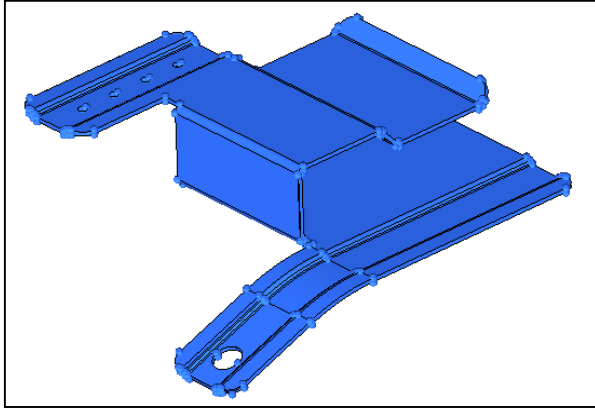


Exercise 2a - Loading and Repairing CAD Geometry

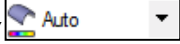
This exercise uses the model file, 02a-TOPOLOGY-REPAIR.hm.

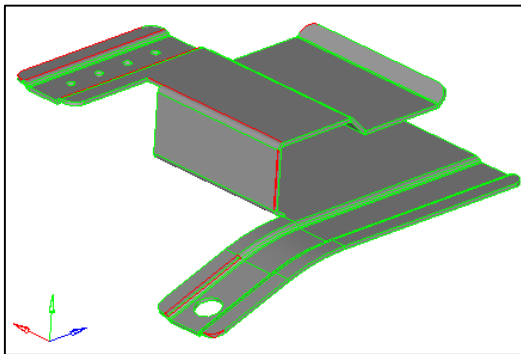



Step 1: Open the model file, 02a-TOPOLOGY-REPAIR.hm.

Step 2: View the model in topology display toolbar to evaluate its integrity.

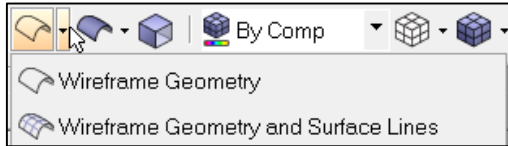
1. Observe where the model has incorrect connectivity and missing or duplicate surfaces.
2. Click **Geometry > Quick Edit** to open the **Quick Geometry Edit** panel.


Note that the surface edges are now colored according to their topology status. This occurs because **Geometry Color** is set to **Auto** ()

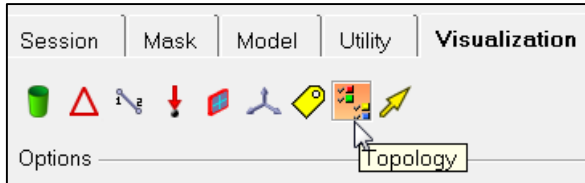


3. Click **Wireframe Geometry** () to display the model in Wireframe mode.

The toolbar contains icons that control the display of the surfaces and surface edges. Surfaces can be shaded with or without edges or wireframe. Place your mouse over the cursor to view a description of the button's functionality and select the icon drop-down menu for additional options.

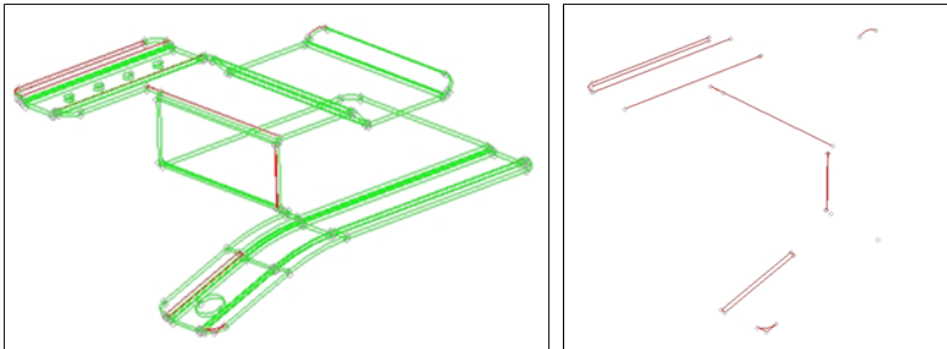



- Click **Visualization** () and navigate to the **Visualization tab > Topology icon**.



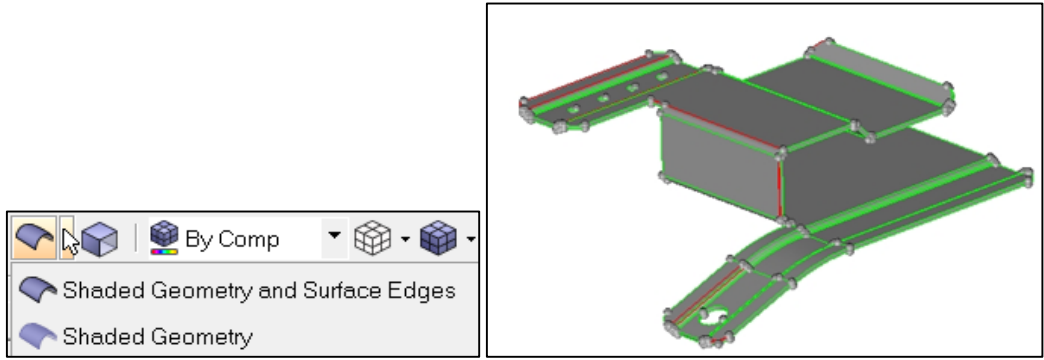
Visualization controls the display of the surfaces and surface edges. Surfaces can be shaded or wireframe. The check boxes within this menu turn the display of the different edge types and fixed points (surface vertices) on or off.

- Clear all the check boxes except the **Free** check box.
Only the free edges should be displayed at this point.
- Observe the free edges and make note of where they are.
The free (red) edges show where there is incorrect connectivity or gaps.
- Note the locations where there are closed loops of free edges. These are locations that probably have missing surfaces.



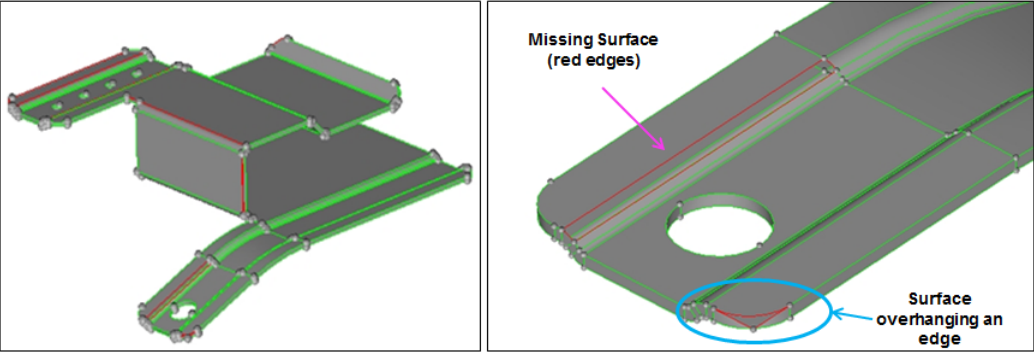
- Select only the **Non-manifold** check box.
- Observe the non-manifold edges and make note of where they are.
The non-manifold edges show where there are more than two surfaces sharing an edge, which might indicate incorrect connectivity or correct T-Connections. For this part, there are no yellow edges. This indicates that there are not duplicate surfaces or T-connection.
- Select all the check boxes.
- Click the **Close** button to close the **Visualization** tab.
- Click **Shaded Geometry and Surface Edges** ().

The surfaces should now appear solid rather than having only their edges displayed.



- 13. Rotate, zoom, and pan to locate any errors in the geometry.
- 14. Make note of the areas to be worked on:

- A surface that overhangs a round corner
- A missing surface

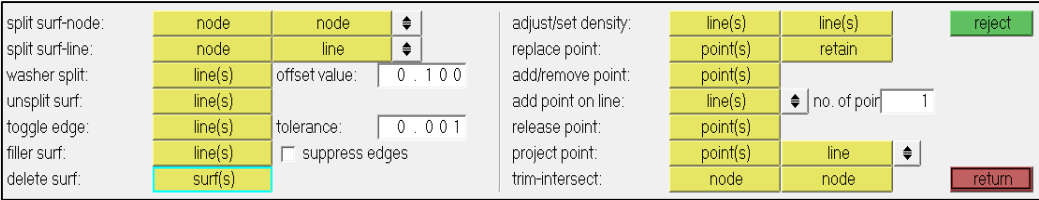


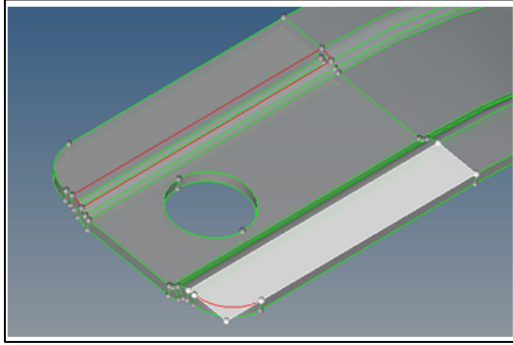
Step 3: Delete the surface that overhangs the round corner.

1. Enter the **Delete** panel in one of the following ways:
 - From the menu bar click **Geometry > Quick Edit > delete surf**
 - OR**
 - From the menu bar click **Geometry > Delete > Surfaces**
 - OR**
 - Press **F2**

2. In the graphics area, select the overhanging surface shown in the picture below.

From the menu bar click **Geometry > Quick Edit > delete surf**

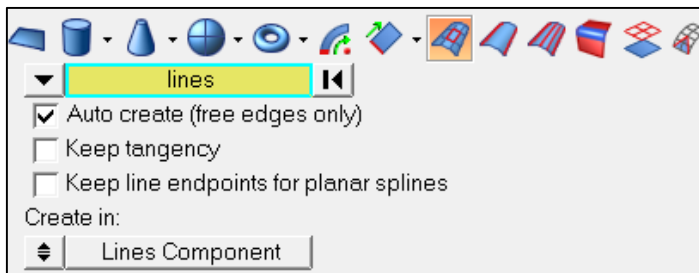




3. This will delete the selected surface.
4. Click **return** to exit the panel.

Step 4: Create surfaces to fill large gaps in the model.

1. Click **Geometry > Create > Surfaces > Spline/Filler** to create the surface.



2. Clear the **Keep tangency** and **Keep line endpoints for planar splines** check boxes.

The **Keep tangency** option is valid for surface edge line selection only. It considers curvature of any surfaces attached to the selected edges and tries to create a surface tangent to them. This helps to form a smooth transition to the surrounding surfaces.

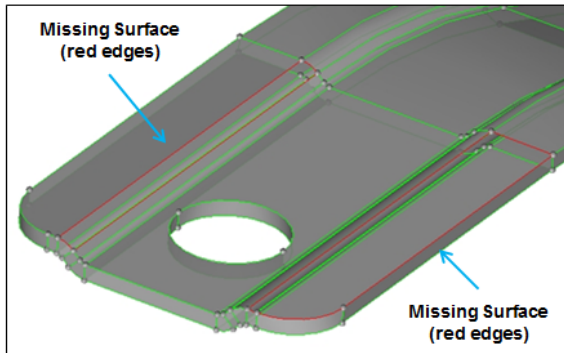
The **Keep line endpoints for planar splines** is valid for surface edge line selection only. This option keeps line endpoints of surfaces created with closed spline/filler lines.

3. Verify the entity type is set to **lines**.
4. Verify the **Auto create (free edges only)** check box is selected.

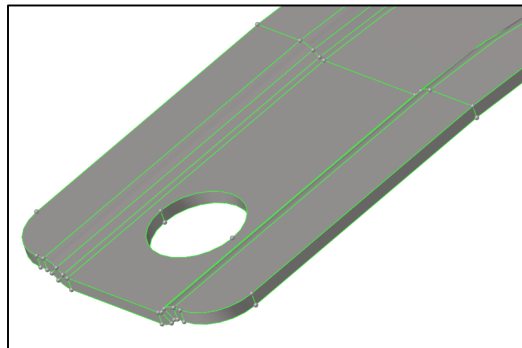
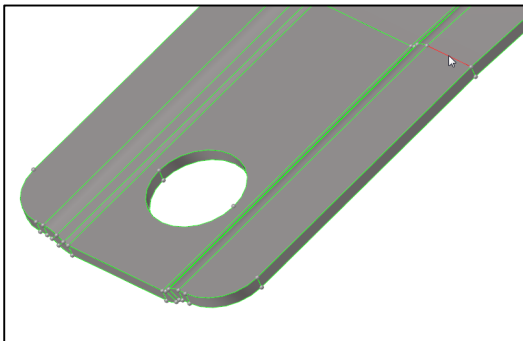
The **Auto create (free edges only)** option is valid for free surface edge line selection only. It creates the surface as soon as a closed-loop free surface edge is selected. This provides a single-click ability to close holes in an existing surface. When this option is enabled, surfaces are created in the component of the selected surface edge, and the topology is updated accordingly; when disabled, multiple bounding lines/edges can be selected to create the surface

The **Create in** defines the resulting surface component organization. Selecting current component organizes the new surfaces to the current component, no topology updates for selected surface edges are made when this option is selected. Selecting lines component adds the new surfaces to the same component that the selected lines already belong to, the result is unpredictable if lines from different components are selected and the topology of the new surface is updated accordingly for any selected surface edges that belong to the determined lines component.

- Zoom into the area indicated in the following image.
Pick one of the **red lines** bounding one of the gaps (missing surfaces).
HyperMesh automatically creates a filler surface to close the hole.
Repeat this step to create a filler surface in the other gaps.



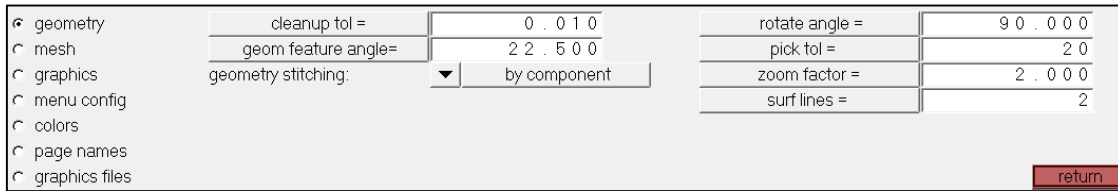
- Click **return** to exit the panel.
- If there is a free (red) edge as well as the figure below on the left, from the menu bar click **Geometry > Quick Edit > toggle edge:**
- Click the red edge (don't change the tolerance).



- Click **return** to exit the panel.

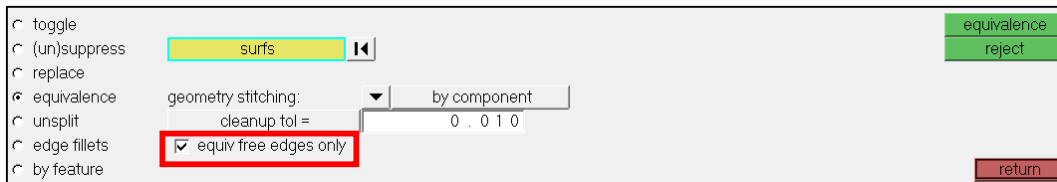
Step 5: Set the global geometry cleanup tolerance to 0.01.

- Press **O** to go to the **Options** panel or from menu bar, click **Preferences > Geometry Options**.
- Go to the **geometry** sub-panel.
- In the **cleanup tol =** field, type **0.01** to stitch the surfaces with a gap less than 0.01.
- Click **return** to exit the panel.



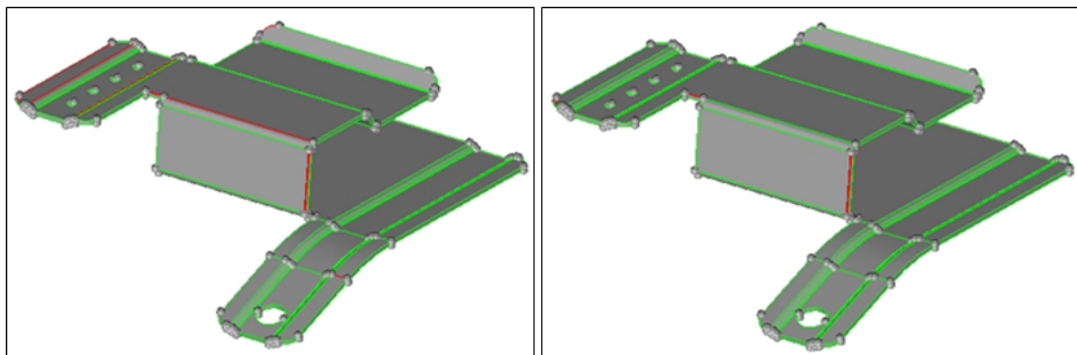
Step 6: Combine multiple free edge pairs at one time with the equivalence tool.

1. From the menu bar, click **Geometry > Edit > Surface Edges > Equivalence**
2. Activate the **equiv free edges only** check box.



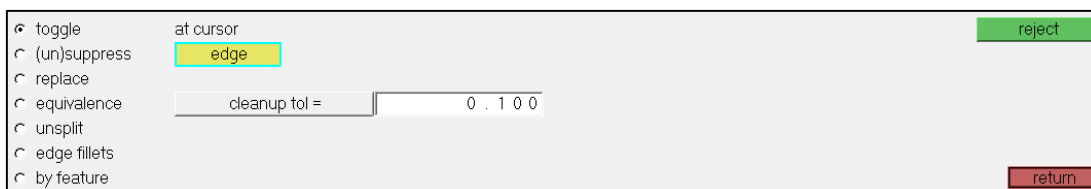
3. Select **surfs >> displayed**.
4. Verify that the **cleanup tol =** is set to **0 . 01**, which is the global cleanup tolerance specified in the **options** panel.
5. Click the green **equivalence** button to combine any free edge pairs within the specified cleanup tolerance.

Most of the red free edges are combined into green shared edges. The few remaining are caused by gaps larger than the cleanup tolerance.



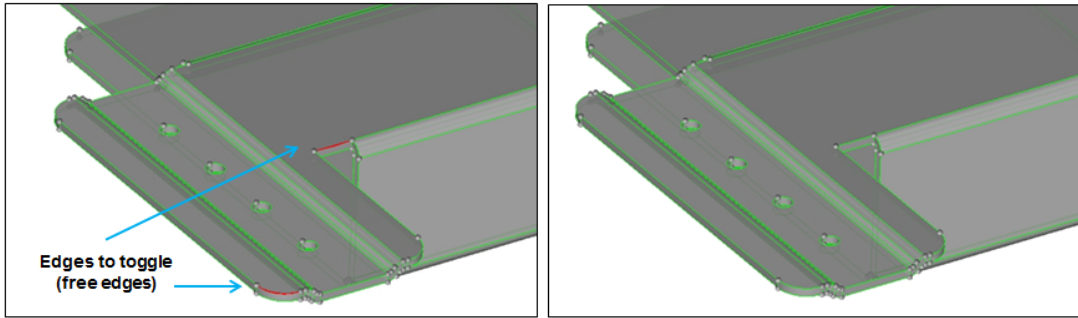
Step 7: Combine free edge pairs, one pair at a time, using the toggle.

1. Go to the **toggle** sub-panel.
2. In the **cleanup tol =** field, type **0 . 1**.



3. In the graphics area, click one of the free edges shown in the following image.

Use toggle to equivalence the other edges shown in the image below on the left.



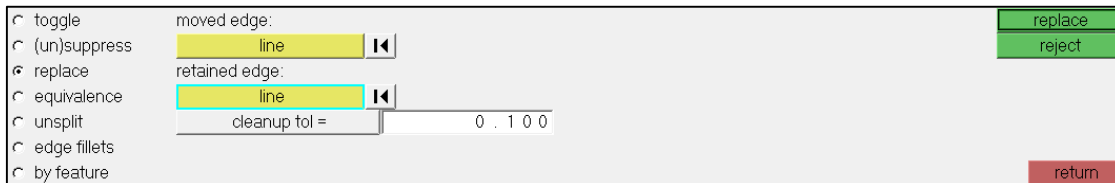
4. Rotate and zoom into the area if needed. When the edge is selected, it will change from red to green, indicating that the free edge pair has been equivalenced.

Step 8: Combine the remaining free edge pair using *replace*.

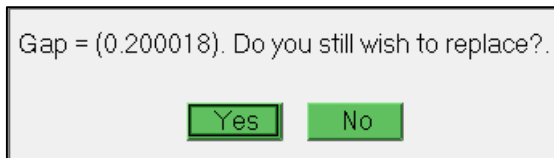
1. Go to the **replace** sub-panel.
2. With the selector under **moved edge:** active, click the leftmost free edge in the graphics area.

Verify that the selector under **retained edge:** is now active.

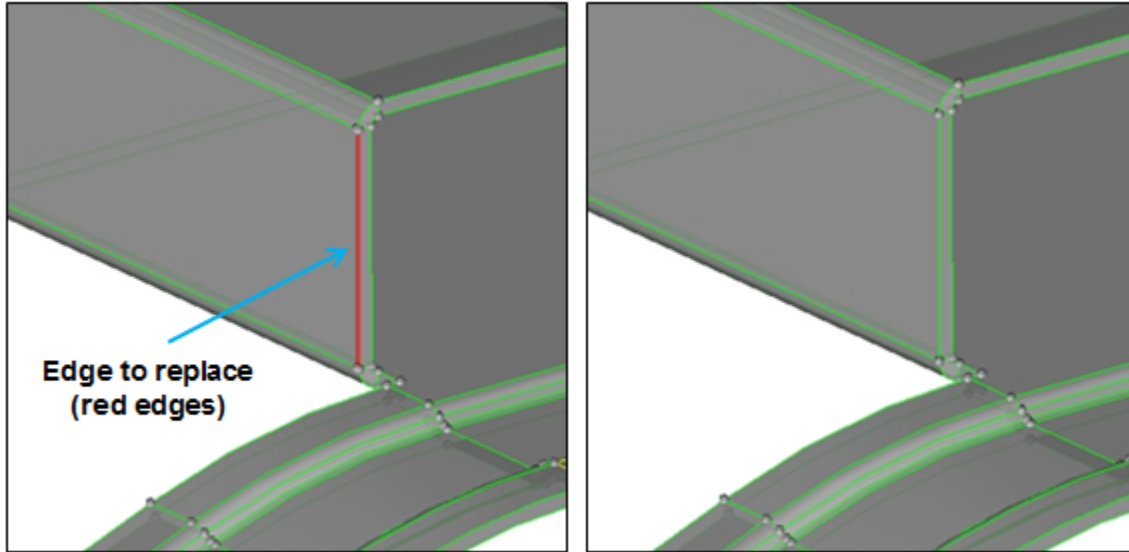
4. Select the rightmost red edge.
5. In the **cleanup tol =** field, enter 0.1.
6. Click **replace**.



Once the line is selected, HyperMesh posts a message similar to:



7. Click **Yes** to close the gap.



Edges to retain and move for replacement

8. Click **return** to exit the panel.

Step 9 (Optional): Save your work.

With the cleanup operations completed, save the model.