UV face representation. And creating a surface.

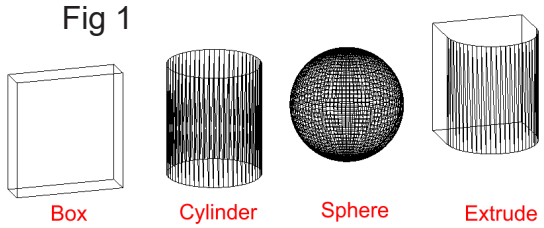
An overview of the face representation, and surface on face tool. Andy H.

Face representation creates a 2d mesh, from a flat or curved facet on a 3d ACIS object. The surface from face tool creates a **TC surface**, from a closed 2d profile, placed on the face representation.

The face can be taken from a flat or curved ACIS solid. To see the mesh that will be represented, If using Native draw GDI mode, go to Options menu - drawing setup, turn on Draw form building edges. (For RedSDK, this is greyed out automatically). Also for GDI and RedSDK. Ensure Drawing setup - ACSI - degenerative faceting is turned off.

A flat face like a box, will often have only one facet, whereas a sphere will have many facets over the whole surface. Cylinders and extrudes often have only one facet high, but many facets around the object. Fig 1.

Fig 1



A few things to consider, when using the two tools.

Workplane.

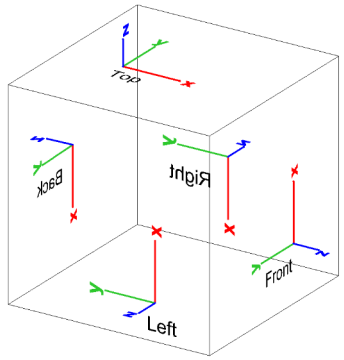
The 2d design, which will be used to create the TC surface. Should be on the same workplane as the face representation. Whilst often one would use the world workplane, If the 2d profile does not highlight when clicked on. The likely cause is that the profile workplane is different to the face.
Often just using place on workplane for the 2d profile will work. Occasionally, use workplane by entity on the face representation. Then use place on workplane for the 2d profile.
I would avoid using place on workplane on the face representation. As it can mess up any rotation.

Axis X.

This means the X directions of the facet of the 3d object, which will be used for the representation.

I suspect most people (using 3d) have tried the workplane by facet tool. And seen that the x directions, on different faces, may not be what one had expected. As in Fig 2. (X is in red).

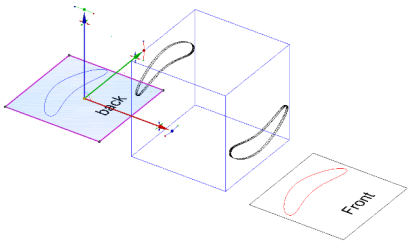
Fig 2



The face representation follows the x of the facet, Therefore this needs to be considered if when placing the 2d profiles. For example. The top direction of the front face is +X. The top direction of the back face is -X.

Looking at Fig 3. We can see the how the back face is different from the front, because the x direction of the facet on the 3D, is opposite to the front face.

Fig 3



Axis Z

If Just using a singe face, Axis Z doesn't really matter. This is simply as one can often just rotate the 2d profile, if things don't show correctly. However. In some instances, especially when using a matching 2d profile on multiple faces, The z direction may need altering.

In fig 4. The 'C' is backwards but the square is correct, being at the top. Therefore the X axis is correct, but the Z needs altering. To resolve, rotate the face 180 degrees, So the z axis points the opposite direction. Fig 5. So z direction is opposite. But Note. when the face is rotated, the workplane will often be wrong. One way to resolve this is. Use the workplane by entity tool, on the face representation. Then select the 2d profile, and use the Place on workplane tool (often shift+alt+w).

Fig 4

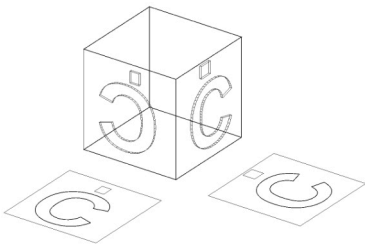
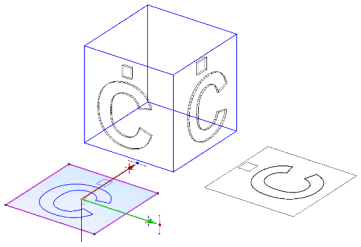


Fig 5



Boolean, and Part tree.

If the 3D ACIS object contains Boolean operations. The Resultant TC surface may by incorrectly positioned with regards the original solid, often a distance away from the original, as in Fig 6. The reason for the is unknown (by me). However this problem is often overcome, by ensuring the part tree is active before the Boolean is carried out. As in Fig 7 (See fillets below)

Fig 6

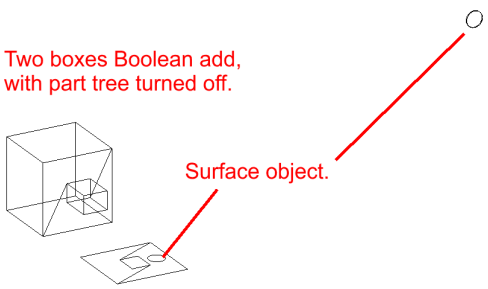
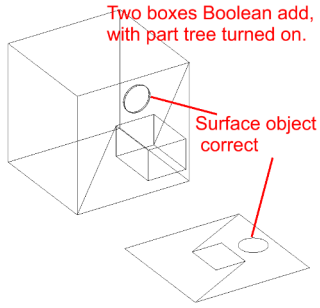


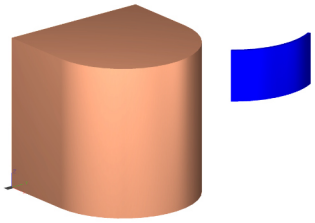
Fig 7



Fillets.

Like Boolean operations. Applying fillets without the part tree turned on, can result in the finished TC surface being a distance away from the solid object. As shown in Fig 8.

Fig 8



The cure is the same as for Boolean, Turn part tree on, before carrying out any filleting. Note, if part tree is not possible. The TC surface shape will be made correctly. So simply, delete the face representation, to sever the connection. And manually move the TC surface into the correct place.

Wrapping.

Like many cases of UV wrapping. There is a compromise to be made. Wrapping on a box, or a cylinder is predictable, However, on multi-shaped objects, some distortion can occur. Even if one is careful to scale the 2d profiles. From what I have read on the internet, this is the same for many programs, not just TC.

UV wrapping is not the same as projection. Projection onto a curved solid, as in the case of extrusion. Will enlarge the profile as it hits the side of the curve, essentially stretching it out.

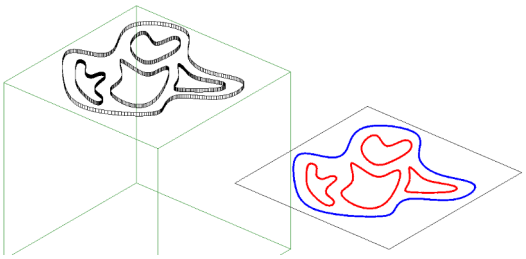
Wrapping will try to keep the original shape of the profile. Though there will still be some variations in shape on some curved faces. The user needs to compensate, by altering the 2d profile, before carrying out the wrapping.

Holes. See amendment on Page 3

The surface itself tool does not produce holes, like the extrude tool with compound profile can achieve, (when using shift key to select multiple profiles).

If we look at Fig 9. We have a surface created from the abstract pattern. Which should have 4 holes.

Fig 9



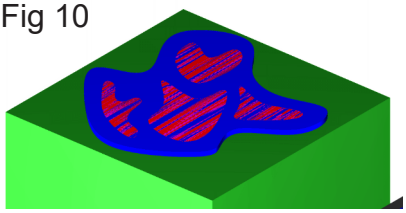
At first glance, in wireframe, it appears like the resultant surface has the holes. However, they are simple extra TC surfaces.

This is clearly visible if we change the colours and draft render.

Fig 10. Shows the striping effect one gets when two objects occupy the same space. The holes have simply been turned into extra thickness objects.

One can use a larger thickness for the holes, and manually Boolean subtract. But obviously, one severs the connection to the 2d profiles.

Fig 10



Creating Holes using the surface on face tool. Amended in TC v2021, posted Feb 2022.

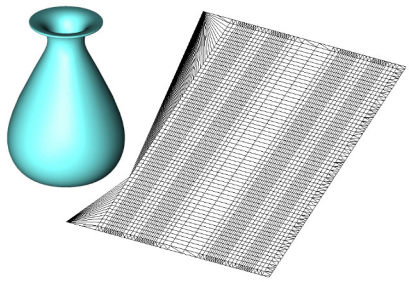
There is a trick which can be used to create holes in the resultant face object, using the create region.

The trick is to create a region of a 2d drawing, apply thickness, explode and remove thickness. TC then accepts the resultant 2D, as a polyline, in the same way text is treated as a single polyline, for letters like A, O etc.

The method is outlined below.

1). Create face representation. of whatever ACIS object one is using. (the mesh image in the attached). Fig 10a.

Fig 10a.



2). Draw the 2d profile with holes as required.

Because we are going to make it into a region, the 2d can overlap, TC will automatically join everything together when a region is created. Fig 10c.

Fig 10b

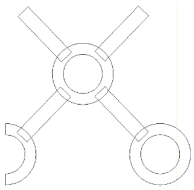
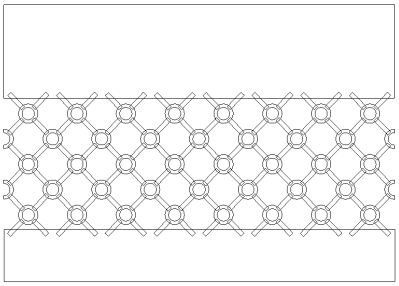


Fig 10c

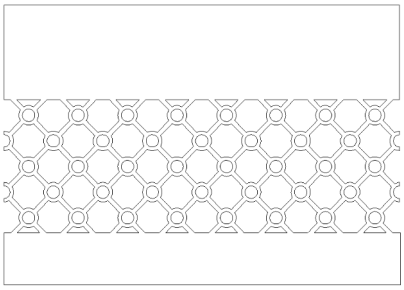


3). Select both the profile and the hole/s. Then format - create region. Ensure all the 2D are on the same workplane, or create region will fail.

In the attached image, I selected all the overlapping 2d objects.

The resultant region is shown in Fig 10d.

Fig 10d



4). Give the region a thickness in 3d properties. 1 unit thickness will do (I used 1 mm).

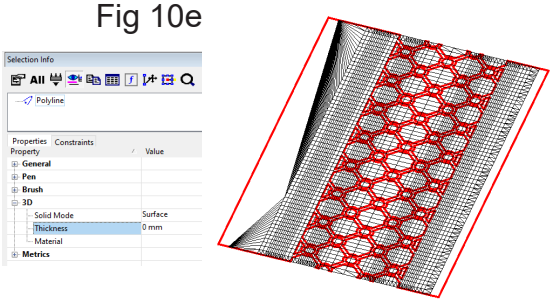
5). Explode the Region once only.

6). Reset thickness back to zero (this helps with speed of face operation).

The resultant profile is reported by selection palette as a single polyline. The finished profile is shown in red

7). Select surface on face tool.

Fig 10e

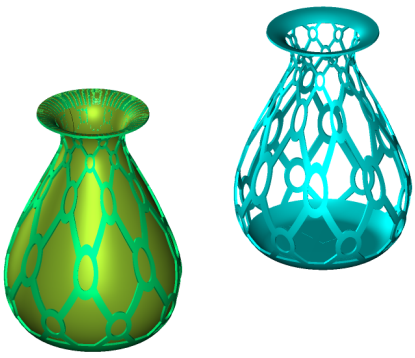


8). Select face representation (mesh). Then select the profile. (red profile in Fig 10e). Note with so many nodes, It took TC quite a while to compute everything.

9). When TC has finished computing the polyline, (cursor will stop spinning). Select finish. (flag on inspection bar, or right click menu).

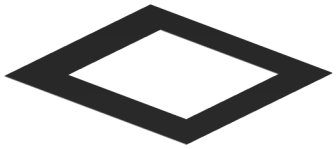
10. To separate the resultant face. Easiest is the select the TC surface created, and use 'Make copy' tool the created a duplicate. That way if it doesn't look quite right, one still has the mesh and profile, which can be adjusted if required.

Fig 10f



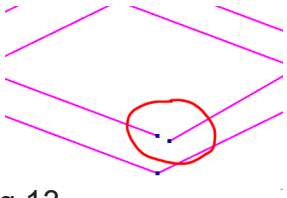
At some point in patching TC 2021 version, a method using a region trick to create holes, started working (it didn't work with the early build of TC 2021 for me).

Fig 11



Original tests showed that When creating the surface from face. The 'hole' is split into separate lines, or spline sections. As shown in Fig 12. This prevents the hole from being used.

Fig 12

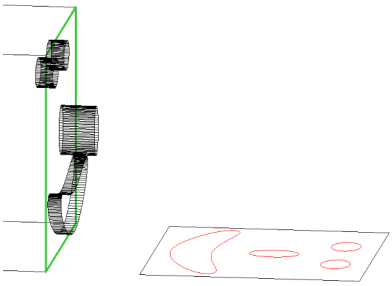


For a method of creating holes using the region tool. See page 15

Variable thickness.

It is possible to use different thickness of TC surfaces, from a single facet representation. This is done by simply setting the thickness, and choosing just certain the parts of the 2d. Then change the thickness and select other 2d parts.

Fig 13



In Fig 13, the mouth was at 4mm. Nose at 8mm, and eyes at -4mm (that is minus 4). However one must remember, that these are TC surfaces, used as a face representation on an ACIS face. Therefore they will not add, nor subtract from the ACIS object. Unless of course one converts the Surface to ACIS prior to using a manual Boolean.

2D profile.

The 2D profile must be a closed shape. It can be polyline, arcs, splines or beziers. However arc, spline and bezier are automatically turned into polyline segments. Therefore the resultant TC surface will be faceted, (as all TC surfaces are).

Looking at Fig 14. We have a design than consists to 28 separate closed 2d profiles.

Fig 14

One option for using this, is to shift key + mouse click on all 28 profiles to select them all. This works well, and allows individual re-positioning if not happy.

Another approach, is to convert them all into a single (reported by TC) profile.

One way to do this is.
1). Select all the 2d profiles (using the normal drag window around them, will work).

2). Format create region.

3). Give the region a thickness in properties (example 0.1).

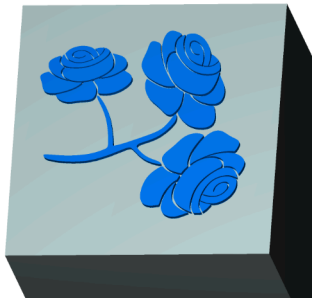
4). Then explode once. The result reported by TC is a single polyline.

5). Resetting the thickness back to zero. This is actually not necessary, but It can help a lot with the speed of operation.

Fig 15. Shows the finished TC surface.

Caution. TC can crash in some situations. Though the crashes are not easily repeatable. Always experiment on a non-important file.

Fig 15

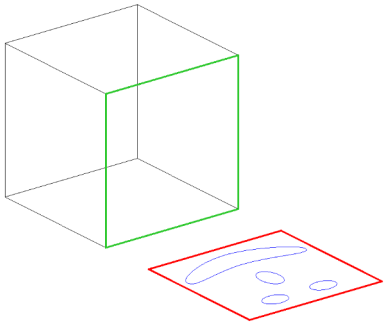


Surface on a box

The simplest UV face is on a box. Which is effectively (assuming no subdivision has taken place), is just one single facet per face. In practice. One would probably use compound profile and ACIS solid extrusion, which does a similar job. Rather than use UV wrapping.

To use...

Fig 16



1). Activate the Face UV Representation tool.
2). Select the desired face (For example, the green outline in Fig 16)
3). Move cursor and click to place the UV face. (Example .. Shown in red in Fig 16

Note.. The face will be placed on the current workplane. Irrespective of which face is chosen. Therefore it is preferable, to set the correct workplane (example, world), before using the tool.

4). Place the closed 2d profiles in the desired position. These can be fully inside the face, or partly outside the face. Only those parts of the 2d objects, that are within the face will be used.

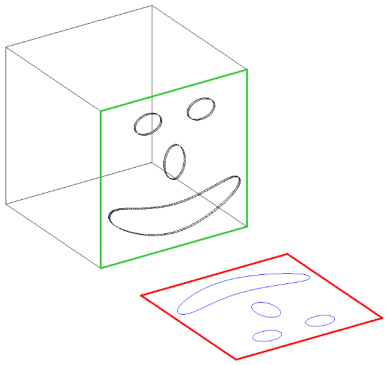
Note.. The profile/s should be on the same workplane as the face representation. If the 2d profile does not get highlighted as in step 7). (probably in magenta). it is likely the representation and the 2d profile are on different workplanes. Use place on workplane to resolve the issue. As one needs to do with some other 2d tools.

5). Activate the Surface on face tool.
6). Enter the desired thickness on the inspection bar.

Note. If there are more than one face representations in a drawing. It is suggested, not to press 'Enter key' after altering the thickness. Pressing 'Enter' will cause the program to select the representation closest to the cursor, which may not be the one you wish to use.

6). Click the face representation (it should highlight).
7). Click a 2d profile. Or hold down shift key and select multiple 2d objects. Again these should highlight.
8). Click finish selection on inspection bar, or right click menu.

Fig 17



The result is shown in Fig 17.

Because we are dealing with only a single facet from the box. The representation should be the correct size, It only looks different in Fig 2, because of the viewing angle. The placement of the 2d objects should be accurately reproduced on the face.

If one wishes a part in a slightly different place. It is simply a matter of moving a 2d profile on the face. And the surface pattern will automatically update.

After reading the above. You may be thinking - what a waste of time.

Well. One advantage of this approach, is that the objects can be 'fine tuned, and will auto update.

In Fig 18. We created a surface from the top representation. But decide we don't like the centred result.
In Fig 19. We simply move the 2d profile. The surface is updated with the new placement.
If we had used the normal extrude. We would have to remake it after every test, if we were not happy with the resultant placement.

Fig 18

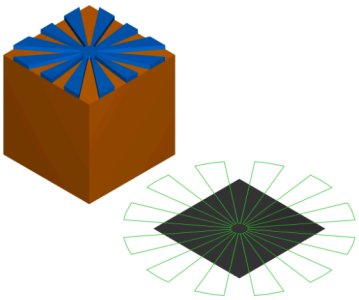
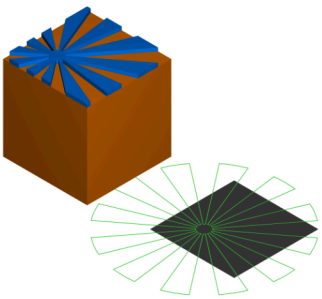


Fig 19



Using multiple face representations

Using multiple faces is possible but has some drawbacks. Note. In the following, Facet is used to describe the 3d object face, Face is used to describe the representation.
The X direction of the face representation must be lined up correctly.
The Z direction of the face may need to be altered, by rotation the face, then placing the 2d profile on the new workplane.

The multiple faces cannot use the same 2d profile, unless the connection is broken first. All this means they can be problematic to set up.

As can be seen in Fig 20. The x direction of the facet may not be what one expects. These are found using the workplane by facet tool.

First. Ensure the face representation's x axis is aligned as per the axis on the relevant face. (this is the normal x,y,z displayed when an object is selected).

This can be done by rotating the face representation after being made, and then snap into place. Fig 21.

Fig 20

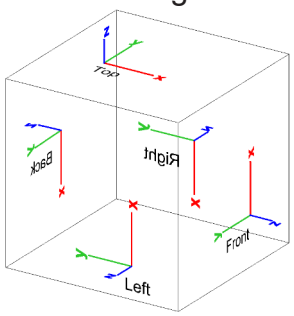
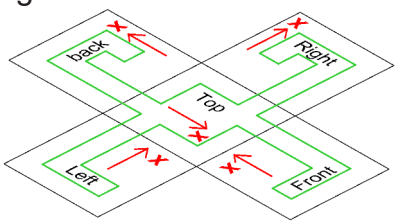


Fig 21



However. That is not the only thing that may be needed.

If we look at Fig 22. One of the profiles (In red) is in incorrect.

To cure we can rotate the face, so Z direction is opposite, Then workplane by Entity (on the face). Then place the 2d profile on the new workplane.

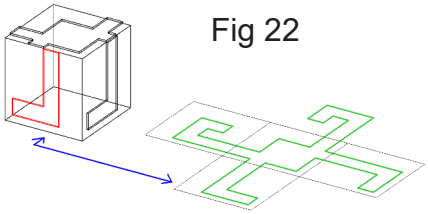


Fig 22

The 2d profile is only linked to one face at a time, And it is linked to both the Representation and the TC surface. Therefore if using a single 2d profile, we need to sever the connection between them all.

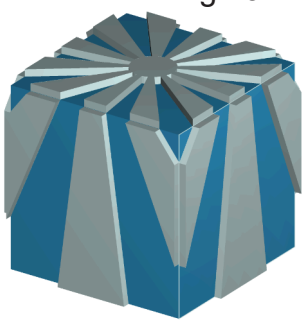
This can be done by exploding the face representation. And, either exploding the TC surface (providing this does not result in individual polylines). Or, Transforming the TC surface into an ACIS solid via properties. The above is often necessary, before we can assign the profile to another face.

We could alternatively use duplicate 2d profiles, (see next page), one for each face, which will maintain the linkage. And may allow for alterations.

To use with a single polyline, we could..
1). Create a face representation for each. And align the x axes of each face correctly.
2). Select the surface on face tool. And select the representation of the Left face.
3). Select the 2d profile, and then finish.
4). Explode the TC surface produced (In this example it results in 3 TC surfaces, which is fine.
5). Explode the left face representation (or delete it).
6). Continue with 3 to 6 using Right, Front and Back faces.
7). Use 3 and 4 to create a TC surface of the top. Now the problem. - The top is a single profile on the surface. So exploding will simply produce lots of polylines. Therefore we can simply leave it linked to the face, or, select the top TC surface, go into object properties, and change it to an ACIS solid.

Fig 23 shows one finished object, consisting of the box, with top ACIS top, and separate TC surfaces around the sides.

Fig 23



Using multiple 2d profiles

Before we leave flat faces. We will look at what should be, an advantage of using duplicate 2d profile, one for each face.

Using the same profile and faces as the previous example. We duplicate the profile. So we have on for each face. Fig 18

The process is simple, select surface from face tool.
Select back face representation. Select one 2d profile, select finish.
Select right face . Select second 2d profile, select finish.
Repeat selecting a different 2d profile each time.

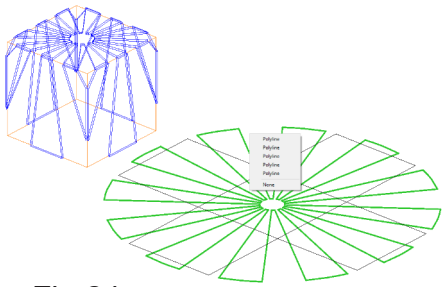
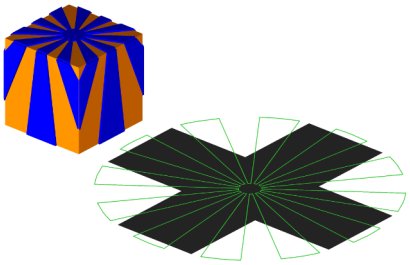


Fig 24

Shouldn't this have advantages.

First, an advantage is that it simpler than exploding faces and surfaces.

But more importantly, it should automatically update all the surfaces.
If one moved all the profiles at one.



Unfortunately in tests. Whilst the top face updates correctly, the other faces, can sometimes update out of alignment.

It is simply a matter of try it and see. Don't forget to align X direction, and if necessary, rotate the representation. to get Z axis correct.

Conclusion.

A problem with this wrapping on multiple faces, is the edges are not closed. Therefore if one wanted closed edges, There the top meets the sides), it would require manually altering each one.

With wrapping onto a single face. It is much easier to just put the 2d profile on the 3d object and extrude (or thicken).

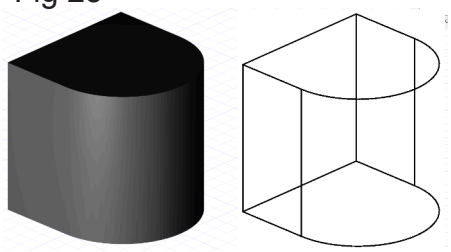
The advantage of this tool, comes in the next pages, when we wrap onto curved facets.

Wrapping on curved facets. Continued on page 8

OK . Onto the main advantage of the tool, Which is wrapping onto a non-flat surface.

This first example uses a box with two fillets, creating a rounded front face, Fig 25. However as can be seen in the wire frame, only the curved part will be included as the face. The flat sides are treated as separate faces by TC.

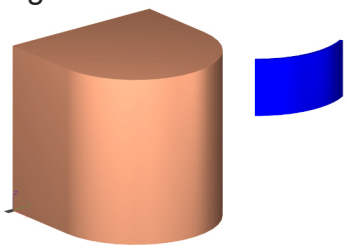
Fig 25



Before going into detail. First an oddity that can occur with filleted edges.

Fig 26. Shows the resultant surface from face (shown in blue), has the surface being produced away from the 3d object. This seems to occur with filleted edges and Boolean operations when the part tree is not turned on. Turning on Part tree (history), before carrying out the fillets, normally solves the problem. Why it occurs, I've no idea.

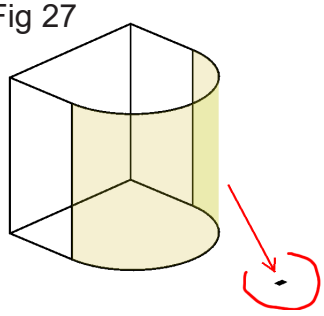
Fig 26



The problem does not occur if the a 2d polyline is extruded to form the same shape. So the bottom line is, if using fillets to create the surface - use the part tree.

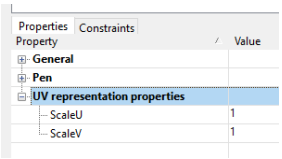
1). We use the face representation tool to extract the face, Fig 27. However the default scale of 1, (selection properties Fig 28). Can be too small to be really useful. This depends on the size of the 3d object. If the object use here, was sized 2mm x 2mm x 2mm the representation would be correct

Fig 27



We need to change the scale, which can be done before or after placing down the representation. But what scale do we use.

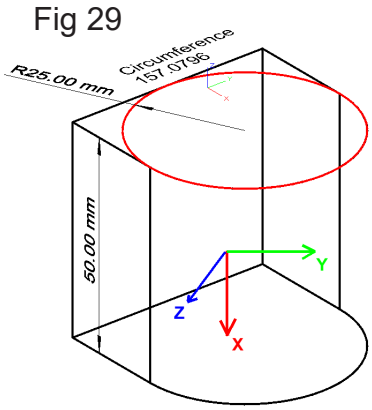
Fig 28



In actual fact, the scale doesn't matter, providing one can scale the 2d profiles being used. However. In this case we will try to get the face scale correct to full size.

There are situations where these calculations will fail. In these circumstances, simply adjust the sizes until they match the expected sizes of circumference and/or length.

Fig 29



In Fig 29. We have the required dimensions of the 3D object. 50 mm high, radius and circumference. Using the work plane by facet tool, we know the facet directions. (X direction is top to bottom).

Scale U = x direction dimension / 2 .. U = 50 / 2 .. U = 25

When the shape is circular. The scale V can be obtained two ways. Either.

Scale V = Radius = 25. Or

Scale V = circumference of face / 6.2832 .. V = 157.0796 / 6.2832 ..
V = 24.9999

Note, it is not always obvious which axes is U and V. If it doesn't appear correct first time. Take a look at the face after created. In general the triangular sections, run vertically. Fig 30 shows the triangles running in the 'X' direction, which as we know is top to bottom.

Where the 6.2832 comes from. I had to think about that for a while, and it is simply, TC uses 2 x Pi (rounded) for PeriodV.

We will test this again, in the next example. But for now, we enter 25 in the scale U, and 25 or 24.9999 in the scale V fields, (in the selection palette properties).

In strict terms, the face is 50mm high by 78.5398 long, and checking the inspection bar (Fig 30), the representation is indeed recorded as very close. (Likely slightly out, due to my rounding the calculation).

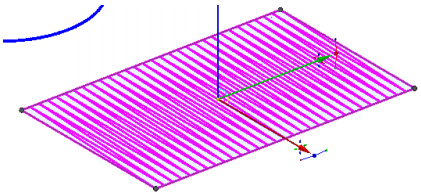
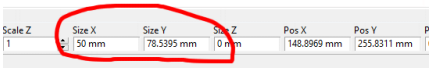
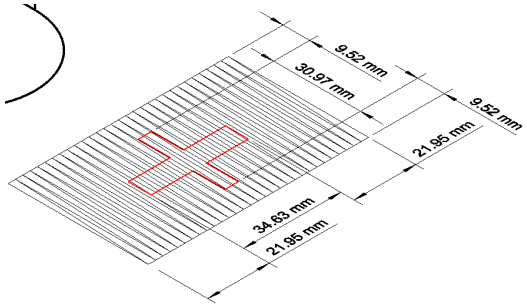


Fig 30



2). Now we have our face representation. We turn to the 2d pattern that we will use.



Here we have a kind of cross, shown red in Fig 31. . Dimensions have been used, to see how accurate the profile is reproduced as a TC surface.

The cross is positioned in the centre, and placed on work plane (just in case it wasn't).

3). The surface from face tool is selected. Clicking on the representation first, and then on the 2d profile.

4). Click finish on the inspection bar or in the right mouse click menu.

The resultant TC surface is shown in Fig 32. The arc lengths were simply obtained by drawing the arc and reading length from selection properties metrics.

And comparing dimensions, it did a pretty good job.

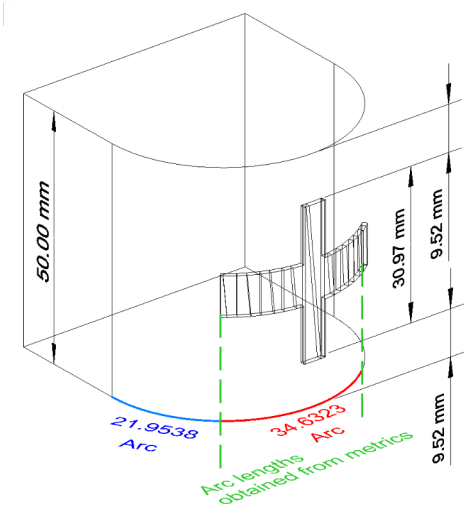


Fig 33

As one can see this is a wrapping, not a projection.

If we compare the dimensions, with a cross produced as a projection (Fig 33). We can see the difference in dimension.

This was done using extrude and intersect to simulate a projection. And like any projection on a curved surface, there will be stretching.

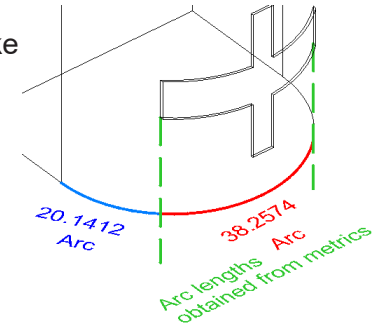
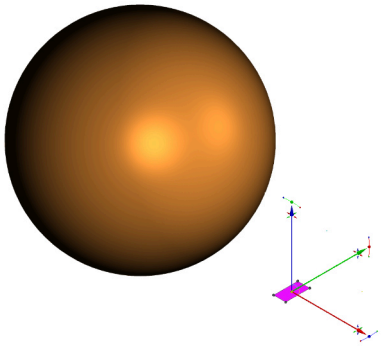


Fig 34

OK that was easy. Now what about curving in two planes.

This is where it gets to a stage of trial and error. By far the biggest problem is Boolean's, and one may have to work with part tree on, to prevent Boolean causing problems.

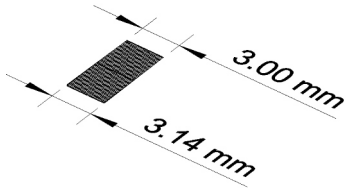
We start with a simple one, a sphere. The representation of a sphere is simply a filled rectangle. First we check which way is the x direction. Fig 34.



We can either, divide the diam by 2, or divide the circumferences by 6.2832. Therefore on this 50mm sphere, The first is 25, the second is 24.9999. This will give both the U and V values.

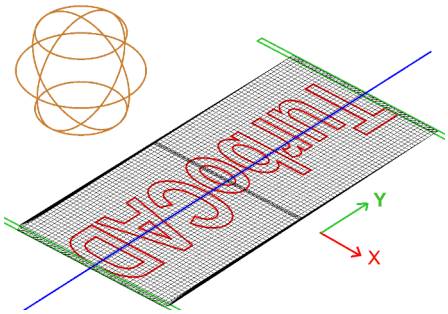
Fig 35

In practice we are allowed some leeway. If we look at the default scale 1, in Fig 35. We can see that the rectangle representation is not actually a rectangle. One side is wider than the other.



Therefore whether we use 25 or 24.9999 we get close enough. The actual value in Fig 35 should be 3.14

Fig 36



As can be seen in Fig 36 we have included the representation, and the 2d profile (the text, exploded to polylines).

However, tests show it is wrapping towards the y axis. Which, as we can see is left the right. Our text is correct for the 'x' direction, but the wrong way for 'y' to a correct wrap. We can either rotate the text 180 degrees, which will make the text look backwards as a 2d, but correct when a surface.

Or, as in this case, rotate the representation by 180. But do not use place on workplane on the representation.

After rotation, the workplane of the face may be different to the text polylines, To correct this. Workplane by entity on the representation, then use place on workplane on the text polylines.

The rest is the same for any wrap, select, surface by face. Click the representation. Then click the polylines (holding down shift key). Click Finish.

Fig 37

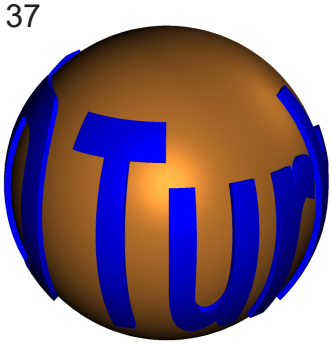
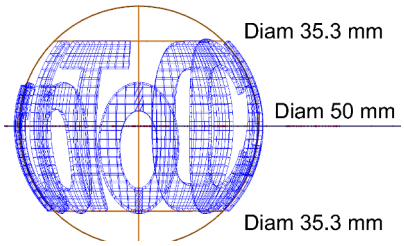


Fig 37 shows the finished surface. The height is correct, but this highlights a problem with any type of wrapping on a sphere, or similar object.

The diameter changes, so text, or any 2d profile gets stretched or contracted, depending on the shape. Fig 38.

Fig 38



With objects like leaves, flowers etc. One can compensate to a certain extent, But with Text it, will never look correct, and this applies whether it is UV wrap, or even if one manually places every character.

This next example, goes some way to compensate for the difference in diameters along a vase shape.

Fig 39. Shows a shape, which has been revolved. The shape is 66.92 mm diam. And 76.5 mm high.

For the length of the representation. We can simply use the largest diam divided by 2.
Giving Scale V as 33.46.

As can be seen in Fig 40. The representation is not a true rectangle. Therefore absolute accuracy is impossible to obtain.

Fig 39

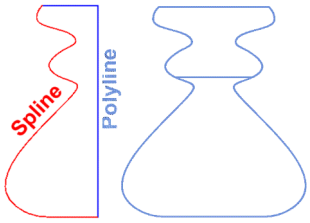
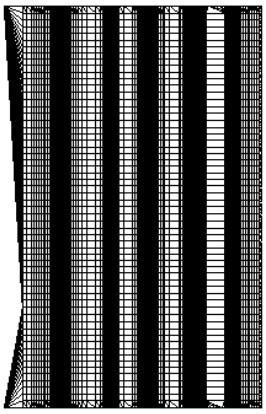


Fig 40



For Scale U (Height). We need the length of the spline. This is simply read from the selection palette - properties - metrics. And in this case is 134.0865 mm.

In this instance. Unlike a sphere, We are only wrapping the length of the spline. Not the spline and polyline.
Therefore we we can enter Scale U as 134.0865.

The figures are entered in properties, as shown in Fig 41

Fig 41

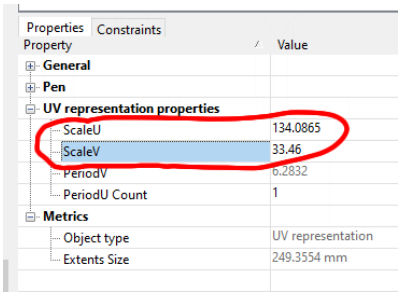
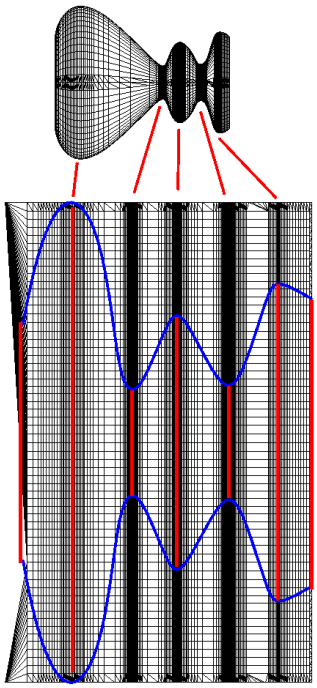


Fig 42



Now for scaling.

Looking at Fig 42. We have our representation, and an outline of the shape we are wrapping onto. The points for the spline shape were obtained from the circumference at certain points (shown in red)

Note. Form building edges was turned on and degenerative faceting turned off. To get the faceted appearance of the revolve.

So how the heck do we use that information. What we are after is 12 hearts around the larger section, and 6 around a smaller section. Roughly in the positions shown in Fig 43

However we wish all the hearts to remain roughly the same size.

Fig 43

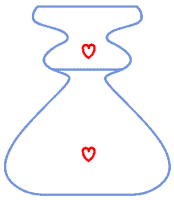
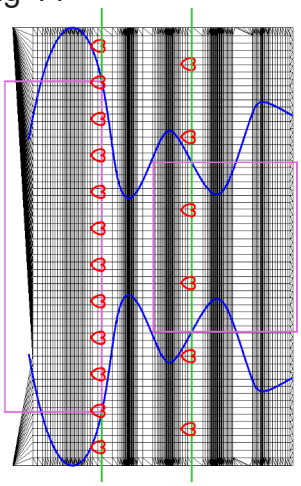


Fig 44



One may think, I'll just space out the hearts along the length of the rectangle. As in Fig 44. That should work, right. Wrong.

Where the hearts are, the rectangle will be scaled down, to the blue outline. Thus the hearts will be squashed in width compared to the original hearts.

Plus the heights will be stretched, because we have not scaled the height. To correspond to the mesh lines.

We can see this, with a simple test creating the surfaces. The result is shown in Fig 45.

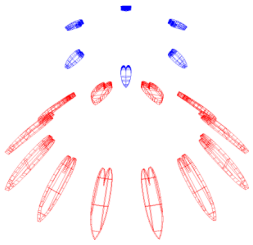


Fig 45

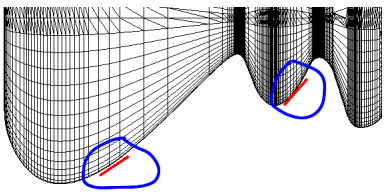
For scaling the hearts One thing to remember is that, the mesh is not cut to the blue line, it is either stretched or shrunk to that size.

Therefore it is our job to pre-stretch the hearts so they will shrink into place at hopefully the correct size. This is the reason the magenta rectangles have been drawn. These allow stretching whilst maintaining the gaps between the hearts and the blue line, at both ends.

How one achieves this is personal preference. Here is one way. First we will do the height of the hearts.

Using the 2d heart profile, put it against the 3d object where one wants to hearts to be. Fig 46. This determines where we place the two green lines on the mesh. And where the top and bottom of the hearts should be positioned, With relation to the mesh lines. These mesh lines are reproduced on the face representation.

Fig 46

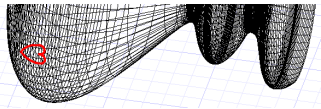


We make a note of which mesh lines the profile is against or between.

The mesh lines we want are the ones going round the object not along the length. (The top to bottom ones Fig 46).

Of course this is fine if the bend is not too much, but what is it is on a sharper bend. We need a different method to get a more accurate result.

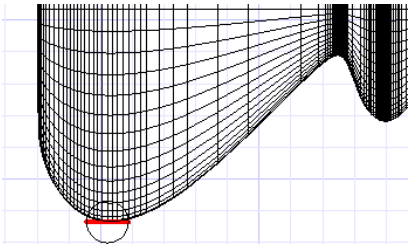
Fig 47



In Fig 47 we want the heart on a sharp bend.

For small objects. An easy way to get an approximation, is to place the 2d profile close to the 3d object, and draw a 2d circle for its extents.

Fig 48

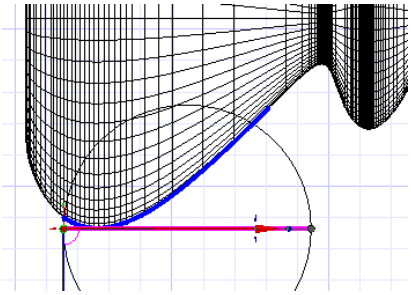


Where the circle meats the 3d, we can find which mesh lines to use on the face representation. Fig 48

However this won't work with longer 2d profiles. Therefore an alternative approach, is to use a 2d spline.

Draw a circle for a approximate position. Draw a 2d spline along the edge of the 3D. Read its length in the selection palette properties, and node adjust to the correct length. Blue line in fig 49

Fig 49



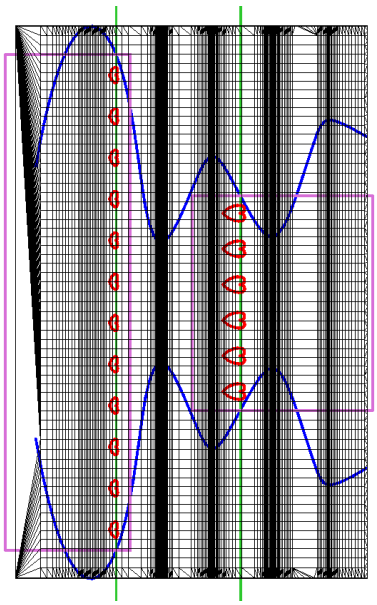
Now we can read the mesh lines for the extents of the 2d spline. And thus we know the height to make the 2d heart profile. So it hopefully end up with the correct height, after the TC surface is produced.

Back to our original hearts..

For the mesh setup. I draw two green lines where the hearts will be. The position determined by the info obtained in Fig 46. On previous page.

These two green line are used as intersect lines with the blue profile. And are at approximately the widest part of the heart.

Fig 50



The magenta rectangles are used to ensure spacing at each end of the hearts. The ends of the these rectangles, is set at the intersection of the green line, and blue profile.

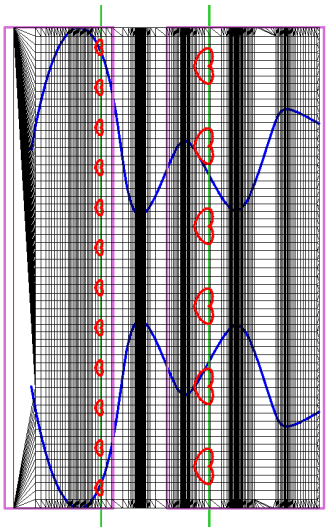
A heart is placed at one intersection, and linear fit copied to the other intersection. I used 13 and 7 for the copies, then deleted the extra one at one end/ (we want 12 and 6).

Select all the 12 hearts and move then up or down so they are centred within the representation. This will leave a small gap at each end between the hearts and magenta rectangle.
As in Fig 50

Select the magenta rectangle, and all 12 hearts. Drag up and down, to the length of the mesh, as shown in Fig 51. This will stretch the hearts and the spaces evenly. Easier than stretching each heart separately.

Stretch or shrink the height of the arcs. To correspond to the mesh we found on previous page (Fig 46).

Fig 51



Complete the setup, by doing the 6 hearts in the same way.

The final setup is shown in Fig 51. As one can see the hearts are stretched sideways. This coupled with the fact we set the height of the hearts, using the mesh lines which go around the 3d object, (in Fig 51 they go top to bottom). The hearts should end up close to the correct size when created.

The only thing left is to use the surface from face tool.

Selecting the representation.
Hold down shift key, and select all the hearts.
Click finish.

The completed process is shown in Fig. 52.

Fig 52

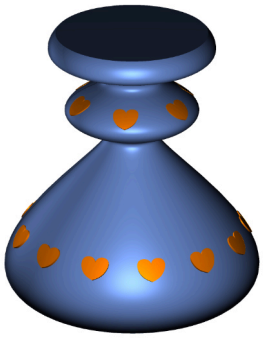
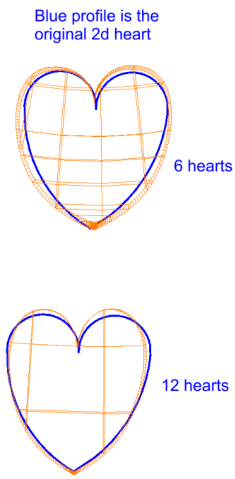


Fig 53



How close did I get.

Well. At the start I said 'roughly' the correct size.

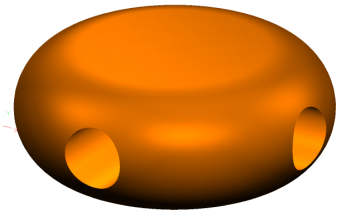
Checking against the 2d profile in Fig 53. We can see the 12 heard ones isn't too bad, But I was a little too big with the 6 heart ones.

The reason was probably a combination of, not getting the green line and its intersection with the blue profile correct. And estimating the height slightly wrong.

But like most UV wrapping, (going off what I read on the internet). There is often a compromise. And often its a case of, 'Roughly' is close enough.

Last example. Using holes.

Fig 54



For this example, Part tree is turned on.

In this final example, we will put a pattern around and between the holes.

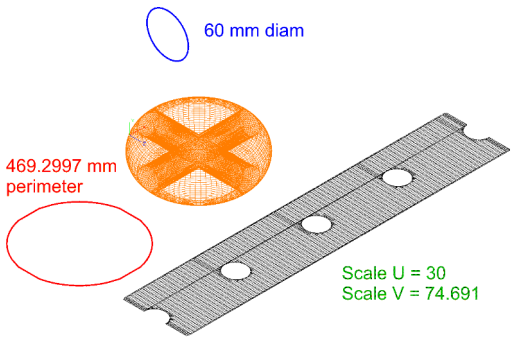
The diameter of the round edges is 60mm.

The first problem was that, because it was made as a revolve. The Z axis was pointing sideways. This appears to have confused things, as the face representation was not created correctly. To get round this, I created a 3d box. And used the 3d add method to reset the z direction of the object.

That then allowed the face to be represented correctly.

The setup Fig 55.

Fig 55



1). Diameter = 60mm. Therefore U = 60 / 2 = 30

For the length, to accommodate the holes, I drew a close polyline using straight sections to cover where the holes would be.

2). The perimeter is V = 469.2997 / 6.2832 = 74.691

I used 6.2832 because the shape is not a full circle.

Would it make a difference. A circle of the diameter of the holes, was anchored at one point, Fig 56. Looking at Fig 57. Which uses the perimeter calculation. It is a very close match. However, using the Diam, Fig 58. There is a small gap on every hole. The gap is small, but had the hole been larger, the difference could be more significant.

Fig 56

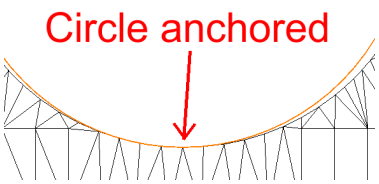


Fig 57

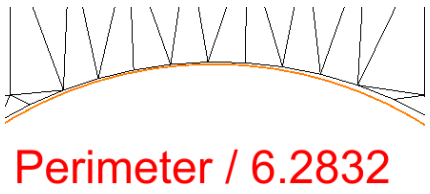
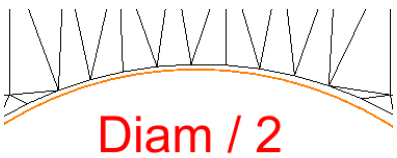
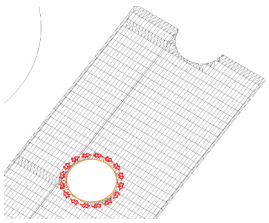


Fig 58



Now for the next problem. Fig 59, shows the half hole at the end.

Fig 59

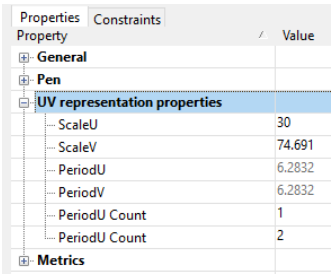


Which is fine if the design has 'gaps' that can be placed in the right position.

However If the design is solid when placed at the end. Then slicing would normally be necessary. But this could cause problems if creating a stl file for 3d printing. As the two parts may not perfectly line up when the surface is created.

So now we introduce a method not yet used in the document.

Fig 60



The new procedure, is to use the PeriodU count setting in the properties.

For some reason using the shape with 4 holes. TC produced 2 x Period U settings. Fig 60. No idea why, but it did not seem to affect the outcome.

To avoid slicing any profiles, we can set Period U to 2. This makes a second reproduction attached to the first. Fig 62

Fig 61

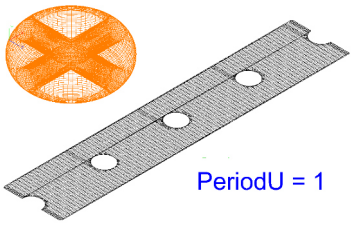
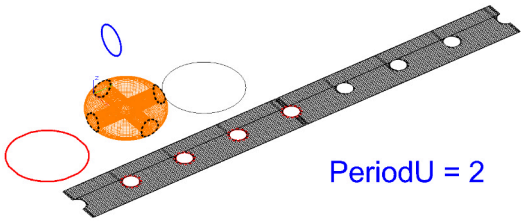


Fig 62



Although there are more holes, one does not have to use all of them. We can use the three full holes from the first representation, and the hole where the 'join' is located. The second PeriodU allows us to utilise the join, as if it was a normal hole. We simply leave the other holes blank.

OK. On many occasions, one would normally just do one hole and radial copy the rest on the 3d solid. But what if each holes surrounding pattern, is different for each one..

Hence the 2d polylines in Fig 63 is used for the final surfaces and rendering (ignore the green line, it's not supposed to be there). The rest of the process is the same as other methods. Select surface from face tool. Select face. Select all the 2d profile. Select finish.

With the final draft render shown in Fig 64

Fig 63

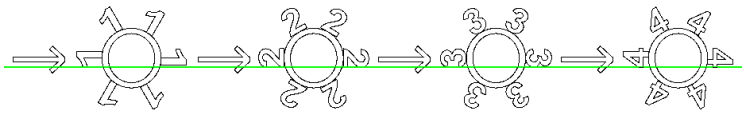
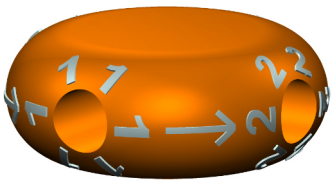


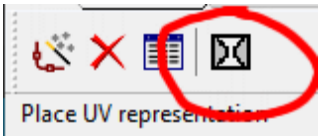
Fig 64



Periodicity

One last thing. There is a button called 'Use Peridocity (Fig 65). This can be activated once the Face UV representation tool is selected, and after clicking the 3d object.

Fig 65



What it's actual purpose is. I don't know.

But in certain situations, It makes a difference as to how the face mesh is produced. And In some instances one could not properly create the correct face, without using periodicity.

A brief overview is on the next page.

One way periodicity can make a difference, is to how the face representation is displayed.

In Fig 66 and 67, the left object is normal face, the right one is with periodicity turned on. And in Fig 67, it allows one to create a surface where the hole is.

Fig 66

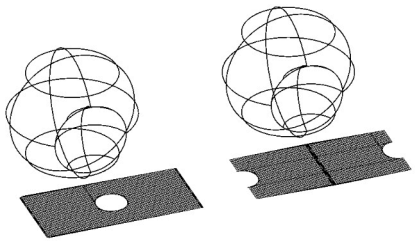


Fig 67

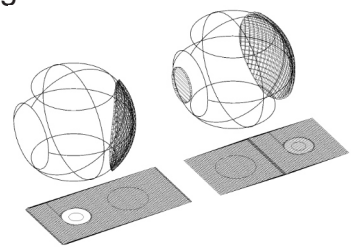
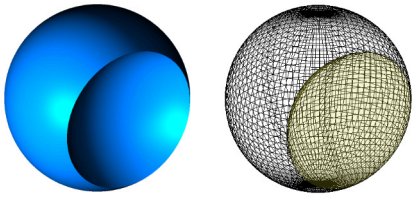


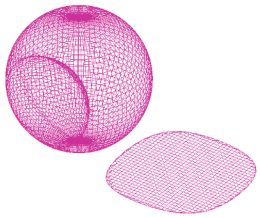
Fig 68



However an important difference between on / off. Can be seen, if we wish to select the concave face from the sphere, in Fig 68.

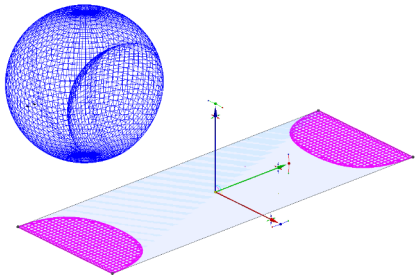
Note, sometimes we can select the correct face of the 3d object, with periodicity off, other times not. It appears to depends, on which axis the shape was created. In this case a Boolean subtract of a sphere on the x axis.

Fig 69



If the Boolean was done on the y axis then we can select the correct face without periodicity. As in Fig 69

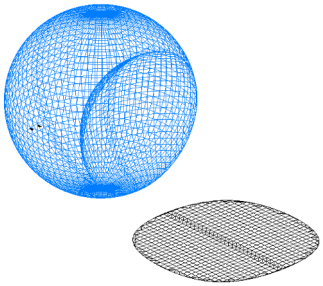
Fig 70



There are occasions, where it will not select correctly, with periodicity turned off. As can be seen in Fig 70. Where instead of selecting all the concave face, it represented it as two half surfaces. This was carried out on the x axis.

This is obviously not what we require.

Fig 71



Therefore selecting the face tool.
Select the face on the 3d object. (Concave section).
Then clicking the Use Periodicity. (Before clicking to place the face).
Click in the work space to place the face.

Produces the correct face, Fig 71. Ready for a 2d profile to be used.

IMPORTANT. Disclaimer. Everything in this document, was written and illustrated by experimentation. As is done with the best intentions. I did not program the tools. So cannot guarantee your findings will exactly match what has been described here. The tool is new. And doesn't always work the way one thinks it should (and crashes occasionally). Always use a copy of any important file, when testing the new tools.

The End.