

POLYGONALmeister
**Operation Guide
(Utilization)**

(ver. 5.0.0)

POLYGONALmeister is software for editing and evaluating the shape represented by the triangle group.

This book explains how to use POLYGONALmeister effectively for each usage scene of the polygon model.

In addition to this manual, the POLYGONALmeister operation manual includes the following documents.

- "Operation Manual (Introduction)"
Explains the operation method for users who are new to POLYGONALmeister.
- "Operation Manual (Basic)"
Describes the entire POLYGONALmeister and explains the functions and operation methods of each command.

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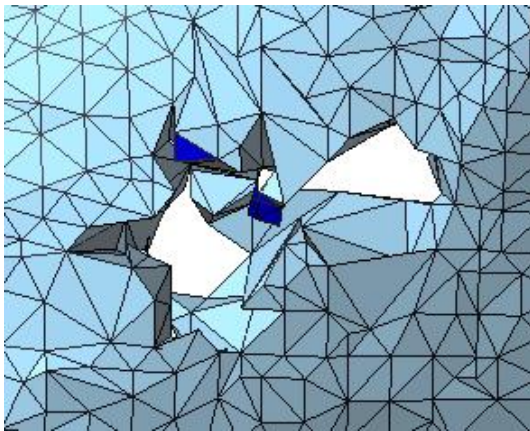
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First mesh correction / reshaping

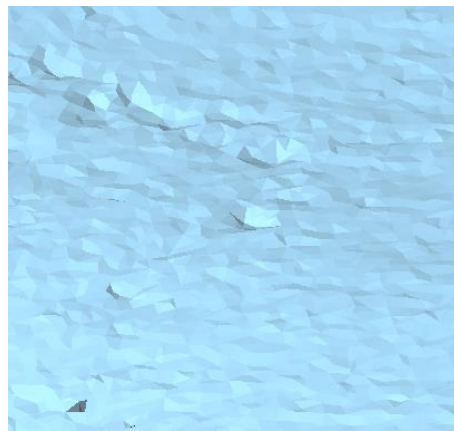
Correction and reshaping of mesh derived from CT measurement

A mesh (a polygon model) created based on X-ray CT measurement data often have the following shape problems that do not exist in the actual object to be measured. This chapter describes commands that fix such issues.

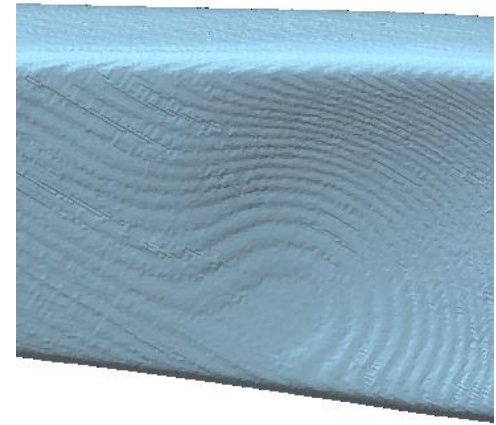
- (a) Self-intersections, folds, and needle-like elongated triangles.
- (b) Edges shared by three or more faces.
- (c) Roughness (small irregularities) on the surface and minute steps.
- (d) Small protrusions and small dents.
- (e) Through holes that appear in thin areas.
- (F) CT artifact of wavy specific to the measurement (stripes).



Incorrect parts and through holes in the mesh



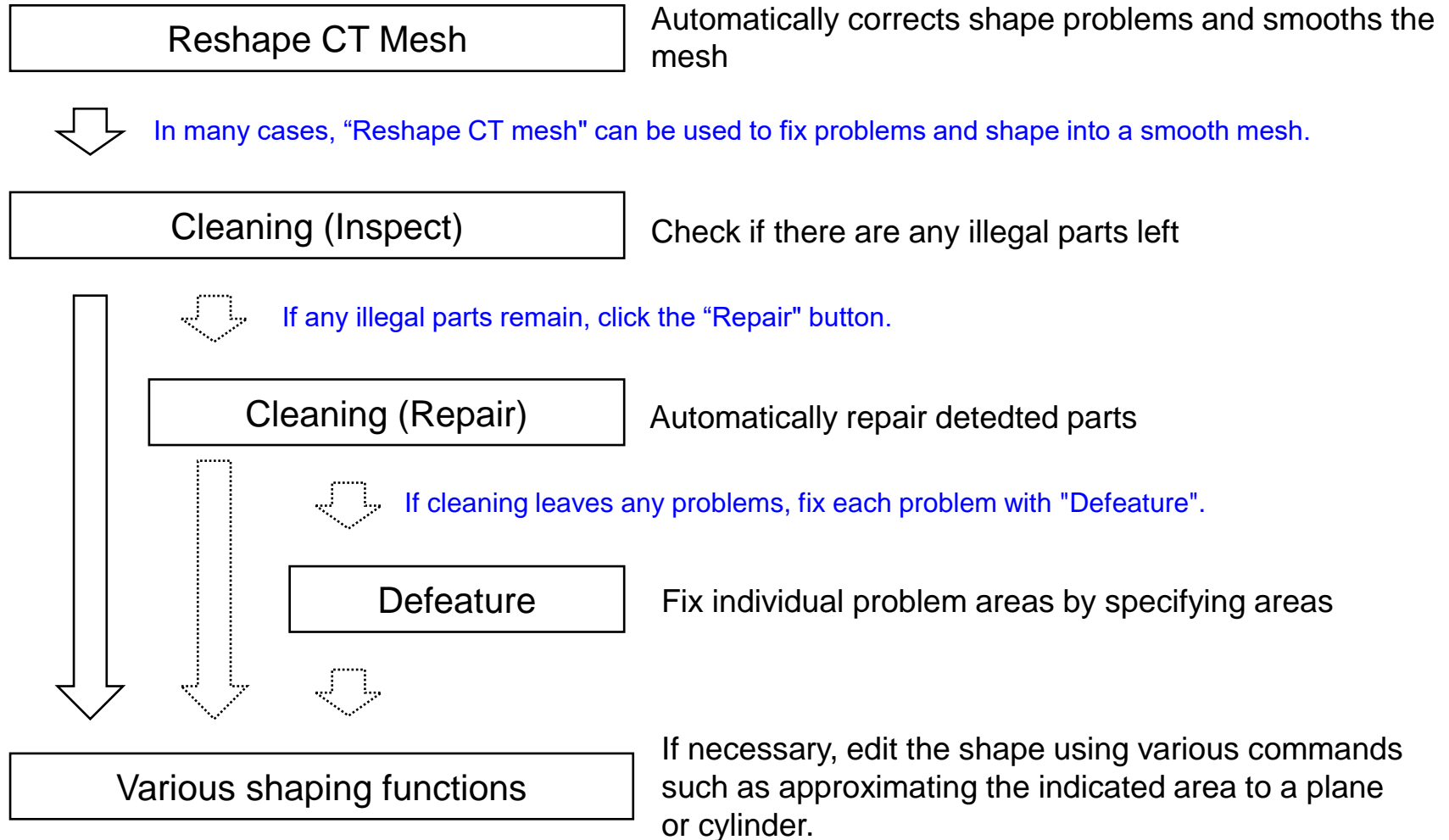
Roughness and dents on the surface



Wavy artifacts

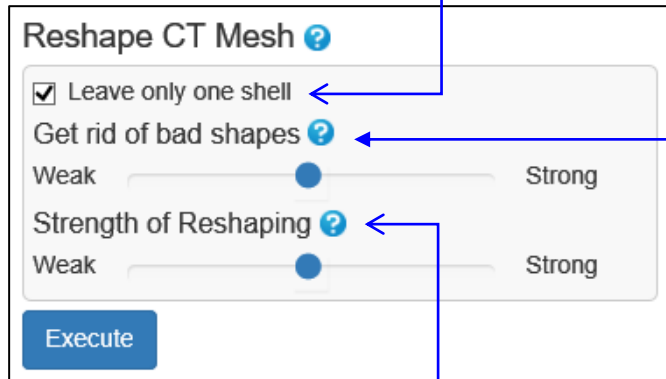
Operating procedure

Simply run the “Reshape CT Mesh” command to solve many of the problems with CT-derived meshes. If any problems remain, correct them as follows. Each function is explained on the following pages.



Reshape CT Mesh (1)

“Reshape CT Mesh“ improves the defective or incorrect shape of the mesh derived from CT measurement, and automatically shapes the mesh so that the face group is smooth and close to an equilateral triangle. By simply executing this command, many of the shape defects and irregularities found in the mesh derived from CT measurement can be automatically corrected.

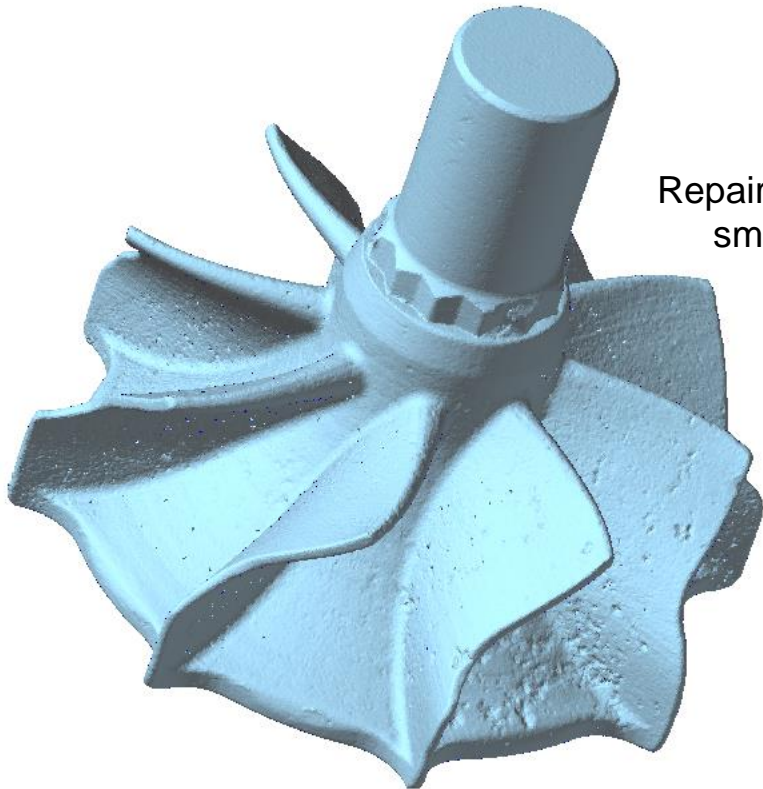


If checked, the shell with the most faces will be left and other shells will be deleted.
Check if you want to leave only one shell after processing.
Uncheck if you want to leave a non-maximum shell, such as a mesh with hollows.
You can also delete unnecessary shells later with the "Delete Shells" command.

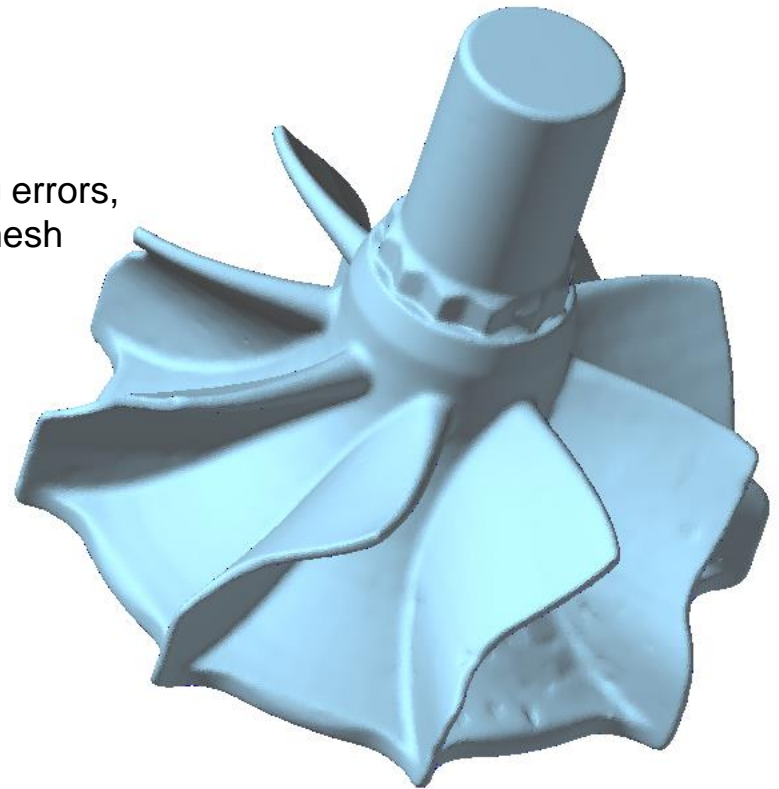
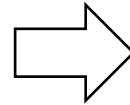
It is the degree of strength to correct the shape. (Select from 3 levels)
"Weak" removes small faces, bad connections, and folds.
"Medium" removes self-intersection in addition to "Weak".
"Strong" removes small protrusions, small blind holes, and small through holes in addition to "medium".

The degree of strength to smooth. (Select from 3 levels)
Select "Weak" if you want to emphasize accuracy (suppressing the shape change), and select "Strong" if you want to emphasize smoothness.

Reshape CT Mesh (2)



Repair cleaning errors,
smoothed mesh

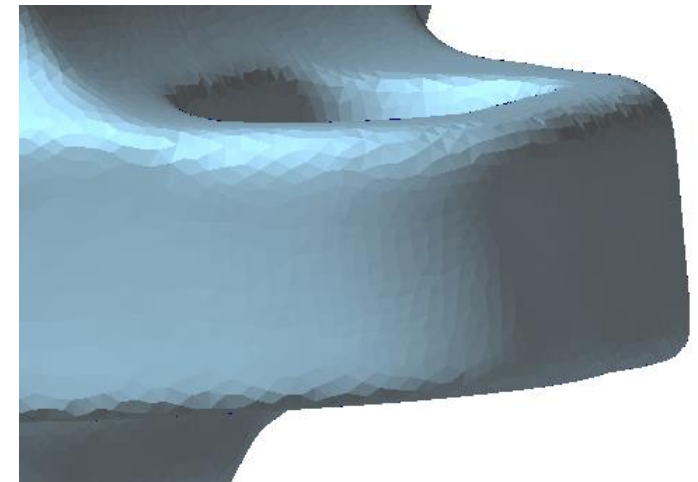
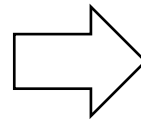
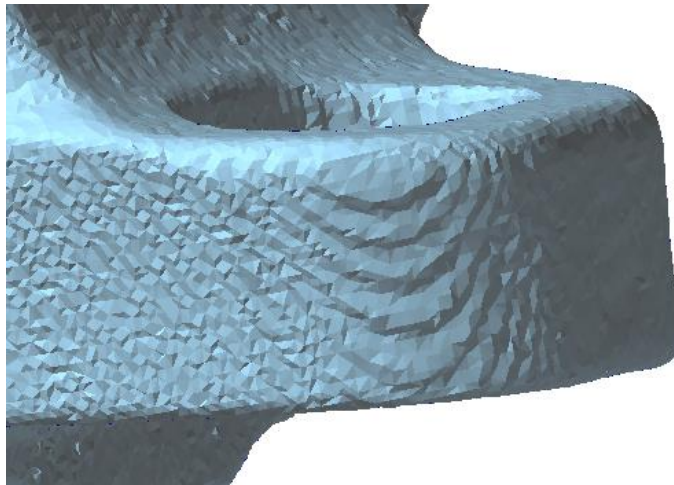
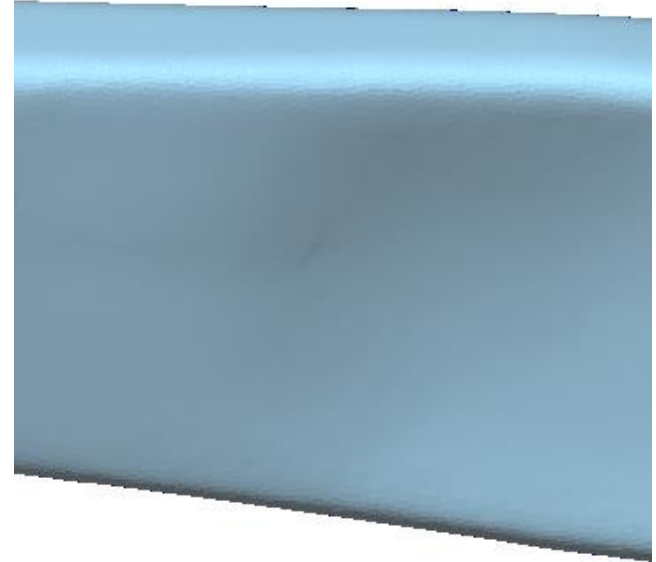
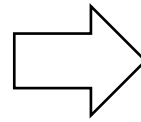
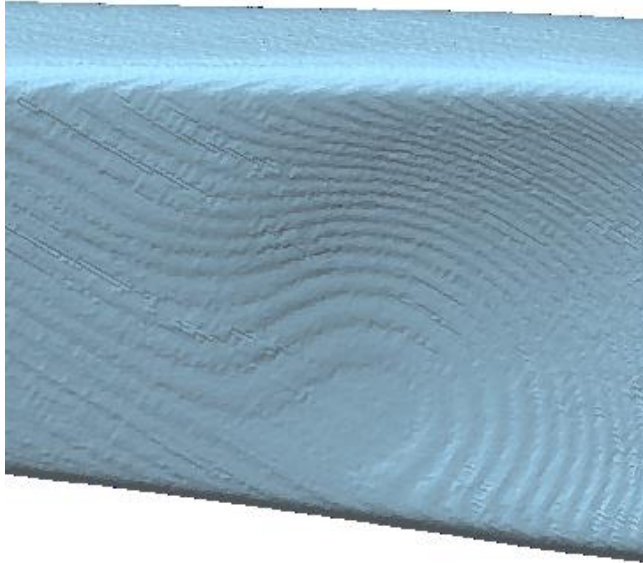


Cleaning		
<input checked="" type="checkbox"/> Inspection Items	▼	Detection Qty
<input checked="" type="checkbox"/> Reversed Faces	?	0
<input checked="" type="checkbox"/> Gap between Shells	▼ ?	0
<input checked="" type="checkbox"/> Tiny Faces	▼ ?	132
<input checked="" type="checkbox"/> Irregular Connection	?	6081
<input checked="" type="checkbox"/> Holes	▼ ?	0
<input checked="" type="checkbox"/> Folded Faces	?	180
<input checked="" type="checkbox"/> Small Shells	▼ ?	855
<input checked="" type="checkbox"/> Overlapped Shells	▼ ?	0
<input checked="" type="checkbox"/> Self-Intersection	?	942

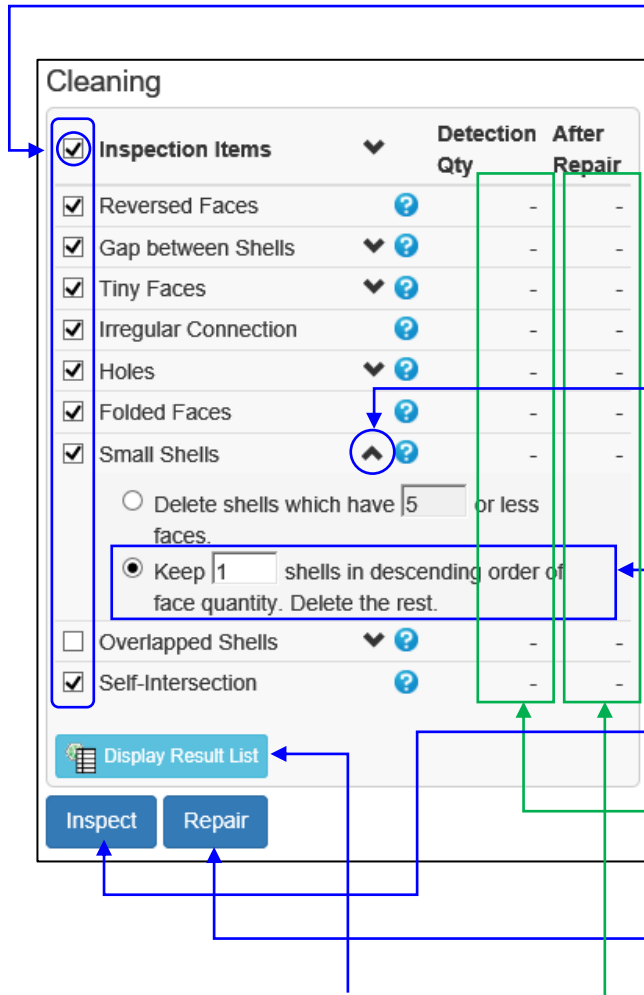
Cleaning		
<input checked="" type="checkbox"/> Inspection Items	▼	Detection Qty
<input checked="" type="checkbox"/> Reversed Faces	?	0
<input checked="" type="checkbox"/> Gap between Shells	▼ ?	0
<input checked="" type="checkbox"/> Tiny Faces	▼ ?	1
<input checked="" type="checkbox"/> Irregular Connection	?	0
<input checked="" type="checkbox"/> Holes	▼ ?	0
<input checked="" type="checkbox"/> Folded Faces	?	0
<input checked="" type="checkbox"/> Small Shells	▼ ?	0
<input checked="" type="checkbox"/> Overlapped Shells	▼ ?	0
<input checked="" type="checkbox"/> Self-Intersection	?	0

Reshape CT Mesh (3)

Reduces wavy artifacts



Cleaning



(1) If the check box at the top is checked, all inspection items will be turned on.
For CT-derived meshes, it is not necessary to inspect / correct "Overlapped Shells".

(2) Click this icon to see detailed parameters.

(3) Turn on this radio button. If you want to leave plural shells, set the number of shells to remain.

(4) Click the "Inspect" button to start the inspection.

(5) The number of detected error parts is displayed.

↓ If there are detected parts, repair them.

(6) Click the "Repair" button to start automatic correction.

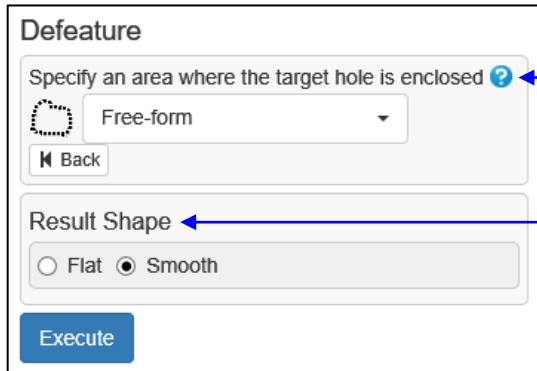
(7) The number of error parts after correction is displayed.

(8) "Display Result List" button is clicked, the temporary figure of the detected parts will not disappear even if "Defeature" command is started.

If there are detected parts after repair, fix them with the "Defeature" command.

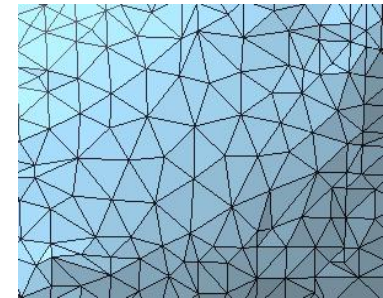
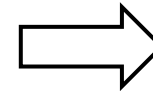
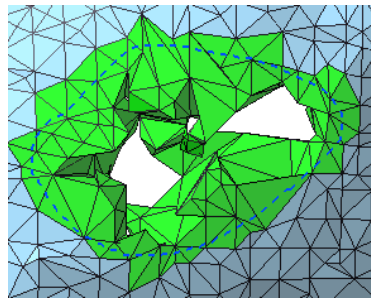
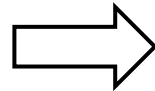
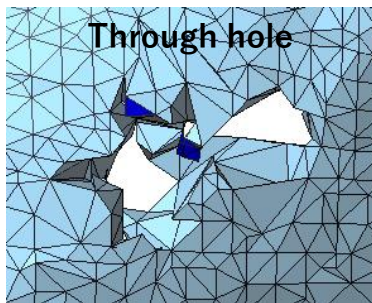
Defeature

“Defeature” command removes cleaning error spots, through holes, blind holes, dents, protrusions, etc. in the indicated area.



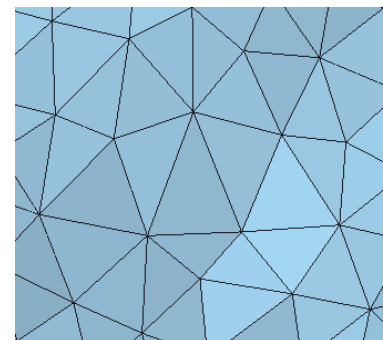
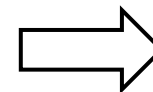
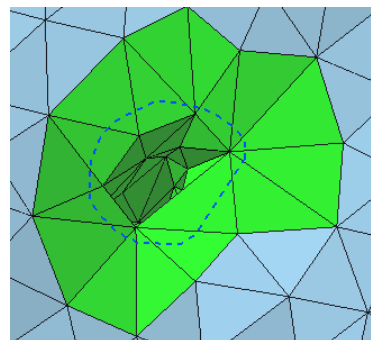
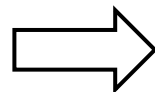
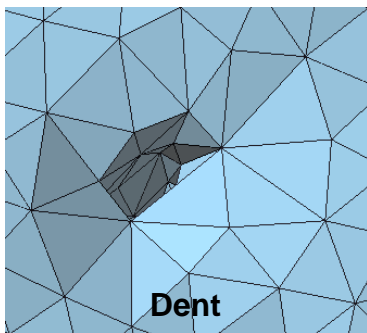
Drag the area while viewing the area to be processed from directly above.

Turn on the radio button "Smooth".



Specify areas to defeature

Execute



Various shaping functions

There are other commands to help shape the CT-derived mesh, such as:

- Functions to smooth (hold down the [Ctrl] key and click [here](#) to go to the description page)

Smoothing

smooths the mesh.

Make Flat / Cylindrical

Makes the indicated area flat or cylindrical.

- Functions to edit holes (hold down the [Ctrl] key and click [here](#) to go to the description page)

Fill Caves

Automatically detects and corrects through holes and blind holes.

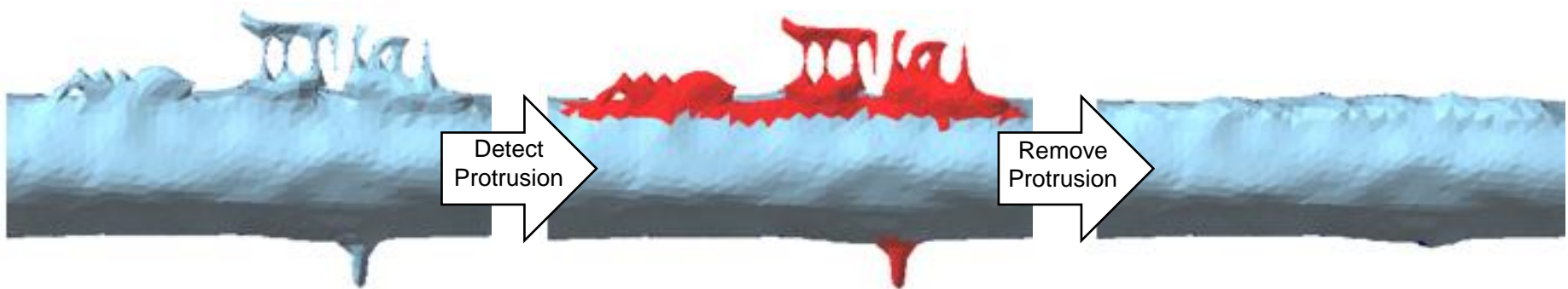
Reshape Hole

Makes the sides and bottom of through holes of blind holes cylindrical or flat.
The hole dimensions such as diameter can be changed.

- Function to remove protrusions

Remove Protrusion

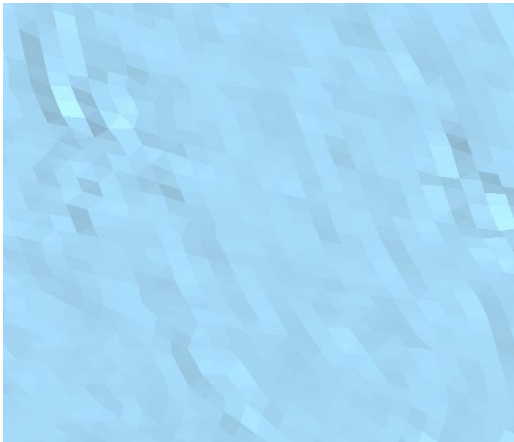
Automatically detects and removes protrusions.



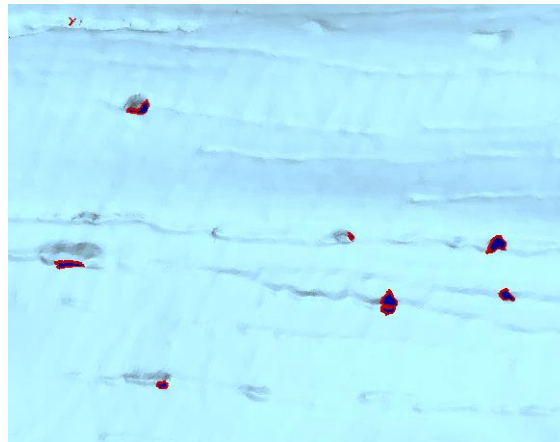
Correction and reshaping of mesh derived from optical measurement

Meshes (polygon models) created based on optical measurement data often have the following shape problems. This chapter describes commands that fix such issues.

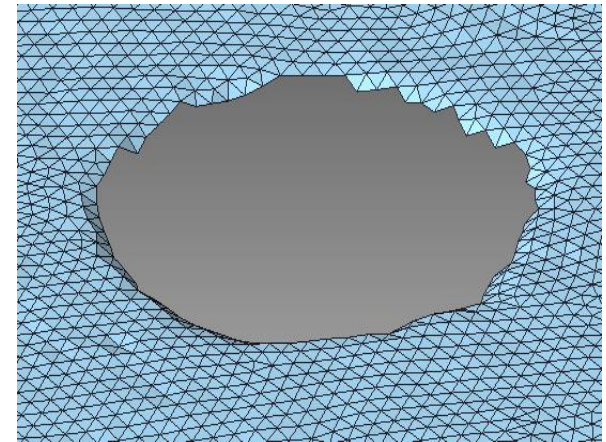
- (a) Self-intersections, folds, and needle-like elongated triangles.
- (b) Edges shared by three or more faces.
- (c) Roughness (small irregularities) on the surface and minute steps.
- (d) Holes in the shell that appears where light does not reach.
- (e) Shape disorder near the shell boundary.
- (f) Noise shells.



Roughness and dents



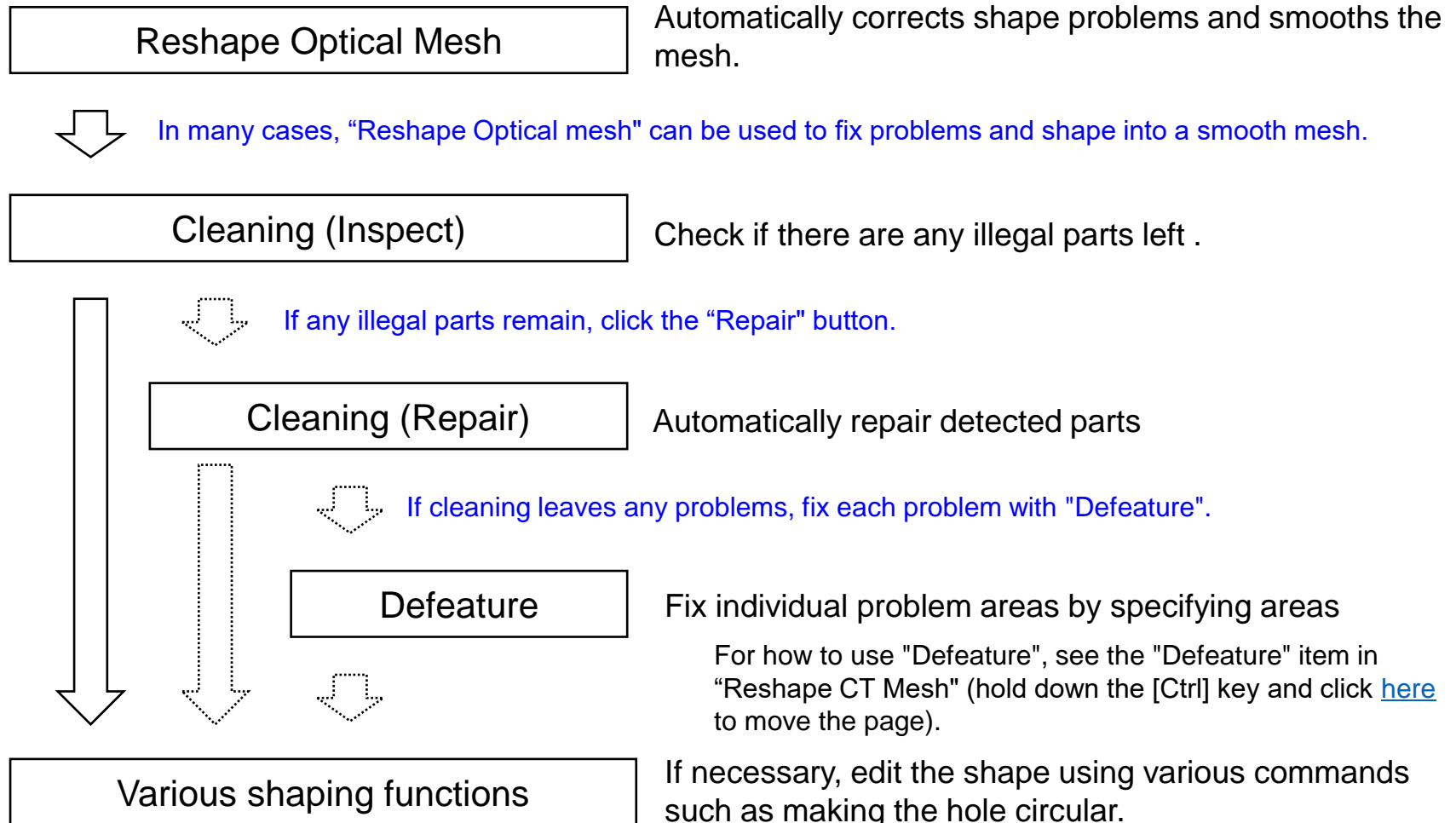
Holes where light does not reach



Shape disorder near the shell boundary

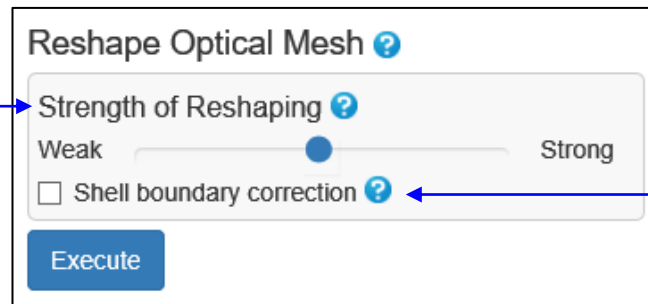
Operating procedure

Simply run the “Reshape Optical Mesh” command to solve many of the problems with optical-derived meshes. If any problems remain, correct them as follows. Each function is explained on the following pages.



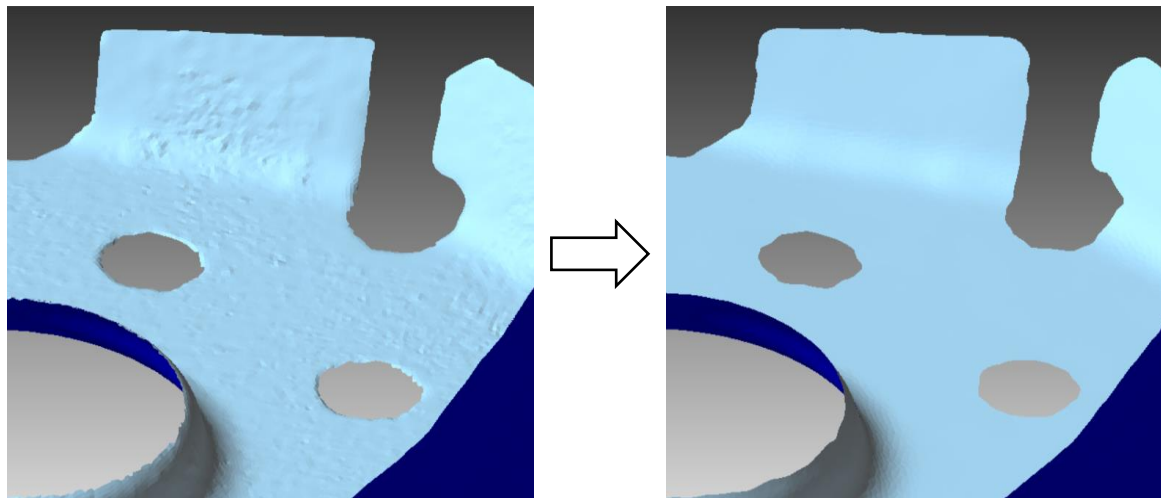
Reshape Optical Mesh

This improves the shape problems found in meshes derived from optical measurements and automatically reshapes the mesh so that it has a smooth, equilateral triangle-like face group. By simply executing this command, many of the shape defects and irregularities found in the mesh derived from optical measurement can be automatically corrected. This command leaves the shell with the largest number of faces and removes the other shells.

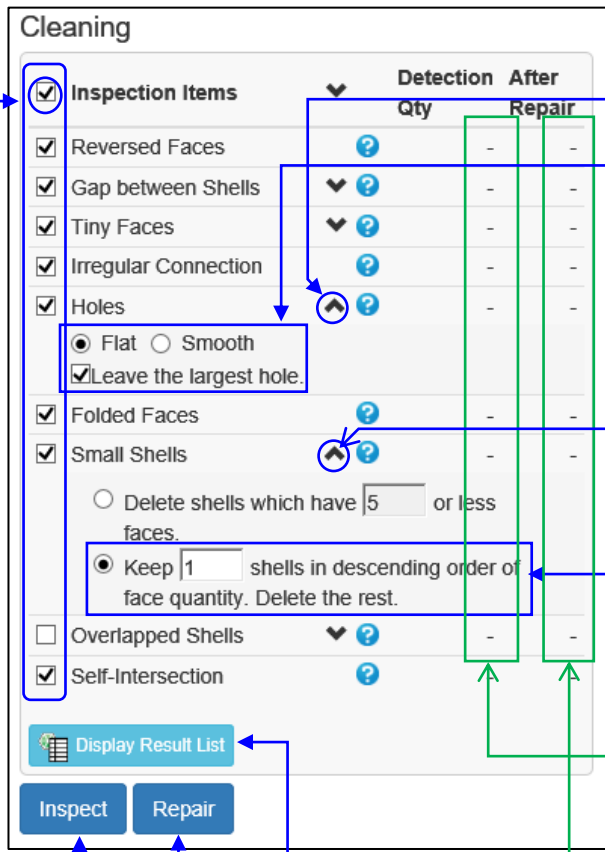


The degree of strength to smooth.
(Select from 3 levels)
Select "Weak" if accuracy is important,
and "Strong" if smoothness is important.

If checked, the bend of the mesh near shell boundaries is reshaped and the shape of the shell boundary lines and the surrounding mesh surface are smoothed.



Cleaning



(1) If the check box at the top is checked, all inspection items will be turned on. For Optical-derived meshes, it is not necessary to inspect / correct "Overlapped Shells".

(2) Click this icon to see detailed parameters of the "Holes".

(3) If you want to create a solid model, do not check "Leave the largest hole". If you want to create a surface model with no holes (only the outer circumference of the shell boundary), check "Leave the largest hole". If you want to create a surface model with holes (there are shell boundaries other than the outer circumference), uncheck "Holes". Use the "Fill hole" command to inspect and repair holes.

(4) Click this icon to see detailed parameters of the "Small Shells".

(5) Turn on this radio button. If you want to leave plural shells, set the number of shells to remain.

(6) Click the "Inspect" button to start the inspection.

(7) The number of detected error parts is displayed.

⇩ If there are detected parts, repair them.

(8) Click the "Repair" button to start automatic correction.

(9) The number of error parts after correction is displayed.

(10) "Display Result List" button is clicked, the temporary figure of the detected parts will not disappear even if "Defeature" command is started.

If there are detected parts after repair, fix them with the "Defeature" command.

Various shaping functions

There are other commands to help shape the CT-derived mesh, such as:

- Functions to smooth (hold down the [Ctrl] key and click [here](#) to go to the description page)

Smoothing

smooths the mesh.

Make Flat / Cylindrical

Makes the indicated area flat or cylindrical.

- Functions to edit holes (hold down the [Ctrl] key and click [here](#) to go to the description page)

Reshape Hole

Makes the sides and bottom of through holes of blind holes cylindrical or flat.

The hole dimensions such as diameter can be changed.

Fill Holes

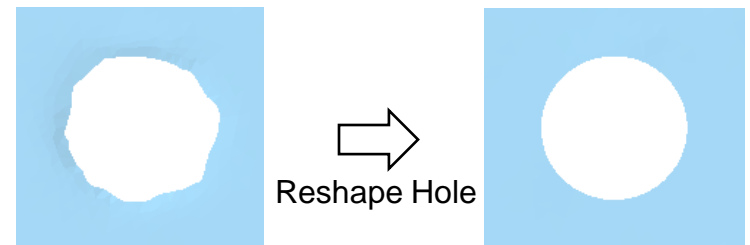
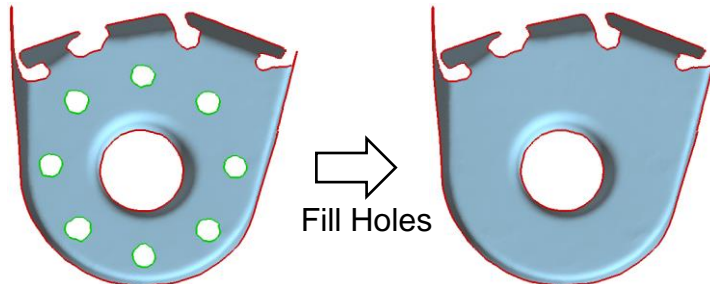
Fills the holes in the shell.

Delete Boundary Faces

Deletes the faces near the shell boundary.

Extension

Smoothly extends the mesh at the shell boundaries.



Correction and reshaping of mesh derived from CAD

Many of the problems found in polygon meshes that approximate CAD data to triangles are due to the following 2 items.

(a) Inconsistency at the boundary of the CAD surface

There may be no adjacency between CAD surfaces, or even if they do, the boundaries may be separated. In this case, the mesh has the following problems at the boundaries of the CAD plane:

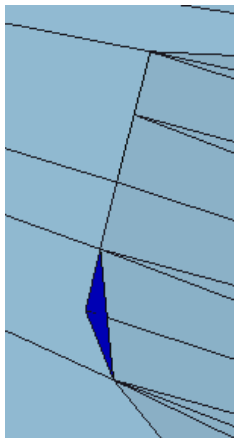
- There are holes
- Steps and overlaps occur

(b) Incorrect polygon output operation

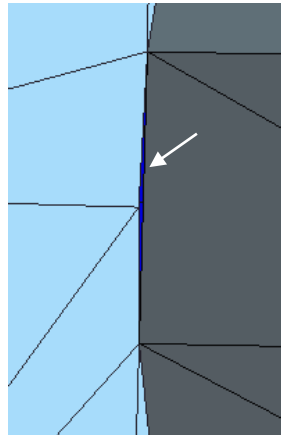
If there are operation errors when converting a CAD curved surface to triangles and outputting them to a file such as STL, the following problems may occur.

- There is a mixture of unnecessary faces or a shortage.
- Polyhedral approximation without trimming

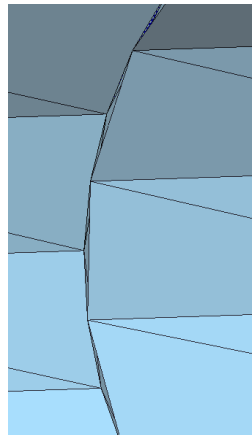
(a) Inconsistency at the boundary of the CAD surface



Self-intersection

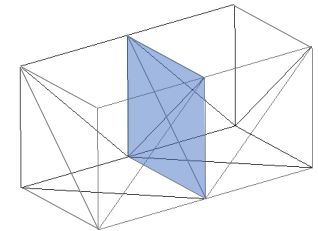
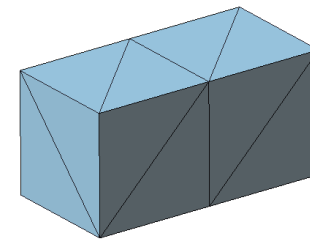


Hole

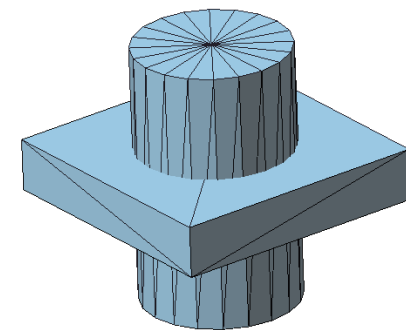


Step

(b) Incorrect polygon output operation



Unnecessary face
(There are faces inside)



Untrimmed surface

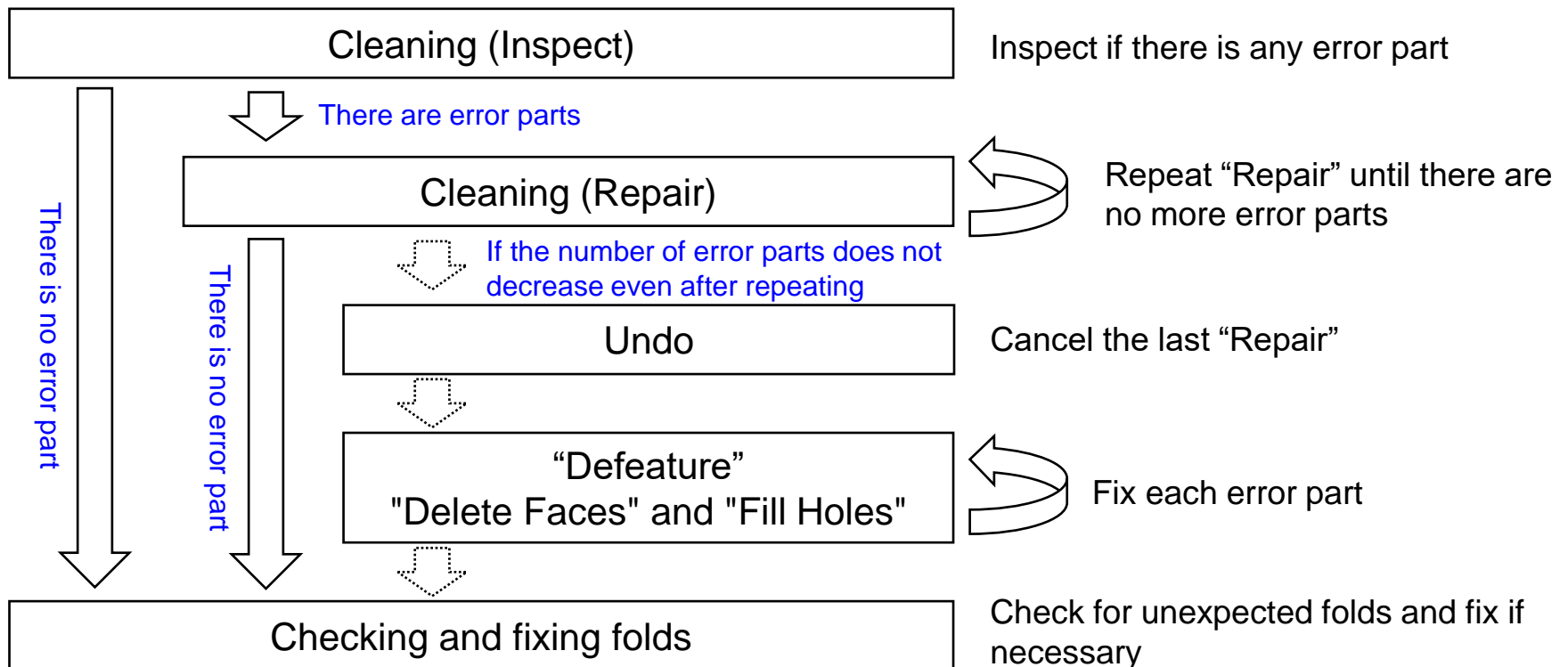
Operating procedure

The "Cleaning" command can fix many bad spots.

If the incorrect part remains even after executing "Correction", repeat "Correction".

If the number of error parts does not decrease even after repeating, the remaining error parts can be corrected by using "Defeature" or by using "Delete Faces" and "Fill Holes".

After making the correction, use the "Crease Detection" command to check for unexpected folds. To remove the folds, use "Defeature", "Merge Vertices", "Swap Edge", "Delete Faces" and "Fill Holes".



Cleaning

(1) If the check box at the top is checked, all inspection items will be turned on.

Inspection Items	Detection Qty	After Repair
<input checked="" type="checkbox"/> Reversed Faces	-	-
<input checked="" type="checkbox"/> Gap between Shells	※	-
<input checked="" type="checkbox"/> Tiny Faces	-	-
<input checked="" type="checkbox"/> Irregular Connection	-	-
<input checked="" type="checkbox"/> Holes <input checked="" type="radio"/> Flat <input type="radio"/> Smooth <input type="checkbox"/> Leave the largest hole.	-	-
<input checked="" type="checkbox"/> Folded Faces	-	-
<input checked="" type="checkbox"/> Small Shells <input checked="" type="radio"/> Delete shells which have 5 or less faces. <input type="radio"/> Keep 1 shells in descending order of face quantity. Delete the rest.	-	-
<input checked="" type="checkbox"/> Overlapped Shells	-	-
<input checked="" type="checkbox"/> Self-Intersection	-	-

If there is a detection point in the "shell boundary gap", there may be a gap between the faces (triangles) at the boundary of the CAD surface.

(2) Click ▼ to see detailed parameters of the "Holes".
 If you want to create a solid model, do not check "Leave the largest hole"
 If you want to create a surface model with no holes (only the outer circumference of the shell boundary), check "Leave the largest hole".
 If you want to create a surface model with holes (there are shell boundaries other than the outer circumference), uncheck "Holes". Use the "Fill hole" command to inspect and repair holes.

(3) Click ▼ to see detailed parameters of the "Holes". There are two types of detection methods.
 In the initial state, shells with 5 or less faces (changeable) are detected as shown in the figure on the left. If you know the number of shells that make up the mesh, select the bottom row and enter the number of shells.

(4) Click the "Inspect" button to start the inspection.

(5) The number of detected error parts is displayed.

⇩ If there are detected parts, repair them.

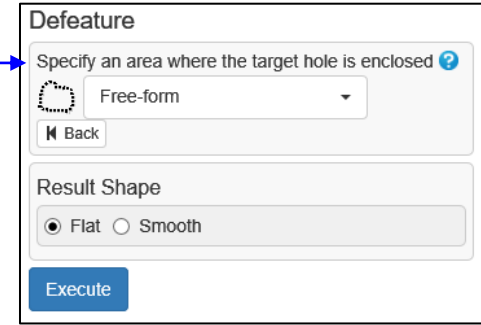
(6) Click the "Repair" button to start automatic correction.

(7) The number of error parts after correction is displayed.

(8) "Display Result List" button is clicked, the temporary figure of the detected parts will not disappear even if other command is started.

“Defeature” “Delete Faces” “Fill Holes”

If the cleaning command could not be repaired, fix it with "Defeature" command. If the shape created by "Defeature" does not match your intention, such as when there is a ridgeline in the modified part as shown in the example below, delete the faces in the problem part with the "Delete Face" command and use the "Fill Holes" command to fill the hole.

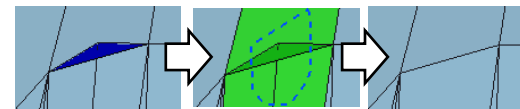


To fix the problem area, set the Defeat command as follows:

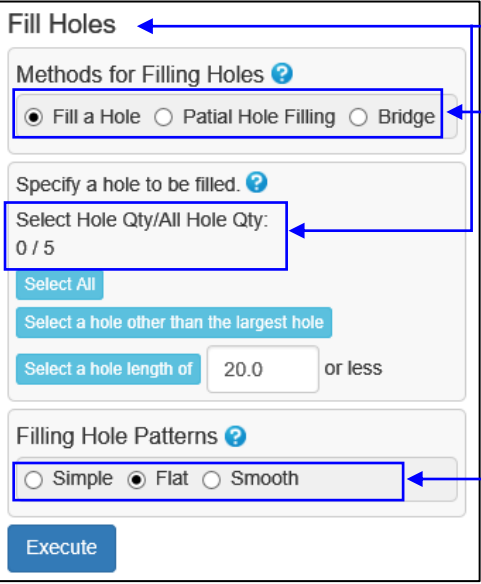
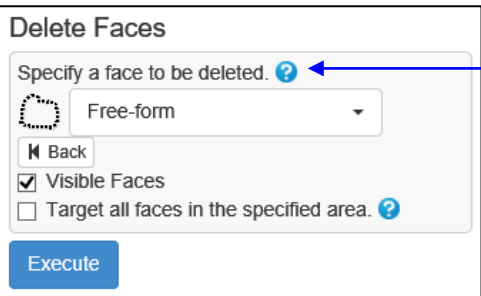
- Area selection method = free area
- "Result shape" = "flat"
- ("Smooth" if you want to add roundness)

To delete the problem area, set the "Delete Face" command as follows.

- Area selection method = free-form
- "Visible face" = checked
- "Target all faces in the specified area" = unchecked



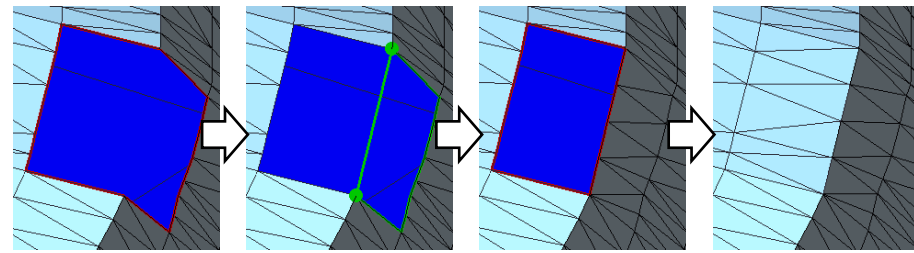
Example of “Defeature”



When "Fill Holes" command is selected, the hole circumference is displayed in red and the number of holes is displayed.

For “Method for Filling-Holes”, usually select "Fill a Hole". Click the hole to fill and the hole circumference will turn green.

If you want to create a ridgeline in the shape after filling the holes as shown in the figure on the right, select "Partial Hole Filling" and click the two vertices at the end of the ridgeline.



Click on the two vertices Execute "Partial Hole Filling" Execute "Fill a Hole"

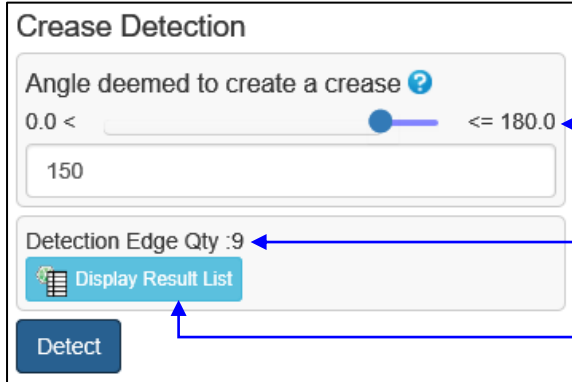
"Simple" connects the vertices around the hole with a line segment.

"Flat" fills the holes flat.

"Smooth" fills the hole so that it connects smoothly to the face around the hole.

Check and fix folds

Use the "Crease Detection" command to check for folds.



"Crease Detection" command detect edges where the faces on both sides are bent more than the specified angle and display them in red.

Specify the angle at which it is considered that there is no part of the mesh that is bent beyond this angle.

The number of detected edges is displayed.

"Display Result List" button is clicked, the temporary figure of the detected parts will not disappear even if other command is started.

Use the following command to correct the folds.

Defeature

Delete Faces & Fill Holes

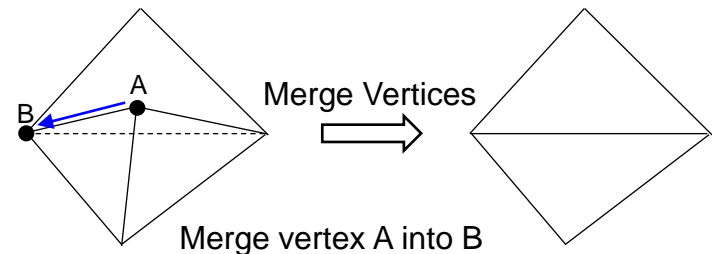
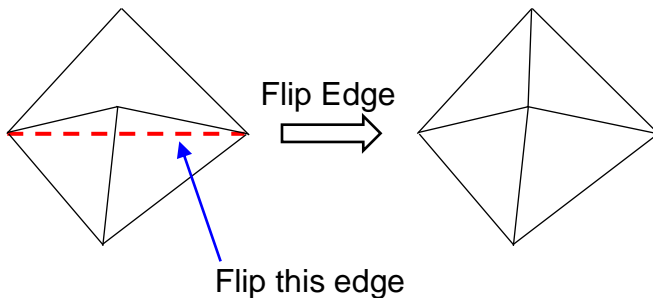
See previous page.

Flip Edge

Replace the edges with the diagonal of the quadrilateral created by the triangles on either side of the edge.

Merge Vertices

Move a vertex to the positions of adjacent vertices and combine them into one vertex.

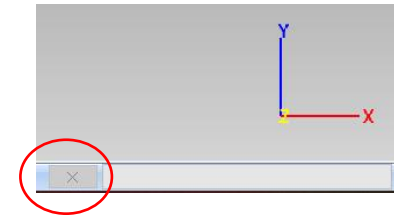


Mesh Edit

Commands to reduce the number of faces

To reduce the number of faces, use the "Simplify" command if accuracy is important, and the "Remesh" command if size uniformity and face shape are important.

Both commands show how the mesh changes as the process progresses. If you click the button to stop processing the command "x" (figure on the right) at the bottom right of the POLYGONAlmeister window, the processing will stop, and the mesh displayed at that time will be the processing result of the command.



Simplify

Reduce the number of faces without changing the shape as much as possible.

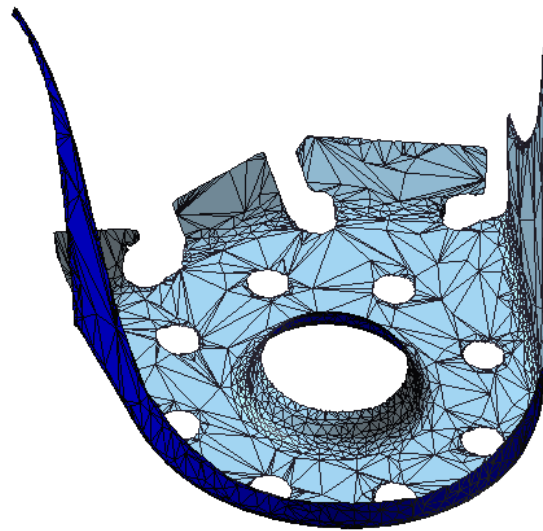
It is also possible to reduce the number of faces on the condition that it does not deviate more than the specified value from the original shape.

Remesh

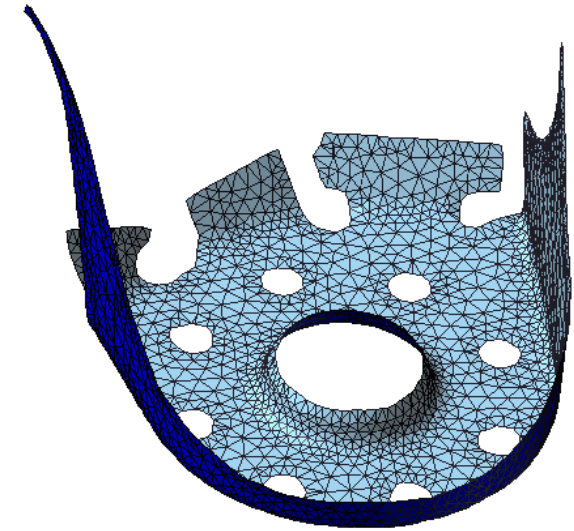
Recreate each face so that it is closer to an equilateral triangle, while keeping the processed mesh away from the original mesh. The number of faces can be reduced by increasing the edge length (parameter value). Decreasing the edge length will increase the number of faces.



Original mesh (about 156,000 faces)



After simplification (about 4,000 faces)



After remeshing (about 4,000 faces)

Commands to smooth

Here are three commands to smooth a mesh.

Smoothing

Reduces unevenness of the mesh. There are four types of smoothing methods.

“Feature Preserving” smooths the unbroken areas so that the change in the normal of the face is small.

“Polish 1” moves each vertex onto a surface that is approximated (almost passed) using the vertices around it.

“Polish 2” approximates a relatively flat area to a smooth surface and moves each vertex so that it is located on that surface.

“Delete Spike Vertex” removes vertices that are only one point off the perimeter due to measurement noise.

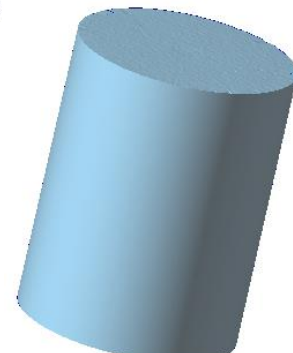
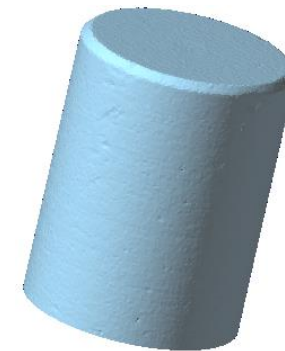
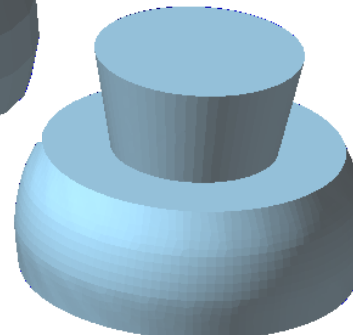
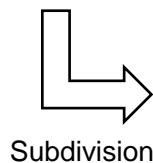
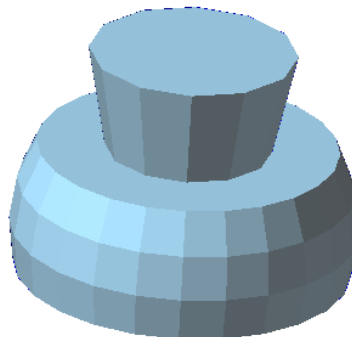
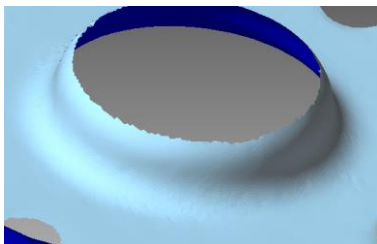
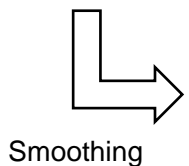
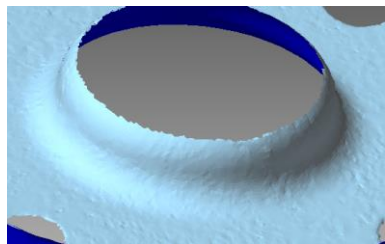
Subdivision

Splits the face into smaller faces, taking into account the bulge.

You can smooth the mesh with rough faces and conspicuous breaks between the faces.

Make Flat / Cylindrical

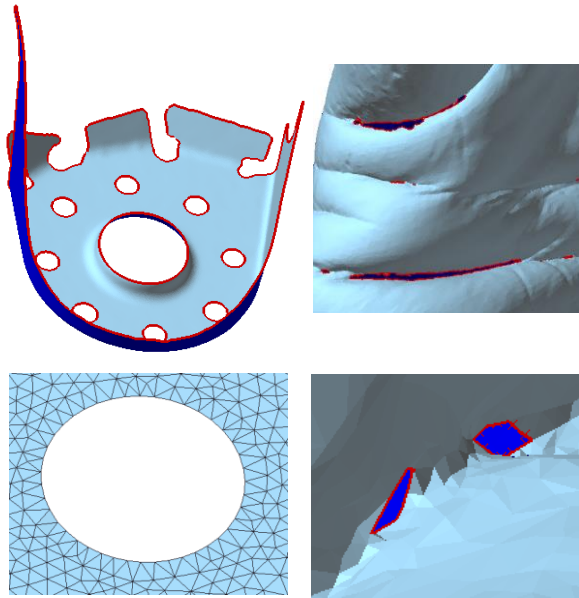
Makes the specified area into a flat or cylindrical shape. (Approximates to a plane or cylinder and moves the vertices on it.)



Commands for holes

There are three types of mesh holes handled by POLYGONALmeister.

Hole



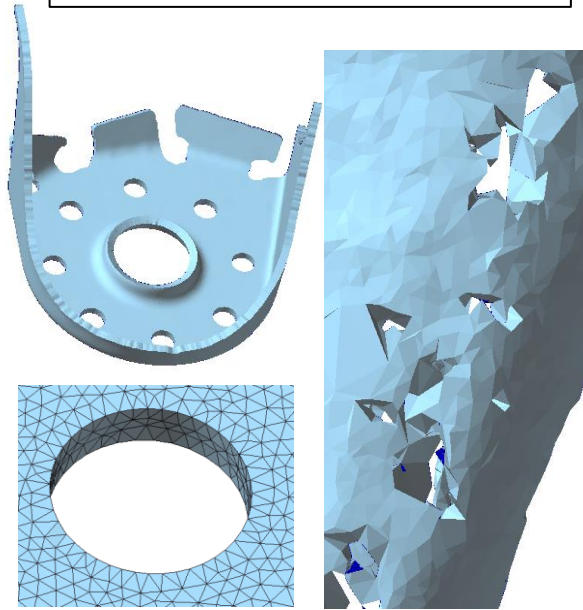
A hole in the surface of the mesh, also called a shell boundary.

Imagine a hole in a piece of paper or cloth (without thickness).

Holes are present in optical measurements, such as when the face is missing due to lack of light or when measuring a model with holes.

To fill holes, use the "Fill Holes", "Cleaning (holes)", and "Defeature" commands.

Through Hole



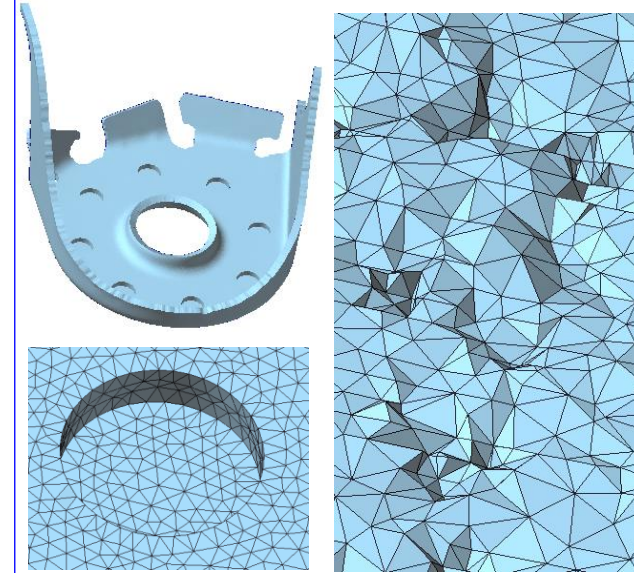
It is a hole that penetrates into a solid.

Imagine a hole that penetrates a solid that was drilled for bolting.

Through holes are present for bolting or when the model is thin on CT measurements.

To fill through holes, use the "Fill Caves", and "Defeature" commands.

Blind Hole



It is a dent on the mesh surface.

Imagine a hole dug in the ground.

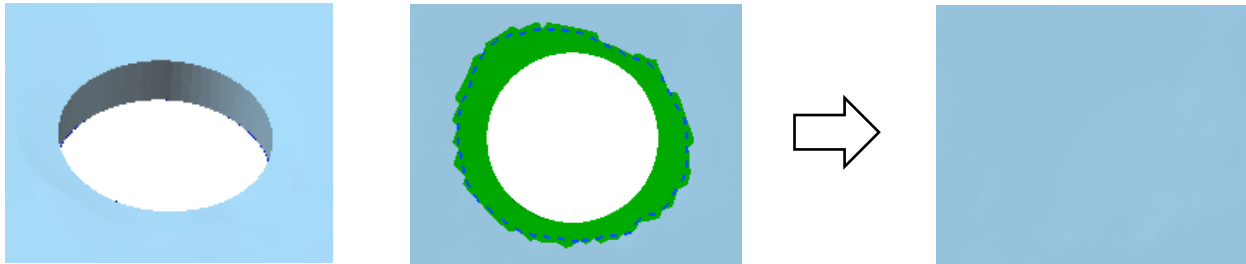
The blind hole exists in the blind hole of the machine part, the dent of the measurement object, the roughness of the measurement surface, and so on.

To fill blind holes, use the "Fill Caves", and "Defeature" commands.

Fill holes (1)

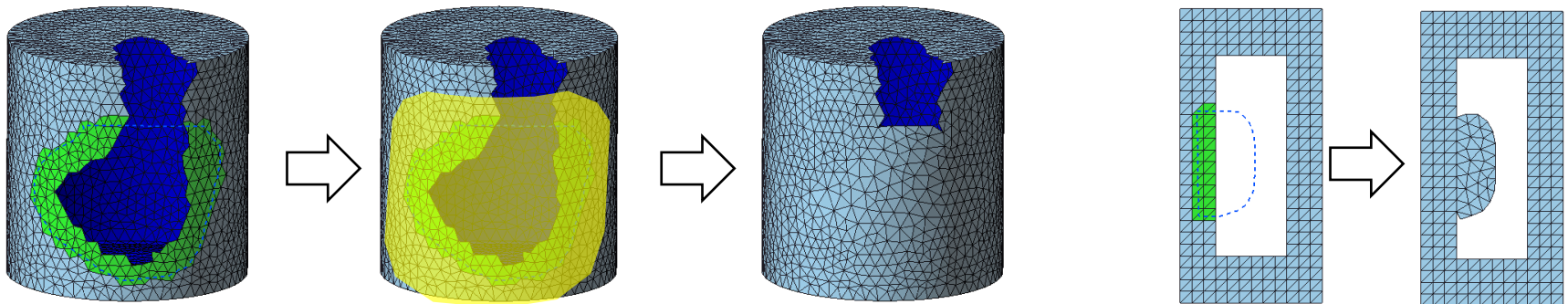
Defeature

This command can fill all three types: holes, through holes, and blind holes. While viewing the hole from directly above, drag around the hole.



Fill Region

Estimate the curved surface that passes through the shape around the hole (on the mesh surface), and create faces that fill the hole so that the faces are located on that curved surface. The range in which the surface to fill the hole is created is determined based on the trajectory of dragging in the hole. .



The system estimates the curved surface that passes through the indicated area (Yellow curved surface in the above figure)

The range to create faces is determined by the trajectory of dragging outside the mesh.

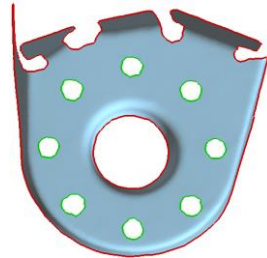
Fill holes (1)

Fill holes

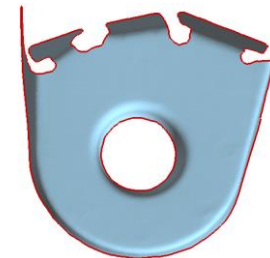
This command fills the holes on the mesh surface. There are three ways to fill the holes.

- Fill a Hole

Fill the specified holes. Plural holes can be filled at once.

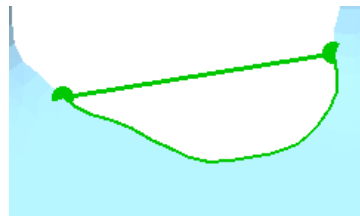


→
Fill the green shell boundaries

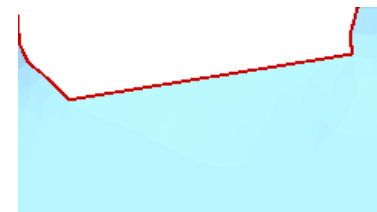


- Partial Hole Filling

Fills only part of the shell boundary, such as the dents on a shell boundary.

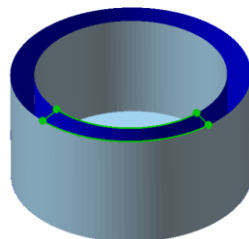


→
Fill the green shell boundaries

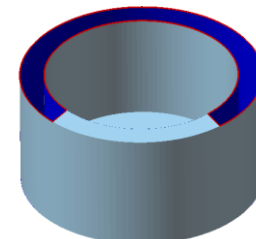


- Bridge

Two shell boundaries can be connected.

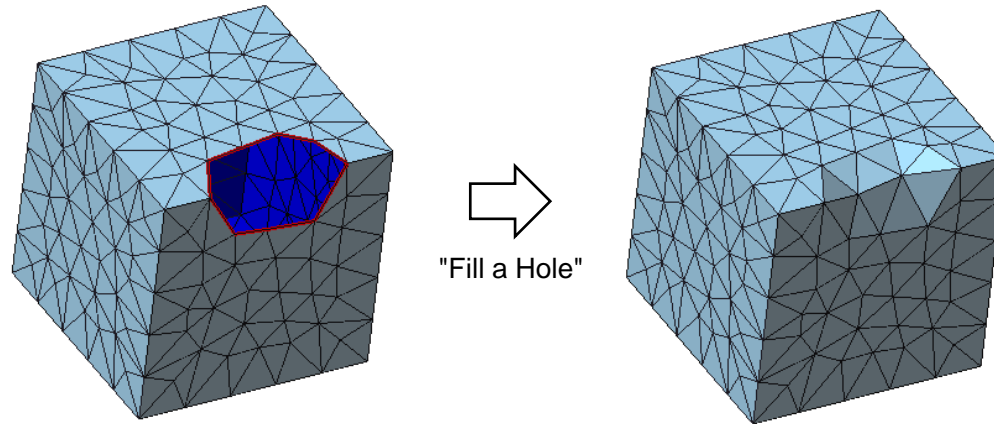


→
Connect the shell boundaries in the green range

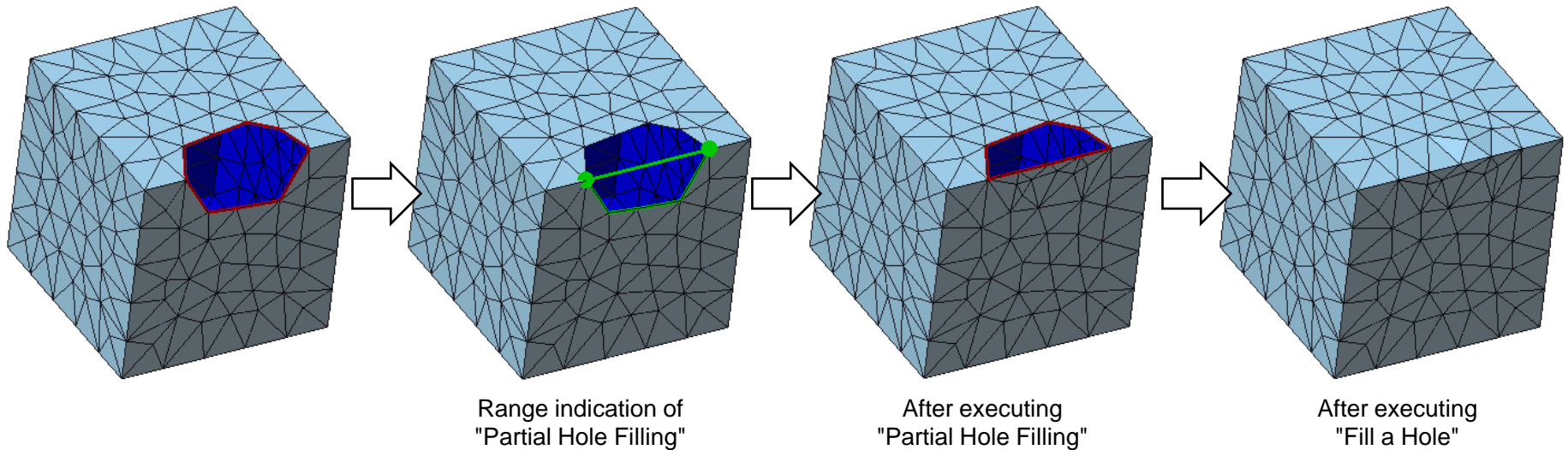


Fill holes (3)

If there is a hole in the area where the ridgeline passes, simply filling the hole may not create a ridgeline in the filled area.



As shown in the figure below, use the "Partial Hole Filling" function to fill in half, and use the "Fill a Hole" function to fill the rest.

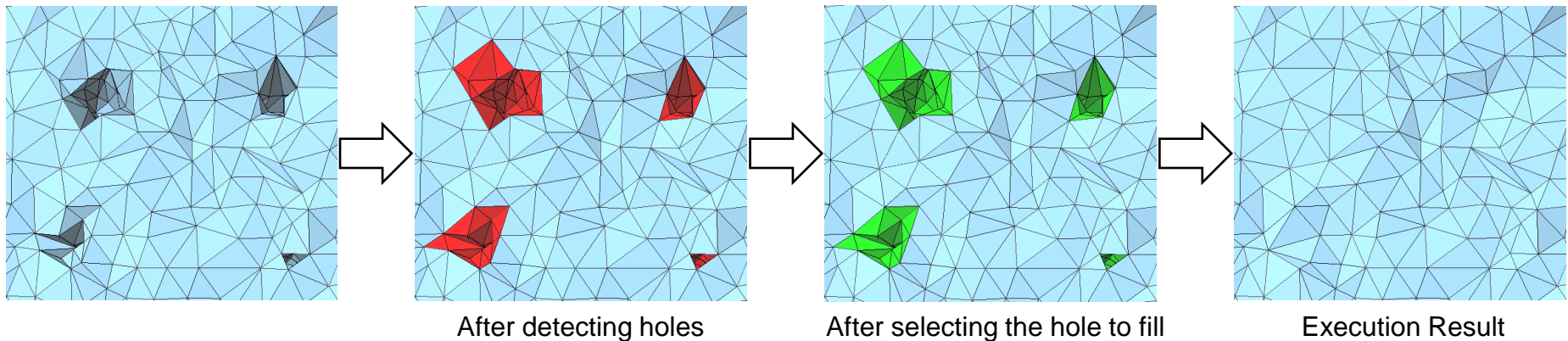


Fill holes (4)

Fill Caves

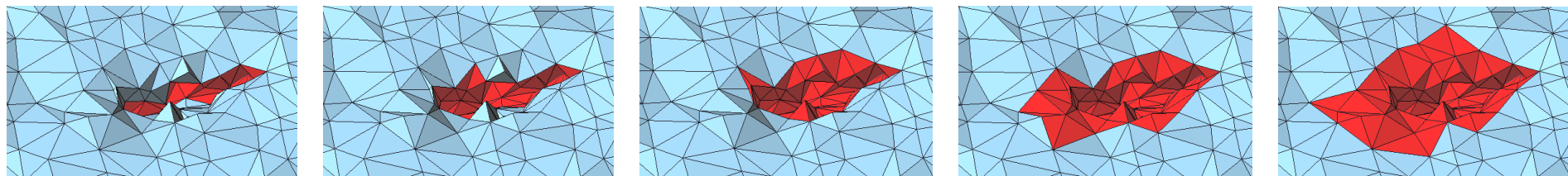
This command fills through holes and blind holes.

The area where a sphere of the specified diameter cannot be inserted is automatically detected as a hole and displayed in red. Click on the red area to turn it green. The green through holes and blind holes are filled.



If you change the hole diameter to be detected, the range of the detected area will change as shown in the figure below.

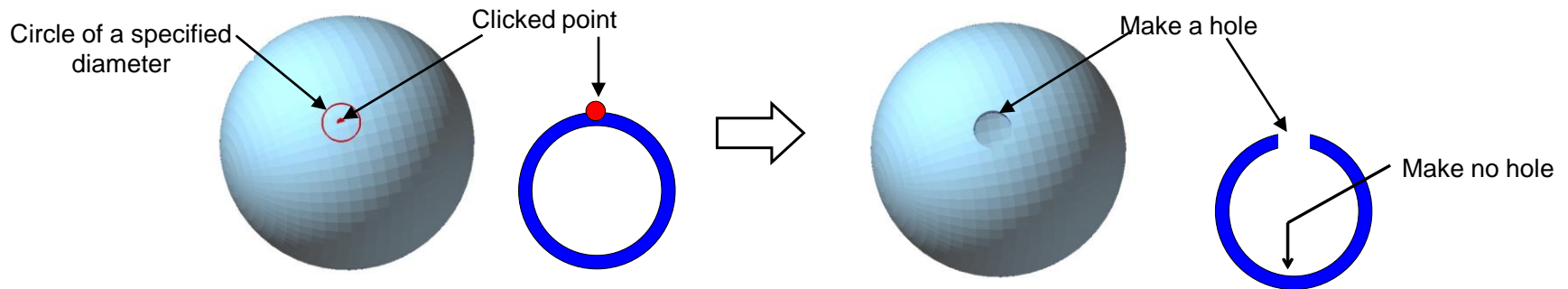
For measurement data with many through holes or blind holes, detect the hole diameter with a size of about the average edge length, and fill the hole in which the appropriate range is selected. Next, it is recommended to repeat the operation of increasing the hole diameter a little, detecting the hole, and filling in the part that seems appropriate.



Make a hole

Through Hole

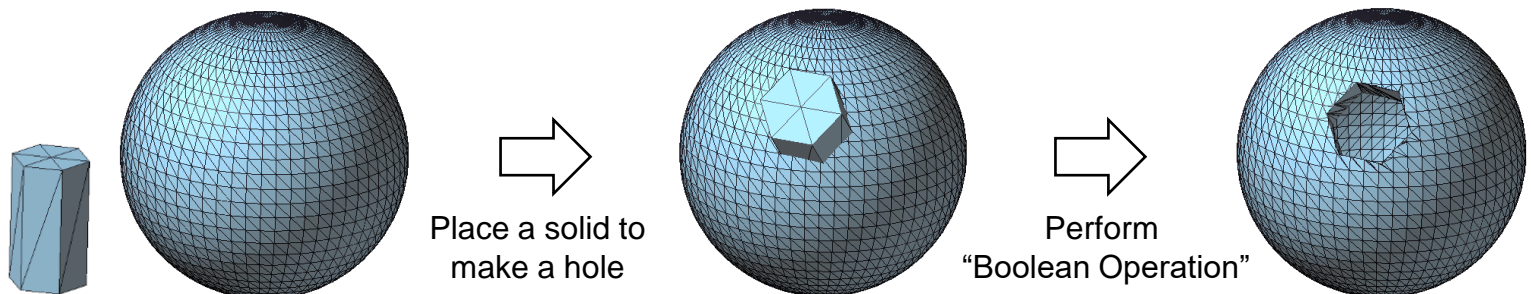
A hole with the specified diameter will be drilled around the clicked position. As shown in the figure below, even if the central axis of the hole intersects the mesh other than the clicked position, the hole will only be made at the clicked position.



Boolean Operation

Make a hole-shaped solid (using "Primitive Solid") and place it where you want to make a hole (using "Move / Copy", "Arrange Shells", "Drag Move").

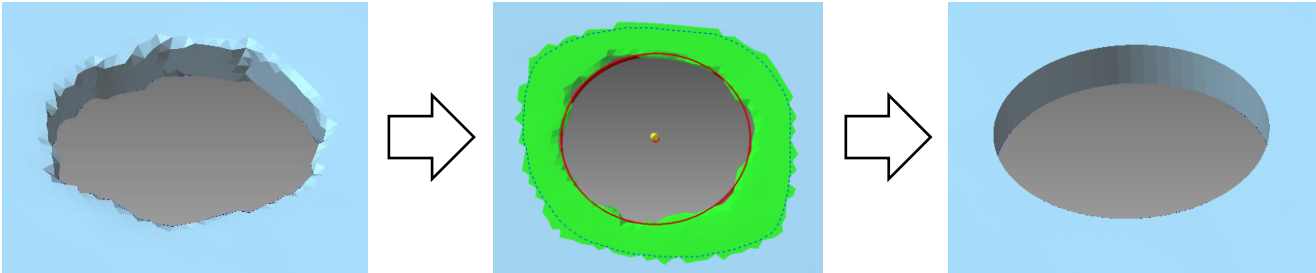
Perform a "Boolean Operation" by subtracting the placed shell from the shell to make a hole. If the outer shell and the inner hollow shell are not connected, perform a "Boolean Operation" of the product of the shell created by the above operation and the inner shell.



Reshape a Hole

Reshape Hole

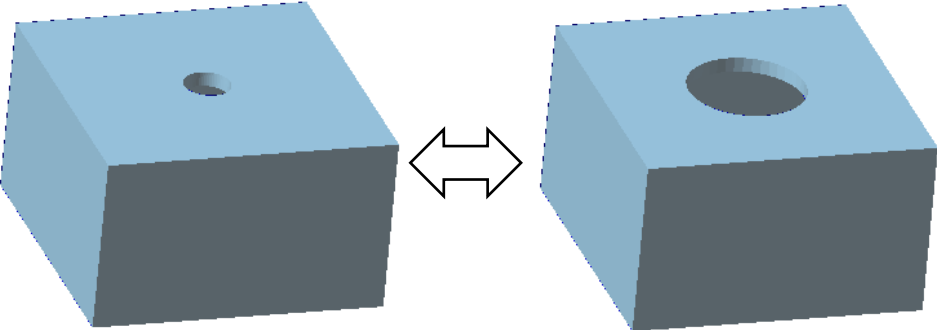
Corrects the turbulence around the holes seen in the mesh derived from the measurement. For round holes, this command supports three types of holes: holes, through holes, and blind holes.



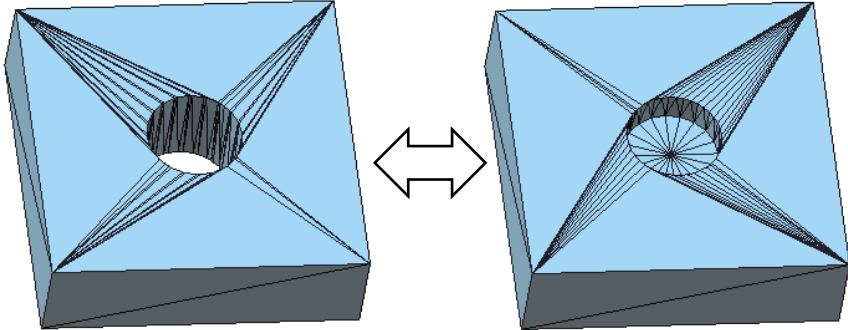
Instructions for the area to be reshaped

The result of reshaping

You can change the hole diameter. You can also change the through hole to a blind hole and the blind hole to a through hole.



Change the hole diameter

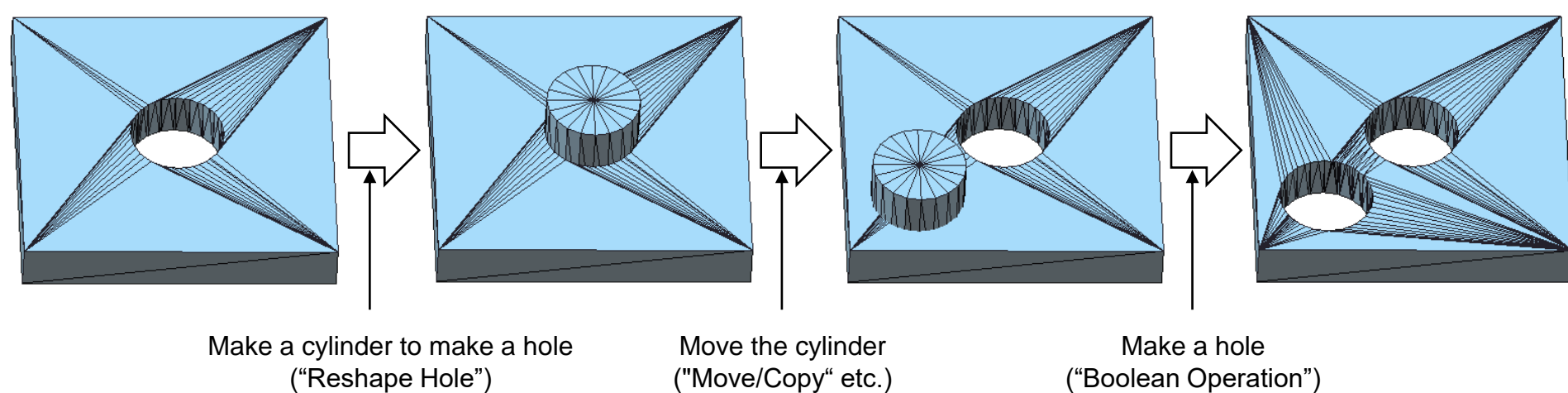


Conversion of through a hole and a blind hole

Move a hole

Reshape Hole

It is possible to copy and move a hole using “Reshape Hole” command.



Check "Create a Cylinder"

"Filled": Select when moving the hole. Create a cylinder and fill the original hole.

"Unfilled": Select when copying the hole. Create a cylinder without filling the original hole.

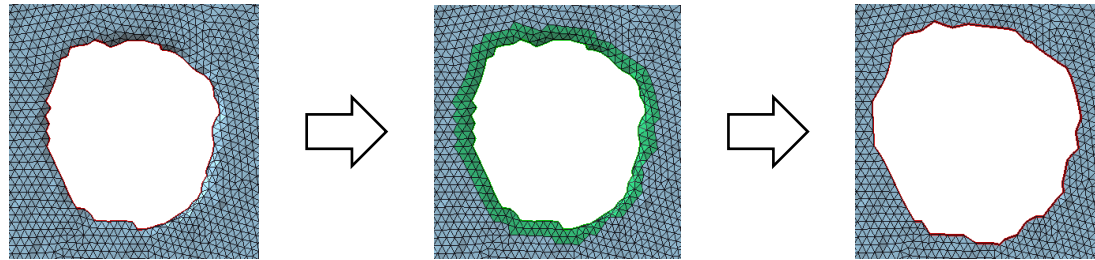
Command dialog of "Reshape Hole"

Remove around the hole

Delete Boundary Faces

Delete faces around shell boundaries. The range to be deleted can be specified by an amount such as the distance from the shell boundary.

Meshes derived from optical measurements can have unwanted irregularities near the shell boundary. This command is useful for deleting faces near shell boundaries like this.

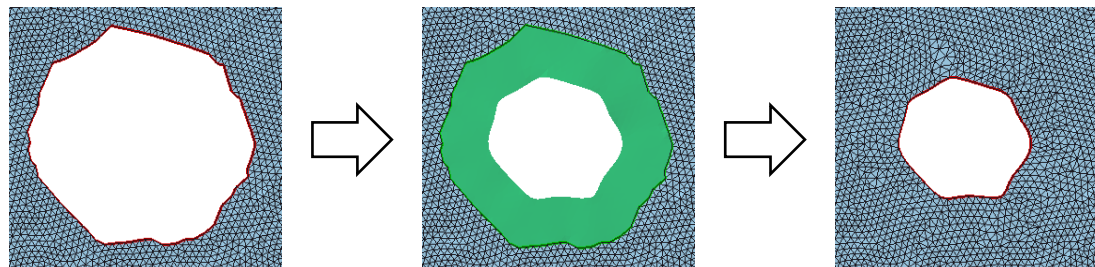


When a hole is specified, the range to be deleted is displayed.

Extend the surface around the hole

Extension

This command extends the mesh smoothly at shell boundaries.



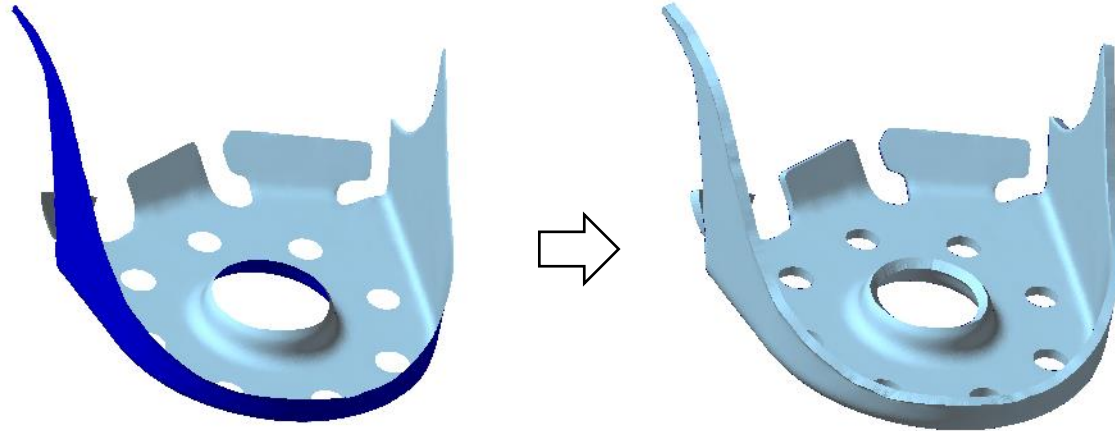
When a hole is specified, the extended image is displayed.

Commands to add thickness

Make a solid from a surface

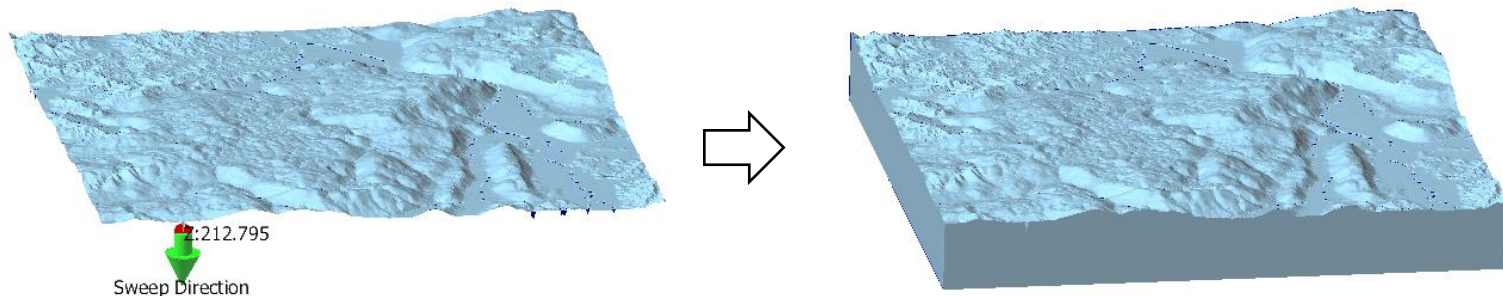
Thicken

Add the specified thickness to a surface (open shell) to make a solid (closed shell).
For a solid (closed shells), add the indicated thickness to make it hollow (add a closed shell).



Projection Solid

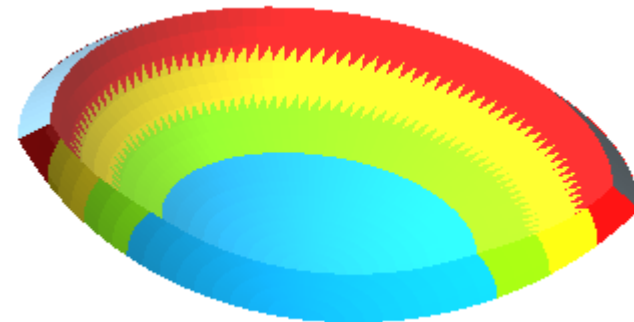
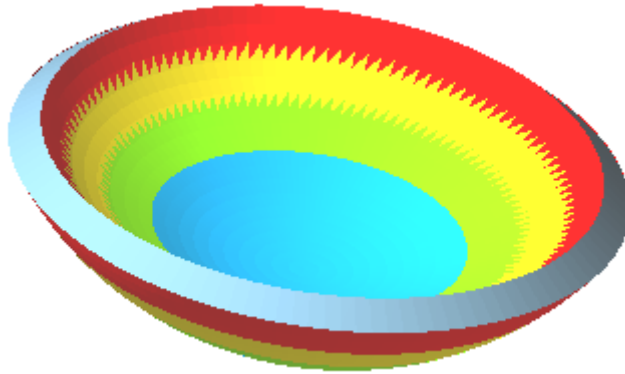
Sweeps the shell boundaries or contours of an open shell to a specified position in the specified coordinate axis direction to make a closed solid shell.



Check the thickness (1)

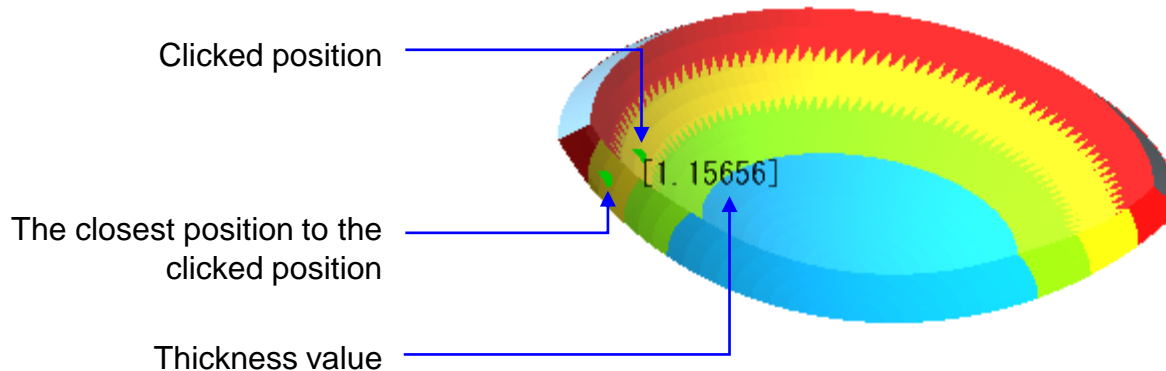
Thickness Inspection

“Thickness Inspection” command detects where the mesh thickness is less than or equal to the specified value. The detected part is painted with colors according to the thickness of 4 steps (displays a color map).



Clipped display

If you click on the detected area, the thickness value of the clicked position will be displayed.

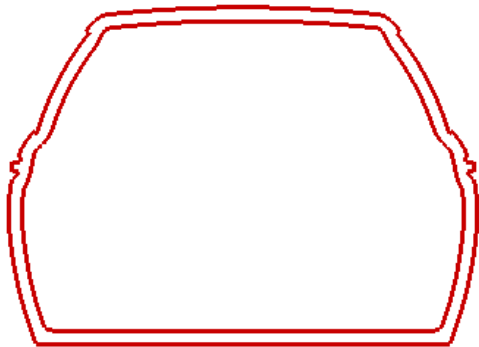
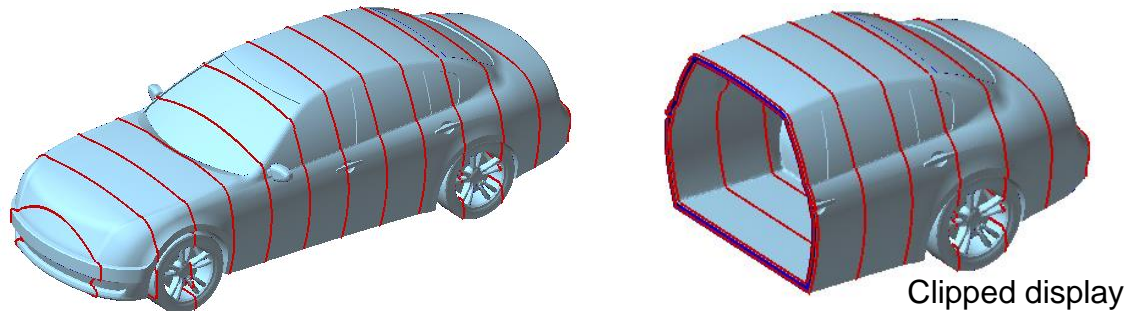


Check the thickness (2)

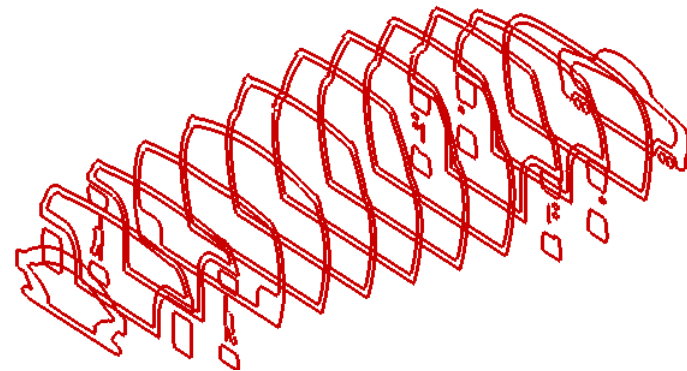
Display Section Lines

“Display Section Lines” command shows the line of intersection between the mesh and planes. There are two ways to set the planes.

- (1) Arbitrary section: A plane that includes a straight line to be dragged and the line-of-sight direction (direction perpendicular to the screen).
- (2) Equidistant section: Equally spaced planes perpendicular to the specified coordinate axis.



Arbitrary section



Equidistant section

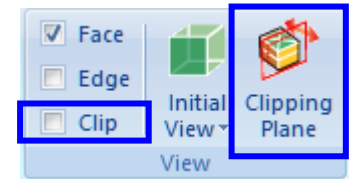
Check the thickness (3)

Clip

By using the clip function, you can see parts that cannot be seen from the outside, such as the inside of a solid, by not displaying the area of the mesh located in front of the clip surface. ◦

■ Set the Clipping Plane

Right-click on the mesh where you want to pass the clipping plane, set the viewing state for the plane orientation (normal direction) to the line-of-sight direction (direction perpendicular to the screen), and click the "Clipping plane" button on the Home tab. When the check box "Clip" is turned ON, the mesh will be clipped on the clipping plane.



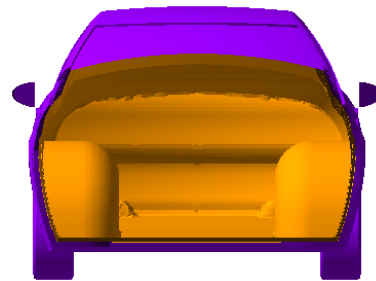
■ Move the Clipping Plane

It is possible to move the clip surface by pressing [Ctrl] key and rotating the mouse wheel (or by pressing the [Ctrl] key and pressing the [PgUp] or [PgDn] key).

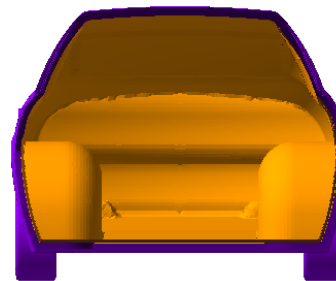
Moving the clipping plane can be operated independently of changing the viewing state such as rotation.



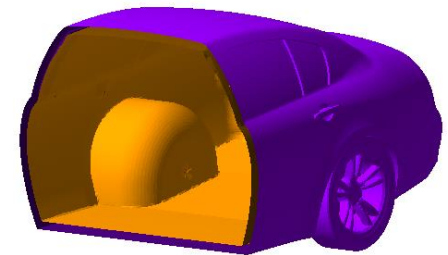
Right-click the red dot and click the "Clipping Plane" button



Check box "Clip" ON



Press the [Ctrl] key and rotate the mouse wheel to move the clipping plane



Change viewing state

Commands for alignment and difference evaluation

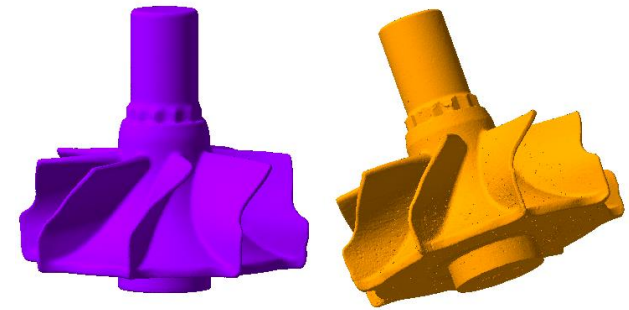
Align

Arrange Shells

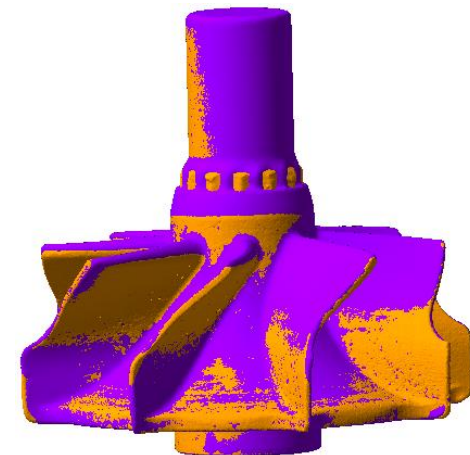
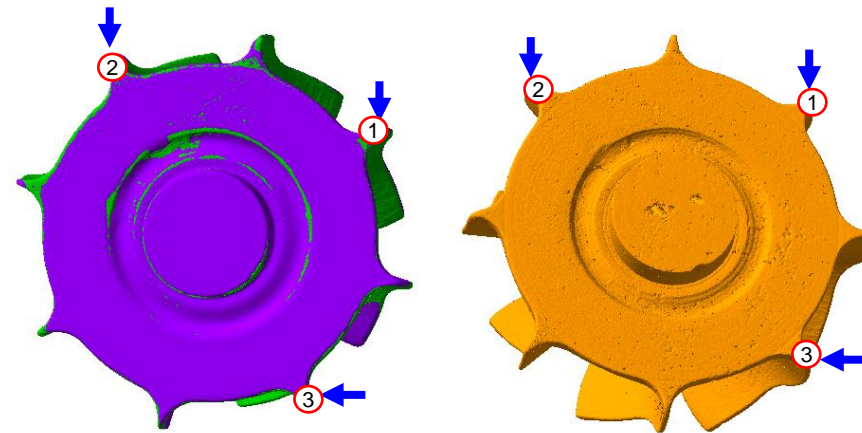
After roughly aligning with "3 vertices-> 3 vertices", align precisely with "Best fit".

Select "3 vertices-> 3 vertices" and click 3 vertices at the corresponding positions. When you specify the vertices, the position of the shell after alignment is displayed in green. Check the position of the green shell and click the "Temporary Arrangement" button.

Then select "Best Fit". The moving shell moves to a position that reduces the distance from each vertex of the moving shell to the non-moving shell. Click the shell that does not move to start the alignment calculation. When the calculation is finished, click the "Execute" button to confirm the placed position.



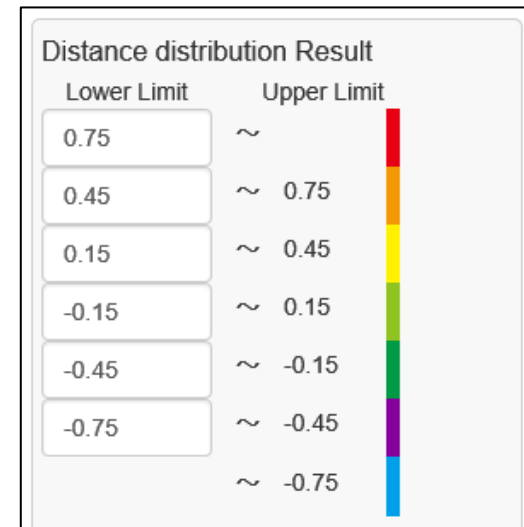
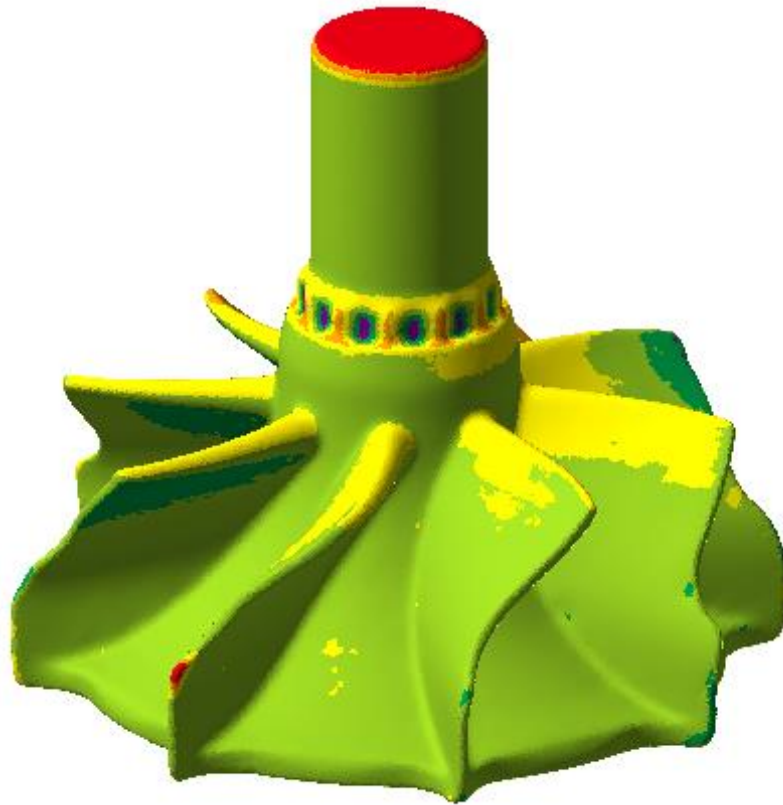
Align the orange shell with the purple shell.



Evaluate the difference

Distance Contour

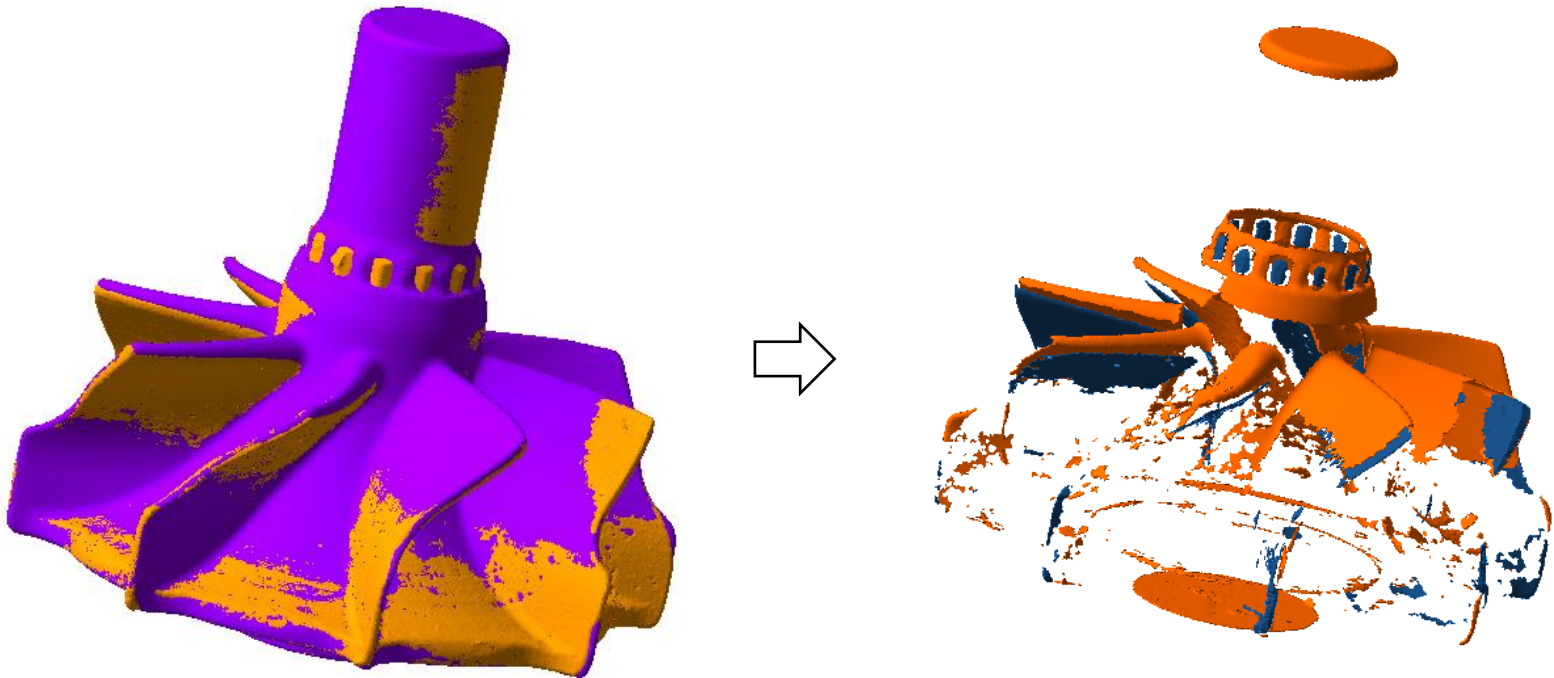
Check the separation of the two shells after alignment.
The distribution is displayed in colors according to the size of the distance.



Make a solid of the difference part

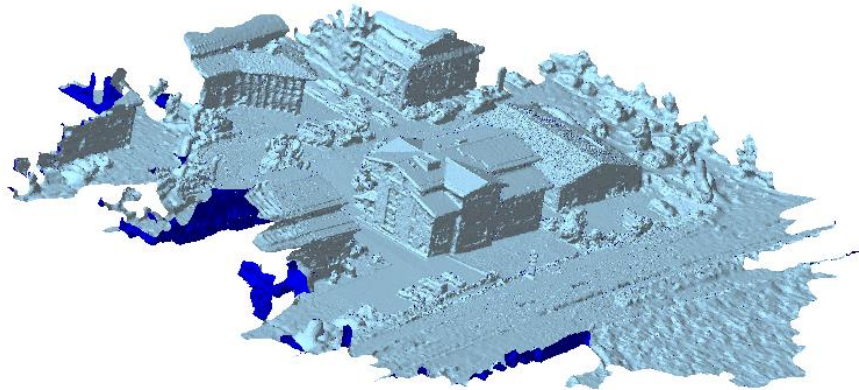
Difference Solid

Compare the shape of the displayed mesh with the mesh of the external file, and create closed shells that show the difference between two meshes at locations that are more than the threshold. For the shells that represent the difference, the shells that are separated from the front side of the other mesh are displayed in blue, and the shells that are separated from the back side are displayed in orange.



Editing textured mesh

The polygon mesh obtained by photo measurement may have photo images attached to each partial area of the mesh. The image attached to the mesh is called a texture. If you compare the two meshes in the figure below, you can see that the visibility of the shape is improved by applying the texture.



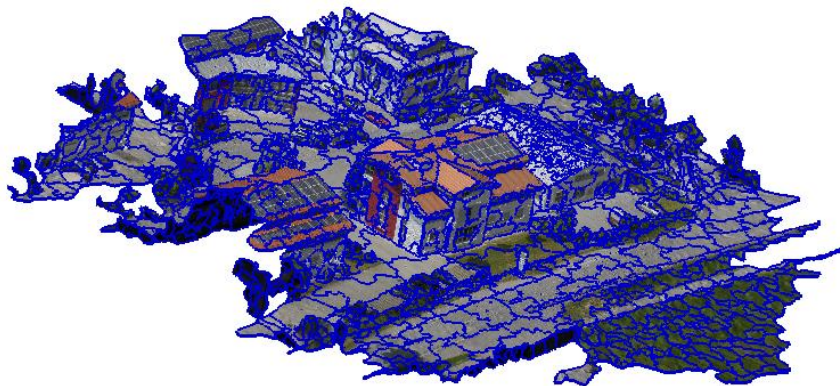
Untextured mesh



Textured mesh

This mesh uses a large number of photo fragments taken from various positions and directions (left in the figure below).

In the case of this mesh, the photo fragments are combined into one image data (left in the figure below).

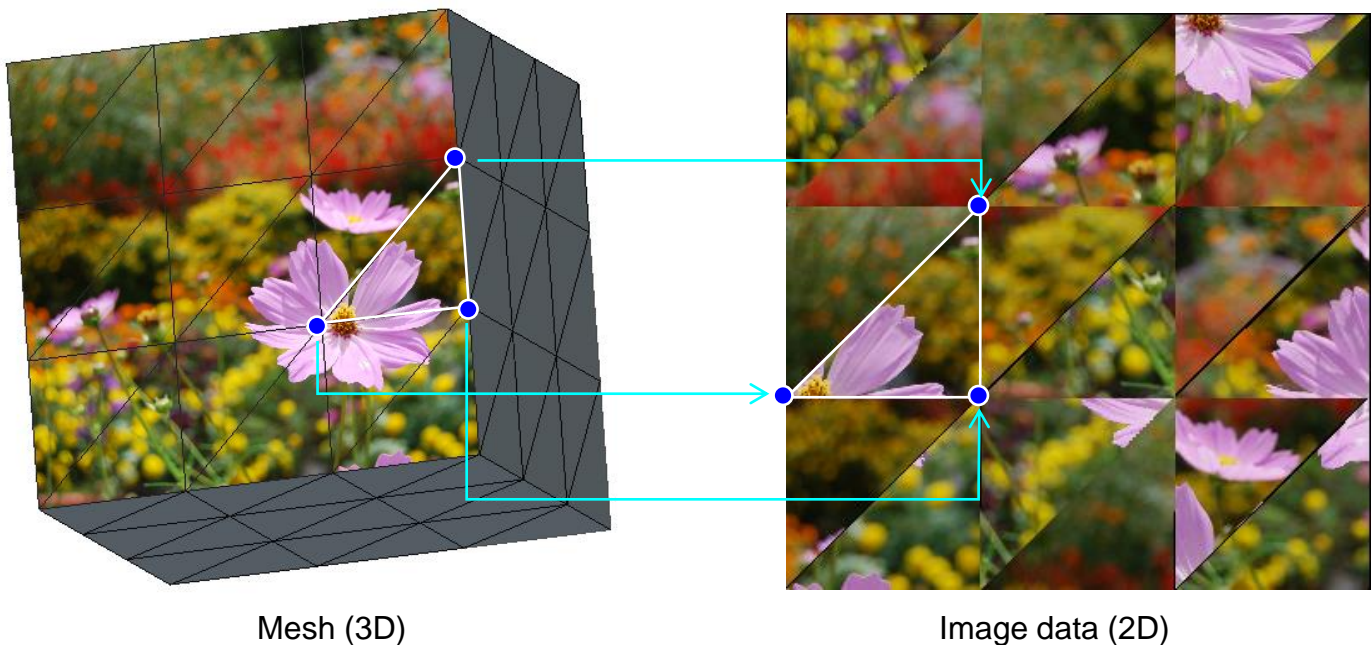


The blue line is the border of the photo fragment



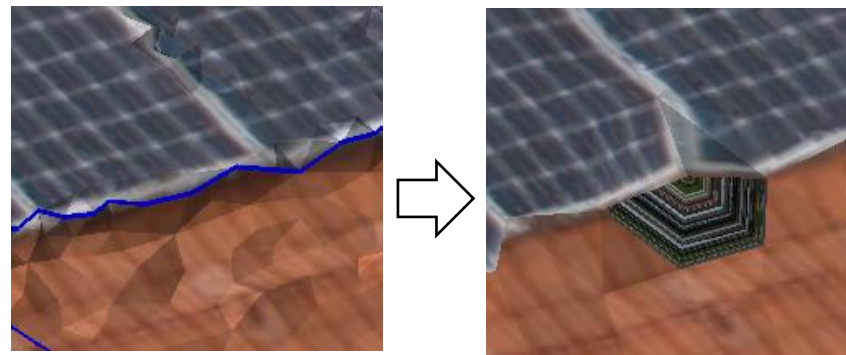
Image data referenced by the mesh

Describes the correspondence between meshes and images. Each face has vertical and horizontal address information of the image data referenced by the three vertices. The triangular area of the image data whose vertices are the positions of the three addresses is the texture of the face.



Since the adjacency of faces and the image data adjacency referred to do not always match, image areas at distant places may be pasted as textures on adjacent faces.

If the system edits the mesh without considering this mismatch between the mesh and the image adjacency, an abnormal texture will be created as shown in the figure on the right.



The blue line (edge) is the boundary of the referenced photo fragment, The areas of the image referenced by the faces on either side of this edge are separated

As explained on the previous page, if a textured mesh is edited in the same way as a non-textured mesh, the texture pattern may be corrupted. Therefore, each function of POLYGONALmeister considers the continuity of the texture.

Here is an example of simplification.

■ When "Recreate texture" is unchecked (center in the figure below)

Since the adjacency of the face and the image match inside the blue line, even if the textured mesh is simplified as well as the untextured mesh, the texture will not collapse. Simplify by not changing the blue edges.

■ When "Recreate texture" is checked (right in the figure below)

After simplifying like a mesh without texture, recreate the texture by referring to the color pattern of the mesh before simplification.

Uncheck if you place importance on saving textures. Check if you want to reduce the number of faces.

Simplify

Deletion Mode [?](#)

Tolerance Face Qty

Simplifying Subject

Entirety Part

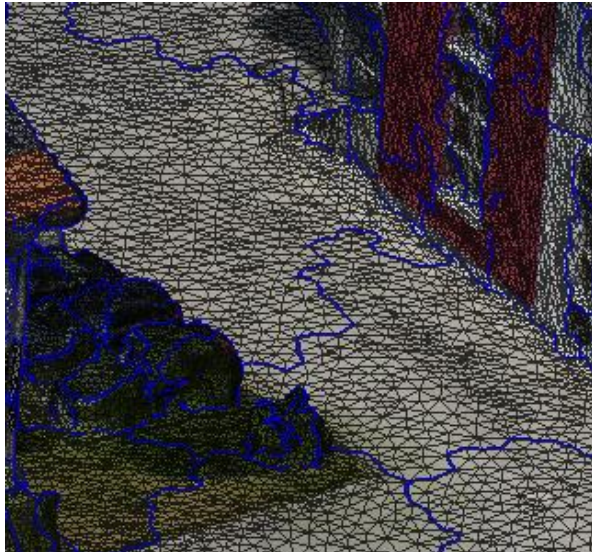
Maximum Gap

0.02

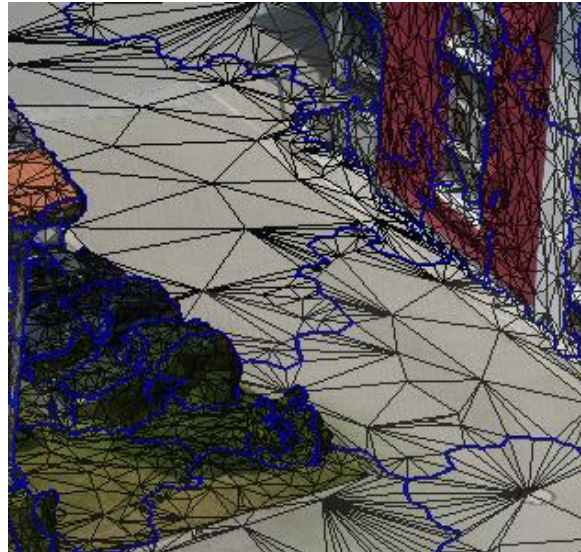
In Progress Display [?](#)

Recreate the texture

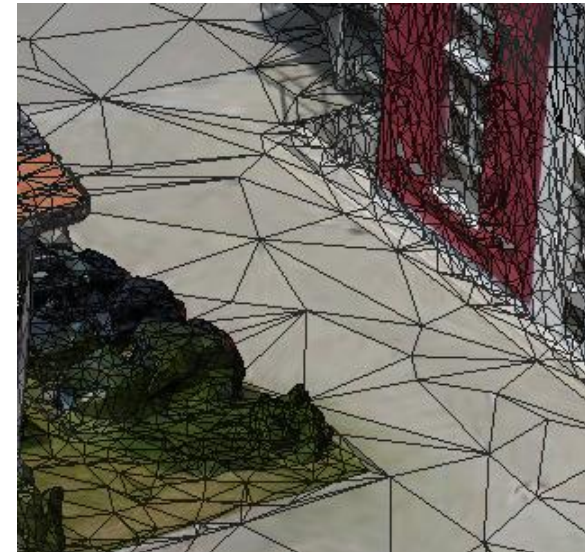
Execute



Before simplification



Result when "Recreate the texture" is unchecked



Result when "Recreate the texture" is checked

There are also commands to edit a texture.

Fill Color

Allows you to apply textures to faces and remove textures.

Texture Alignment

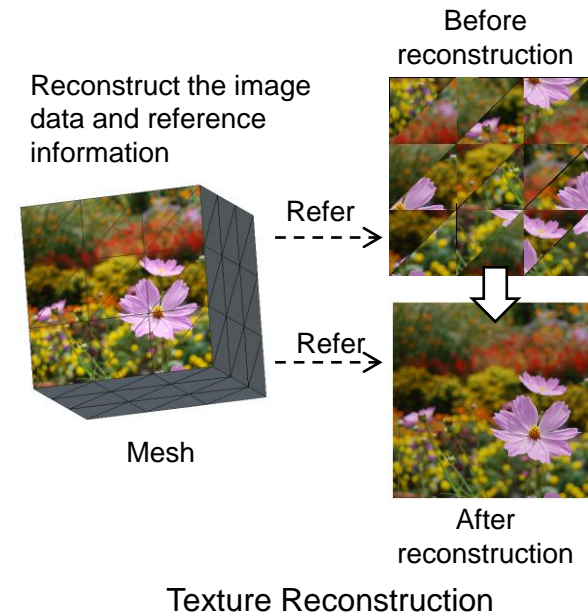
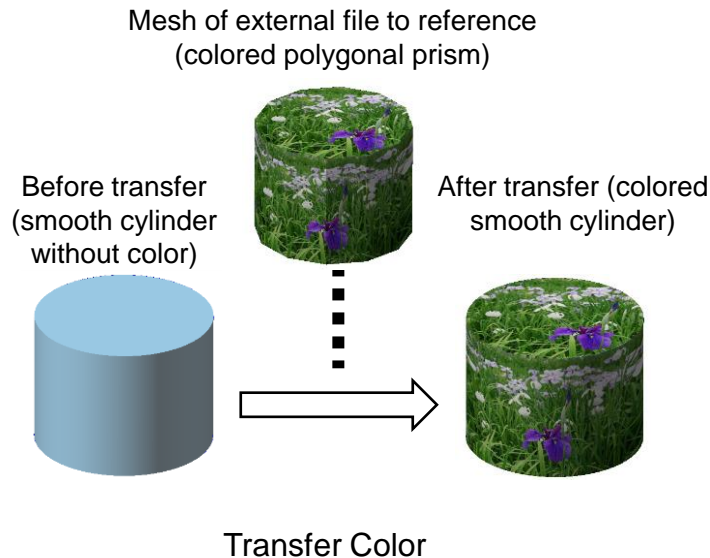
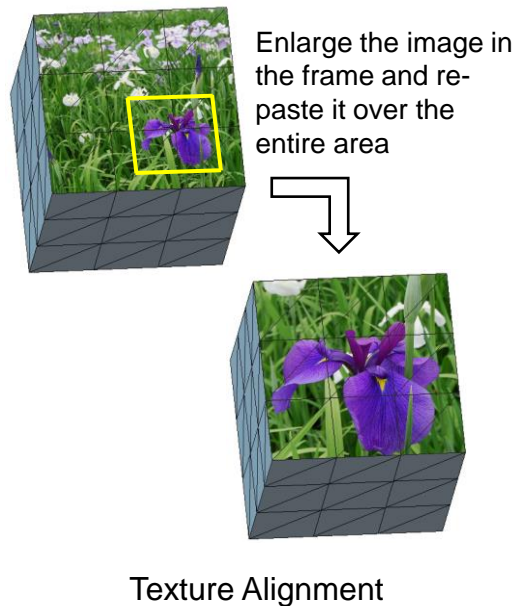
Changes the position of the triangle in the image data referenced by the face.

Transfer Color

If the external file has a mesh that has almost the same shape and position as the mesh being operated, the color of the mesh in the external file is pasted as a texture on the mesh being operated.

Texture Reconstruction

Reconstruct the image data and reference information so that the faces in the specified area and the triangles in the image file they reference have the same adjacency.



Mesh Utilization

Editing mesh for 3D printing

Commands to edit the mesh for forming with a 3D printer is explained according to the purpose.

- Smooth the mesh (hold down the [Ctrl] key and click [here](#) to go to the description page)

Smoothing

Smooths the rough surface of the measurement-derived mesh.

Make Flat / Cylindrical

Is effective when the partial area of the mesh derived from the measurement is shaped like a flat surface or a cylindrical surface.

Subdivision

Smooths meshes that should be smooth and have conspicuous creases between adjacent faces (such as meshes that roughly approximate a CAD curved surface with polygons).

- Removes creases and wrinkles in the mesh

Defeature

Removes creases and wrinkles in the specified area.

Remesh

If the mesh has wrinkles or steps due to the elongated triangles, remeshing will bring the elongated triangles closer to equilateral triangles. A partial area can be also remeshed.

Remove Acute Triangles

Detects and removes sharp, crease faces that cause small steps in the mesh.

Flip Edge

Replace the edges with the diagonal of the quadrilateral created by the triangles on either side of the edge.

Merge Vertices

Move a vertex to the positions of adjacent vertices and combine them into one vertex.

- Reduce the number of faces (hold down the [Ctrl] key and click [here](#) to go to the description page)

Simplify

The slicing software of 3D printers may have an upper limit on the amount of data (number of faces). You can use the simplification command to reduce the number of faces with as little change as possible.

Remesh

Faces can be reduced by increasing the value of the triangle size (edge length) parameter.

- Change the size (make a model with a different size)

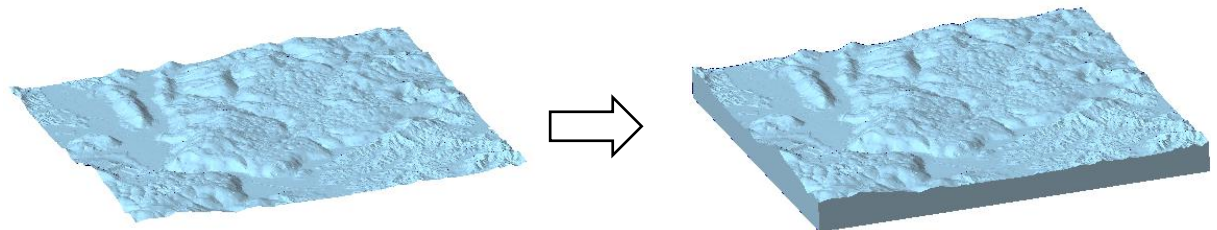
Scaling

Scale the mesh or shell. You can specify the dimensions after scaling as the scaling factor.

- Make the surface solid

Projection Solid

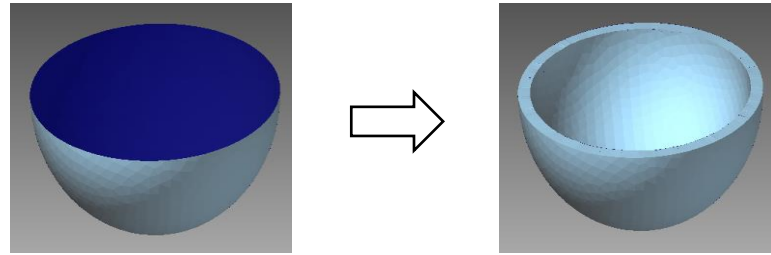
Project an open (non-solid) shell onto a plane and add sides to make it a closed solid shell.



- Check thickness / Thicken (hold down the [Ctrl] key and click [here](#) to go to the description page)

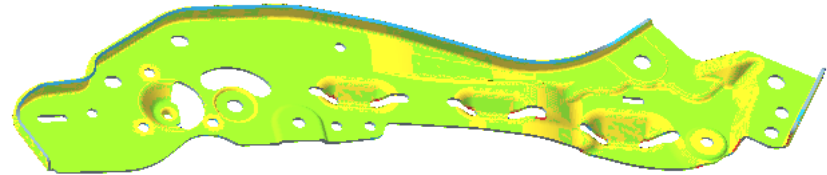
Thicken

Thicken the mesh. In the case of a closed shell (solid), it becomes a hollow solid, and in the case of an open shell(non-solid), it becomes a thick solid.



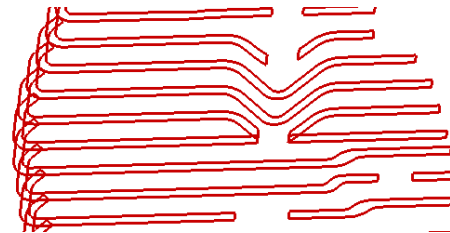
Thickness Inspection

Detects where the mesh thickness is less than the indicated value. The detected part is painted with a color according to the thickness.



Display Section Lines

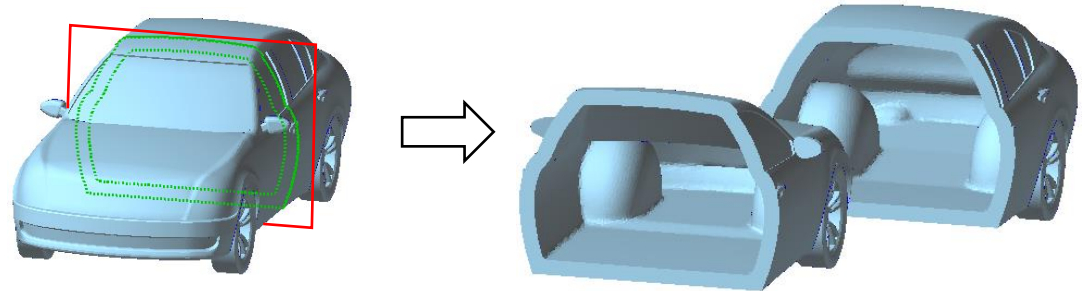
Shows the line of intersection between the mesh and the plane.



- Divide (when the size exceeds the size that can be modeled by a 3D printer)

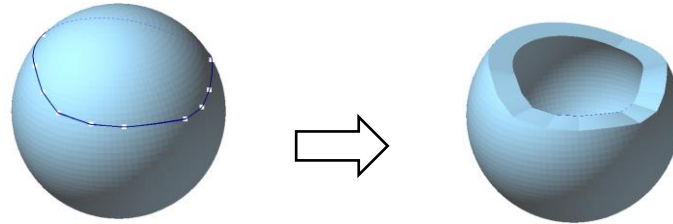
Cut

Cut the mesh on a plane or a polygonal line swept surface.



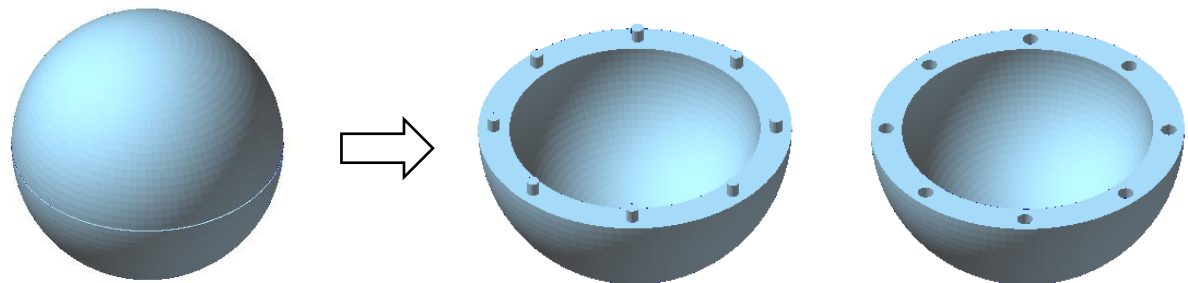
Loop Cut

Draw a closed polygonal line on the mesh and cut the mesh along that line. Cut the hollow shell together.



Pinned Cut

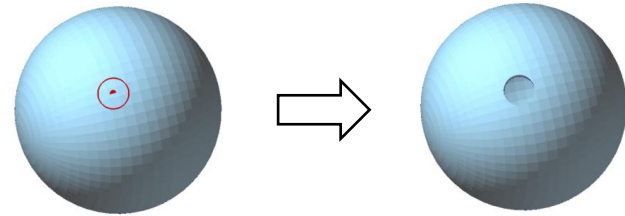
Due to the fitting of the divided parts, the contact surface may have a hole corresponding to a cylindrical protrusion (pin). This command cuts the mesh and creates protrusions and holes on the cut surface.



- Make a hole (a hole for taking out the powder material inside the hollow solid)

Through Hole

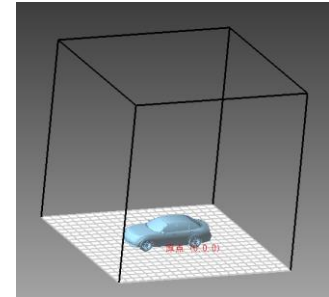
Makes a hole in the mesh with the specified diameter and axial direction, centered on the clicked position.



- Place shells on the modeling table

Display Forming Table

Displays the modeling table of the 3D printer in the figure display area. You can register the size of the modeling table.



Forming Arrangement

Places shells on the modeling table with a simple operation.

Move / Copy

Translates, rotates, and mirrors shells. You can also make a copy of a shell.

Drag Move

Translates a shell by dragging.

Editing mesh for CAE

Describes the commands to edit the mesh to suit your CAE system.

■ Reshape

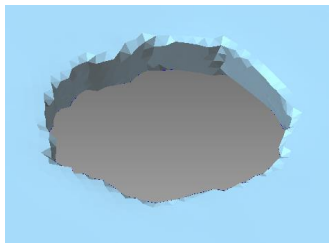
Make Flat / Cylindrical

Makes the specified area a flat surface shape or a cylindrical surface shape.

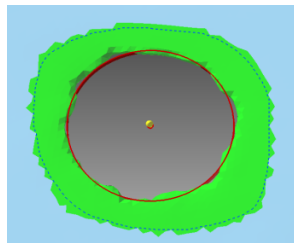
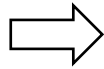
Reshape Hole

For a round hole (through hole, blind hole, shell hole), change the shape of the holes to circles or polygons. It is also possible to change the hole diameter and move the hole. (hold down the [Ctrl] key and click [here](#) to go to the description page)

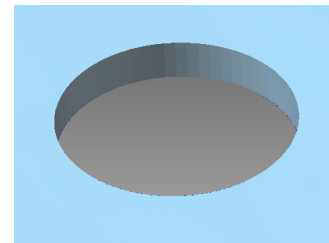
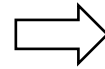
< Example of reshaping a hole >



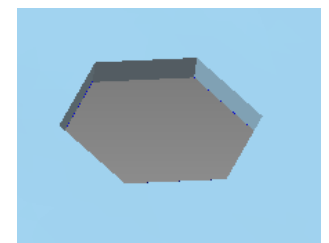
Original mesh



Specify the area including around the hole
(Operate in the view in the hole axis direction)

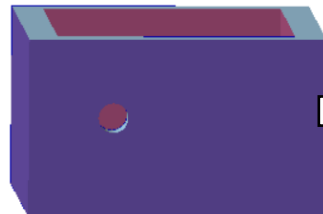
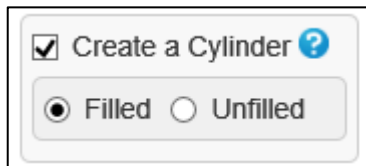


Processing result
(Changed to circular)



Processing result
(Changed to hexagon)

< Example of moving a hole >



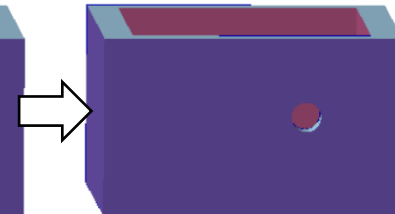
Original mesh



Make a cylinder and
fill the hole



Move the cylinder

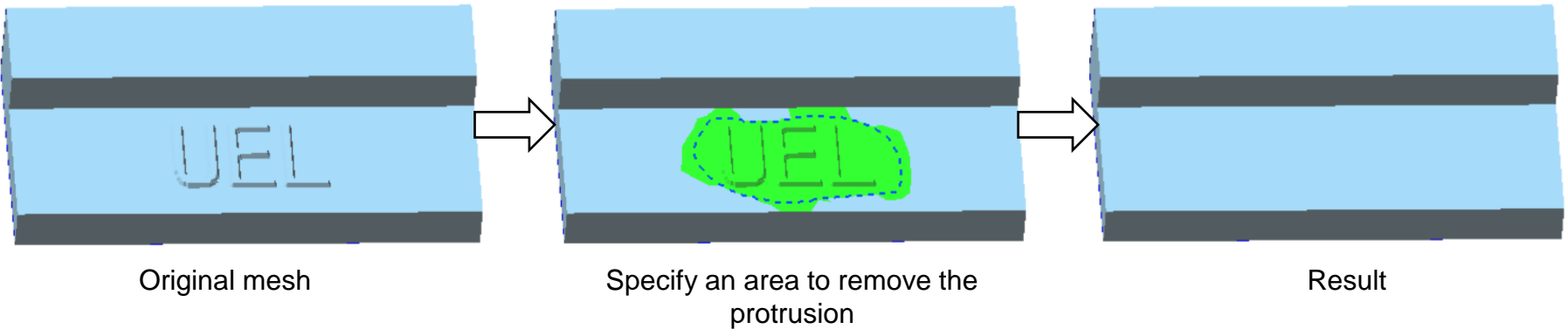


Boolean
Operation

■ Eliminate shape features

Defeature

Remove holes and protrusions to flatten.



Sharpen

Sharpens the area of the indicated rounded ridgeline.

