Chapter 18

Working with the FreeStyle Workbench



Learning Objectives

After completing this chapter, you will be able to:

- *Understand the FreeStyle workbench of CATIA V5*
- *Create surfaces in the FreeStyle workbench*
- *Modify surfaces in the FreeStyle workbench*
- *Use control points for deformations*
- *Use advanced operations on surfaces*

THE FREESTYLE WORKBENCH

As we know, most of the times, the shape of a product is designed using the surface modeling techniques. Surface models are three-dimensional models with no thickness and mass properties. CATIA V5 provides a number of surface modeling tools to create complex three-dimensional surface models. Various workbenches in CATIA V5 with surface creation tools are:

1. Wireframe and Surface Design
2. Generative Shape Design
3. FreeStyle

In this chapter, you will learn about the surface modeling tools in the **FreeStyle** workbench. The tools available in the **FreeStyle** workbench are used to manipulate and refine the surface created in this workbench. Moreover, you can create independent free form surfaces by using the tools available in this workbench. The workbench also provide tools to analyze the surfaces. You can use these tools of the **FreeStyle** workbench in the Part mode as well as the Shape mode.

STARTING A NEW FREESTYLE FILE

When you start CATIA V5-6R2022, a new **Product** file with the name **Product1** is displayed on the screen. Close this file by choosing the **Close** option from the **File** menu. To invoke the **FreeStyle** workbench, choose the **FreeStyle** option from the **Shape** flyout in the **Start** menu; the **New Part** dialog box will be displayed, as shown in Figure 18-1. Enter the desired name in the **Enter part name** edit box available in this dialog box and then choose the **OK** button; the file with specified name will be created and the user interface will be displayed, as shown in Figure 18-2.

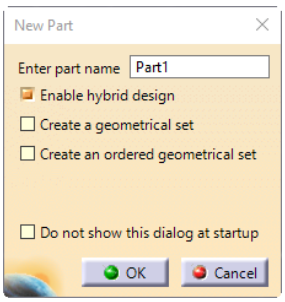


Figure 18-1 *The* ***New Part*** *dialog box*

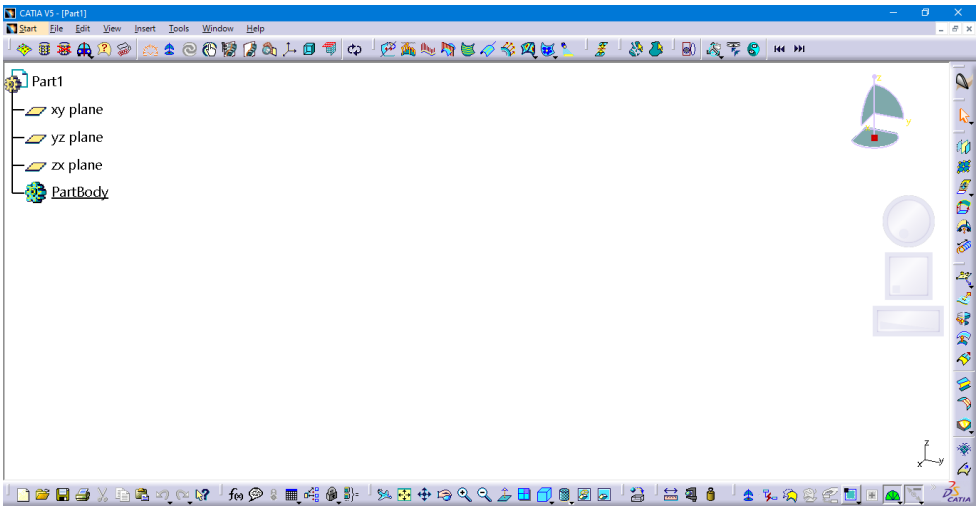


Figure 18-2 *CATIA V5-6R2022 with* ***FreeStyle*** *workbench invoked*

Alternatively, choose **New** from the **File** menu; the **New** dialog box will be displayed. Select **Shape** from the **List of Types** list box in the **New** dialog box or write the word **Shape** in the **Selection** edit box at the bottom of the **List of Types** list box. Next, choose the **OK** button; the **Shape name** dialog box will be displayed, as shown in Figure 18-3. Enter the file name in it and choose the **OK** button; a new file in the **Shape** workbench will be displayed on the screen.

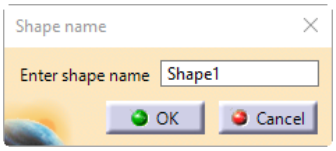


Figure 18-3 *The* ***Shape name*** *dialog box*

SETTING THE FREESTYLE WORKBENCH

After invoking the **FreeStyle** workbench, parameters such as tolerance, minimum deviation, tuning, and so on need to be set. To do so, invoke the **Options** dialog box by choosing **Options** from the **Tools** menu. Next, expand the **Shape** node by clicking on the + sign on the left of the node in the dialog box. Choose **FreeStyle** from the expanded node; the tabs corresponding to this selection appear on the right in the **Options** dialog box. Next, choose the **General** tab, if it is not selected by default. The **Options** dialog box after choosing the **General** tab is shown in Figure 18-4.

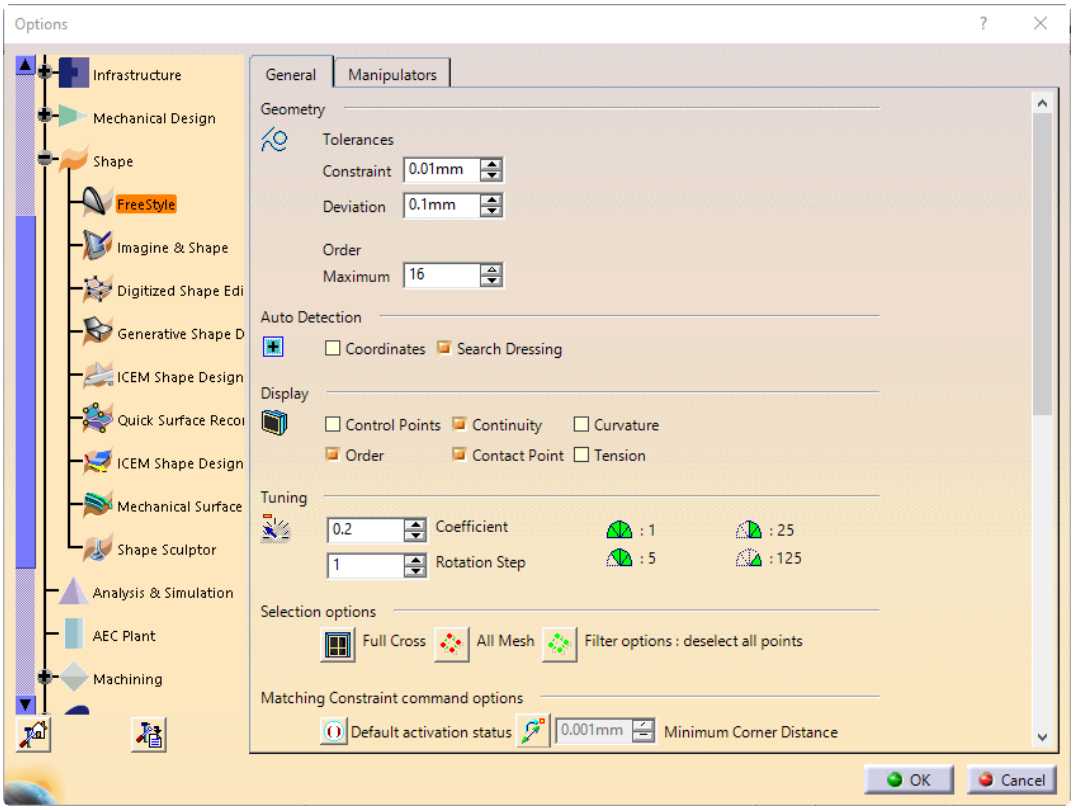


Figure 18-4 *The* ***Options*** *dialog box with the* ***General*** *tab chosen*

Set the values for tolerances, tuning, display settings, and so on by using the options available in this tab.

You can change the color of various entities available in the **FreeStyle** environment by using the options available in the **Manipulators** tab. The **Options** dialog box after choosing the **Manipulators** tab is shown in Figure 18-5. After setting the required values, choose the **OK** button from the **Options** dialog box.

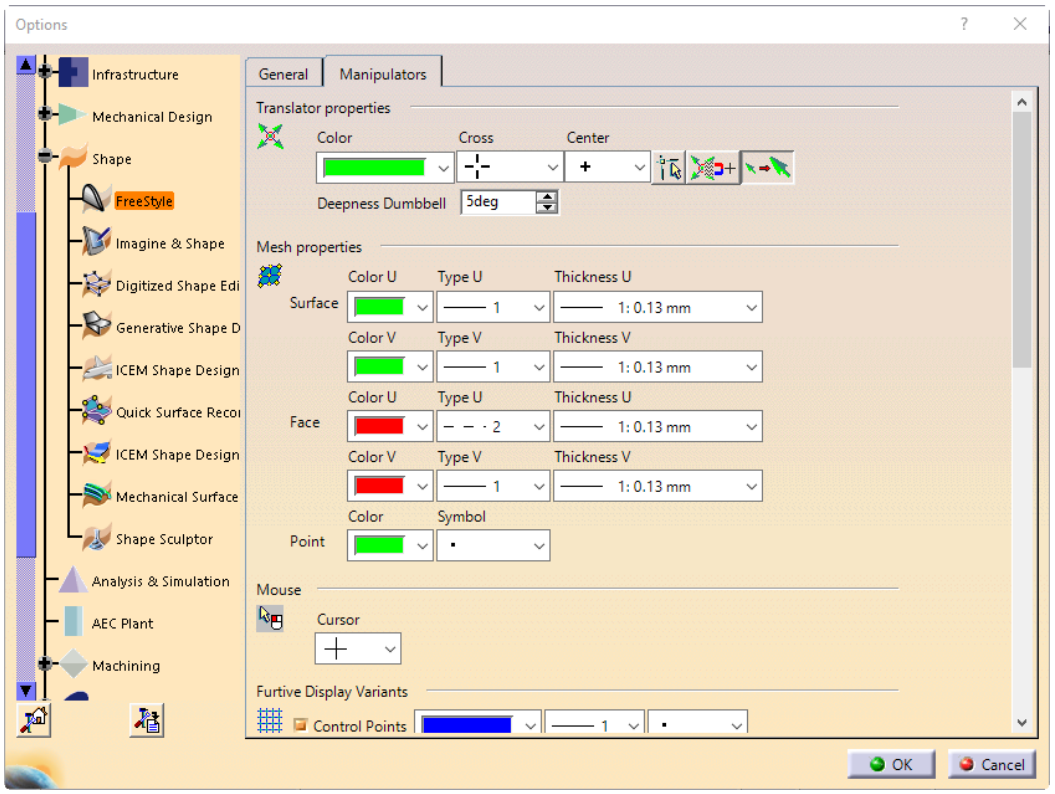


Figure 18-5 *The* ***Options*** *dialog box with the* ***Manipulators*** *tab chosen*

CREATING SURFACES

The tools available in the **Surface Creation** toolbar are used to create various types of surfaces, refer to Figure 18-6. These tools are discussed next.

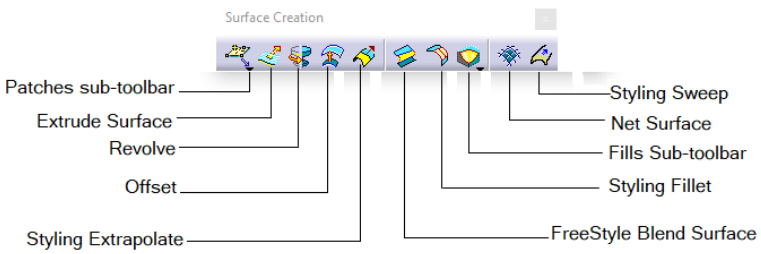


Figure 18-6 *The* ***Surface Creation*** *toolbar*

Patches Sub-toolbar

The **Patches** sub-toolbar is used to create patches using various tools available in this sub-toolbar, The tools available in this sub-toolbar are discussed next.

Unified Patch

This tool is used to create various planar patches. To do so, choose this tool from the **Patches** sub-toolbar; the **Unifies Patch** dialog box will be displayed, as shown in Figure 18-7. Various options available in this dialog box are discussed next.

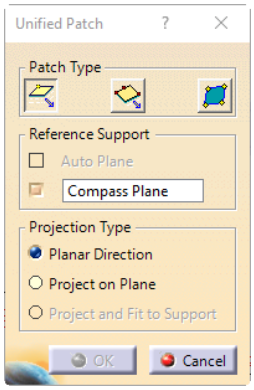


Figure 18-7 *The* ***Unified Patch*** *sub-toolbar*

2-Point Patch



This option is used to create planar patches by using two points. To create a planar patch, choose the **2-Point Patch** button from the **Patch Type** area of this dialog box; you will be prompted to specify the start point of the planar patch. Click to specify the start point of the patch, refer to Figure 18-8; you will be prompted to specify the Second point of the planar patch, refer to Figure 18-9. Click at a desired location in the drawing area to specify the end point of the patch or specify the dimensions of the patch. To specify the dimensions of the patch, right-click in the drawing area; a shortcut menu will be displayed, as shown in Figure 18-10. Choose the **Edit Dimensions** option from the shortcut menu; the **Dimensions** dialog box will be displayed, as shown in Figure 18-11. Now, specify the value of dimensions in the edit boxes available in this dialog box. If you want to change the order of the surface patch (U and V values), choose the **Edit Orders** option from the shortcut menu; the **Orders** dialog box will be displayed, refer to Figure 18-12. Set the value of order in the **U** and **V** spinners. If you hold the CTRL key while selecting the end point in the drawing area, the planar patch will be created symmetric about the starting point.

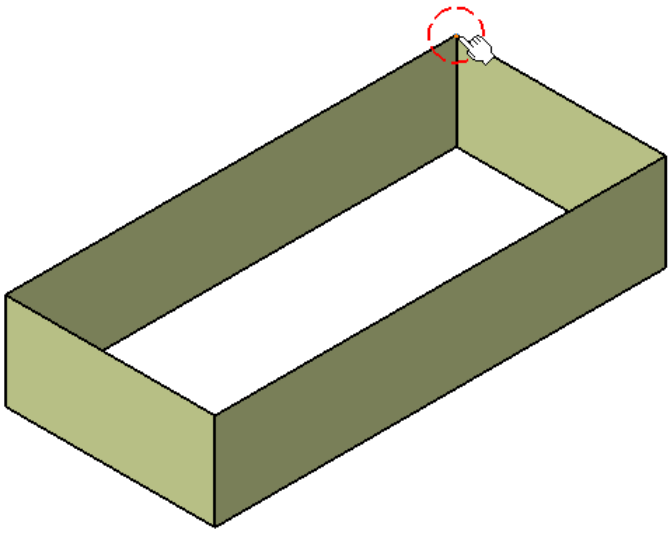


Figure 18-8 *The start point specified on the surface*

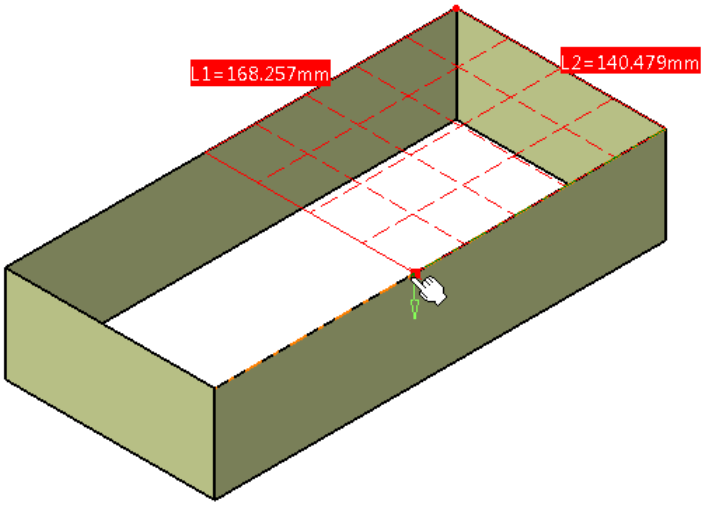


Figure 18-9 *The end point specified on the surface*



Figure 18-10 *The shortcut menu displayed*

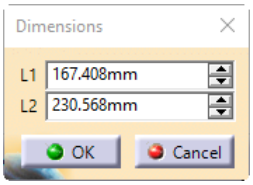


Figure 18-11 *The* ***Dimensions*** *dialog box*

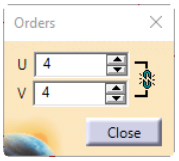


Figure 18-12 *The* ***Orders*** *dialog box*

3-Point Patch

This option is used to create surface patches by using three points. To create a 3-point patch, choose the **3-Point Patch** button from the **Patch Type** area of this dialog box; you will be prompted to specify the first point for the patch. Click to specify the first point, refer to Figure 18-13. Now, move the cursor; a rubber band line will be displayed and you will be prompted to specify the second point for the surface patch. Click in the drawing area to specify the second point, you will be prompted to specify the third point to complete the creation of the patch. Click in the drawing area again at the desired position to specify the third point; the patch will be created. If you hold the CTRL key while specifying the third point, the patch will be created symmetric to the line joining the first and second points. Figure 18-14 shows the preview of the patch to be created on specifying the third point.

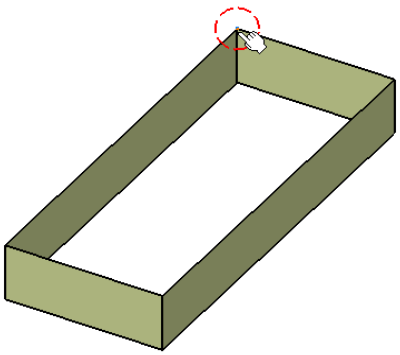


Figure 18-13 *First point to be specified*

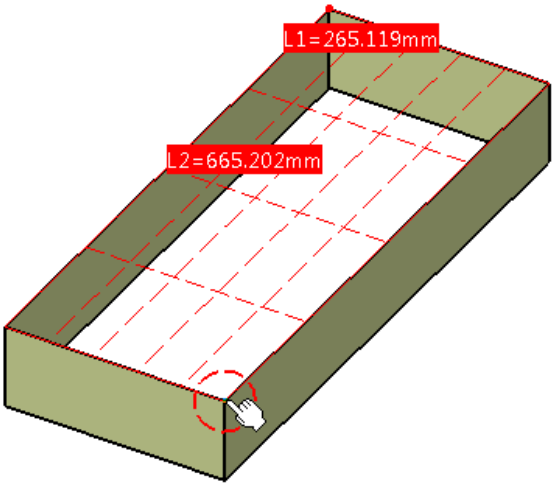


Figure 18-14 *The preview of the patch to be created*

4-Point Patch

This option is used to create surface patches by using four points. To create a 4-point patch, choose the **4-Point Patch** option from the **Patch Type** area of this dialog box; you will be prompted to specify the first point of a patch on a surface or a datum plane. Click to specify the start point; you will be prompted to specify the second point of the patch. Specify the second point by clicking at the desired location on the surface or plane; you will be prompted to specify the third point. Specify the third point on a plane or a surface; you will be prompted to specify the fourth point. Click in the drawing area to specify the fourth point; the patch will be created by using the four specified points as corner points.

Geometry Extraction

This tool is used to create surface patches on an already created surface. To do so, choose the **Geometry Extraction** tool from the **Patches** sub-toolbar; you will be prompted to select a surface or a curve. Select an already created surface; you will be prompted to specify the start point for the surface patch. Select a point on the surface; you will be prompted to specify the end point of the patch surface, refer to Figure 18-15. Click on the surface to specify the end point; the surface patch will be created.

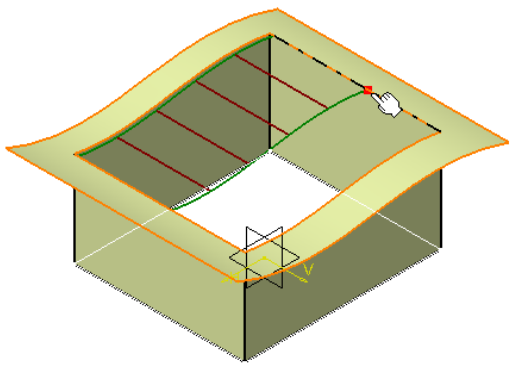


Figure 18-15 *Creating surface patch on a surface*

Extrude Surface

This tool is available in the **Surface Creation** toolbar. Using this tool, you can create a surface by extruding a curve or curves in vertical or horizontal direction. To do so, choose the **Extrude Surface** tool from the **Surface Creation** toolbar; the **Extrude Surface** dialog box will be displayed, as shown in Figure 18-16, and you will be prompted to select a curve. Select a curve from the drawing area; a surface of the length specified in the **Length** edit box will be created. Specify the desired value of length in this edit box. To change the direction of extrusion, you can choose the desired button from the **Direction** area of this dialog box.

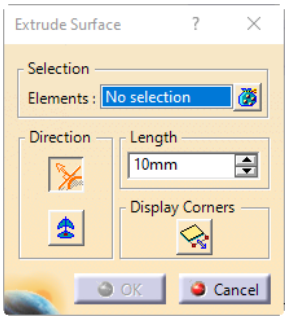
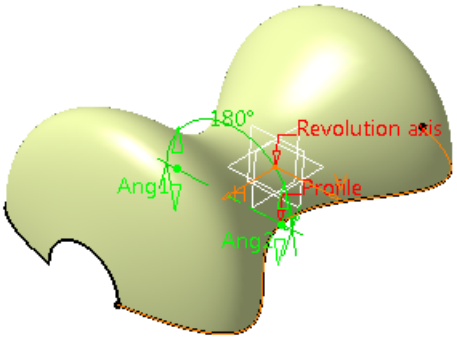


***Figure 18-16** The **Extrude Surface** dialog box*

Revolve

Using this tool, you can create a surface by revolving a curve or curves around an axis. To do so, choose the **Revolve** tool from the **Surface Creation** toolbar; the **Revolution Surface Definition** dialog box will be displayed and you will be prompted to select a profile. Select the curve(s) you want to use as a profile for the revolved surface; you will be prompted to specify the axis of revolution. Select a curve or axis from the drawing area; a revolved surface will be created. Figure 18-17 shows preview of the revolved surface along with the corresponding values in the **Revolution Surface Definition** dialog box. Using the **Angle 1** and **Angle 2** edit boxes, you can specify the value of revolution angle.



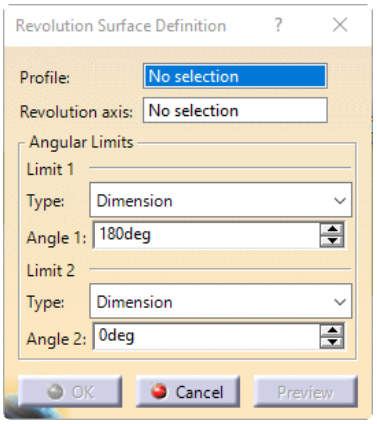


***Figure 18-17** A revolved surface along with the **Revolution Surface Definition** dialog box*

Offset

Using this tool, you can create an offset surface at a specified distance from the selected surface. To do so, choose the **Offset** tool from the **Surface Creation** toolbar; the **Offset Surface** dialog box will be displayed, as shown in Figure 18-18, and you will be prompted to select a mono-cell surface. Select a surface from the drawing area; an offset surface will be created. You can change the distance between the native surface and the offset surface by using the dynamic edit box displayed on the surface. Alternatively, use the drag handles displayed on the surface to change the distance. By default, the **Simple** radio button is selected so the offset surface is created at a constant distance from the native surface. You can specify a different offset distance at each corner point by selecting the **Variable** radio button from the **Type** area of the **Offset Surface** dialog box. Figure 18-19 shows an offset surface created by using the **Variable** radio button from the **Type** area.

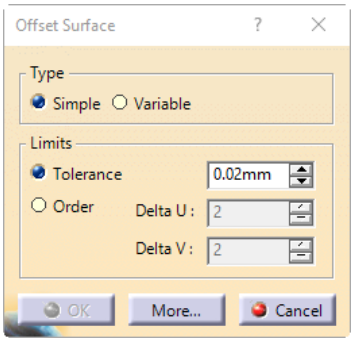


Figure 18-18 *The* ***Offset Surface*** *dialog box*

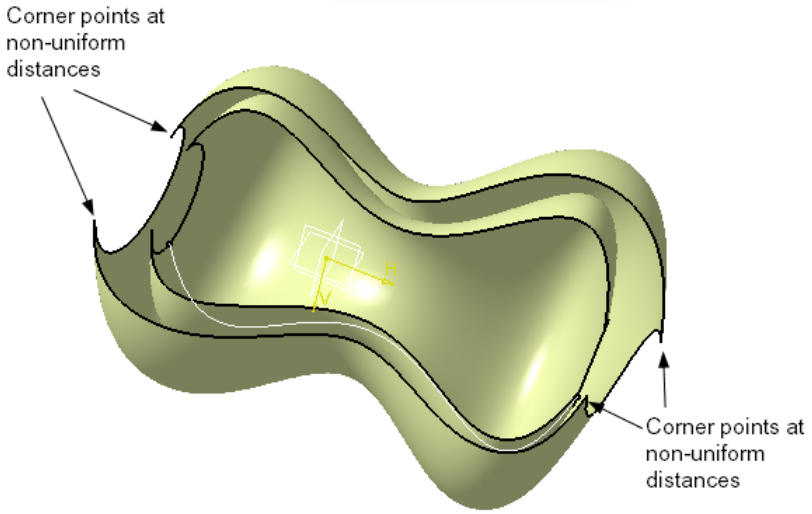


Figure 18-19 *An offset surface created after selecting the* ***Variable*** *radio button*

Styling Extrapolate

Using this tool, you can create surface by extrapolating an edge or a curve. To do so, choose the **Styling Extrapolate** tool from the **Surface Creation** toolbar; the **Extrapolation** dialog box will be displayed and you will be prompted to select a curve or the boundary of a surface. On doing so, the preview of the surface will be displayed, refer to Figure 18-20. Also, the **Extrapolation** dialog box will be displayed, as shown in Figure 18-21.

By default, the **Tangential** radio button is selected in the **Type** area of the dialog box. As a result, the surface created is tangential to the selected curve. If you select the **Curvature** radio button from the **Type** area, the surface created will follow the curvature of the selected curve. You can also change the extent of surface by using the options available in the **Limit Type** drop-down list.

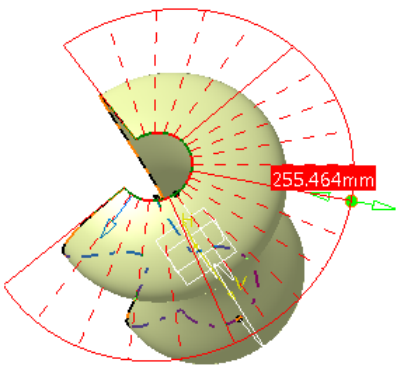


Figure 18-20 *Preview of the surface created by using the* ***Styling Extrapolate*** *tool*

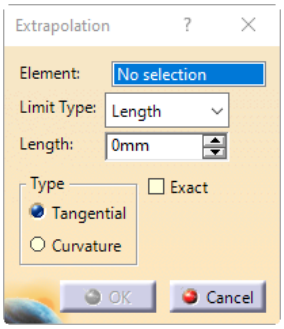


Figure 18-21 *The* ***Extrapolation*** *dialog box*

FreeStyle Blend Surface



Using this tool, you can create a blend surface between two surfaces. To create this type of surface, choose the **FreeStyle Blend Surface** tool from the **Surface Creation** toolbar; the **Blend Surface** dialog box will be displayed, as shown in Figure 18-22, and you will be prompted to select a curve or an isoparameter. Select a curve or an isoparameter of a surface; you will be again prompted to select a curve or an isoparameter. Select a curve or an isoparameter of another surface; a blend surface will be created. You can dynamically change the shape of blending surface by moving the end points of the surface. Figure 18-23 shows two surfaces for blending and Figure 18-24 shows the surfaces after blending.

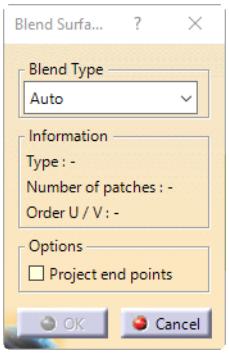


Figure 18-22 *The* ***Blend Surface*** *dialog box*

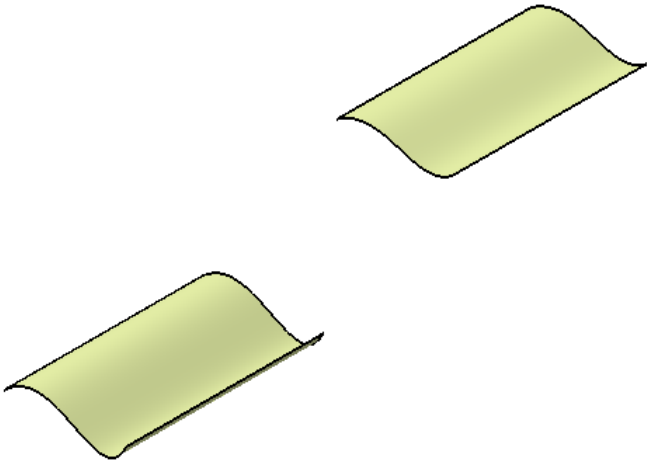


Figure 18-23 *Surfaces for blending*

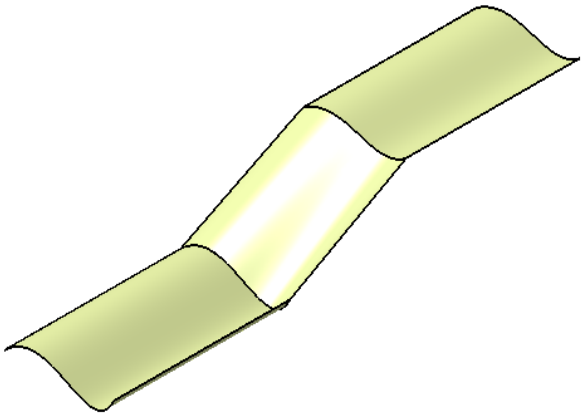


Figure 18-24 *Surfaces after blending*

Styling Fillet



Using this tool, you can create fillets on the sharp edges of surfaces. To create a styling fillet, choose the **Styling Fillet** tool from the **Surface Creation** toolbar; the **Styling Fillet** dialog box will be displayed, as shown in Figure 18-25, and you will be prompted to select the first support to create a fillet. Select the first support; you will be prompted to select the second support for the fillet. Select the second support, refer to Figure 18-26, and then choose the **Apply** button from the dialog box; a fillet will be created between the selected set of surfaces, as shown in Figure 18-27. You can choose the **Trim Support 1** and **Trim Support 2** buttons from the **Styling Fillet** dialog box to trim the extended surfaces in the fillet zone.

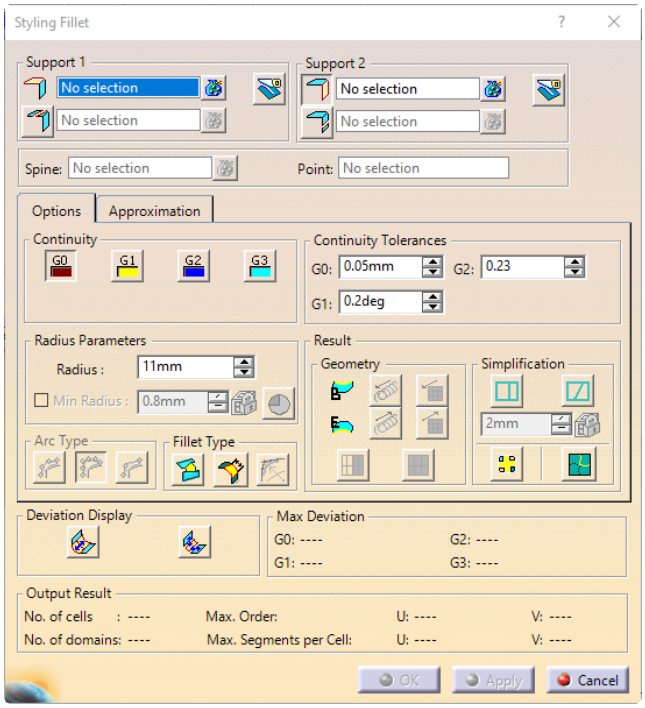


Figure 18-25 *The* ***Styling Fillet*** *dialog box*

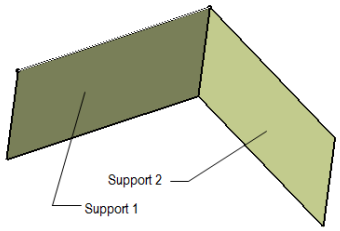


Figure 18-26 Supports for the styling fillet

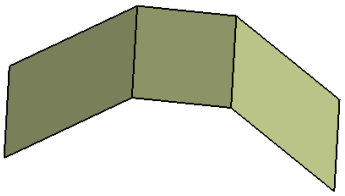


Figure 18-27 Resultant styling fillet

Fills Sub-toolbar

The tools available in this sub-toolbar are used to fill the empty space created by three or more contiguous surfaces, refer to Figure 18-28. The tools available in this sub-toolbar are discussed next.

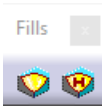


*Figure 18-28 The **Fills** sub-toolbar*

Fill



This tool is used to create a fill surface. To do so, choose the **Fill** tool from the **Fills** sub-toolbar; the **Fill** dialog box will be displayed, as shown in Figure 18-29, and you will be prompted to select the contiguous edges. Select two or more contiguous edges, refer to Figure 18-30, and then choose the **Apply** button from the dialog box; a fill surface will be created and the continuity callouts will be displayed attached to the edges, as shown in Figure 18-31. By using these continuity callouts, you can specify the point and tangent continuity between the surrounded edges and filling surface. To specify the continuity, click on the continuity pop-up once to invoke the contextual menu and then select the required type of continuity from it. After specifying the continuity between the surrounding edges and the filling surface, choose the **OK** button from the dialog box.

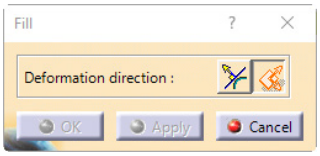


*Figure 18-29 The **Fill** dialog box*

Similarly, you can create a freestyle fill surface by using the **FreeStyle Fill** tool available in the same sub-toolbar. Freestyle fill surfaces are associative to the selected surfaces.

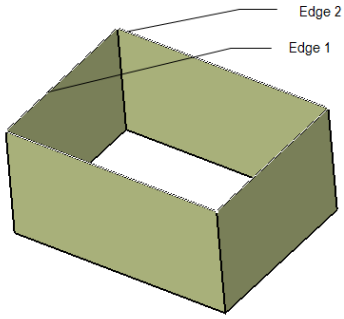


Figure 18-30 *Edges to be selected for fill surface*

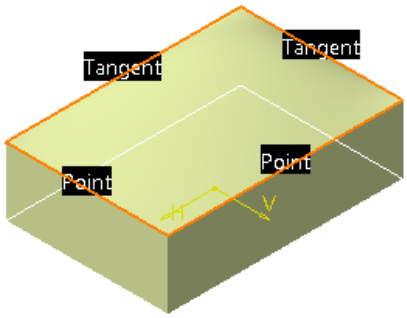


Figure 18-31 *The fill surface created*

Net Surface



This tool is available in the **Surface Creation** toolbar. Using this tool, you can create a surface of specified profile following the path given by a guide curve. To create a net surface, choose the **Net Surface** tool from the **Surface Creation** toolbar; the **Net Surface** dialog box will be displayed, as shown in Figure 18-32. Also, you will be prompted to select a guide curve and the **guides(0)** option will be highlighted in the preview area of the dialog box. Select a curve or curves by holding the CTRL key. Now, select the **profiles(0)** option from the preview area and select curves to be used as profile from the drawing area; the **OK** and **Apply** buttons will get activated in the dialog box. Choose the **OK** button to create the net surface and exit the tool. Figure 18-33 shows the curves required to create a net surface and Figure 18-34 shows a net surface created by using the curves.

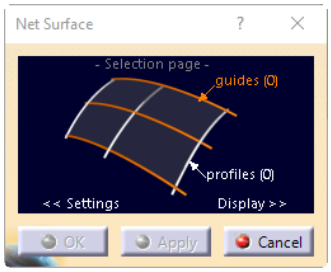


Figure 18-32 *The **Net Surface** dialog box*

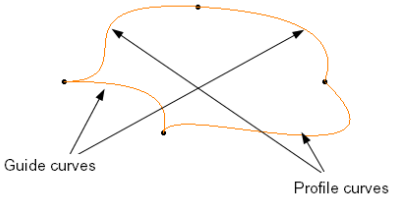


Figure 18-33 *The profile and guide curves for net surface*

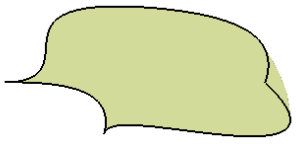


Figure 18-34 *The resultant net surface*

Styling Sweep

This tool is available in the **Surface Creation** toolbar. Using this tool, you can create a styling sweep surface. To do so, choose the **Styling Sweep** tool; the **Styling Sweep** dialog box will be displayed, as shown in Figure 18-35. By default, the **profile** option is selected in the Preview area and you are prompted to select a curve to specify a profile for the swept surface. Select a profile and then choose the **spine** option from the Preview area of the dialog box; you will be prompted to specify a curve for spine. Select a curve for spine; the **OK** and **Apply** buttons will get activated. Choose the **Apply** button to check the preview of the surface and then choose the **OK** button to create the styling sweep surface. There are four buttons available on the left of the dialog box to create styling sweep surface using various parameters.

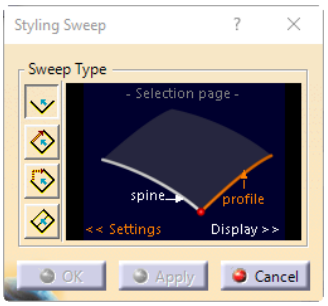


Figure 18-35 *The* ***Styling Sweep*** *dialog box*

MODIFYING SURFACES

The tools available in the **FreeStyle** workbench are used to modify a surface. The tools required to modify a surface are available in the **Shape Modification** toolbar, refer to Figure 18-36. Various tools available in this toolbar are discussed next.

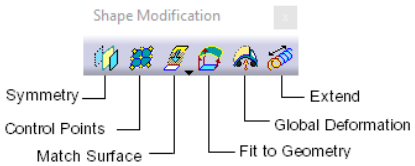


Figure 18-36 *The* ***Shape Modification*** *toolbar*

Symmetry

This tool is used to create a copy of the selected surface or a shape which is symmetric about a specified reference. To create a symmetric copy of an element, choose the **Symmetry** tool from the **Shape Modification** toolbar; the **Symmetry Definition** dialog box will be displayed, as shown in Figure 18-37, and you will be prompted to select the element to be transformed. Select the element to be transformed; you will be prompted to specify a reference point, a line or a plane. Select a reference element; preview of the symmetric element will be displayed in the drawing area, as shown in Figure 18-38. Choose the **OK** button to create the symmetric element and exit the tool.

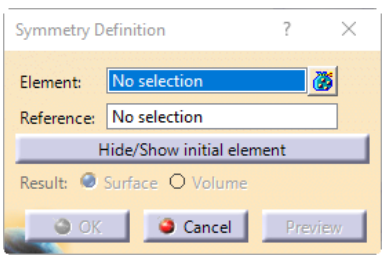


Figure 18-37 *The* ***Symmetry Definition*** *dialog box*

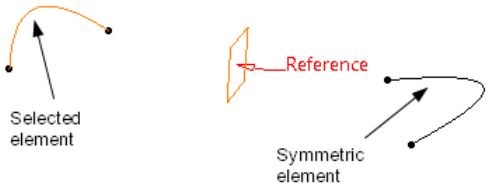


Figure 18-38 *Preview of the symmetric element*

Control Points

This tool is used to modify an element by using the control points on the surface. To modify an element, choose the **Control Points** tool from the **Shape Modification** toolbar; the **Control Points** dialog box will be displayed, as shown in Figure 18-39, and you will be prompted to select a surface or a curve for modifications. Select a surface from the drawing area; control points will be displayed on the surface, refer to Figure 18-40. You can increase the controlling curves by clicking on the **Nu:XX** callout. Using the control points displayed on the surface, you can dynamically modify a surface. After modifying the surface, choose the **OK** button to accept the changes.

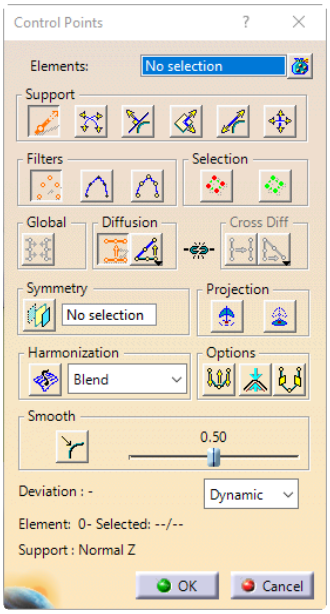


Figure 18-39 *The **Control Points** dialog box*

The buttons available in the **Control Points** dialog box are discussed next.

Support Area

There are six options available in this area: **Normal to compass**, **Mesh Lines**, **Local Normals**, **Compass plane**, **Local Tangents**, and **Screen Plane**. These options are discussed next.

Normal to Compass

The **Normal to compass** button is used to modify a surface in a direction perpendicular to the compass.

Mesh Lines

The **Mesh Lines** button is used to modify a surface along the mesh lines.

Local Normals

The **Local Normals** button is used to modify a surface along the normal vector on each grid line.

Compass plane

The **Compass Plane** button is used to modify a surface along the compass plane in the X and Y directions of the compass plane.

Local Tangents

The **Local Tangents** button is used to modify a surface along and normal to the local tangents.

Screen Plane

The **Screen Plane** button is used to modify a surface along the screen plane.

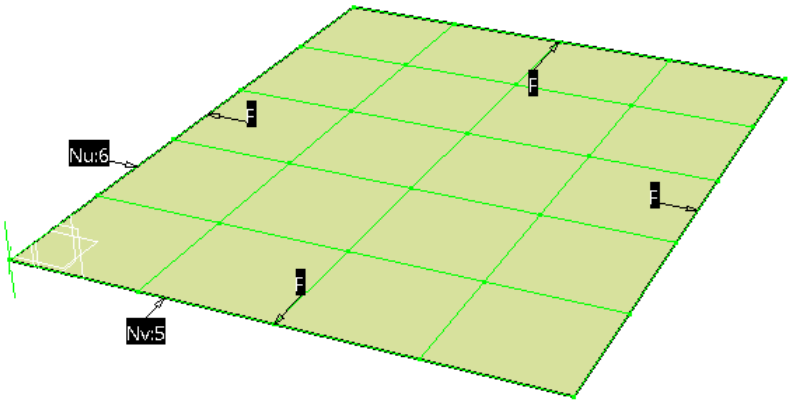


Figure 18-40 *The surface with control points*

Filters Area

The options in this area are used to filter entities during selection. There are three options available in this area and are discussed next

Points only

Choose this button if you need to select only points on the surface for modification.

Mesh only

Choose this button if you need to select only mesh on the surface for modification.

Points and mesh

Choose this button if you need to select points as well as mesh on the surface for modification.

Selection Area

The buttons in this area are used to select or deselect points available on the surface and are discussed next.

Select all points

Choose this button if you need to select all the points available on the surface.

Deselect all points

Choose this button if you need to deselect all the points selected on the surface.

Global Area
There is only one button available in this area. This option is used to modify a surface in the global mesh mode.

Diffusion Area
The buttons in this area are used to specify the pattern to be followed while modifying a surface.

Cross Diff Area
The buttons available in this area are used to specify the laws to be applied on the points and mesh, which are not directly manipulated while modifying the surface.

Symmetry Area
The buttons available in this area are used to make a surface symmetric about a reference plane.

Projection Area
There are two buttons available in this area: **Project along the compass normal** and **Project in the compass plane**. The **Project along the compass normal** button is used to project the modified surface along the direction normal to the compass plane. The **Project in the compass plane** button is used to project the modified surface in the compass plane.

Harmonization Area
The buttons in this area are used to harmonize control points and mesh lines of the surface.

Options Area
The buttons in this area are used to display or hide the inflections, deviations, and harmonization planes.

Smooth Area
The buttons in this area are used to smoothen the transition of control points and mesh of the surface while modifying it up to a desired level.

Match
The **Match** sub-toolbar, refer to Figure 18-41, is available in the **Shape Modification** toolbar. There are two tools available in this sub-toolbar which are discussed next.



Figure 18-41 *The **Match** sub-toolbar*

Match Surface

This tool is used to match two surfaces or a surface and a curve. To do so, choose the **Match Surface** tool from the **Match** sub-toolbar; the **Match Surface** dialog box will be displayed, as shown in Figure 18-42, and you will be prompted to select a boundary to be matched with a curve. Select the boundary of the surface; you will be prompted to select the target curve for the boundary. Select an edge of another surface; the match surface will be created. Figure 18-43

shows two surfaces before applying the **Match Surface** tool and Figure 18-44 shows the surfaces after applying the **Match Surface** tool.

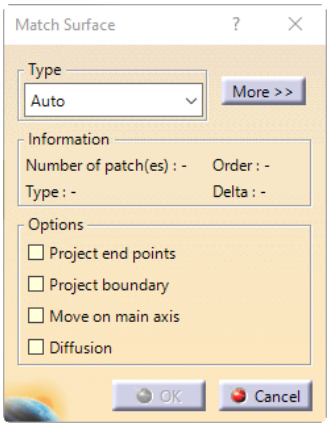


Figure 18-42 *The* ***Match Surface*** *dialog box*

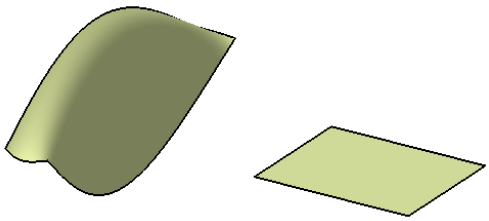


Figure 18-43 *The surfaces before applying the* ***Match Surface*** *tool*

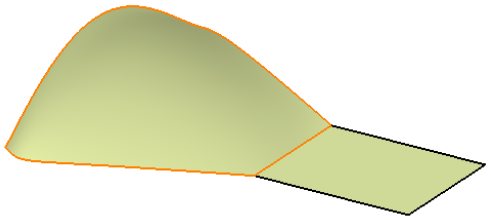


Figure 18-44 *The surfaces after applying the* ***Match Surface*** *tool*

Multi-Side Match Surface

This tool is used to match a surface with two or more surfaces. To create a multi-side match surface, choose the **Multi-Side Match Surface** tool from the **Match** sub-toolbar; the **Multi-side Match** dialog box will be displayed, as shown in Figure 18-45, and you will be prompted to select an edge.

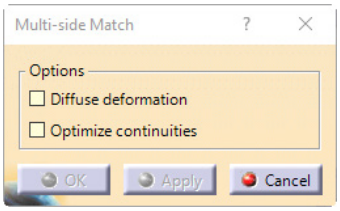


Figure 18-45 *The* ***Multi-side Match*** *dialog box*

Select the desired option from the dialog box and then select the edges to be matched one by one. Next, choose the **OK** button to create a multi-side match surface.

Fit to Geometry



This tool is used to change the shape of a surface by fitting it over the control points. To do so, choose the **Fit to Geometry** tool from the **Shape Modification** toolbar; the **Fit to Geometry** dialog box will be displayed, as shown in Figure 18-46, and you will be prompted to select a surface to be fitted. Select the **Sources** radio button from the **Selection** area of the dialog box and then select the source surface from the drawing area. Next, select the **Targets** radio button from the dialog box and then select the target surface from the drawing area. Next, choose the **Fit** button from the dialog box to display the preview of surface. Choose the **OK** button to create the surface.

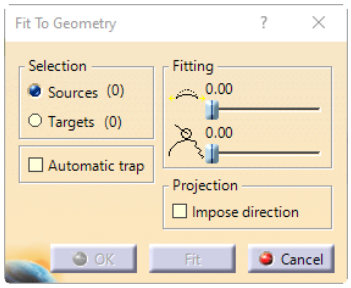


Figure 18-46 *The* ***Fit To Geometry*** *dialog box*

Global Deformation



This tool is used to deform a surface globally. To do so, choose the **Global Deformation** tool from the **Shape Modification** toolbar; the **Global Deformation** dialog box will be displayed, as shown in Figure 18-47, and you will be prompted to select a surface. Choose the desired options from the **Type** area and the **Guides** area, and then select the surface; the **Run** button will be activated in the dialog box. Choose the **Run** button; the surface with the control points and mesh will be displayed. Change the shape of the surface by using these points and mesh, and then choose the **OK** button from the **Control Points** dialog box to accept the changes.

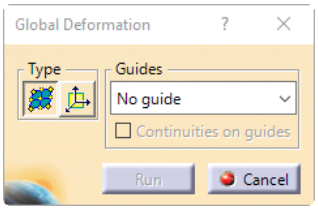


Figure 18-47 *The* ***Global Deformation*** *dialog box*

Extend



This tool is used to extend a surface by using the control points displayed on the surface. To do so, choose the **Extend** tool from the **Shape Modification** toolbar; the **Extend** dialog box will be displayed, as shown in Figure 18-48, and you will be prompted to select a surface. Select the surface; control points will be displayed on the surface. Using these control points, you can deform the surface. After deformation, choose the **OK** button to accept the deformation and exit the tool.

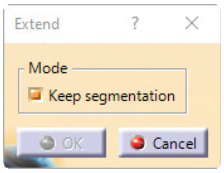


Figure 18-48 *The* ***Extend*** *dialog box*

You can make further changes in the surfaces to get the final shape by using the tools available in the **Operations** toolbar, refer to Figure 18-49. These tools are discussed next.

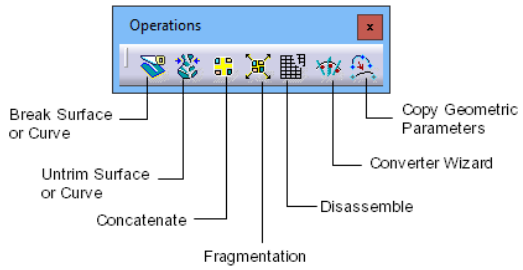


Figure 18-49 *The* ***Operations*** *toolbar*

Break Surface or Curve

This tool is used to break a surface or a curve at a specified reference. To break a surface or a curve, choose the **Break Surface or Curve** tool from the **Operations** toolbar; the **Break** dialog box will be displayed, as shown in Figure 18-50, and you will be prompted to select a cutting element. Choose the **Break Surfaces** option from the **Break Type** area of the **Break** dialog box and then select the cutting surface from the drawing area; a red dot will be attached to the cursor. Click on the desired location on the surface; a manipulation handle will be displayed on that location, refer to Figure 18-51. Using this manipulation handle, you can change the position of the trimming line. Now, choose the **Apply** button to display the preview of trimming, refer to Figure 18-52. Next, choose the **OK** button from the dialog box to accept the preview.

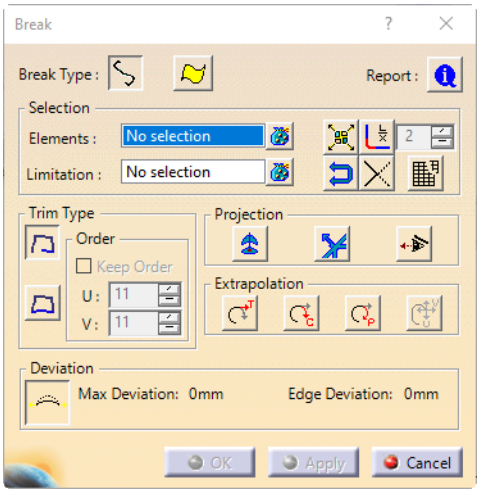


Figure 18-50 *The* ***Break*** *dialog box*

Untrim Surface or Curve

This tool is used to recreate the surface or the curve trimmed by the **Break Surface or Curve** tool. To do so, choose the **Untrim Surface or Curve** tool from the **Operations** toolbar; the **Untrim** dialog box will be displayed and you will be prompted to select elements to be untrimmed. Select the trimmed surface from the drawing area and choose the **OK** button from the **Untrim** dialog box; the trimmed surface will be untrimmed.

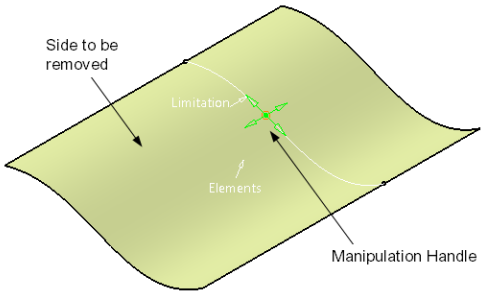


Figure 18-51 *The surface to be trimmed with manipulation handle*

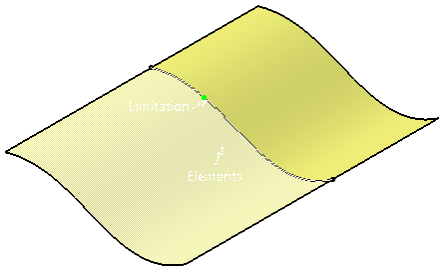


Figure 18-52 *Preview of the surface after trimming*

Concatenate

This tool is used to convert the contiguous curves into a mono-cell curve. To do so, choose the **Concatenate** tool from the **Operations** toolbar; the **Concatenate** dialog box will be displayed and you will be prompted to select the contiguous curves to be concatenated. Select the curves and then set the desired value of tolerance in the spinner available in the **Concatenate** dialog box. Now, choose the **Apply** button to display the preview of concatenated curve. Now, choose the **OK** button to accept the preview and exit the tool.

Fragmentation

This tool is used to convert a mono-cell curve into multiple contiguous curves. To do so, choose the **Fragmentation** tool from the **Operations** toolbar; the **Fragmentation** dialog box will be displayed and you will be prompted to select a mono-cell curve. Select the mono-cell curve and choose the **OK** button to create contiguous curves.

Disassemble

This tool is used to create multiple mono-cell objects from the multi-cell objects. To do so, choose the **Disassemble** tool from the **Operations** toolbar; the **Disassemble** dialog box will be displayed and you will be prompted to select multi-cell objects. Select a multi-cell object and then choose the **OK** button from the dialog box to create multiple mono-cell objects.

Converter Wizard

This tool is used to change the tolerance, order, and segments of a curve. To do so, choose the **Converter Wizard** tool from the **Operations** toolbar; the **Converter Wizard** dialog box will be displayed, as shown in Figure 18-53, and you will be prompted to select a curve. Select the curve and choose the desired toggle button from the left in the dialog box to apply the transformation. The options corresponding to the selected toggle button will be activated in the dialog box. You can change the values as required and then choose the **Apply** button to display the preview. Now, choose the **OK** button to accept the preview.

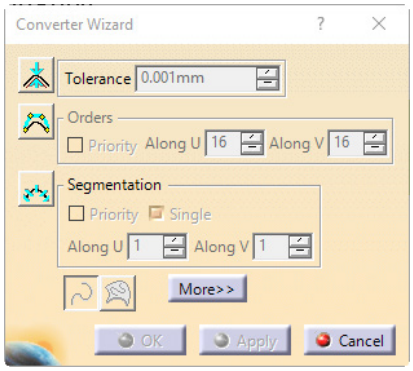


Figure 18-53 *The* ***Converter Wizard*** *dialog box*

Copy Geometric Parameters



This tool is used to copy the parameter of a selected curve on the target curve. To do so, choose the **Copy Geometric Parameters** tool from the **Operations** toolbar; the **Copy Geometric Parameters** dialog box will be displayed, as shown in Figure 18-54, and you will be prompted to select a reference curve. Select the reference curve; you will be prompted to select a target curve. Select the target curve and choose the **OK** button from the dialog box; the parameters of the selected curve will be copied on the target curve. Note that the target curve should be a datum curve made of only one edge and should have same limit as the curve.

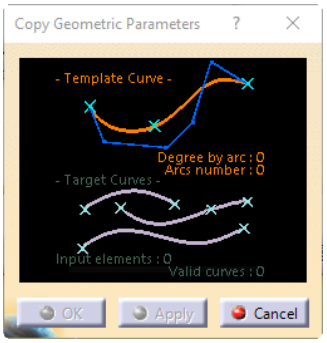


Figure 18-54 *The* ***Copy Geometric Parameters*** *dialog box*

TUTORIALS

Tutorial 1

In this tutorial, you will create the model of a car bonnet, as shown in Figure 18-55.

(Expected time: 45 min)

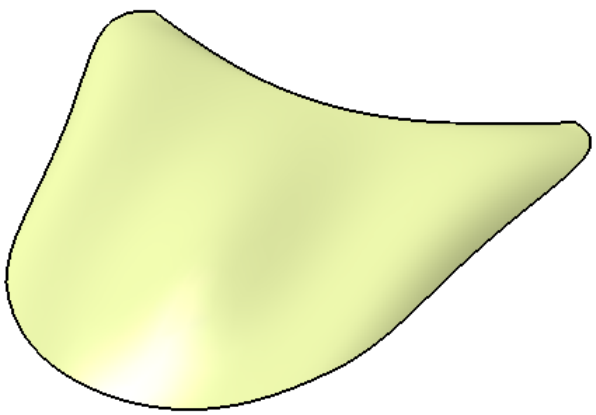


Figure 18-55 *Final model of the car bonnet*

The following steps are required to complete this tutorial:

a. Start a new file in the **FreeStyle** workbench and create a planar surface.
b. Create a curve at the center of the surface.
c. Change the number of control points.
d. Create a datum plane for making the deformation symmetric about centerline.
e. Deform the surface by using control points.

Starting a New File in the FreeStyle Workbench

You need to start a new file in the **FreeStyle** workbench. To start a new file you will use the **Start** menu.

1. Choose **Start** > **Shape** > **FreeStyle** from the menubar to display the **New Part** dialog box.

2. Enter the part name in the **Enter part name** edit box and choose the **OK** button from the **New Part** dialog box; a new file is started in the **FreeStyle** workbench.

Creating a Planar Surface

The planar surface for this tutorial will be created on the xy plane.

1. Select the xy plane and then choose the **Unified Patch** tool from the **Patches** sub-toolbar of the **Surface Creation** toolbar; the **Unified Patch** dialog box is displayed.

2. Select the **2-Point Patch** button from this dialog box, if it is not selected by default; you are prompted to specify the start point of the planar surface.

3. Click in the drawing area to specify the start point of the planar surface and then invoke the shortcut menu to specify the dimension of the planar surface. Choose the **Edit Dimensions** options from the shortcut menu; the **Dimensions** dialog box is displayed. In the dialog box, enter the value in **L1** and **L2** edit boxes as **150**. Next, choose the **OK** button from the **Dimensions** dialog box.

4. Keeping rest of the options as default in the **Unified Patch** dialog box, choose the **OK** button from this dialog box and close it. Figure 18-56 shows the resultant planar surface.

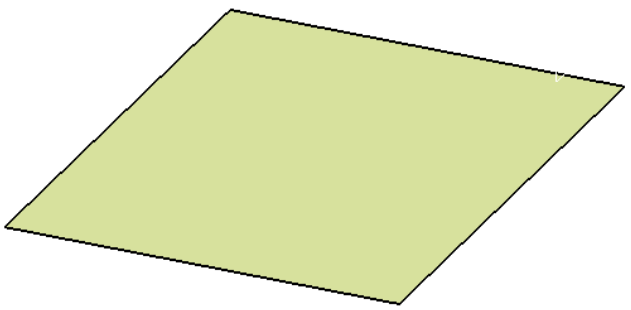


Figure 18-56 *A planar surface*

Creating a Curve at the Center of the Planar Surface

To create a datum plane on the surface, first you need to create a curve.

1. Choose the **Curve on Surface** tool from the **Curve Creation** toolbar; the **Options** dialog box is displayed and you are prompted to select a face.

2. Select the planar surface; you are prompted to select a point on the face.

3. Select the **Automatic selection** option from the drop-down available in the **Mode** area of the **Option** dialog box.

4. Specify **0** and **1** as value in the **U** and **V** spinner respectively and choose **OK** from this dialog box. Figure 18-57 displays the curve created on the planer face.

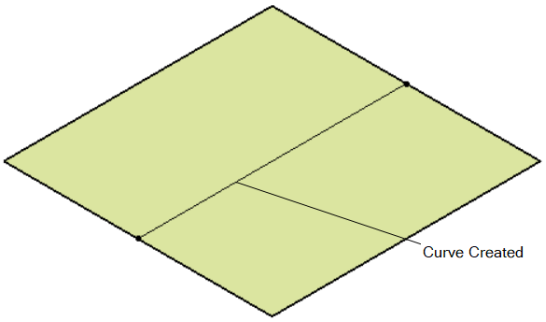


Figure 18-57 *The curve created on the planer face*

Changing the Number of Control Points

1. Select the planar patch on the surface and then choose the **Control Points** tool from the **Shape Modification** toolbar; the surface is displayed, as shown in Figure 18-58. Also, the **Control Points** dialog box is displayed, as shown in Figure 18-59.

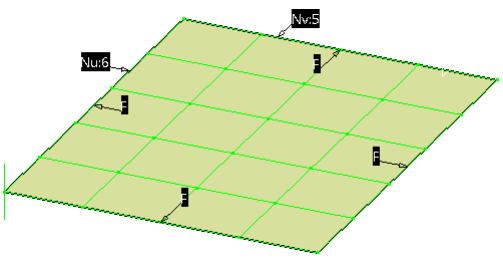


Figure 18-58 *The surface after choosing the* ***Control Points*** *tool*

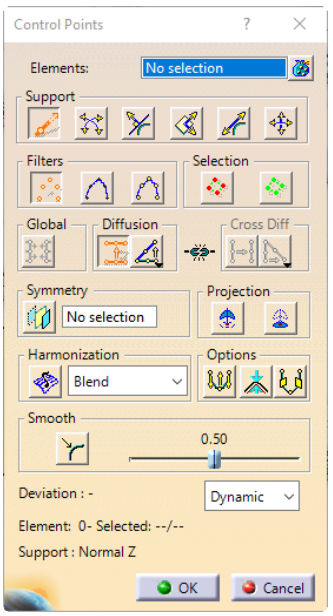


Figure 18-59 *The* ***Control Points*** *dialog box*

2. Keep on clicking on the horizontal **Nv:4** pop-up on the surface until it changes to **Nv:11**.

3. Similarly, keep on clicking on the vertical **Nv:4** pop-up on the surface until it changes to **Nu:11**. After changing the values, the surface is displayed, as shown in Figure 18-60.

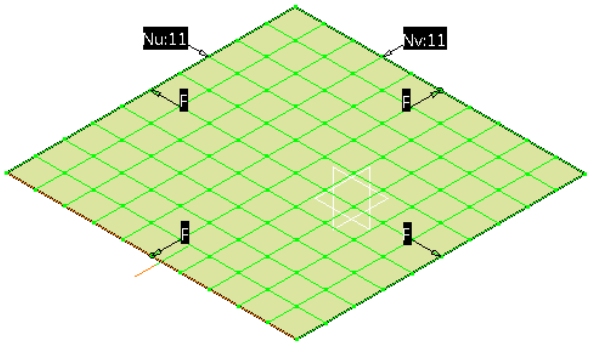


Figure 18-60 *The surface after changing the* ***Nu*** *and* ***Nv*** *options*

Creating the Datum Plane on the Surface

1. Right-click in the selection box of the **Symmetry** area in the **Control Points** dialog box; a shortcut menu is displayed, as shown in Figure 18-61.

2. Choose the **Create Plane** option from the shortcut menu; the **Plane Definition** dialog box is displayed.

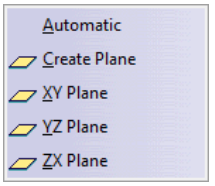


Figure 18-61 *The shortcut menu*

3. Select the **Normal to curve** option from the **Plane type** drop-down list in the dialog box; the **Plane Definition** dialog box is modified, as shown in Figure 18-62.

4. Select the curve created earlier and choose the **OK** button; a plane is created, as shown in Figure 18-63, and the **Control Points** dialog box is displayed again.

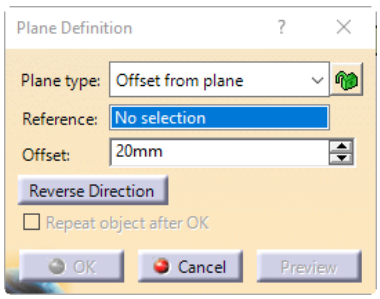


Figure 18-62 *The* ***Plane Definition*** *dialog box with the* ***Normal to Curve*** *option selected*

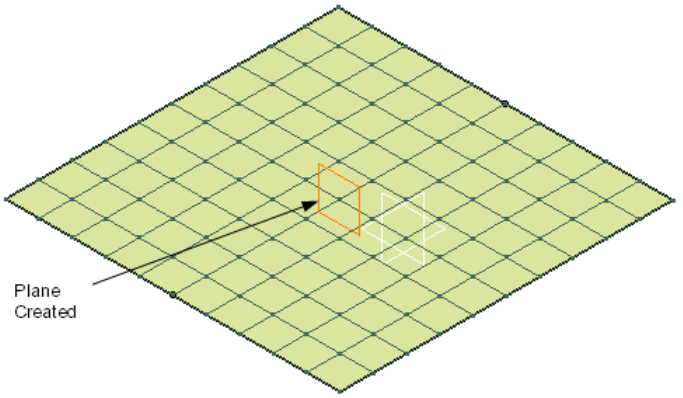


Figure 18-63 *The plane created*

5. Select **Top View** from the **Quick View** sub toolbar; the top view of the surface is displayed.

Deforming the Surface

1. Choose the **Points only** option from the **Filters** area of the **Control Points** dialog box to deform the surface using only points, if it is not chosen by default. Next, select the center

control point and slightly drag it toward the left, as shown in Figure 18-64. Make sure that **Screen Plane** button is selected in the **Support** area.

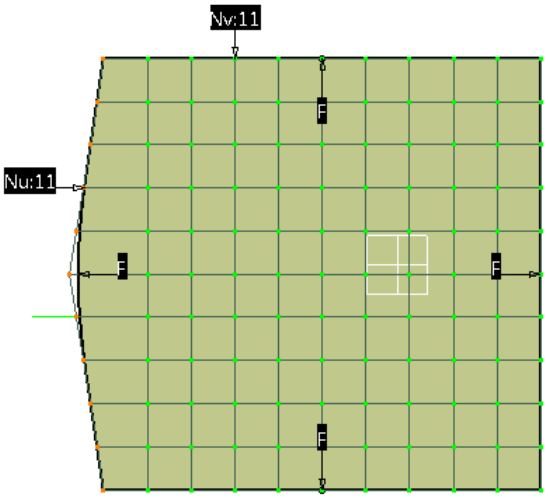


Figure 18-64 *The surface after dragging the center control point*

2. Select the corner point and drag it inward in the surface; the surface after dragging the corner point is displayed, as shown in Figure 18-65.

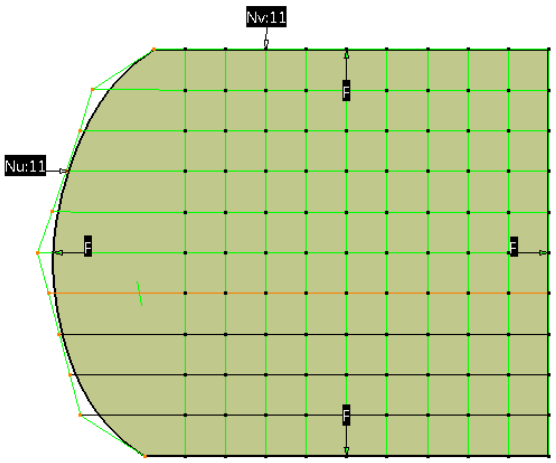


Figure 18-65 *The surface after dragging the corner control point*

3. Select the **Mesh only** option from the **Filters** area of the **Control Points** dialog box and deform the surface, as shown in Figure 18-66.

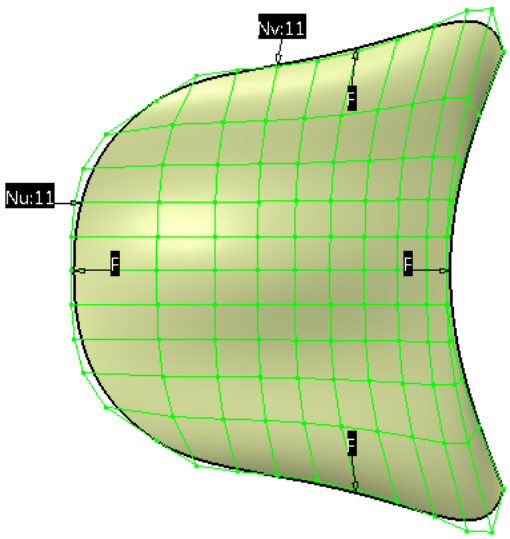


Figure 18-66 *The surface after deformation using the mesh*

4. Change the view to Isometric and choose the **Normal to compass** option from the **Support** area of the dialog box.

5. Using the mesh, deform the surface such that the surface is displayed, as shown in Figure 18-67.

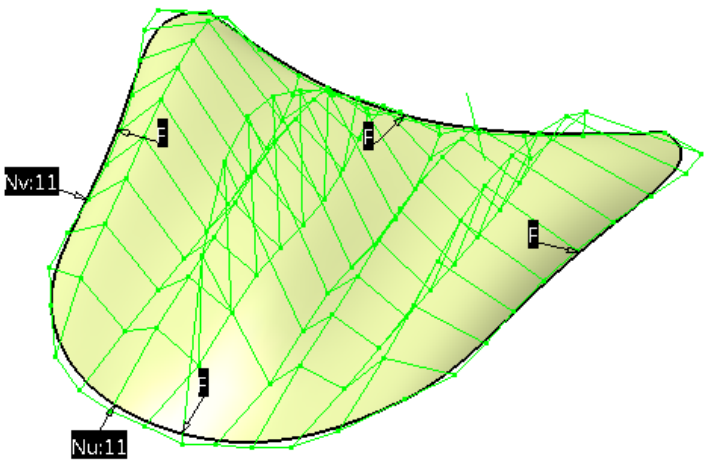


Figure 18-67 *The surface after deformation in vertical direction using the mesh*

6. Choose **OK** from the **Control Points** dialog box and hide the curve and the datum plane. The final model of the car bonnet is displayed, as shown in Figure 18-68.

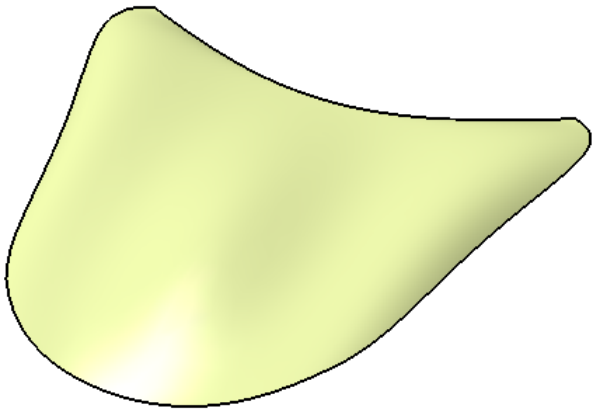


Figure 18-68 *Final model of the Car bonnet*

Saving and Closing the File

1. Choose the **Save** button from the **Standard** toolbar to save the file.

2. Close the file by choosing **File > Close** from the menu bar.

Self-Evaluation Test

Answer the following questions and then compare them to those given at the end of this chapter:

1. Which of the following tools is used to join two or more surfaces?

   (a) **FreeStyle Blend Surface** (b) **3-Point Patch**
   (c) **Extrude Surface** (d) **Offset Surface**

2. Which of the following tools is used to create a surface using the guide and profile curves?

   (a) **Operations** (b) **Control Points**
   (c) **Styling Extrapolate** (d) **Net Surface**

3. The _____ tool is used to convert a mono-cell curve into multiple contiguous curves.

4. Tools in the **FreeStyle** workbench can be used in both the Part mode and the Shape mode. (T/F)

5. The **Patch** tool is available in the **Shape Modification** toolbar. (T/F)

Review Questions

Answer the following questions:

1. Which of the following toolbars contains the **Break Surface or Curve** tool?

   (a) **Operations** (b) **Shape Modification**
   (c) **Surface Creation** (d) None of these

2. Which of the following tools is used to modify the shape of a surface by using mesh?

   (a) **Operations** (b) **Control Points**
   (c) **Styling Extrapolate** (d) **Net Surface**

3. The _____ tool is used to create a copy of the selected surface or shape symmetric about a specified reference.

4. The **Geometry Extraction** tool is used to create a surface by using an existing surface shape. (T/F)

5. You can select only one surface while creating an offset surface using the **Offset Surface** tool. (T/F)

EXERCISE

Exercise 1

Create the surface model, as shown in Figure 18-69. The surface model with control vertices is displayed in Figure 18-70. For dimensions, refer to Figure 18-71.

(Expected time: 15 min)

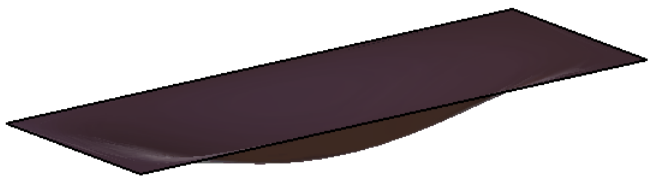


Figure 18-69 *The surface model of an Ashtray*

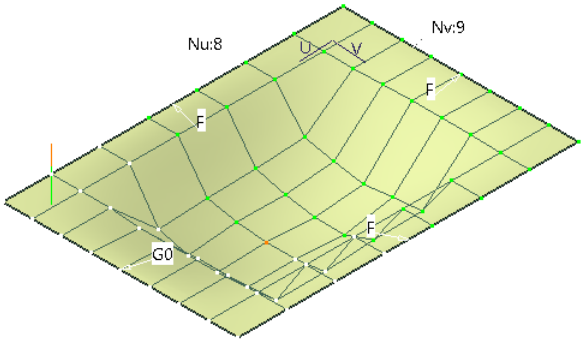


Figure 18-70 *The surface model with control vertices*

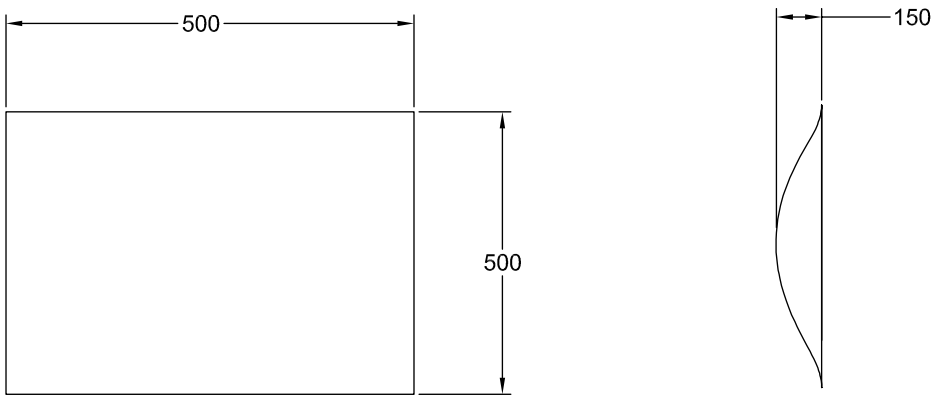


Figure 18-71 *The dimensions of the surface model*

Answers to Self-Evaluation Test

1. FreeStyle Blend Surface, **2. Net Surface**, **3. Fragmentation**, **4.** T, **5.** F