How to create a high quality fitting surface

The application has the Boundary Fit Surfacing function and it helps you to easily create a surface body using curve boundary on the mesh even though target face of the mesh has complex freeform shape.

Through this technical tip, you can understand how to create a high quality fitting surface.

Step 1: Mesh Optimization

First, you need preparing process such as “Mesh Optimizing Operation” to create a high quality fitting surface on the mesh using curve boundary.
As size of poly-face is regular and resolution of mesh is enough to apply fitting operation, you will get better fitting surface.

How to optimize a mesh to get a high quality fitting surface

Note

The application provides you several methods to optimize a mesh according to its current state, such as Healing Wizard, Fill Hole, Smooth, Enhance Shape and Optimize Mesh and so on.
If some abnormal faces and various defects are existed in the mesh, you can easily find and clean them by Healing Wizard method.
If some missing holes are existed in the mesh, you can easily close them by Fill Hole method.
And you can enhance a quality of the mesh using Enhance Shape and Optimize Mesh
methods.

1. Double-click the mesh or click (Mesh Mode) in the Tool Palette to enter Mesh Mode.

2. Click the (Healing Wizard) button or click Tools > Mesh Tools > Healing Wizard.

3. You can check which kinds of defect are existed in the mesh and how many those are as shown in the image below.

4. Click the OK button

**Note**

The Healing Wizard automatically heals various defects in the mesh.

- **Folded Poly-Faces** – If checked, folded poly-faces will be deleted.
- **Dangling Poly-Faces** – If checked, you can input 2 or 3 side open poly-face which will be removed.
- **Small Clusters** - If checked, you can input a value in the **Face Count In A Cluster** box and a cluster (a group of connected poly-faces) that have less than the specified number of poly-faces will be removed.

![Small Clusters](image)

- **Small Poly-Faces** - If is checked, you can input a value in the **Area Is Smaller Than** box and poly-faces whose areas are smaller than this value will be removed.

![Small Poly-face Whose Area Is Smaller Than 0.1](image)

- **Non-Manifold Poly-Faces** - If checked, non-manifold faces and redundant poly-faces will be removed.

- **Crossing Poly-Faces** – If checked, all the crossing faces will be removed. There are three methods. The **Smooth** method smoothly regenerates poly-faces around the crossing poly-faces. The **Merge Poly-Vertices** method merges poly-vertices around the crossing poly-faces. The **Delete And Fill Hole** method removes poly-faces around the crossing poly-faces and fills holes.

- **Small Tunnels** – Small tunnels mean poly-faces’ shape is constructed such as a tunnel or handle. If Small Tunnels is checked, you can input in the **Poly-Face Count In Tunnel** box and the tunnel faces, whose faces’ number to the tunnel direction is shorter than this value, will be removed.

![Tunnel Shape](image)
5. Click the (Defeature) button or click Tools > Mesh Tools > Defeature.

6. Select the Flat option as Method and select region to remove feature and fill faces in there as shown in the image below.

7. Click the OK button.
**Note**

Defeature removes the selected poly-faces and fill with adjacent poly-face information. If you want to re-form the feature after you generate whole surface body, you have to prepare a feature profile previously. In another way, before Defeature operates, if you copy the original feature registering another mesh using **Copy (Ctrl + C)** and **Paste (Ctrl + V)** operation, you will be able to use it later.

**Note**

You can fill face in the missing area using ![Fill Holes](Fill Holes) or clicking **Tools > Mesh Tools > Fill Holes.**

8. Click the ![Optimize Mesh](Optimize Mesh) button or click **Tools > Mesh Tools > Optimize Mesh.**

9. Select the **High Quality Mesh Conversion** option as Method and adjust options as shown in the image below.

10. Click the **OK** button
11. Check the result.
Step 2: Create Curve Boundary

Second, you can prepare curve boundary to create a fitting surface on the mesh. As number of curve boundary is 4 and its shape is regular rectangle feature, you will get better fitting surface. Otherwise, A fitting surface will be twisted and have self-intersection face.

![Image]

How to organize curve boundary to get a fitting surface

- Create 3D Mesh Sketch
  - Create curve boundary which can keep the equilibrium of forces
  - As number of curve boundary is 4 and its shape is regular rectangle feature, you will get better fitting surface as shown in the image below.

- Even though you can keep that the number of curve boundary is 4, if its shape is forming into sudden narrow or twisted as shown in the image below, twisted and self-intersection face could be created when surface is generated.
• Match Curve Boundary
  - If possible, avoid “T-Junction” matching when you create curve networks
  - If not, organize “T-Junction” matching so that the curve networks can keep the equilibrium of forces as shown in the image below.

<Good>  <No Good>
- Except 4 side of curve boundary, others will create a trimmed fitting surface.
- If trimmed surfaces are neighbored with same matching boundary, those will not be matched.
- Organize curve network so that surface matching condition can be applied.

**Example >**

Untrimmed Surface – Untrimmed Surface
Untrimmed Surface – Trimmed Surface – Trimmed Surface
Untrimmed Surface – T-junction matching – Untrimmed Surface

![<Good>](image1)
![<No Good>](image2)

- If possible, adjust same number of control point in the each matching boundary of surface patch to improve surface matching continuity.
- If possible, set the curve boundary using appropriate control point to apply fitting operation.

**Create Curve Network**

- If shape is going sharp or dull, you can manage number of curve boundaries according to the shape as shown in the image below.

![Increase no. of Curves](image3)
![Decrease no. of Curves](image4)

- If fitting curve is not correctly put on the mesh, an accurate fitting surface could not be created.
- It then, increase the number of control point of curve using rebuild option.
**Step 3: Create Boundary Fitting Surface**

Final you can create a fitting surface using the pre-defined curve boundary. But, even though curve networks are well organized on the mesh, creating fitting surface will be differently created according to the defined fitting options.

How to use options to get a high quality fitting surface

Boundary Fit operation has been separated into 2 stages. You can set the Mesh Curves, Curve Loops, and Loop options in the first stage and define sharp edges to keep the sharpness in the boundary and set the control point of creating surface in the second stage as shown in the image below.
**1st Stage (Setup Curve Loops)**
- **Allow Hole (Boundary)** – If this option is turned on, surface will be created even though a hole is existed inside the boundary of curve as shown in the image.

**2nd Stage (Adjust Fitting Options)**
- **Set Resolution** – you can adjust resolution of surface patch by Number of Control Points or Allowable Deviation.
  - If possible, as set the same control point along the U, V direction, you can get better surface body.
  - Use Set Manually, you can easily set the control point along the U, V direction of surface patch as shown in the image below.
- **Set Sharp Edge** – If sharp area is existed in a mesh or you need to keep the sharp feature in a surface body. Use this option. Position matching operation will be applied to the boundary only. So, you can preserve sharp edge in the creating surface body and modify it whenever you want.

- **Resample** – If this option is turned on, fitting area will be regularly simplified and smoother surface will be generated. But, you can decide whether you turn the option on or not according to your application. If you want to generate a surface body on the mesh as close as possible and as it is even though shape has positive or negative complex features like under-cut area, turn off this option.