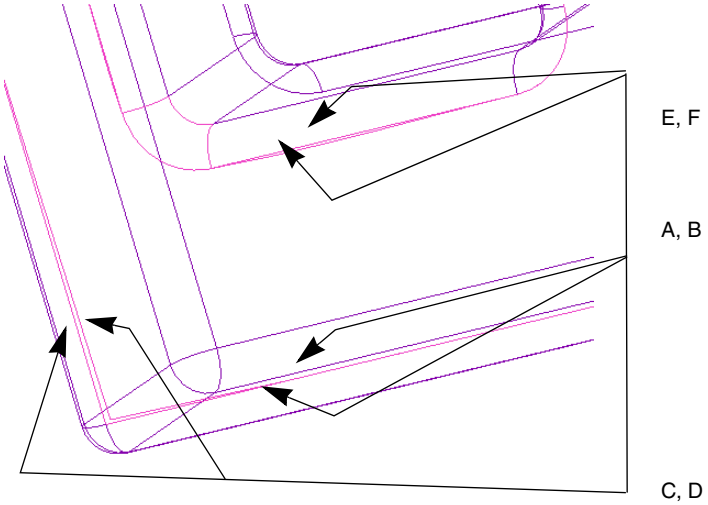
After you have determined where the gaps are, by either finding them with the Search Tool or defining them manually, use the following procedure to add wireframe edges to repair them. When you add edges to the wireframe model, and click **Repair**, the defined wireframe gaps are closed.

1. Click  on the Repair Tools toolbar or **Edit** > **Add to Wireframe**.
2. Click  on the Repair Tools toolbar. The Repair dashboard appears. The surfaces that are being repaired are highlighted in the graphics window.
3. Click  . The gaps are closed.

Define Gaps Manually

You will now define the gaps in your model by selecting them in the graphics window. Use the following figure for reference.

1. Click  on the Repair Tools toolbar, or click **IDD** > **Define Gap**. The **Define Gaps** dialog box opens. `GAP0001` appears on the left side of the dialog box.
2. Click the **Side 1** collector box and select edge `A` (`1-sided edge id 95`) in the graphics window.
3. Click the **Side 2** collector box and select edge `B` (`1-sided edge id 181`) in the graphics window.
4. Now click **New Gap**, or right-click in the graphics window and choose **New Gap** from the shortcut menu.
5. Select, then right-click edge `C` (`1-sided edge id 94`). It appears in the **Side 1** collector.
6. Click the **Side 2** collector box and select edge `D` (`1-sided edge id 191`). It appears in the **Side 2** collector .
7. Repeat steps 4-6 for edges `E` (1-sided edge `id 44`) and `F` (1-sided edge `id 89`).
8. Click **OK**. The selected edges appear in red in the graphics window.



Note

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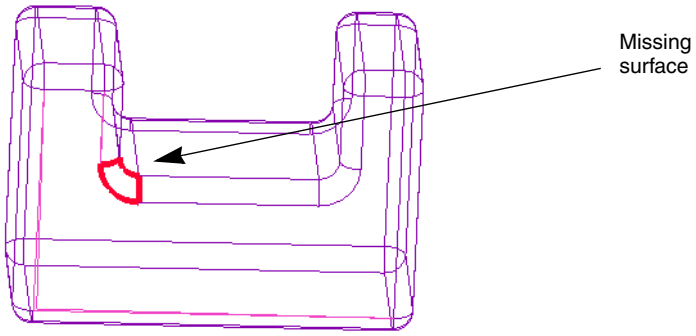
Close the Gaps

After you have determined where the gaps are, by either finding them with the Search Tool or defining them manually, use the following procedure to add wireframe edges to repair them. When you add edges to the wireframe model, and click Repair, the defined wireframe gaps are closed.

1. Click  on the Repair Tools toolbar or **Edit** > **Add to Wireframe**.
2. Click  on the Repair Tools toolbar. The Repair dashboard appears. The surfaces that are being created are highlighted in the graphics window.
3. Click  . The gaps are closed.

Add Missing Surfaces

After the gaps are closed, you must add missing surfaces. Use the Boundary Blend tool to create a boundary blend surface between reference entities. This tool defines the surface in one or two directions. The first and last entities selected in each direction define the surface boundary. Use the following figures for reference.



1. Click on the Display toolbar to enter Featurize mode.

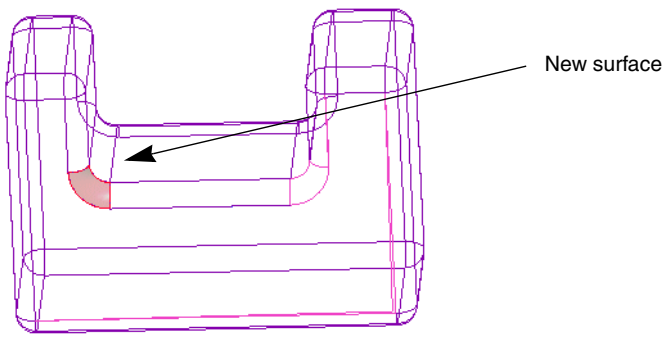
   Note
   You must be in Featurize mode to add boundary blend surfaces.

2. Click on the Featurize Tools toolbar or **IDD** > **Boundary Blend Surface**. The dashboard appears. Open the **Curves** slide-up panel. The **First direction** collector is active.

3. Select curves `A` and `B` for the first surface direction.

4. Click in the **Second direction** collector and select curves `C` and `D` in the graphics window.

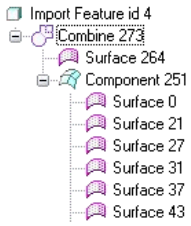
5. Click on the dashboard. The surface is created.



Combine the Surfaces

The final task is to combine the new surface you have just created with the rest of the import feature. You will use the Combine tool to connect the new boundary blend surface to the component containing the quilt.

1. In the GTS Tree, select the imported feature, hold down SHIFT or CTRL, and select the surface.
2. Click **Edit** > **Combine** or right-click and choose **Combine** from the shortcut menu.
3. The combined surface appears in the GTS Tree as shown below:



4. Click . The surface and the component appear as a combine node in the GTS Tree.

You can also drag the new surface node onto the component node:

1. Click **Undo** . The last operation (**Combine**) is undone.
2. In the GTS Tree, click the surface icon and drag it on top of the component icon (be sure to hold down the left mouse button until the component auto-expands before letting go). The surface is now a member of the component and is attached to the rest of the quilt.

Set the Solid Attribute for the Import Feature

Although you have combined the boundary blend surface with the other surfaces, the model is a surface quilt and must be converted into a solid import feature.

1. Click  in the feature toolbar to exit IDD and reenter Edit Definition mode.
2. Click **Edit** > **Feature Properties**. The **Properties** dialog box opens.
3. Select the **Make Solid** check box.
4. Click **OK**. The imported model is now a solid Pro/ENGINEER feature.
5. Click  in the feature toolbar.
6. Save the model to your working directory.

Summary

These are some of the basic tools and operations used in Import DataDoctor to repair imported models. For more complete information, see the Pro/ENGINEER Wildfire 4.0 Resource Center available through the Pro/ENGINEER Help Center.

3

Using Repair Mode: Advanced Repairs

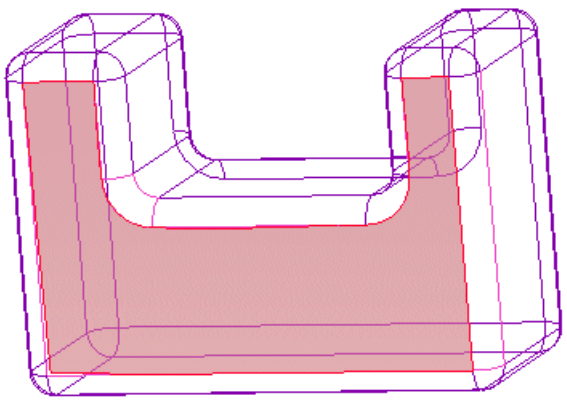
In the previous chapter you learned how to use some of the basic repair tools in Import DataDoctor. In this chapter, you will learn additional ways to repair models. These include the replacement of the trimming edges of a surface boundary, and then copying and pasting a surface to a new location.

To begin, reimport the STEP file from chapter 2. Now right-click the model feature in the Model Tree and choose **Edit Definition** from the shortcut menu. Click **Geometry** > **Import DataDoctor** to enter the IDD environment.

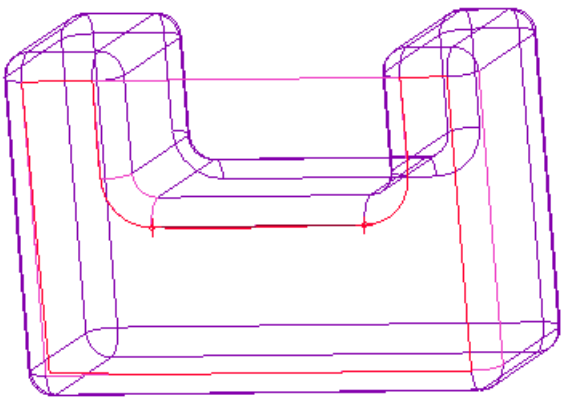
Repeat the procedure under Remove Coincident Surfaces from chapter 2. You are now ready to repair the side surface of the imported model.

Repair the Side Surface

In this procedure you will learn how to create a new UV curve through points that lie on a selected surface in the imported model. You will use this new curve to replace the existing trimming edge on the boundary of the surface highlighted below.



1. Select  on the Display toolbar to enter Repair mode.
2. Select the side surface in the graphics window.
3. Click  **Insert curve through points on a surface** from the  **Insert curve by projection** fly-out menu on the Repair Tools toolbar. The dashboard appears.
4. Select vertices A and B.



Note

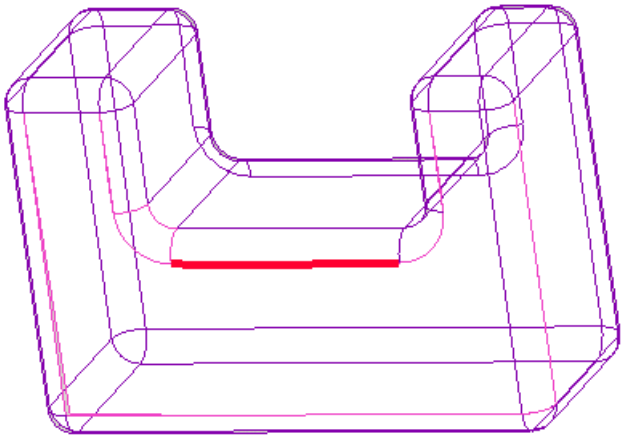
Remember to hold down CTRL to select both vertices at the same time.

5. Click  on the dashboard. The UV surface curve is created and is highlighted in blue.

Replace the Boundary Edge

Now you will replace the boundary edge of the surface that you selected in the previous section with the curve that you have just created. You will then use the Search tool to close the gaps.

1. Select the existing boundary edge (the slightly bowed edge just below the new curve you created earlier) from the graphics window. The selected edge appears in red on the model, as shown below.



2. Click  on the Repair Tools toolbar. The dashboard appears and the **Replace with** collector is active.

   Note

   The Replace tool is available only if you select an existing boundary edge to replace.

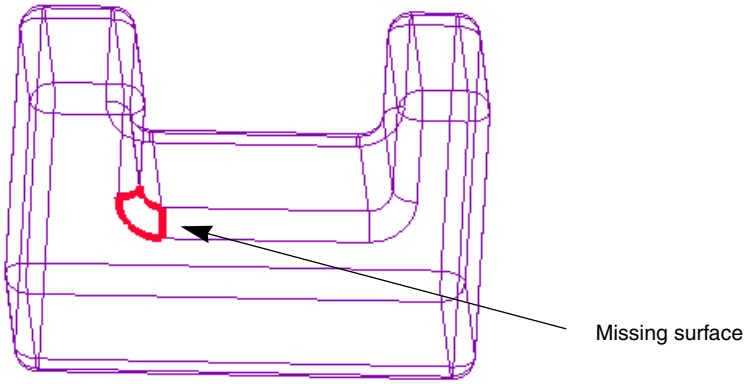
3. In the graphics window, select the newly created UV curve. It appears in the **Replace with** collector.

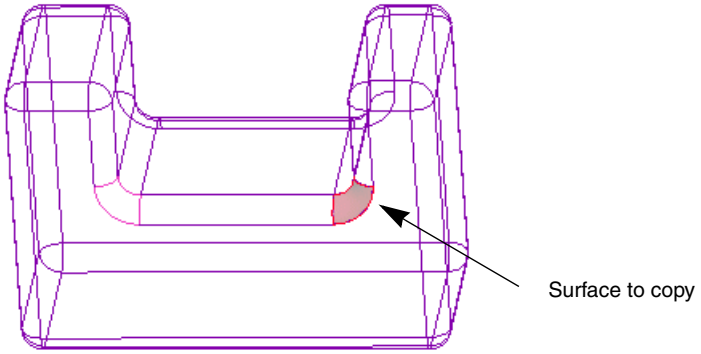
4. Click  on the dashboard. The bowed surface edge is replaced by the new curve.

Now use the techniques you learned in chapter 2 to define and repair any gaps in the quilt.

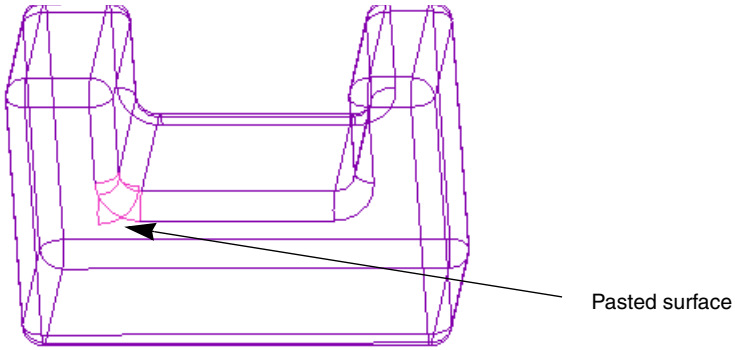
Replace the Missing Surface

In the previous chapter, you used the Boundary Blend Surface tool to add a missing surface. Now you will learn another way to repair the import model, using the Copy and Paste Special tools to fill in the hole left by the missing surface. You will copy an existing surface and add the copied surface using the Paste dashboard. Finally, you will align the new surface. Use the following figures as references.

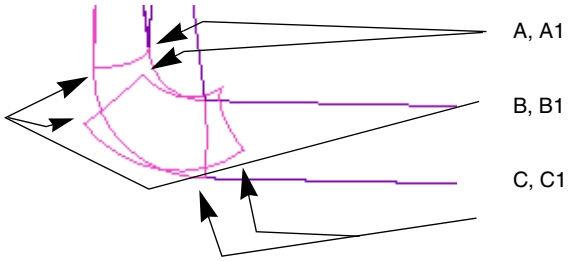




1. Select `surface 49` on the GTS Tree and click **Edit** > **Copy**.
2. Click **Paste Special** on the Edit toolbar or click **Edit** > **Paste Special**. The copied surface is pasted onto the model in the same place as the original and the Transform dashboard appears.
3. Click the **Move** slide-up panel and make sure the **Motion Type** is **Translate**.
4. Select the pasted surface in the graphics window and move it to the empty area.



5. Click the **Move** slide-up panel, change the **Motion Type** to **Rotate**, and rotate the pasted surface as shown.



6. Click the **Placement** slide-up panel and set the **Constraint Type** to **Align**.
7. Click the **Select component item** collector and select `Vertex A`.
8. Click the **Select assembly item** collector and select `Vertex A1`. `Vertex A` and `Vertex A1` are aligned.
9. Click **New Constraint**.
10. Click the **Select component item** collector and select `Vertex B`.
11. Click the **Select assembly item** collector and select `Vertex B1`. `Vertex B` and `Vertex B1` are now aligned.
12. Click **New Constraint** to define another constraint and align `Vertex C` and `Vertex C1`
13. Click ✔ on the dashboard. The surface is replaced.
14. Finally, as you did in chapter 2, use the Combine tool to combine the surface with the quilt component or drag the new surface into the component.

Summary

So far, you have learned to close gaps using the Copy and Paste Special tool and using the Search tool. You have replaced the edge of a surface with a curve. In the next chapters you will learn about various Modify and Featurize Mode tools.

4

Using Modify Mode

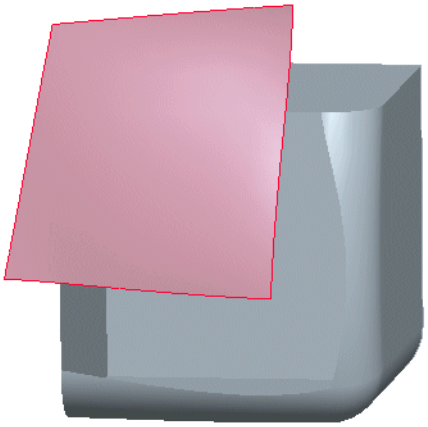
In the previous chapter you learned how to use surface boundary modifications to help repair a model, and to use the Copy and Paste Special tools. Now you will learn how to modify a larger surface and incorporate it in the solid component as part of the quilt

To begin, open `big_gap.prt`. Orient it in the graphic window so the top surface is up, right-click it in the Model Tree and choose **Edit Definition** from the shortcut menu. Click **Geometry** >  **Import DataDoctor** to enter the IDD environment.

You are now ready to modify the top surface of the imported model.

Align the Top Surface

In this procedure you will learn how to delete trimming boundary edges, and then align the surface to conform and modify the surface to match the model quilt. Use the following figures as references.

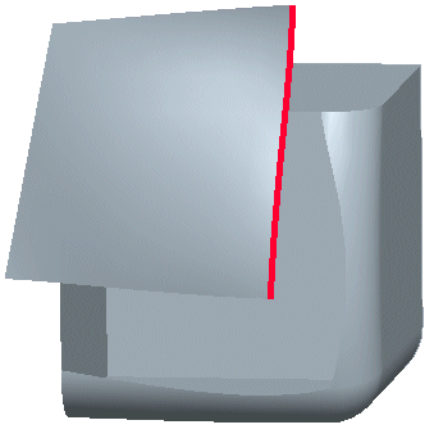


1. Select `Surface 43` from the Model Tree.
2. Select  on the Display toolbar to enter Modify mode.
3. Select the right edge of the surface, and then click **Edit** > **Delete**.

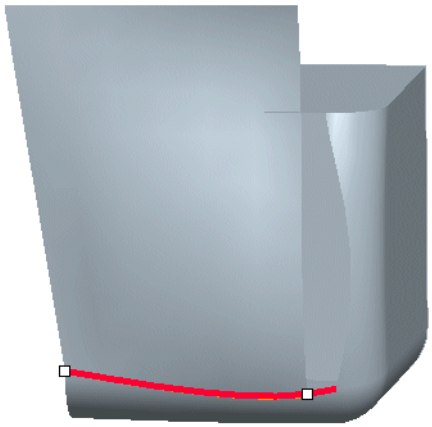
   Note

   Since a trimming edge cannot be incomplete or open, when you delete one trimming edge, all trimming edges that form a closed loop for that surface are also deleted. For example, if the surface had an internal hole through the surface, selecting and deleting an edge of

that internal loop of trimming edges would remove the hole from the surface.

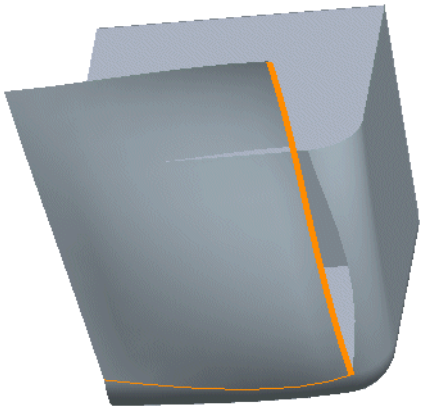


4. Now select the surface and click **Connect and align**. The dashboard appears. The bottom edge is prehighlighted. This is the surface edge to be aligned.
5. Select the corresponding boundary edge on the adjacent quilt boundary. The surface edge is aligned to the quilt edge.



6. Click and drag the edge until it is the same length as the corresponding curve on the quilt (the drag handles will turn white).

7. Open the Surface Sides slide up panel. The front edge and the front curve appear as `Side 1`. The Tangent Constraint tool is active.
8. Click inside the Side 3 collector to preselect the right edge of the surface. The Tangency constraint is also active for this edge.



9. Select the right curve as Side 3. The surface edge aligns to the quilt boundary. Use the drag handles to adjust the start and end points of the aligned edge.
10. Click  on the dashboard. The two edges merge with the model.

Note

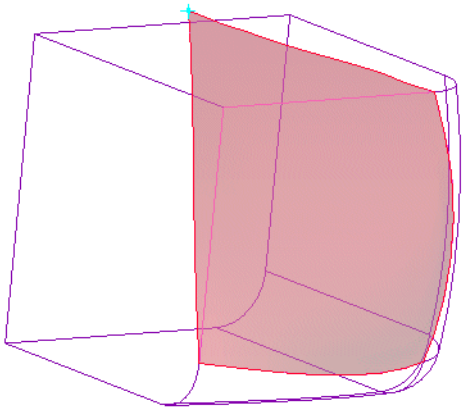
Only two of the four edges of the surface are aligned. You cannot align edges 2 and 4 because there are active Tangency constraints. If

you change the constraints on sides 1 and 3 to Position, you can align sides 2 and 4 (also constrained to Position).

Modify the Surface to Match the Model

Now you will modify the other sides of the surface that you selected in the previous section with the model.

1. Change the view to Wireframe and select the surface. Click **Move Vertex**.
2. Select the point of intersection of the remaining two sides. Click and drag it until it is close to the corresponding point on the model. You may need to move or rotate the model for better access.



3. Click **OK** to exit the tool.
4. Select the surface, and then click **Modify**. The mathematical mesh that defines the surface appears.
5. Click and drag points on the surface mesh until the remaining sides correspond with the curves on the model.
6. Click on the dashboard.

Find the Remaining Gaps

You may notice that you've gotten the last two edges close to the quilt boundary but some gaps still remain. You will use the Search tool to find and repair these gaps as you have done before.

1. On the Model Tree, click and drag `Surface 43` so that it appears under `Component 52`.
2. Select  on the Display toolbar to enter Repair mode.
3. Click  on the Edit toolbar. The **Search Tool** dialog box opens.
4. Select **Gaps** in the **Look for** list.
5. Set the Value to `2.0` and click **Find Now**. `Gap 0001` and `Gap 0002` appear in the **Items Found** list.
6. Select the gaps and click  to add them to the **Selected Items** list.
7. Click **CLOSE** to close the Search tool.
8. Now click  **Add to Wireframe**. The remaining sides of the surface highlight in black.

Repair the Model

1. Click  **Repair**. The model is displayed as a quilt.
2. Click  on the Options dashboard and then  on the toolbar to accept.
3. Click **Edit** > **Repaint**.

5

Using Featurize Mode

In the previous chapter you learned how to use surface modifications to repair a model. In this chapter, you will learn to create pseudo-features in the imported model using Featurize mode. These pseudo features can later be modified, if desired. You will learn to:

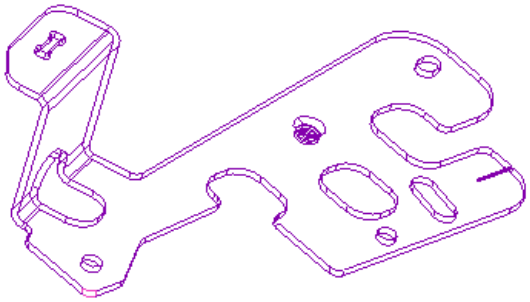
- Use the Boundary Blend tool to add a missing surface.
- Select surfaces and convert them to a Cylinder feature, modifying the diameter in the process.
- Select seed and boundary surface sets to create an Extrude feature, and then move the Extrude node with the Transform command.
- Use the Remove tool to remove surfaces of geometry that are no longer needed.

To begin:

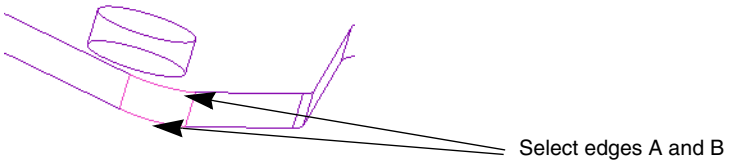
1. Open the `d_step214_shtmtlpartlow.prt` file and save it in your working directory.
2. Load the model, then right-click it in the Model Tree and choose **Edit Definition** from the shortcut menu.
3. Click **Geometry** >  **Import DataDoctor** to enter the IDD environment.

Add the Missing Surface

Once again you will use the Boundary Blend Surface tool to add a missing surface and close the entire quilt.



1. Select `edge A` and `edge B` as shown in the figure below:



2. Click on the Featurize Tools toolbar or **IDD** > **Boundary Blend Surface**. The dashboard appears. The selected edges are in the **first direction chain** collector.

3. Click on the dashboard. The boundary blend surface is created and the missing surface is added. A new surface (`surface 661`) appears on the GTS Tree.

4. Select the new surface from the GTS Tree and drag it over the component node in the tree. Hover over the node until it expands, and then drop the surface into the component.

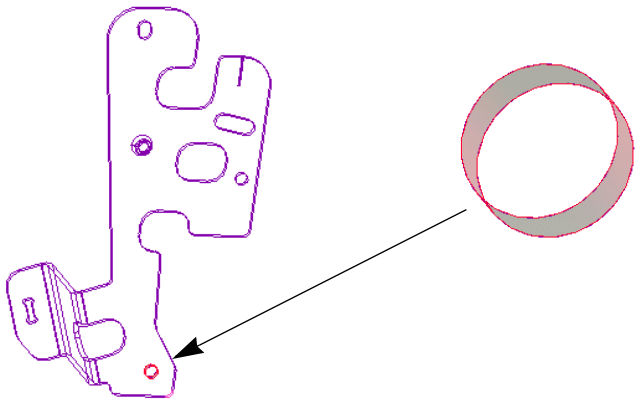
   Note

   Remember that all surfaces in a component are logically joined together and will connect automatically if they can. If they do not, use the techniques you learned in chapters 1 and 2 to close any gaps.

Convert Surfaces to a Cylinder Pseudo-Feature

You will now convert the surfaces of a hole to a Cylinder pseudo-feature. Use the figure below as reference.

1. Select `surface 353` and `surface 356`.



2. Click **Convert to Cylinder** from the **Convert to Plane** menu on the Featurize Tools toolbar. The dashboard appears.
3. Set the radius to `3.50`.
4. Click on the dashboard. The Cylinder pseudo-feature is created. The new pseudo-feature appears as the `Cylinder 682` node, part of the `Combine 693` node on the GTS Tree. The remaining surfaces are grouped under `Component 660`.

Note

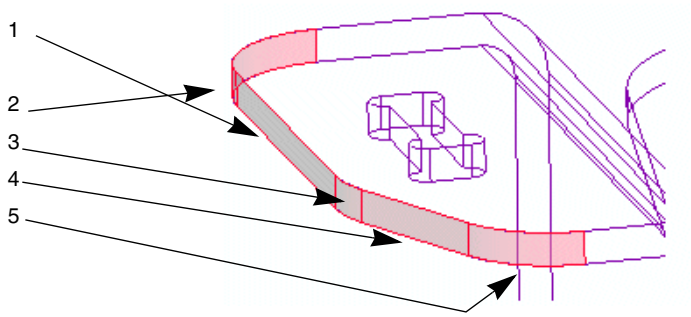
You can change the radius of the Cylinder pseudo-feature after you create it. Select the Cylinder node in the GTS tree, and then right-click and choose **Modify** from the shortcut menu to access the Cylinder dashboard.

Convert Surfaces to an Extrude Feature

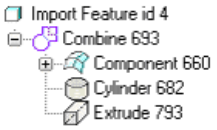
Now you will create an Extrude feature from a selected surface set.

Use the following figureas reference:

1. Select surfaces `1`, `2`, `3`, `4`, and `5`..



2. When all the surfaces have been selected, click **Convert to Extrude** from the **Convert to …** menu on the Featurize Tools toolbar. The dashboard appears.
3. Click on the dashboard. The Extrude pseudo-feature is created.
4. The new pseudo-feature appears as a combine node on the GTS Tree.
5. The new feature appears as `Extrude 793`, part of the `Combine 693` node on the GTS Tree.



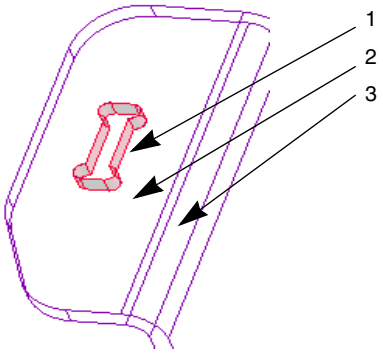
Remove Geometry

You will now use the Close tool to remove unwanted geometry. When you remove geometry, adjacent surfaces are extended or trimmed to converge and close the openings. Or, as in this case, selected surfaces are deleted and internal loops on the adjacent surfaces are removed to close the openings.

Note

The Extrude (and Revolve) pseudo-features are based on sketches extracted from the geometry selected at the time they are created. You can modify these sketches when creating them or right-click and choose **Edit Definition** from the shortcut menu to access the pseudo-feature's dashboard.

Use the seed and boundary surface selection technique to select the surfaces. Use the following figures as reference.



1. Select the seed surface (1).
2. Hold down CTRL and select surfaces 2 and 3. Surface 3 is beneath surface 2.
3. When you finish selecting surfaces, the seed and boundary surface set is highlighted.
4. Click **Close** on the Featurize Tools toolbar. The dashboard appears and the surface set appears in the **Collect surfaces to remove** collector.
5. Click on the dashboard.

Note

No node is created the GTS Tree when you select **Close**. However, you can select Undo to restore the surfaces that you have removed.

Transform the Extrude Node

Now you will transform the location of the extrude. To do so, you will create a new Datum node as a permanent reference for the Transformation process.

1. Select the vertical planar face of the Extrude pseudo-feature, and then select the datum plane tool from the toolbar.
2. Drag the datum plane parallel to the face of the Extrude pseudo-feature face.
3. Click OK. The **Datum Plane** dialog box closes.
4. Select the Extrude node on the GTS Tree, right-click and choose **Transform** from the shortcut menu. The Transformation dashboard opens.

   Note

   You can either drag a node to another approximate location or use a Mate or Align constraint to place objects in relation to other objects. The second method moves the component precisely.
5. Select the vertical face of the Extrude pseudo-feature and then select the face of the datum plane. The Extrude pseudo-feature should snap to the datum reference.
6. Click  on the dashboard. The Extrude pseudo-feature and the surrounding surfaces update and connect.
7. Exit IDD.
8. Select **Edit** > **Feature Properties**. The **Redefine Feature** dialog box opens.
9. Select the **Make Solid** check box.
10. Click **OK**.

Summary

You have now learned to replace a missing surface using the Boundary Blend tool, convert surfaces to a Cylinder or Extrude pseudo-feature, and use the Close tool to remove geometry. You have also learned to change the model to meet new requirements.

6

Tips and Techniques

The tips and techniques in this chapter show you how to close gaps in Repair mode. You can use similar techniques to repair tangencies between surfaces.

Scoping the Extent of a Repair

The scope of a repair depends on how many independent, top-level component nodes (direct children of the import feature) are in the IDD environment. If there is only one component node, it will automatically be selected for repair. If there is more than one node, you must manually activate the component node you want to repair.

> **Tip**
>
> Always activate the required node in the GTS Tree before you begin working. This is helpful whenever you need, for example, to detach a surface (making it a base node) so that you can manually recreate its trimming boundary.

If there is more than one component node immediately below the import feature, and you have not activated the one you wish to repair, the wireframe display disappears and the Repair tool is not available. When you activate a node in the GTS Tree, the repair is limited to the surfaces of the active node. You can also limit a repair by activating specific surfaces on an existing component. Alternatively, you can detach the surfaces, combine them into their own component, and then activate and work on the component (which contains the detached surfaces) by itself.

Before beginning to repair anything, examine the wireframe display. If the display is mostly satisfied (the wireframe curves are green) with only a few instances where they are black, do not try to repair the entire component. The repair will take a long time to compute, and some surfaces may become distorted (we'll discuss later how to work around such distortions).

Another way to make sure the repair affects only an isolated area is to freeze the entire component. Select a component node in the GTS tree or in the graphic display, right-click and choose Select **Parent Node** from the shortcut menu, and then click **Freeze**. Unfreeze the surfaces adjacent to the black wireframe curves to repair.

About Freezing Surfaces

Freezing drastically limits the scope of allowed changes to a surface, but does not prevent its repair. Local changes along the boundary edges are still possible even if the surface is frozen. Even if all the activate surfaces are frozen they can still be repaired. When a surface is frozen, changes during repair are limited to tweaks to a small adjacent surface or boundary. Neither the UV parameterization grid nor the mathematical properties of the surface change. If the surface is not frozen, however, the repair process will both tweak and change the parameterization grids and surfaces.

The **Freeze** and **Unfreeze** commands are always available whenever multiple surfaces with different Freeze statuses are selected. Frozen surfaces are marked by a unique identification icon. When you select **Unfreeze**, only those surfaces that can be unfrozen are unfrozen. The rest will be marked as frozen.

About Unfreezing Surfaces

Sometimes a surface cannot be unfrozen. When this occurs, the system cannot calculate a quadrilateral or triangular patch based on its current boundary. You work around the situation by merging two adjacent wireframe curves (select the curves, and then click **Merge Curves**) of such surfaces. This may be sufficient to Unfreeze them.

> **Tip**
>
> If the above method does not work, use UV curves to subdivide the surface (create the UV curves and add them to the wireframe, one subdivision at a time), and then unfreeze each piece individually.

In general, analytical surfaces (including spheres, cylinders, and planes) are frozen by default. When you unfreeze an analytic surface, it converts to a modifiable free-form surface.

Defining Gaps

You must define a gap as an input for the Repair tool in order to repair it. A gap is displayed as a black wireframe curve. In most cases, gaps are automatically found and defined automatically during the import process. If adjacent pairs of one-sided edges remain that are not included in the wireframe display, you must define new gaps and add them to it.

Tip

Carefully examine the wireframe display. Pay special attention to areas with black wireframe curves with many vertices (click **Display Vertices** to show vertices). Sometimes the gaps are not correctly defined (only a portion of the one-sided edge may appear in the gap, when the whole edge should be, for instance). Select the incorrect wireframe curves, click **Remove from Wireframe**, and then select the Define Gaps tool to define new, correct gaps.

In rare cases an identified gap cannot be closed. Try either of the following methods to resolve the problem:

- Use manual local editing tools (available mostly in Modify mode) to detach the surface, modify it and fix its boundary, and then put it back into the component.
- When gaps fail to add to the wireframe or do not close when the repair is done, click **Close** in Repair mode. In this mode, unlike in Featurize mode, the input (and only one allowable) to the **Close** tool is the selected black wireframe.

Fixing Geometric Discrepancies

There are two types of geometric discrepancies: improper surface trimming (bad edges) or corrupt surface definition (bad surfaces). These local geometric discrepancies can prevent a successful Repair operation or cause bad results. A geometric discrepancy may also make the model unusable in downstream Pro/ENGINEER applications. Use the manual tools in Modify mode to clean up bad geometry.

Bad Edges

Use a Geometry check to locate bad edges, especially overlapping geometry, short edges, and misaligned vertices. Click **Remove from Wireframe** to convert two-sided bad edges into one-sided in Repair mode. Use the **Merge Edges**, **Edit Edge**, and **Move Vertex** tools for simple cases.

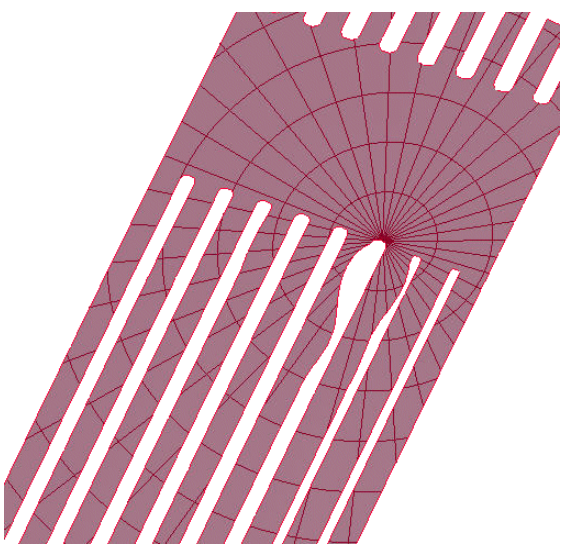
In more complex cases, you must replace the bad edges with UV curves. In some extremely complex cases you must recreate the entire boundary. To do this, detach the surface with bad edges, select one of its edges and click **Delete**. Use the **UV Curves** and **Replace Edges** tools to create a new

boundary, and then cut and paste or drag the new surface back into the component. If the new boundary matches that of its neighbors, the two-sided edges are automatically created. If not, define new gaps and click **Repair**.

Bad Surfaces

Bad surfaces are either badly distorted or have bad singularities. Use the following techniques to find bad surfaces:

- Run a geometry check to find bad surfaces. Since a bad surface often has bad edges, a bad surface usually indicates a bad edge.
- Check for visible discrepancies in Shaded view: waves, bulges, and apparent holes.
- Check for visible discrepancies in Wireframe view: bad silhouette curves, wavy edges.
- Selected surface does not highlight properly: visibly mismatched highlighted and non-highlighted displays.
- Bad surface mesh: self-intersecting mesh; points where all mesh curves passing through it are locally parallel to each other (an indication of a bad singularity); unreasonable mesh for the surface shape; dense or sparse mesh in a specific area of the surface (adjust mesh density to see this). Notice the bad surface singularity in the figure shown below.
- Locally bad shaded surface analysis (curvature, slope, zebra, and so forth).



Delete these surfaces, and then use the Boundary Blend tool to recreate them. In some cases, when the general shape is similar to one of the supported procedural or analytical types, you can use Featurize mode to convert the surface to the similar supported surface type.

Dealing with Bad Repair Results

A bad (distorted) surface is usually the result of a badly performed repair. Use the same technique to find the bad surface either after the repair has been saved to the model or use the Repair dashboard to view old and/or new geometry, and then perform a surface analysis. The most commonly used analysis is a Compare Surfaces analysis. Click **Curvature Analysis** > **Compare Surfaces**.

One way to work around a bad surface after a repair is to delete it and to create a new surface, or you can revert the component to a pre-repair state by canceling the repair or clicking **Undo**. Play with the surface's frozen status and with the tangency constraints along its edges before attempting to repair it again.

Sometimes you can get better results by editing surface math properties (make the number of gridlines smaller if they seem excessively dense) and/or use the Edit Surface tool to make the control polyhedron look more regular.

Tip

Remember to check whether the surface that distorts was bad to begin with.

Modify Mode

Use Modify mode to make changes to both individual surfaces and curves as well as to boundary edges of surfaces.

Tip

Wherever possible, the system creates two-sided edges when you modify the edges of a component surface. To prevent this or to work in a manner similar to that of the Edit Boundary functionality, detach the surface, perform all necessary operations on its edges, and drop it back into the component.

The following tools are available:

- The Edit tool edits a one-sided edge using control polygon manipulation.
- The Move Vertex tool moves a vertex between one-sided edges of the same surface.
- The Merge tool merges two adjacent one-sided edges.

- The Split tool splits a one-sided edge at a selected point.
- The Delete tool deletes a one-sided edge.

  Note

  The system does not remember the edge control polygon. It is recreated every time you enter **Edit**.

Before you can create new boundary edges, you must create UV curves on the surface. Now use the UV curve creation options from the IDD menu or Repair mode toolbar to replace a selected chain of existing one-sided edges by a chain of UV curves. You can use the same editing operations for both curves and UV curves and shape the new boundary as required.

Final Comments

Hopefully this Import DataDoctor Getting Started Guide has shown you how to begin using the powerful set of data repair and reuse tools in Import DataDoctor. Remember that several different methods have been demonstrated in this getting started guide to achieve a similar goal. Make sure to refer to the Pro/ENGINEER Help for more information.

7

Getting Support

This chapter provides information about all the sources you can count on for support in working with Pro/ENGINEER. The three main areas of support are:

- Pro/ENGINEER Help Center
- Pro/ENGINEER Wildfire 4.0 Resource Center
- Technical Support
- PTC Training Services
- PTC User Community

As you become more familiar with these sources, you'll find that they overlap in areas of expertise. A PTC online account is required to access PTC documentation from the Web. Register for a PTC online account at www.ptc.com/appserver/common/account/basic.jsp.

> **Note**
>
> The Adobe Acrobat Reader is required to read PDF files. See www.adobe.com/supportservice/custsupport/download.html to download a free Acrobat Reader.

Pro/ENGINEER Help Center

You can access Pro/ENGINEER context-sensitive Help and books in PDF format by clicking **Help > Help Center** in Pro/ENGINEER or through context sensitivity. In the Help Center, see **Using the Help Center** for more information.

Pro/ENGINEER Resource Center

Web-based usability tools can help when learning Pro/ENGINEER. Access the Pro/ENGINEER Wildfire 4.0 Resource Center from the Pro/ENGINEER browser, through the Pro/ENGINEER Help Center, or at www.ptc.com/community/proewf3/newtools/index.htm. The tools include the following:

- **Web Tools and Tutorials**—Step-by-step instructions and other helpful topics. Navigate to the tutorials from the Resource Center or go directly to www.ptc.com/go/wildfire/get/index.htm and click **Online Tutorials**.
- **Quick Reference Card**—Handy reference for toolbars, selection techniques, dynamic viewing, and more.
- **Productivity Tools**–An interactive guide to new tools to increase your productivity. Included are the selection tools, enhancements to viewing tools (Spin, Pan, and Zoom), and the Model Tree.
- **Menu Mapper**—A cross-reference of menu commands from Pro/ENGINEER 2001 and Pro/ENGINEER Wildfire to latest menu commands.

PTC Technical Support

Technical support for Pro/ENGINEER is available 24 hours a day, 7 days a week. You can contact them by phone, fax, e-mail, or FTP.

You can easily access the most current technical support contact information from within Pro/ENGINEER by clicking the **Support** link on the Pro/ENGINEER browser homepage.

PTC Training Services

PTC Training Services offers a multitude of solutions that embrace the Precision Learning methodology. Precision Learning is a continuous cycle of Learn-Assess-Improve focused toward providing the right training to the right people and doing this at the right time using the right method.

Learning activities, whether taught by an industry-experienced PTC certified instructor or a PTC Web course, embrace a “tell me, show me, let me do” philosophy to maximize understanding and retention. Visit www.ptc.com for a wide range of instructor-led and Web courses offered by PTC Training Services (click on **Services & Training** > **Training Services**).

PTC Training Services prides itself in the flexibility of its solutions. The flexibility in delivery of PTC instructor-led courses includes:

- Course Customization—Courses are tailored to the individual needs of your company, eliminating any topics that are not relevant to your company's situation.
- On-site Training—PTC sends the instructor to you and provides training machines through our responsive traveling laptop centers.

Assessing the impact of training is key to planning the most efficient training, and to measuring the return on your training investment. Pro/FICIENCY Evaluator lets you gain an accurate and impartial evaluation of your personal, department, and company skills.

Pro/FICIENCY Evaluator reveals any areas where skill improvement would prove beneficial to your design team. Improvement activities include Web lessons, (short, tactical how-to topics provided on the PTC customer support Web pages,) books, mentoring, and so forth.

Pro/ENGINEER User Community

Pro/USER provides education and communication for users of PTC software. They offer ad-hoc yearly seminars at the Pro/USER International Conference. Visit http://www.ptcuser.org for a list of training seminars.