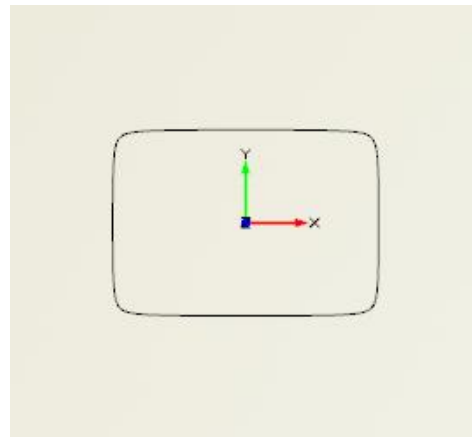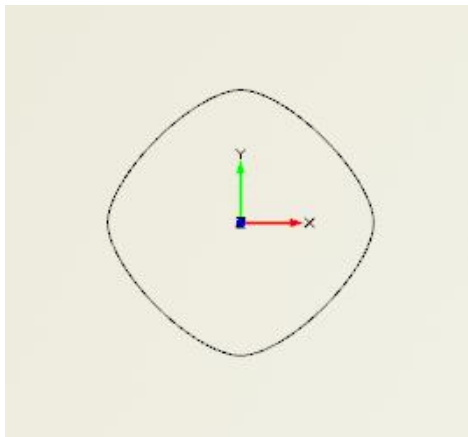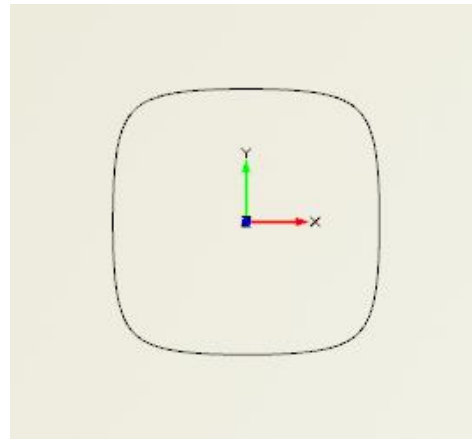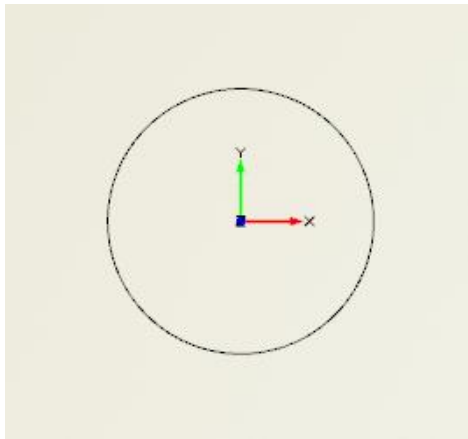# Tutorial

Parametric Contour

In this tutorial a simple contour curve is created. The curve is controlled by a small set of parameters and generates several different but still related shapes.

Only one quarter of the symmetric contour is modeled and connected to parameters. The remaining part of the contour is then created using image curves of the base contour.

For instance, such a basic contour can be used for duct or diffuser design. Another tutorial will show you how to generate advanced parametric surfaces using these kinds of parametric 2D definitions.


CAESES Project

The resulting model can be found in the section *samples > tutorials* in the documentation browser.
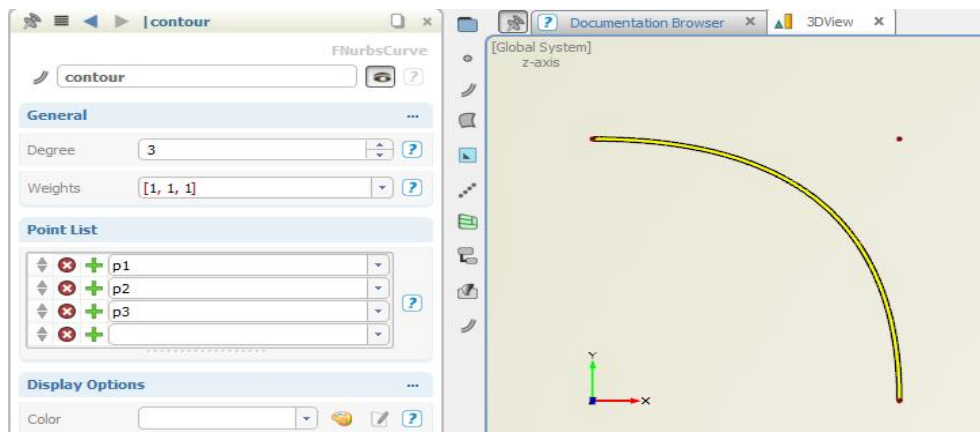
Basic Contour

1

In the first step, a *NURBS curve* is created based on three points (so-called *control vertices*) since we want to utilize the *weights* of a NURBS curve. The weight controls how much the curve is attracted to a corresponding control vertex.

► Click on the button *rotate to z-axis* at the 3D view to have a plane view.

► Create a point via *CAD > points > 3D point*.

► Set the y-coordinate to "0.5".

► While "p1" is selected, press CTRL and move "p1" in positive x-direction (drag the red axis of the selected point): this will create another point "p2".
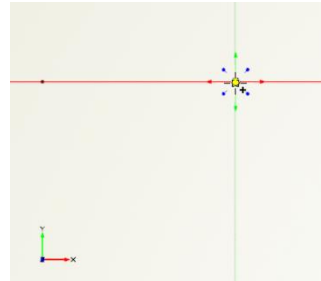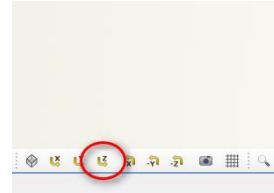
✓ A small "+" icon at the mouse cursor indicates that you are creating a new point.

► Set the x-coordinate of "p2" to "0.5".

► Make sure that the y-coordinate of "p2" is also still set to "0.5".

► While "p2" is selected, press CTRL again and move "p2" in negative y-direction: this will create "p3".

► Set the y-coordinate of "p3" to "0".

► Select "p1", "p2" and "p3" (multi-selection, in this order) and choose *CAD > curves > NURBS curve*.

► Set the name of the new curve to "contour".

2

Parameter for Weight

We want to create basic parameters for our contour such as height and width as well as a weight for the inner control vertex. The weight is introduced in this step:

► Create a *parameter* for the second weight of "contour" by highlighting the second value "1" and choose *create parameter*.

► Set the name of the new parameter to "weight".

► Try out different values for "weight" such as "0.5", "2", "10".

► Finally, set the value of "weight" to "1/sqrt(2)" which generates a circular arc.

Parameters for Height and Width

3
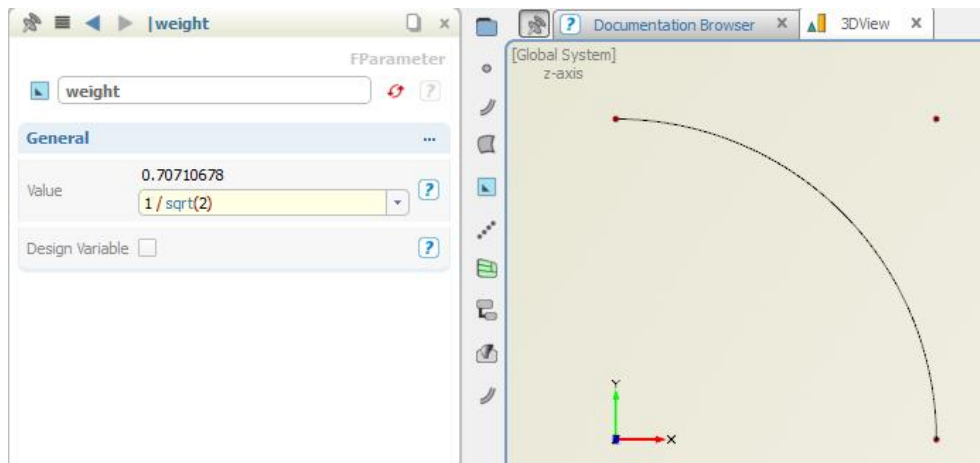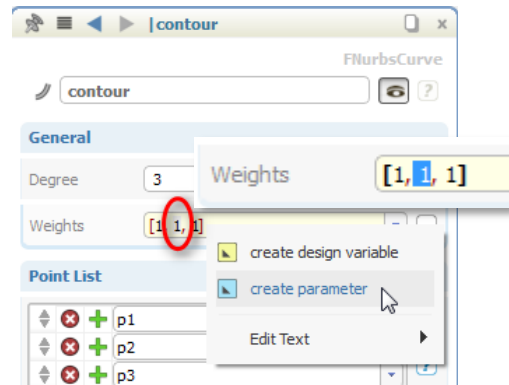
Let's add some further parameters for height and width. Since we model only one quarter of the total contour, we need to divide the parametric coordinate values of the points by "2".

▶ Select "p1" as well as "p2" using CTRL and create a *parameter* for the y-coordinate via the context menu.

✓ You can set common attributes of a selection at once. In this case we create and set a new parameter for the y-coordinate of the two points with this multi-selection.
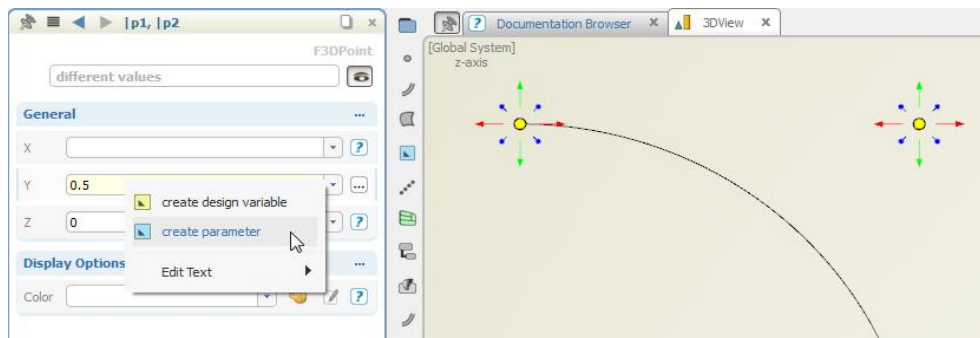

▶ Set the name of the new parameter to "height".
▶ Set the value of "height" to "1".
▶ In the y-coordinate of "p1" and "p2", divide height by the factor "2" (this is only one quarter of the entire contour).

In the same manner, create a parameter for the width of the contour:

▶ Select "p2" and "p3" using CTRL and create a parameter "width" for the x-coordinate.
▶ Set the value of "width" to "1".
▶ Divide the x-coordinate by "2".

So far, the three parameters "weight", "height" and "width" control the shape of the contour. Try out different values for them.


4
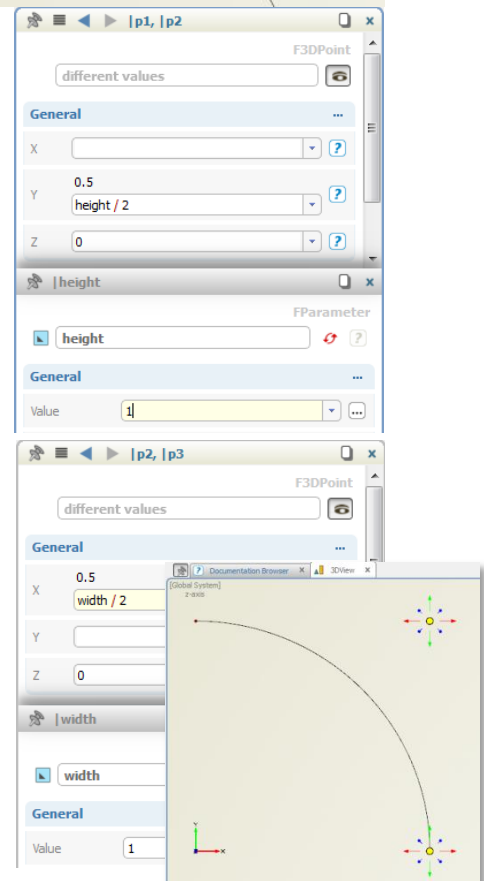
4 Complete Contour

We need to create the remaining parts of the contour in order to finalize it. For this purpose, *image curves* are created.

► Select "contour" and create an image curve via *CAD > curves > image curve.*

► Set the name of the new image curve to "contour2".

► From the pull-down menu of *image transformation*, create a *scaling* transformation.

► Set the name of the new scaling object to "scale2".

► Set *factor y* to "-1".
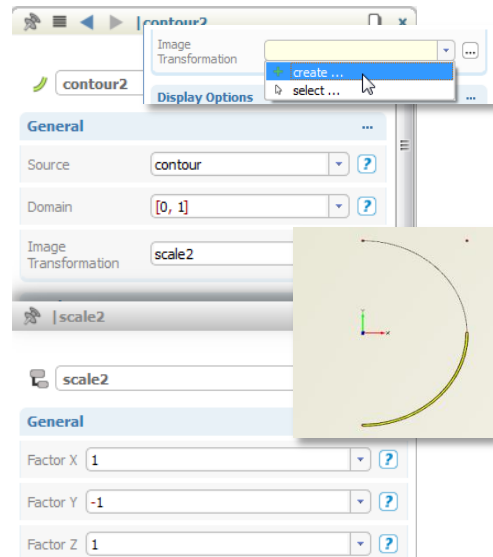
Now, the next curve:

► Select "contour2" and "scale2" using CTRL.

► Copy & paste this selection which creates "contour3" and "scale3".

► For "scale3", set *factor x* and *factor y* to "-1".

Finally, the last curve:

► Select "contour2" and "scale2" using CTRL.

► Copy & paste this selection which creates "contour4" and "scale4".

► For "scale4", set *factor x* to "-1".
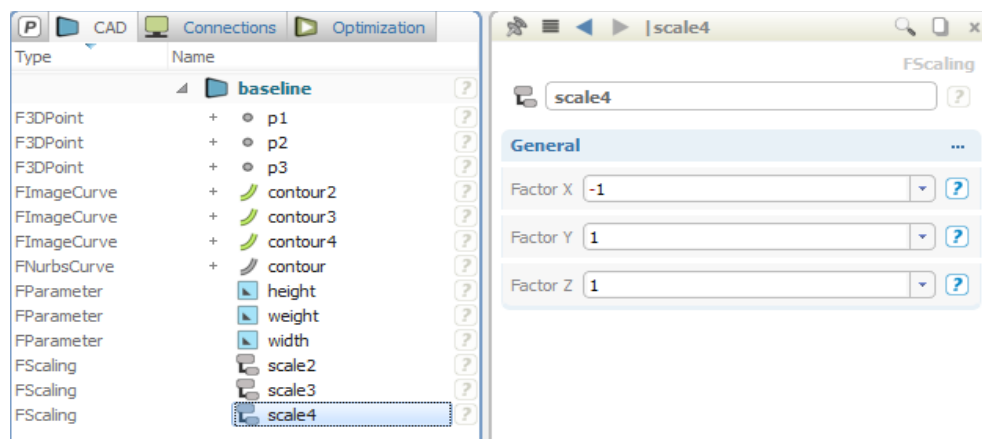
Single Contour Curve

5

Finally, all four curves are put into a *polycurve* which then represents the complete parametric contour.

► Select "contour", "contour2", "contour3" and "contour4" (order is important!).

► Choose *CAD > curves > polycurve* and set the name of the new curve to "totalcontour".

► Activate the option *auto-orientation* so that the input curves are sorted automatically according to their orientations.

► Change the contour parameters to receive different shapes.
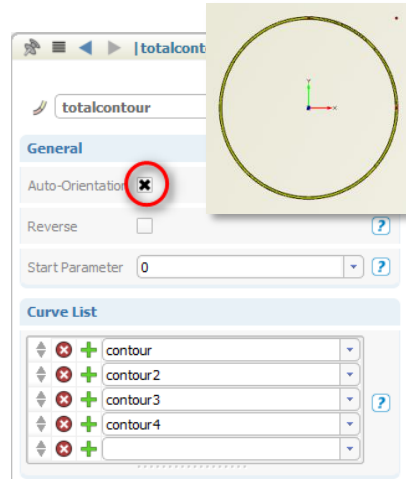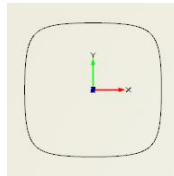
✓ Switch on the orientation indicator by using the corresponding button in the category *display options.*

You can also reverse the orientation of an image curve by simply changing its curve domain from "[0,1]" to "[1,0]". For example, if the curve orientations are set correctly (the next curve starts at the end of the previous curve), no auto-orientation is required for the polycurve.
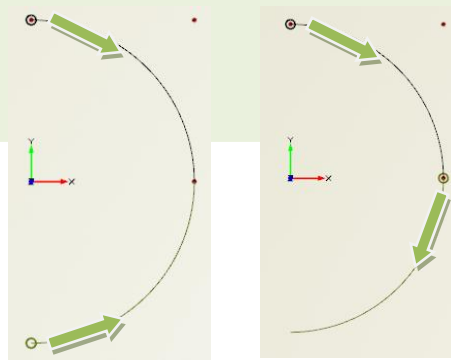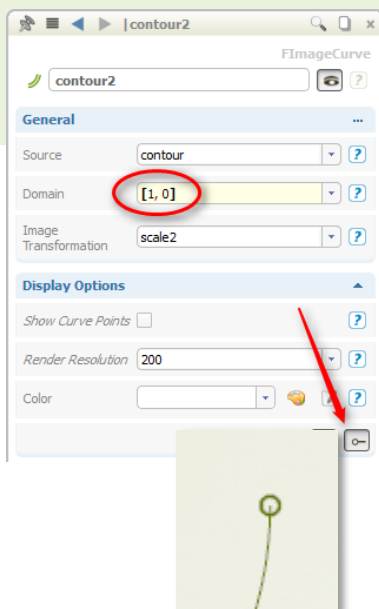
6 Conclusion

The contour in this example is rather simple and introduces some basic modeling issues of CAESES such as introducing parameters, curve orientations etc. Although the geometry is simple, the applications can be quite sophisticated, for instance, when such geometries are used for *meta surface* design. There is a follow-up tutorial which is based on this contour. It shows how to create an advanced sweep surface by utilizing the parameters that have been introduced here.