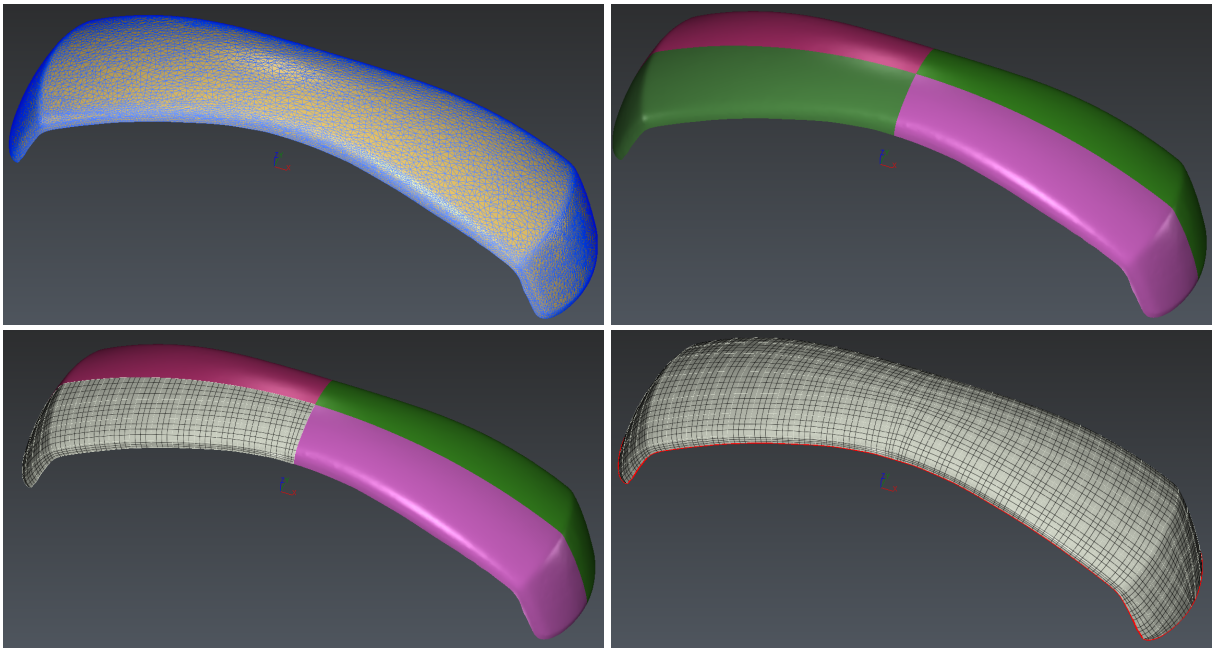
3DR | Meteor

REVERSE ENGINEERING OF PHONE COVER

Help 2020.1

HEXAGON
MANUFACTURING INTELLIGENCE



Reverse engineering is the creation of CAD surfaces from scan data.

In most cases, a scanner provides the point clouds used to create a 3D mesh. Then, CAD surfaces can be computed from the 3D mesh and a polyline network. CAD surfaces can be exported in IGES or STEP format and further used in other software for Computer Aided Manufacturing (CAM), Finite Element Analysis (FEA) or for comparison and inspection.

Exercice overview

In this exercise, we will see how to create CAD surfaces from a mesh of a phone. Main steps of the process are:

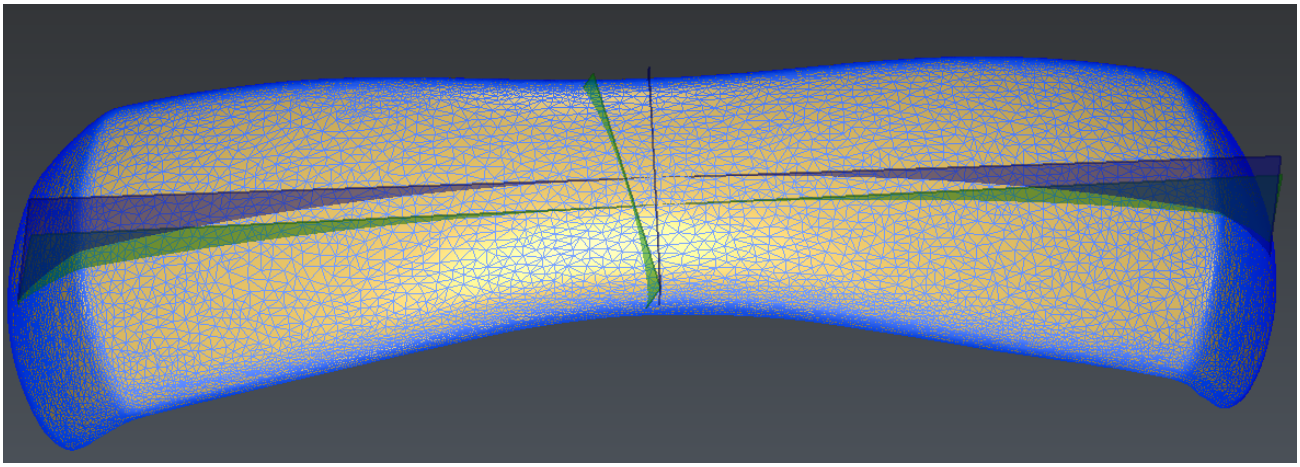
1. Compute Best Symmetry Plane in order to work only on a quarter of the shape
2. Cut a mesh according to plane intersection
3. Generate the CAD Surface using Generate Patches command and edit the network if necessary
4. Use Symmetry to construct the complete model

The file used in this tutorial is **Phone_Cover.3dr**

1 Best Symmetry Plane

To compute the best symmetry plane of an object, you need a first rough plane close to the expected solution to use as a starting solution. Launch the command Draw Plane and draw two planes near the two symmetrical planes of the phone, like shown in the picture below.

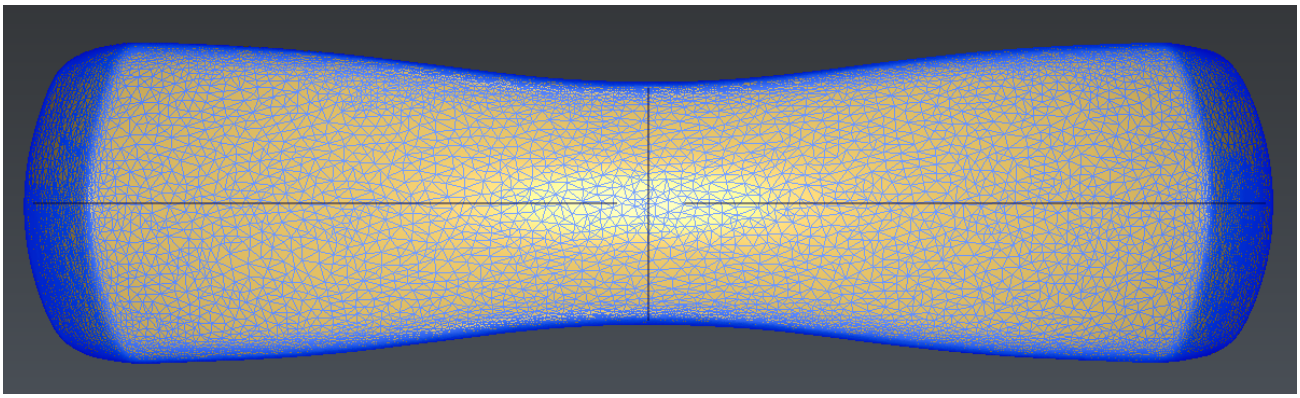
To draw the first plane, just click at least three points on the mesh where the first symmetry plane should approximately be. Then click **OK, Next** and click at least three points for the second plane. Once the two planes are drawn, click **OK, Exit** to validate the results.



1 Draw first planes (in green)

To compute the final symmetry plane, select the rough **Plane** and the mesh **MeshUpperPart** and launch the command Best Symmetry Plane. Make sure the **Define constraints** option in unchecked, then click on **Preview** to see the result and **OK** to validate. A new plane has been created called **MeshUpperPart Symmetry Plane**. You can now delete the rough plane **Plane**.

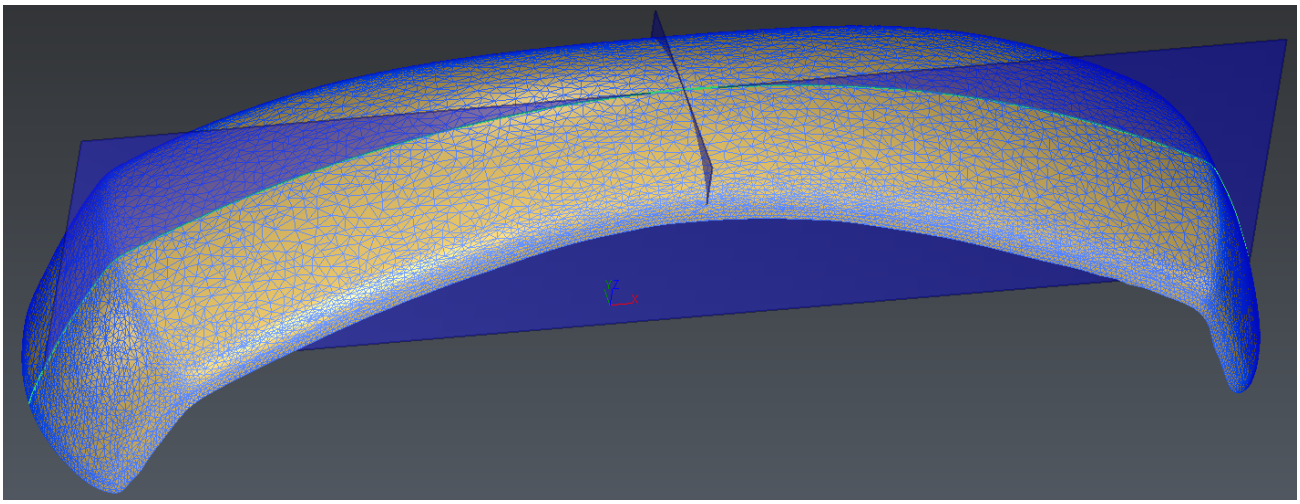
Repeat the same process with the **Plane 2.**



2 Final symmetry planes

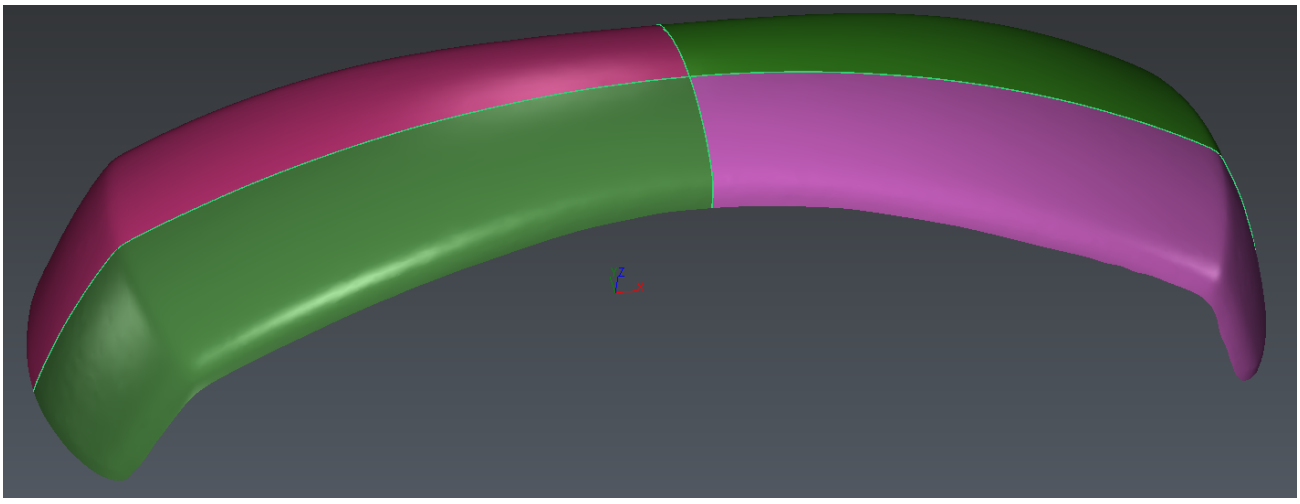
2 Cut the mesh

Now, we will cut the mesh in 4 parts, in order to work on a quarter of the mesh and then use symmetries to create the complete model. To cut the mesh, we first need to compute intersections. Launch the command Intersection and click the mesh and a plane. It will create a polyline corresponding to the intersection between the plane and the mesh. Click **OK, Next** to validate this first intersection and then click the mesh again and the other plane. It will create the second intersection. Click **OK, Exit** to validate and quit the command.



3 Compute Intersections

Now we have a mesh and two polylines, and we want to cut this mesh along these polylines. Select the mesh **MeshUpperPart** and the polylines **Intersection MeshUpperPart Symmetry Plane & MeshUpperPart** and **Intersection MeshUpperPart Symmetry Plane & MeshUpperPart 2** and launch the command Cut Mesh. Click **OK**. You will obtain 4 independents meshes.



4 Cut the mesh according to polylines

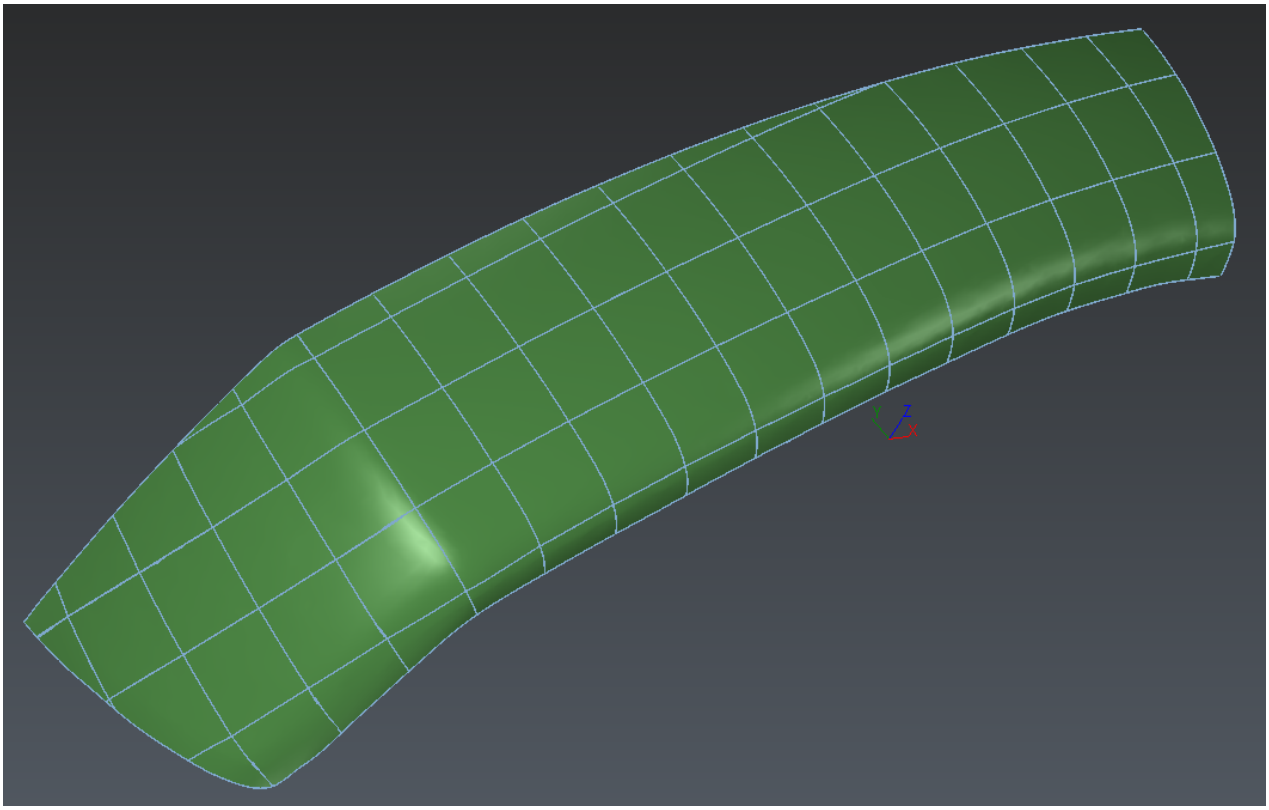
3 Create the polyline network automatically

Show only one of the 4 meshes (right click on a mesh and then click **Show Only**).

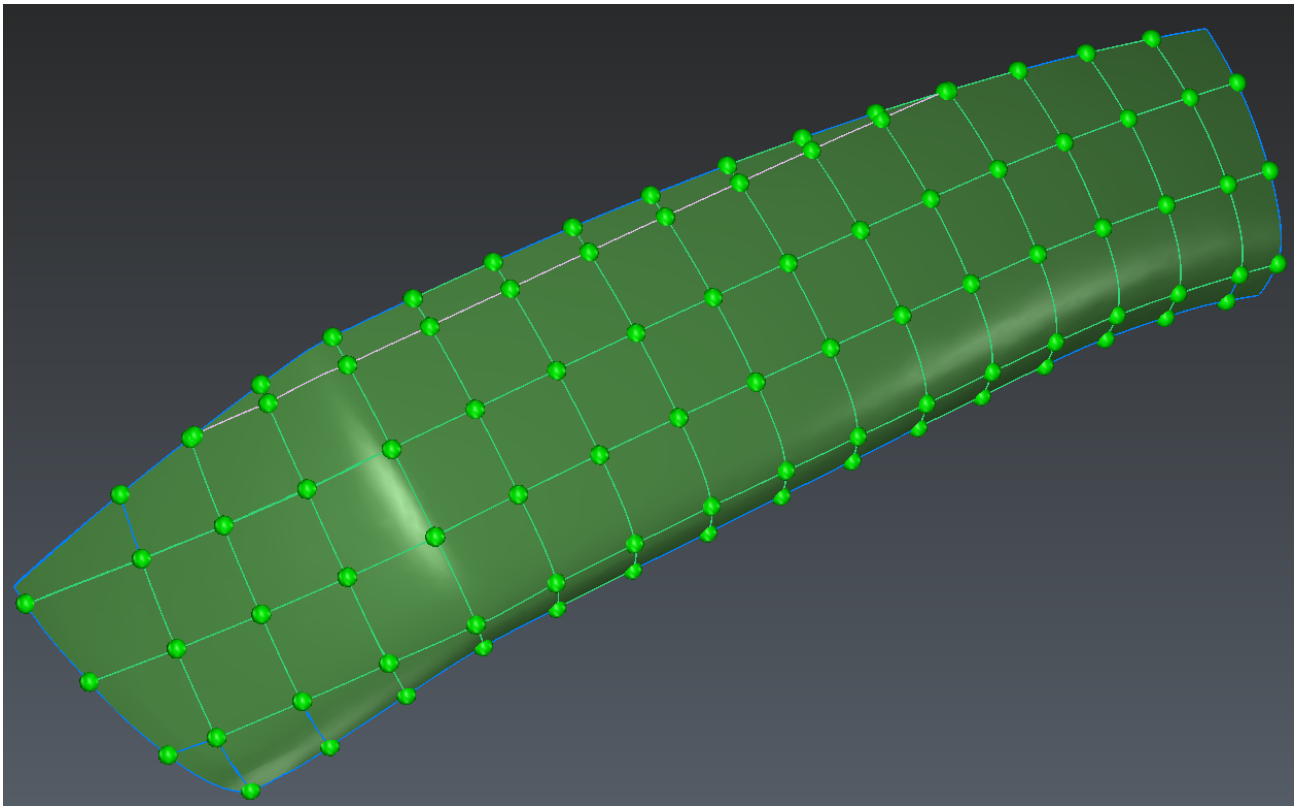
Select the mesh and launch Create Network. It creates a polyline network (Use 8 for the **Edge length** parameter with **Extend to border** option). Click **OK**.

This result, obtained automatically is almost perfect. One critic that we can do on this resulta is that the long section which is close to the symmetry axis is not relevant as this would create 3 sided patches close to the symmetry axis.

These sections can be easily edites: select the network of lines and the mesh to edit the network. Select the segments shown in magenta as in the image below and delete them (use the CTRL key to select several elements.



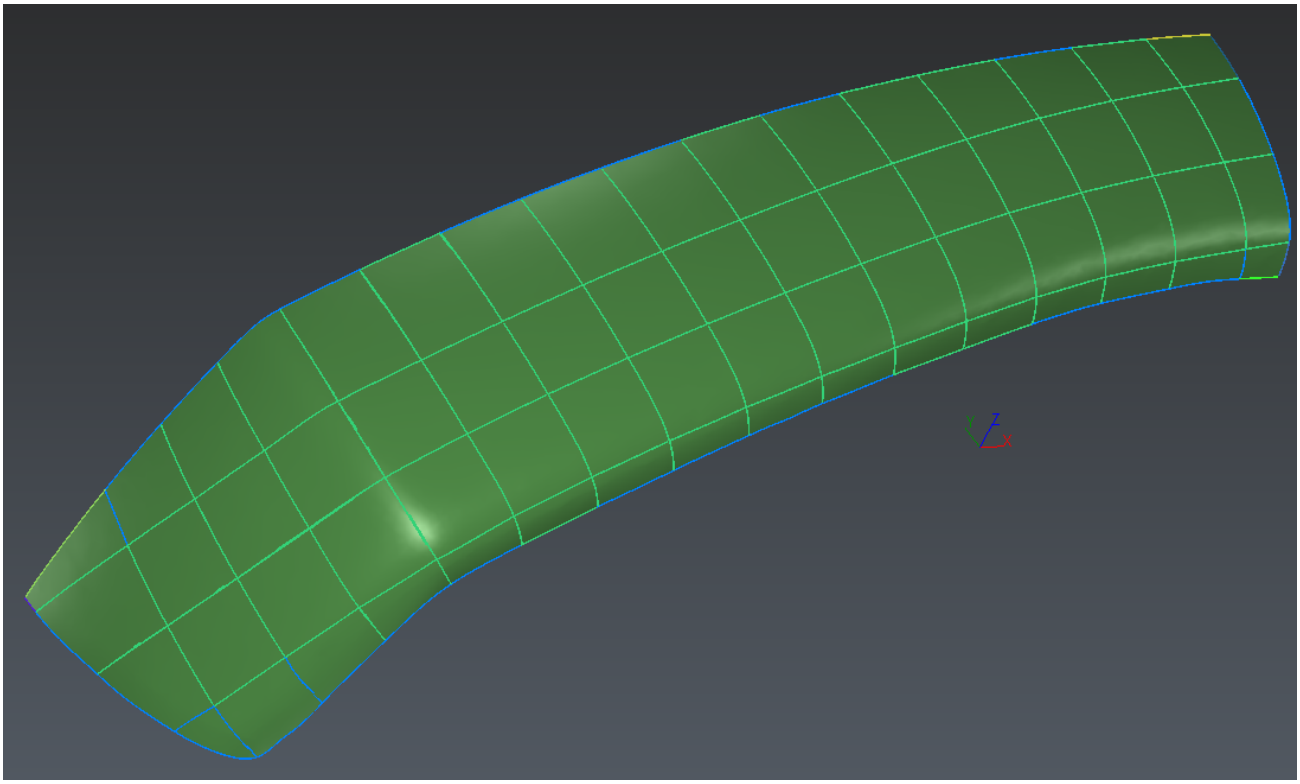
5 Create the network including the external border



Another critic that we can do in this network is that the corners where the surface is close to the symmetry planes are not clearly marked by nodes: in the picture above, there are no balls in these corners.

In order to create these nodes, launch the command Cut Polyline and cut the polyline using the Vertex / End option. We have to be very precise here in order to pick the exact vertex on the symetry plane. Do not hesitate to zoom close to the vertex.

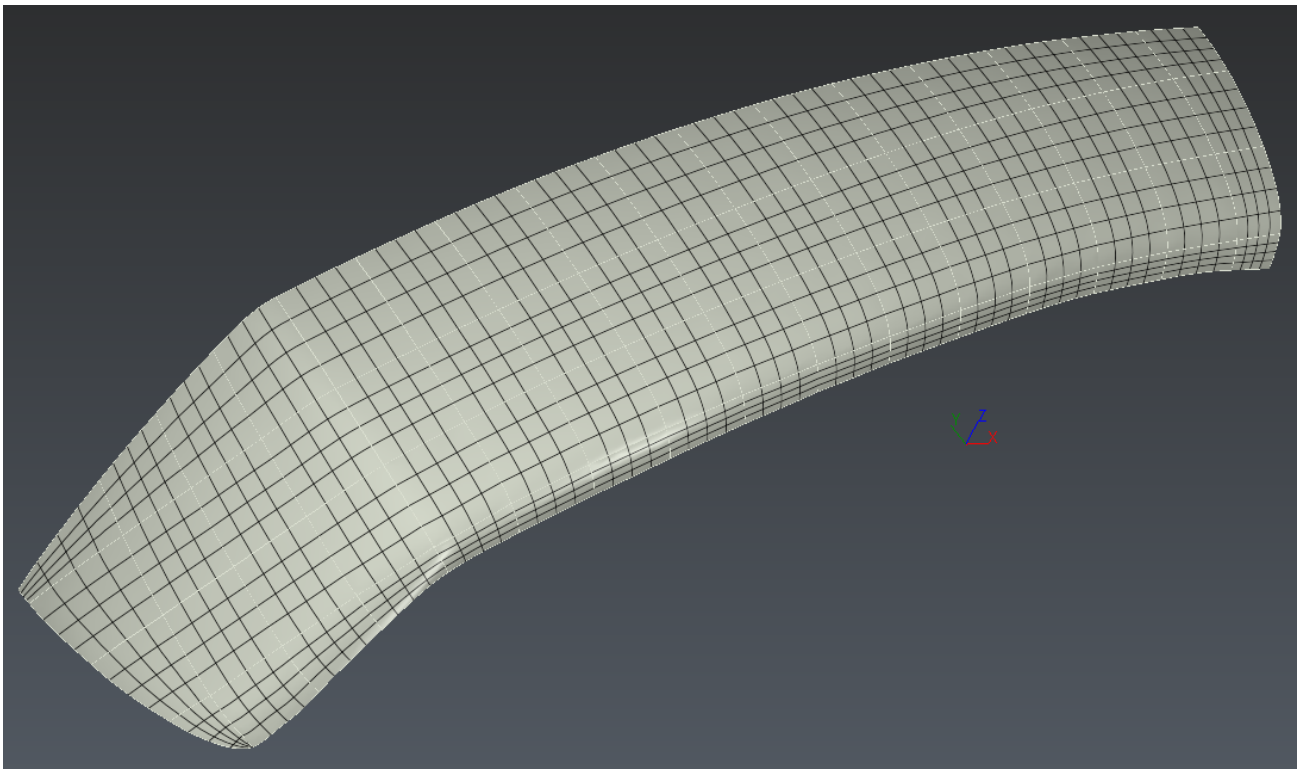
The picture below shows the final result. This result is also available in the folder **Polyline Network** in the project.



6 Final Network

4 Create CAD surfaces

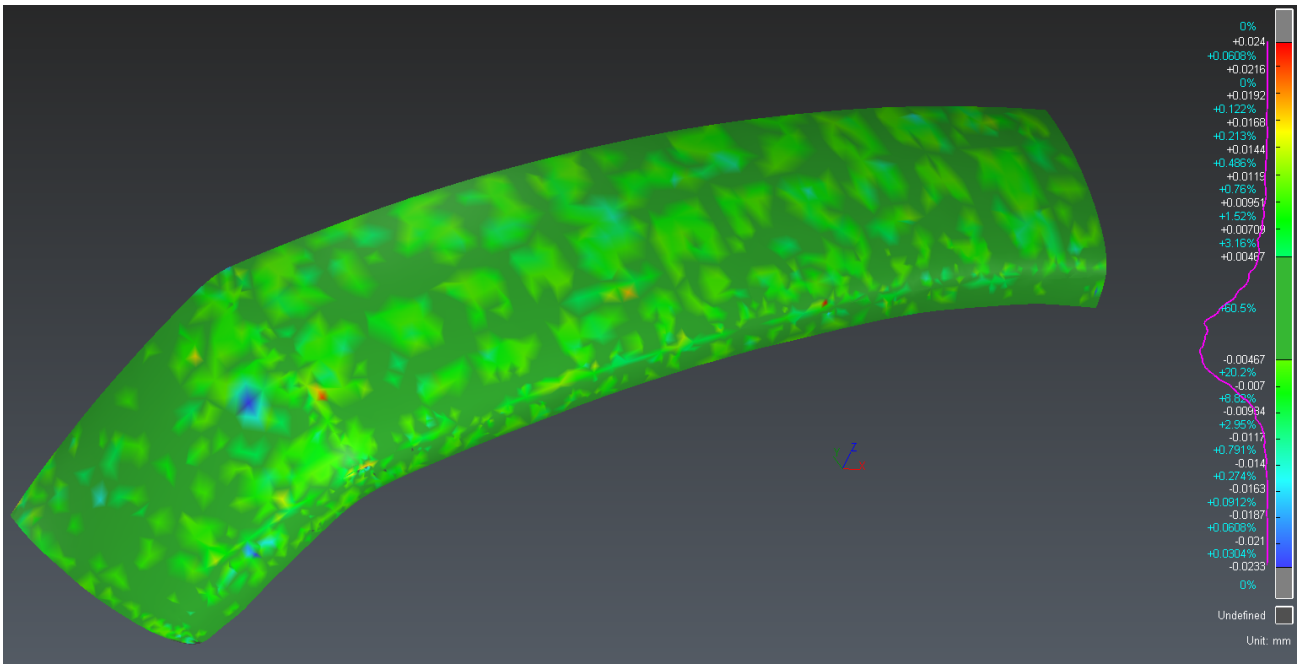
Select the mesh and the network of polylines and launch the command Generate Patches.



7 Patch creation - Surfaces

5 Inspect the result

Select the mesh and the CAD shape and launch the command vs CAD to compare and check the accuracy of the resulting CAD model against the original mesh.



8 Automatic

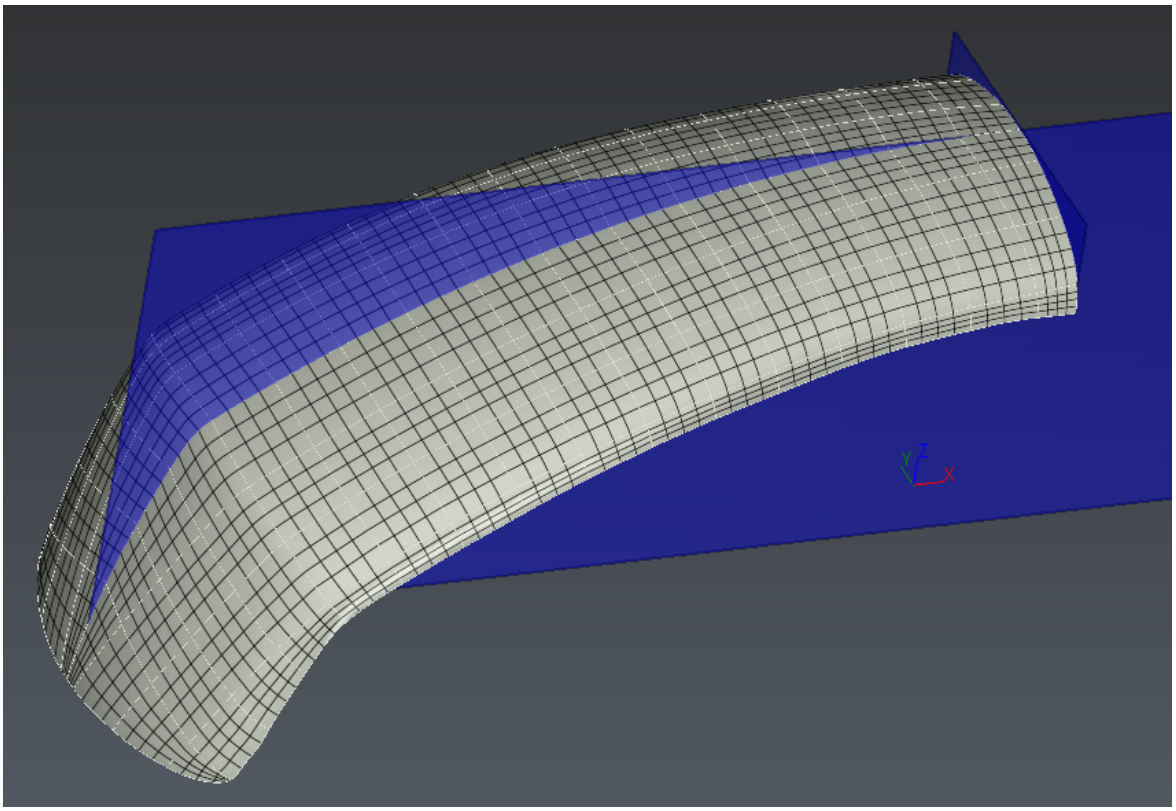
6 Create the complete model

Show the two symmetry planes computing earlier. Select the CAD surface and launch the command Symmetry.

Select the option **Planar Symmetry.** Then we have to define the symmetry plane in two steps:

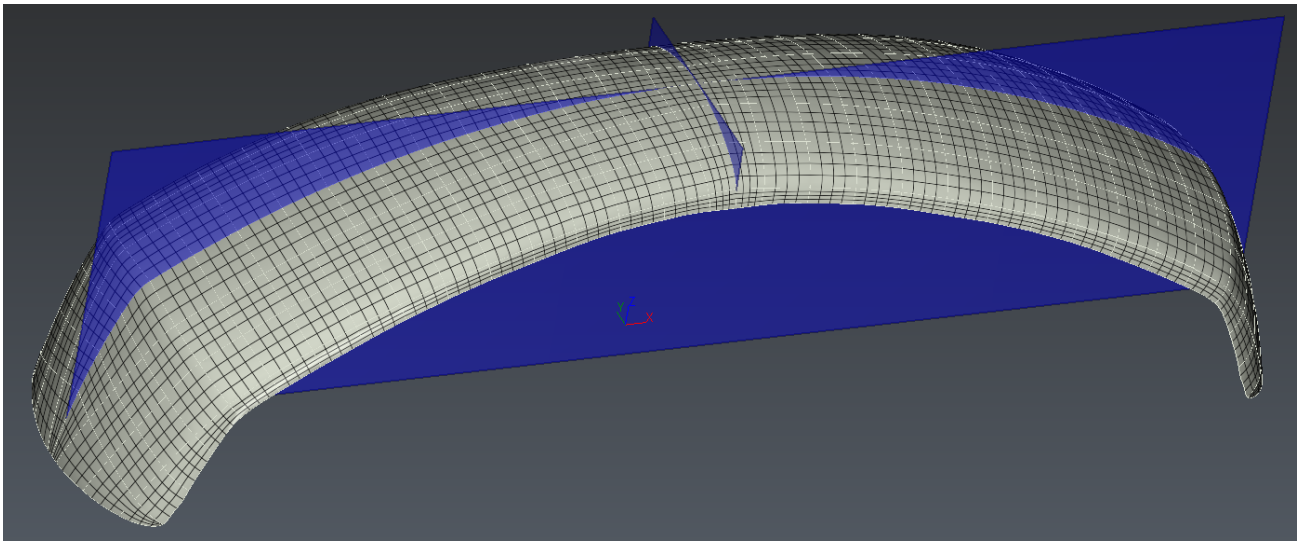
- click  and click a point on one of the two planes
- click  , then click  (to click the normal of a component) and click a point on the same plane

Make sure the option **Create copy** is checked and press **Preview** to see the result. Press **OK** to validate.



9 First Symmetry

Select the **two** CAD surfaces and repeat the process with the second plane.



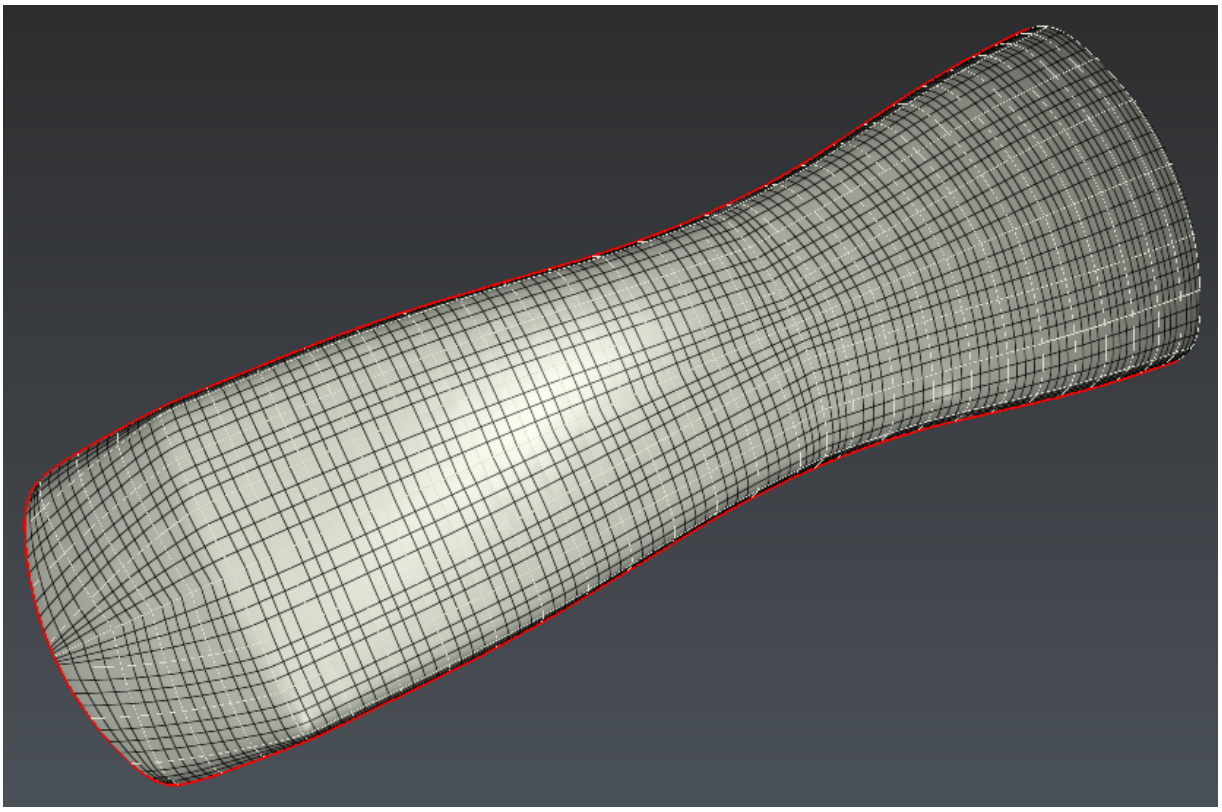
10 Second Symmetry

7 Sew surfaces to make one shell and export to IGES/STEP

To get one a CAD shell, with sewed surfaces, select all the patches and launch the command Sew Surfaces. Enter a distance of tolerance of 0.1 mm.

The surface created is made of one single external bounday. This external bounday can be extracted with the command From CAD Surface.

The **shell** object can now be exported in IGES/STEP (File/Export).



11 Figure 15: Final CAD Model