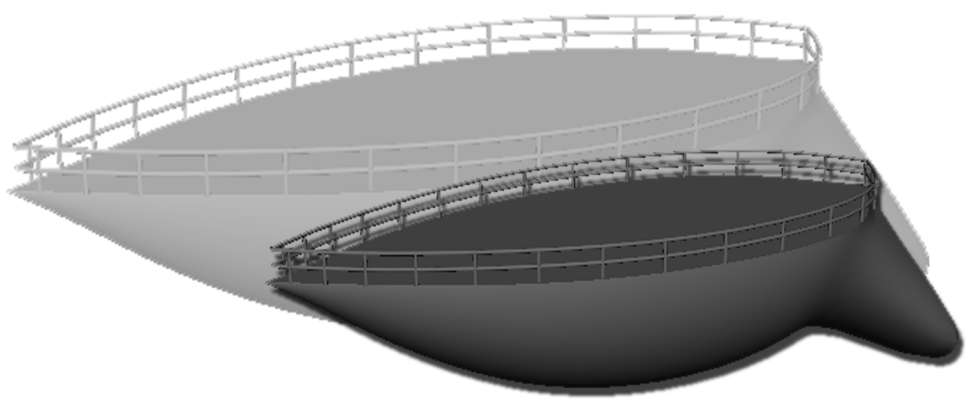
Chapter 7

Modeling

Learning Objectives

After completing this chapter, you will be able to:

- *Understand NURBS editing techniques*
- *Use the Trim and Sculpt Geometry tools*
- *Use different tessellation methods*



NURBS MODELING

The NURBS (Non uniform Rational B-Spline) modeling is mainly used to do organic modeling. These are mathematical representations of 3D geometry. NURBS modeling can be used to model any simple or complex model using a 2D line, circle, arc, or curve. In the earlier chapters, you have learned about different methods of creating NURBS surfaces. In this chapter, you will learn about various editing techniques used for modifying NURBS surfaces. The tools for modifying the NURBS surfaces are discussed next.

Duplicate NURBS Patches

Main menubar: Edit NURBS > Duplicate NURBS Patches

The **Duplicate NURBS Patches** tool is used to make a duplicate NURBS patch from an existing one. To do so, choose **Create > NURBS Primitives > Sphere** from the main menubar and create a NURBS sphere in the viewport. Select the sphere, press and hold the right mouse button over the sphere and choose **Surface Patch** from the marking menu, as shown in Figure 7-1; the surface patch component will be activated on the NURBS sphere. Now, select the surface patch that you want to duplicate. Choose **Edit NURBS > Duplicate NURBS Patches** from the main menubar; a duplicate surface patch will be created. Invoke the **Move** tool from the toolbox and move the duplicate surface patch away from the NURBS sphere. Note that the pivot point of the duplicate surface patch will remain at the same position as does the NURBS sphere. To reset the pivot point to the center of the duplicate patch, choose **Modify > Center Pivot** from the main menubar; the pivot point will be reset to its default position automatically.

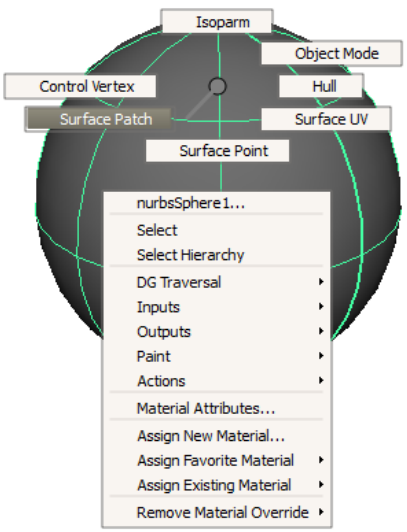


Figure 7-1 *Choosing the* ***Surface Patch*** *option from the marking menu*

Project Curve on Surface

Main menubar: Edit NURBS > Project Curve on Surface

The **Project Curve on Surface** tool is used to project a NURBS curve on a NURBS surface. To do so, activate the front viewport and choose **Create > NURBS Primitives > Square** from the main menubar. Now, create a square in the front viewport and choose **Surfaces > Planar** from the main menubar to create a NURBS surface. After creating the NURBS surface, press 5 to switch to the shaded mode. Next, choose **Create > CV Curve Tool** from the main menubar to create a curve, as shown in Figure 7-2. Next, select the NURBS curve, press and hold the SHIFT key and choose NURBS surface. Then, choose **Edit NURBS > Project Curve on Surface** from the main menubar to project the curve on the surface and activate the perspective viewport; the NURBS curve will be projected over the NURBS surface, as shown in Figure 7-3.

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Note

The curve will be projected exactly at the same position, as visible through the camera of that particular viewport.

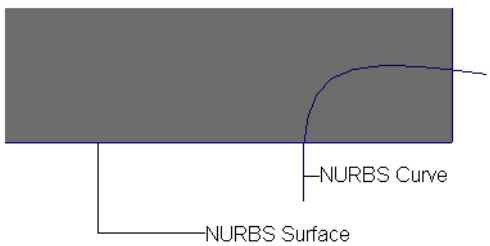


Figure 7-2 *NURBS curve created*

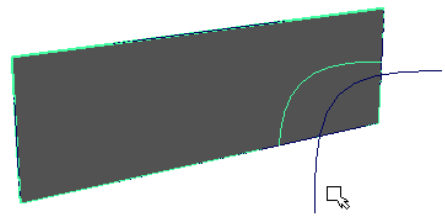


Figure 7-3 *NURBS curve projected on the NURBS surface*

Intersect Surfaces

Main menubar: Edit NURBS > Intersect Surfaces

The **Intersect Surfaces** tool is used to create a new segment at the intersection of two NURBS surfaces. To do so, create two surfaces, as discussed earlier, and align them such that they intersect with each other, as shown in Figure 7-4. Select both the surfaces and choose **Edit NURBS > Intersect Surfaces** from the main menubar; the selection handles will be displayed at the intersection point, refer to Figure 7-4. You can now move these handles to align the intersection point anywhere on the NURBS surface.

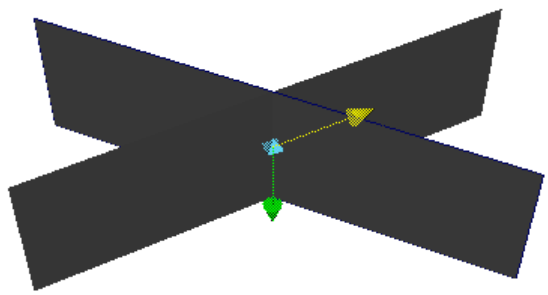


Figure 7-4 *The aligned surfaces and the selection handles*

Trim Tool

Main menubar: Edit NURBS > Trim Tool

The **Trim Tool** is used to trim a particular area from the NURBS surface. To do so, project a curve on the surface as discussed in the **Project Curve on Surface** section. Next, select the NURBS surface and choose **Edit NURBS > Trim Tool** from the main menubar; the NURBS surface will change to the wireframe mode with a dotted outline. Select the part that you want to trim from the surface and press ENTER; the surface will be trimmed. You can also change the settings of the **Trim Tool** as per your requirement. To do so, choose **Edit NURBS > Trim Tool > Option Box** from the main menubar; the **Trim Tool** property window will appear on the left of the viewport, as shown in Figure 7-5. You can select the **Keep** radio button to keep the part that you selected from the NURBS surface and trim the unselected part. Similarly,

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you can select the **Discard** radio button to trim the selected part from the NURBS surface and keep the deselected part.

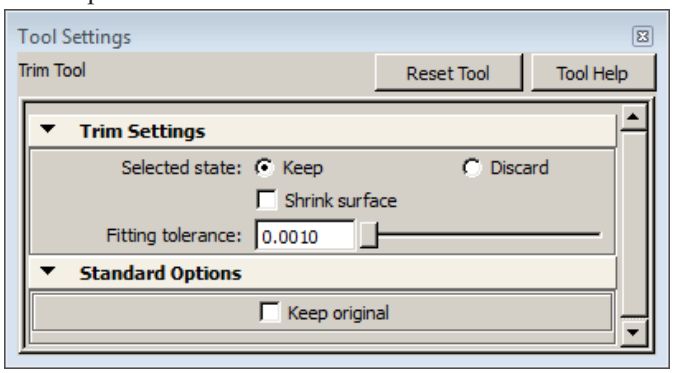


Figure 7-5 *The* ***Trim Tool*** *property window*

Untrim Surfaces

Main menubar: Edit NURBS > Untrim Surfaces

The **Untrim Surfaces** tool is used to untrim the trimmed surface. To do so, select the trimmed surface and choose **Edit NURBS > Untrim Surfaces** from the main menubar; the surface changes back to the untrimmed surface.

Attach Surfaces

Main menubar: Edit NURBS > Attach Surfaces

The **Attach Surfaces** tool is used to attach two selected NURBS surfaces. To do so, choose two NURBS surfaces in the viewport, as shown in Figure 7-6. Then, choose **Edit NURBS > Attach Surfaces > Option Box** from the main menubar; the **Attach Surfaces Options** dialog box will be displayed in the viewport, as shown in Figure 7-7. The **Blend** radio button is selected by default in the **Attach method** area of this dialog box. Choose the **Apply** button; the selected surfaces will be connected, as shown in Figure 7-8. You can also select the **Connect** radio button from the **Attach method** area to connect one end of the surface to another end of other surface, as shown in Figure 7-9.

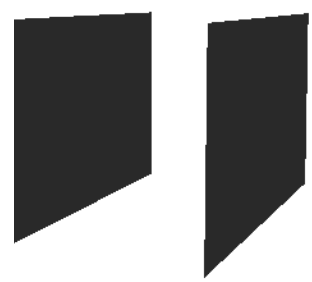


Figure 7-6 *The two NURBS surfaces*



Note

The ***Attach Surfaces*** *tool does not attach trimmed surfaces. For attaching two surfaces, they need to be untrimmed.*

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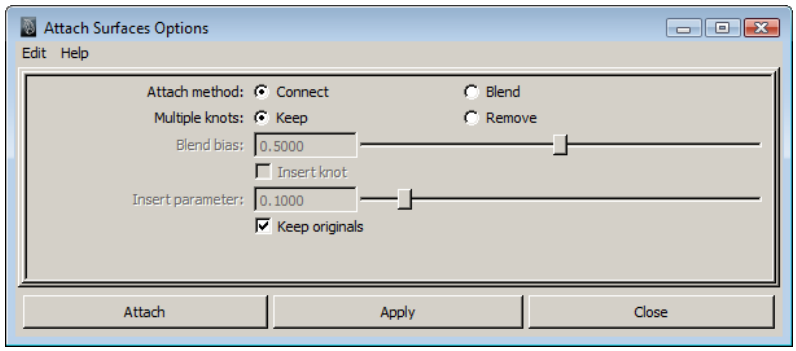


Figure 7-7 *The* ***Attach Surfaces Options*** *dialog box*



Figure 7-8 *Surfaces blend by using the* ***Blend*** *radio button*



Figure 7-9 *Connecting surfaces using the* ***Connect*** *radio button*

Attach Without Moving

Main menubar: Edit NURBS > Attach Without Moving

The **Attach Without Moving** tool is used to attach two NURBS surfaces by selecting their respective isoparms. To do so, create two NURBS surfaces and select one isoparm each from the two surfaces. Now, choose **Edit NURBS > Attach Without Moving** from the main menubar; the two surfaces will be attached along the two isoparms.

Detach Surfaces

Main menubar: Edit NURBS > Detach Surfaces

The **Detach Surfaces** tool is used to detach the attached NURBS surfaces. To do so, select the isoparm of a surface that is attached to another surface and then choose **Edit NURBS > Detach Surfaces** from the main menubar; the surface will detach from the selected isoparm.



Tip. *You can make changes in the attached surfaces by using the* ***attachSurface1*** *tab in the* ***Attribute Editor****. To do so, choose* ***Window > Attribute Editor*** *from the main menubar; the* ***Attribute Editor*** *will be displayed. Choose the* ***attachSurface1*** *tab from the* ***Attribute Editor****; the properties of the attached surface will be displayed, as shown in Figure 7-10. You can apply different styles on the surface by using the parameters in the* ***Attribute Editor****.*

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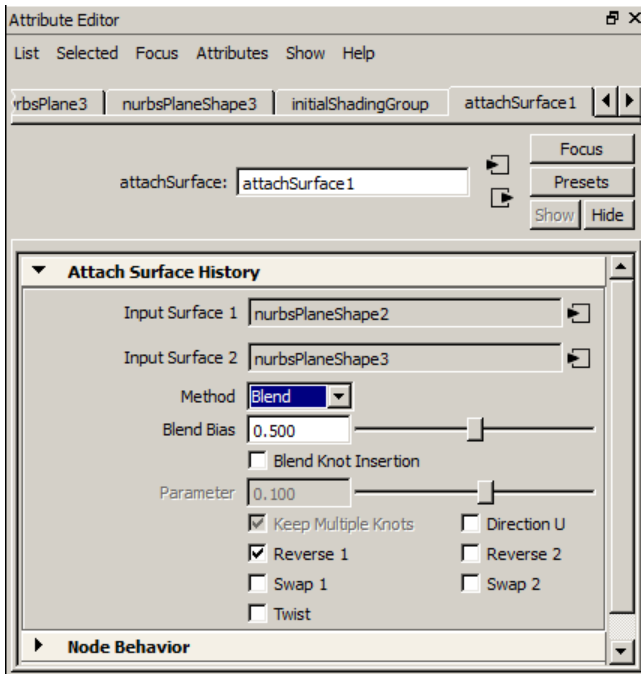


Figure 7-10 *The* ***attachSurface1*** *tab properties area*

Align Surfaces

Main menubar: Edit NURBS > Align Surfaces

The **Align Surfaces** tool is used to align selected NURBS surfaces. To do so, select the NURBS surfaces that you want to align. Choose **Edit NURBS > Align Surfaces > Option Box** from the main menubar; the **Align Surfaces Options** dialog box will be displayed, as shown in Figure 7-11. Now, you can try different options in this dialog box to align the selected NURBS surfaces as per your requirement.

Open/Close Surfaces

Main menubar: Edit NURBS > Open/Close Surfaces

The **Open/Close Surfaces** tool is used to open or close the NURBS surfaces. To close an open surface, as shown in Figure 7-12, select the surface and choose **Edit NURBS > Open/Close Surfaces** from the main menubar; the open surface will be closed, as shown in Figure 7-13. Similarly, select the closed surface in the viewport and choose **Edit NURBS > Open/Close Surfaces** from the main menubar; the closed surface will change into an open surface.

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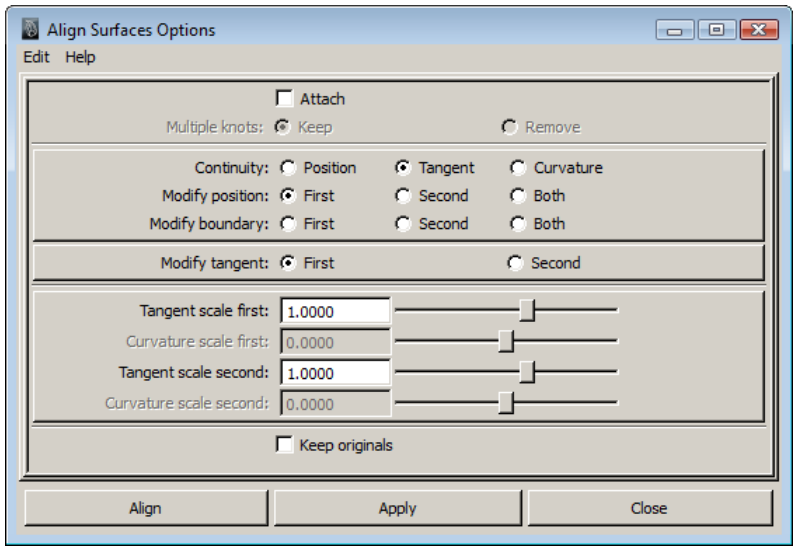


Figure 7-11 *The* ***Align Surfaces Options*** *dialog box*

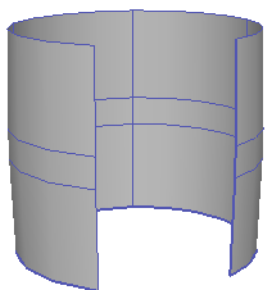


Figure 7-12 *The open NURBS surface*

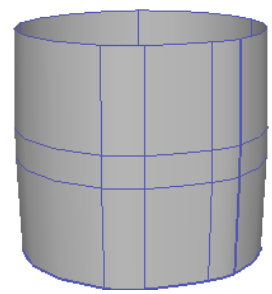


Figure 7-13 *The closed NURBS surface*

Insert Isoparms

Main menubar: Edit NURBS > Insert Isoparms

The **Insert Isoparms** tool is used to insert an isoparm on a NURBS surface. To do so, create a NURBS surface and then select it. Next, press and hold the right mouse button on the NURBS surface and choose **Isoparm** from the marking menu; the isoparms will be highlighted on the selected NURBS object. Now, press and hold the left mouse button on any NURBS isoparm and drag the mouse to specify the position for the new isoparm; a yellow dotted line will appear over the NURBS surface, as shown in Figure 7-14. Next, choose **Edit NURBS > Insert Isoparms** from the main menubar; a new isoparm will be inserted in place of the yellow dotted line.

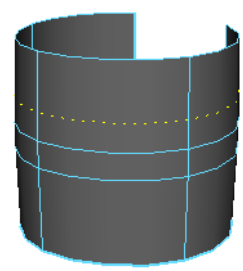


Figure 7-14 *The yellow dotted line displayed on the NURBS surface*

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Tip. *To create multiple isoparms, press and hold the SHIFT key over a NURBS isoparm and then drag the mouse; multiple yellow dotted lines will appear on the NURBS surface. Now, choose* ***Edit NURBS > Insert Isoparms*** *from the main menubar; As a result, multiple isoparms will be created.*

Extend Surfaces

Main menubar: Edit NURBS > Extend Surfaces

The **Extend Surfaces** tool is used to extend a NURBS surface. To extend a surface, create a NURBS surface in the viewport. Then, press and hold the right mouse button on the NURBS surface and choose **Isoparm** from the marking menu. Now, select the isoparm that you want to extend from the NURBS surface and choose **Edit NURBS > Extend Surfaces** from the main menubar; the selected surface will be extended. To set the properties of the extended surface, choose **Edit NURBS > Extend Surfaces > Option Box** from the main menubar; the **Extend Surface Options** dialog box will be displayed, as shown in Figure 7-15. Adjust the values in the dialog box to make changes in the working of the **Extend Surfaces** tool. Figures 7-16 and 7-17 show a hut roof before and after applying the **Extend Surfaces** tool. Any change made in the original surface will also be displayed in the offset surface created.

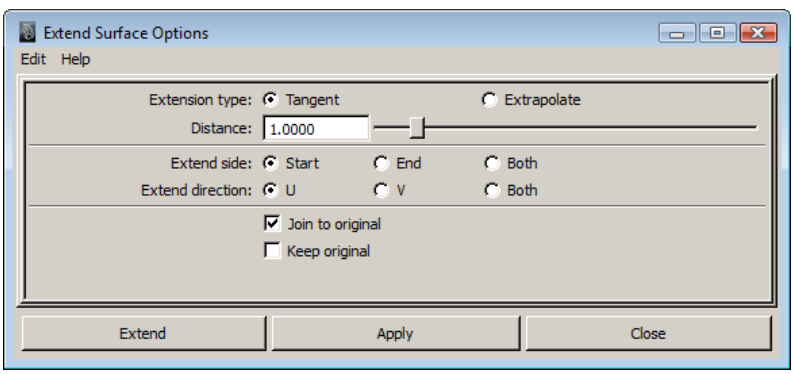


Figure 7-15 *The* ***Extend Surface Options*** *dialog box*

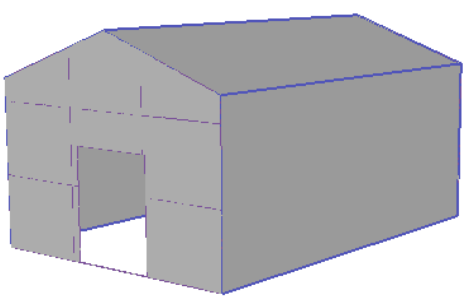


Figure 7-16 *The hut roof before applying the* ***Extend Surfaces*** *tool*

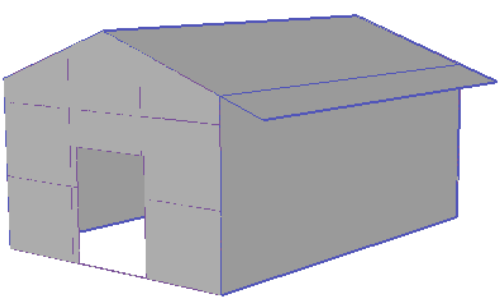


Figure 7-17 *The hut roof after applying the* ***Extend Surfaces*** *tool*

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Offset Surfaces

Main menubar: Edit NURBS > Offset Surfaces

The **Offset Surfaces** tool is used to create a copy of the selected surface. To do so, create a NURBS surface in the viewport, select it, and then choose **Edit NURBS > Offset Surfaces** from the main menubar; a copy of the selected surface will be created. To set the properties of the **Offset Surfaces** tool, choose **Edit NURBS > Offset Surfaces > Option Box** from the main menubar; the **Offset Surface Options** dialog box will be displayed, as shown in Figure 7-18. The **Offset distance** option in the dialog box is used to specify the distance of the copied surface from the original surface.

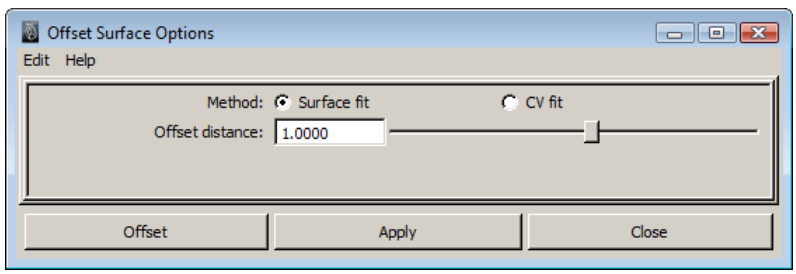


***Figure 7-18** The **Offset Surface Options** dialog box*

Reverse Surface Direction

Main menubar: Edit NURBS > Reverse Surface Direction

The **Reverse Surface Direction** tool is used to reverse or swap the U and V directions of a selected surface. To do so, create a NURBS surface in the viewport, select it, and then choose **Edit NURBS > Reverse Surface Direction > Option Box** from the main menubar; the **Reverse Surface Direction Options** dialog box will be displayed, as shown in Figure 7-19. Select the required radio button from the **Surface direction** area of this dialog box and then choose the **Reverse** button to reverse the surface direction.

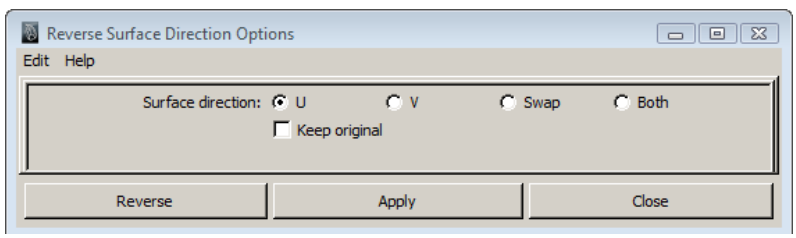


***Figure 7-19** The **Reverse Surface Direction Options** dialog box*

Rebuild Surfaces

Main menubar: Edit NURBS > Rebuild Surfaces

The **Rebuild Surfaces** tool is used to rebuild the number of U and V spans on a selected NURBS surface. To do so, select the NURBS surface that you want to rebuild and choose **Edit NURBS > Rebuild Surfaces > Option Box** from the main menubar; the **Rebuild Surface Options** dialog box will be displayed, as shown in Figure 7-20. The options in this dialog box are discussed next.

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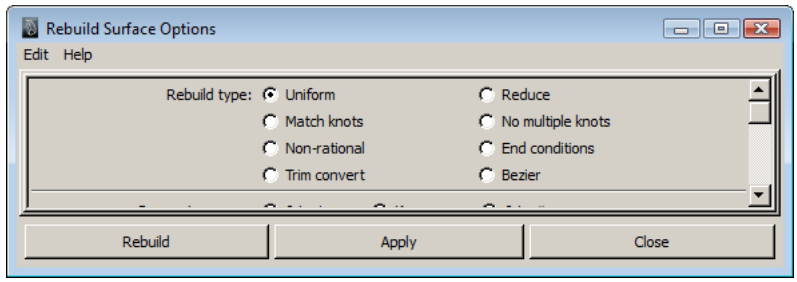


Figure 7-20 *The* ***Rebuild Surface Options*** *dialog box*

Rebuild type

You need to specify the **Rebuild type** parameter by choosing any of the following radio buttons:

Uniform

Select the **Uniform** radio button to rebuild the surface with uniform parameterization. On doing so, the number of spans will be entered uniformly on the selected surface.

Reduce

Select the **Reduce** radio button to remove the knots from the NURBS surface.

Match knots

Select the **Match knots** radio button to match the curve degree, knot values, number of spans, and sections of two surfaces.

No multiple knots

Select the **No multiple knots** radio button to remove the extra knots formed while rebuilding a surface.

Non-rational

Select the **Non-rational** radio button to convert a rational surface into a non-rational surface.

End conditions

Select the **End conditions** radio button to rebuild the positioning of the CVs and knots of the surface.

Trim convert

Select the **Trim convert** radio button to convert a trimmed surface into a non-trimmed surface.

Bezier

Select the **Bezier** radio button to rebuild a surface as a bezier surface.

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Parameter range

The **Parameter range** parameter is used to specify the U and V parameters to rebuild a surface. There are three different ways to specify the U and V parameters, which are discussed next.

0 to 1

Select the **0 to 1** radio button to specify the U and V parameters from 0 to 1.

Keep

Select the **Keep** radio button to match the U and V parameters with the original surface.

0 to #spans

Select the **0 to #spans** radio button to get the rebuild surface value in integers.

Direction

The **Direction** parameter is used to determine the parametric direction of the surface in the **U**, **V**, or both **U and V** directions.

Keep

The **Keep** parameter is used to ensure that some particular characteristics of the original object or surface are retained while creating a new surface. Select the **Corners**, **CVs** or the **NumSpans** radio button to retain the corresponding characteristics.

Rebuild Method

Select the **Match Knots** radio button from the **Rebuild type** attribute area to activate this radio button. The **Rebuild method** parameter is used to rebuild the surface by specifying the quality of the new surface. Select the **Classic** radio button to get the surface quality similar to that obtained with the version 5.0 or earlier versions of Maya. Select the **Match** radio button to get a better quality for surfaces having multiple knots at the end.

Number of spans U and Number of spans V

The **Number of spans U** and **Number of spans V** options are used to set the number of spans in the U and V directions of the rebuild surface respectively.

Degree U and Degree V

The **Degree U** and **Degree V** options are used to set the degree of the rebuild surface.

Keep original

The **Keep original** check box is selected to keep the original surface and rebuild a new surface.

Use tolerance

The **Use tolerance** option will be available only on selecting the **Non-Rational** or **Reduce** radio button in the **Rebuild type** area. The tolerance value is used to make the rebuild surface resemble the original surface. Smaller the tolerance value, more the rebuild surface will resemble the original surface.

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Output geometry

The **Output geometry** option is used to specify the output type for the rebuild surface. Select the **NURBS**, **Polygons**, or **Subdiv** radio button to specify the output geometry.

Sculpt Geometry Tool

Main menubar: Edit NURBS > Sculpt Geometry Tool

The **Sculpt Geometry Tool** is used to sculpt an object manually in viewport. On invoking this tool, the cursor sign will change to a brush sign. To sculpt an object, create a NURBS surface in the viewport and choose **Edit NURBS > Sculpt Geometry Tool > Option Box** from the main menubar; the **Sculpt Geometry Tool** property window will be displayed on the left of the viewport, as shown in Figure 7-21.

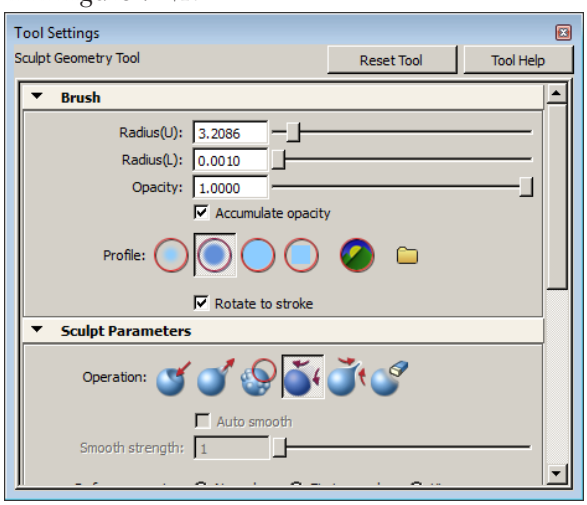


Figure 7-21 *Partial view of the* ***Sculpt Geometry Tool*** *window*



Note

More the number of segments on an object, better sculpting can be done on it using the ***Sculpt Geometry Tool****. You can sculpt an object using five different tools:* ***Push****,* ***Pull****,* ***Smooth****,* ***Relax****, and* ***Erase****. All these methods are discussed next.*

Push



The **Push** tool is used to push down a NURBS mesh. To do so, create a NURBS plane in the viewport. Next, choose **Edit NURBS > Sculpt Geometry Tool > Option Box** from the main menubar; the **Sculpt Geometry Tool** property window will be displayed on the left of the viewport, refer to Figure 7-21. Choose the **Push** button in the **Sculpt Parameters** area; the cursor will be modified, as shown in Figure 7-22. Move the cursor over the NURBS plane, press and hold the left mouse button and drag the brush over the plane. Now, move it to sculpt the mesh surface. Figure 7-23 shows a NURBS plane before sculpting and Figure 7-24 shows the NURBS plane sculpted using the **Push** tool.

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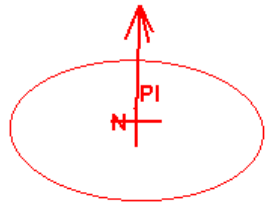


Figure 7-22 *The* ***Sculpt Geometry Tool*** *cursor*

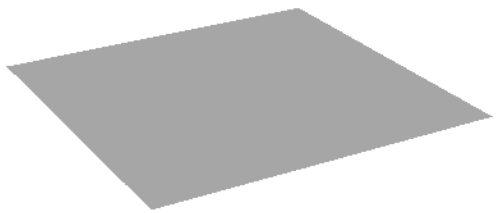


Figure 7-23 *The NURBS plane before sculpting*

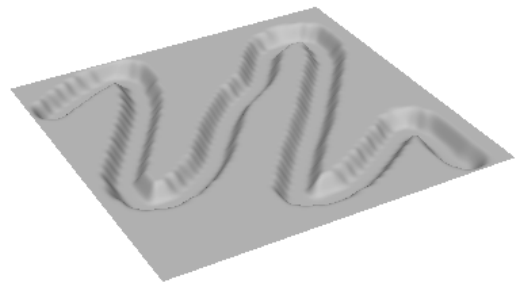


Figure 7-24 *The NURBS plane sculpted using the* ***Push*** *tool*

Pull



The **Pull** tool is used to pull the NURBS mesh from the surface. This tool works similar to the **Push** tool and the procedure to apply it on a NURBS plane is same as that of the **Push** tool. Figure 7-25 shows a NURBS plane sculpted using the **Pull** tool.

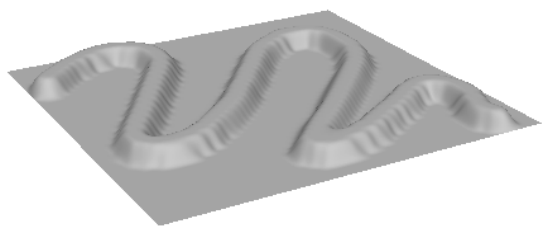


Figure 7-25 *The NURBS plane sculpted using the* ***Pull*** *tool*

Smooth



The **Smooth** tool is used to paint a mesh to give it a smoother look. To use this method, follow the steps as discussed in the **Push** tool, and choose the **Smooth** button from the **Sculpt Parameters** area of the **Sculpt Geometry Tool** property window. Figure 7-26 shows a surface before smoothening and Figure 7-27 shows the surface after smoothening.

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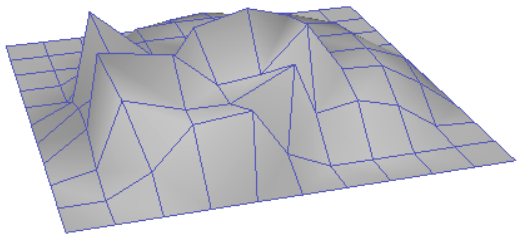


Figure 7-26 *Surface before smoothening*

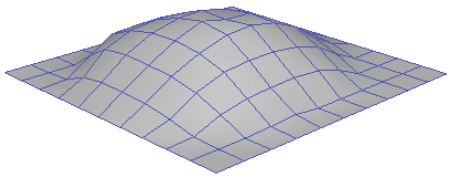


Figure 7-27 *Surface after smoothening*

Relax



The **Relax** tool works similar to the **Smooth** tool. It is used to relax the bumps over the surface, thus maintaining the overall shape of the mesh.

Pinch



The **Pinch** tool is used to pull selected vertices toward each other. It helps in bringing the vertices closer in order to make sharp or well defined creases.

Erase



The **Erase** method is used to erase the changes made by using the push or pull method on the surface. For example, create a polygonal cylinder in the viewport and paint the surface of the cylinder by choosing the **Push** button, as shown in Figure 7-28. Next, choose the **Erase** button from the **Operation** option of the **Sculpt Parameters** area and erase the required part; you will get the output, as shown in Figure 7-29.

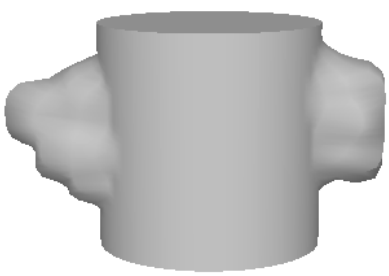


Figure 7-28 *Surface before erasing*

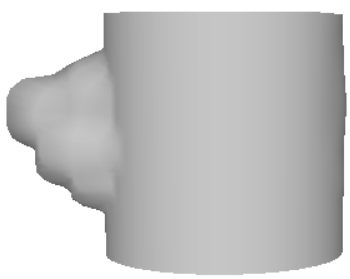


Figure 7-29 *Surface after erasing*

CONVERTING OBJECTS

In Maya, you can convert object from one form to another form. For example, using this method you can convert a NURBS object to polygonal object and vice-versa. To use this method, select an object in the viewport and choose **Modify > Convert** from the main menubar; a flyout will be displayed. Choose the conversion type from the flyout to specify the output geometry for the selected object. Various options in this flyout are discussed next.

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Converting NURBS to Polygons

Main menubar: Modify > Convert > NURBS to Polygons

The **NURBS to Polygons** conversion tool is used to convert a NURBS mesh into a polygonal mesh. To do so, choose **Modify > Convert > NURBS to Polygons > Option Box** from the main menubar; the **Convert NURBS to Polygons Options** dialog box will be displayed in the viewport, as shown in Figure 7-30. You can use this dialog box to set the options for the conversion of the object from NURBS to polygons. The options in the **Convert NURBS to Polygons Options** dialog box are discussed next.

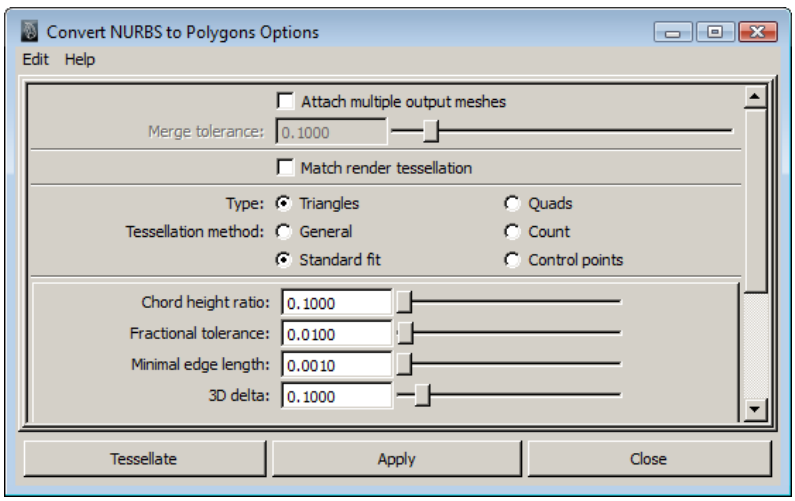


Figure 7-30 *The* ***Convert NURBS to Polygons Options*** *dialog box*

Type

The **Type** parameter is used to set the output of the conversion. If you select the **Triangles** radio button, then three-sided polygons will be created on the surface, as shown in Figure 7-31. If you select the **Quads** radio button, then four-sided polygons will be created on the surface, as shown in Figure 7-32.

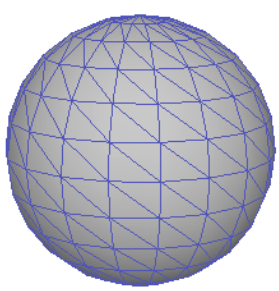


Figure 7-31 *Surface created on applying the* ***Triangles*** *polygon type*

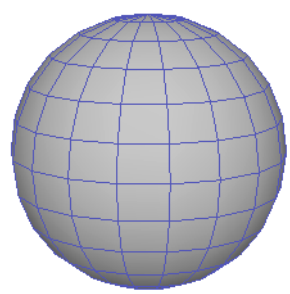


Figure 7-32 *Surface created on applying the* ***Quads*** *polygon type*

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Tessellation method

The **Tessellation method** parameter is used to convert a NURBS mesh to a set of polygons. In Maya, there are four tessellation methods that are discussed next.

General

The **General** radio button is used to define the number of polygons in the U or in the V direction. On selecting this radio button, various options for setting the tessellation are displayed. Set the attributes as per your requirement.

Standard fit

The **Standard fit** tessellation method is the default tessellation method. This method is used to determine when to stop the tessellation by setting the fractional tolerance value. On selecting this radio button, the options related to it are displayed. Adjust them as per your requirement.

Count

The **Count** tessellation method is used to specify the polygon count in the mesh after the conversion. More the count value, smoother will be the object.

Control Points

The **Control Points** tessellation method is used to create a new mesh while matching its CVs to the original NURBS surface. The resulting polygons will be quads by default.

Converting NURBS to Subdiv

Main menubar: Modify > Convert > NURBS to Subdiv

The **NURBS to Subdiv** conversion tool is used to convert a NURBS mesh into a subdiv mesh. To do so, select the NURBS object in the viewport and choose **Modify > Convert > NURBS to Subdiv > Option Box** from the main menubar; the **Convert NURBS/Polygons to Subdiv Options** dialog box will be displayed, as shown in Figure 7-33. The options in the **Convert NURBS/Polygons to Subdiv Options** dialog box are discussed next.

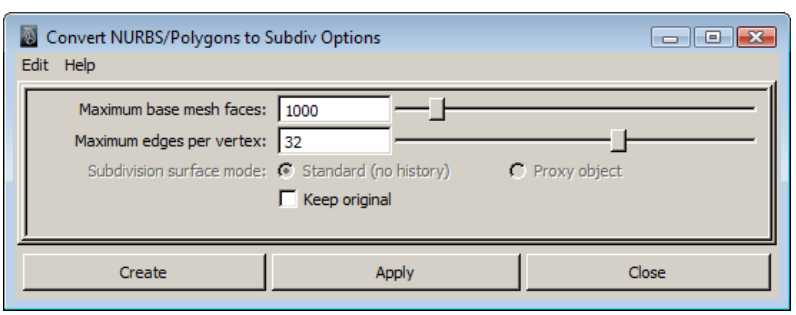


*Figure 7-33 The **Convert NURBS/Polygons to Subdiv Options** dialog box*

Maximum base mesh faces

The **Maximum base mesh faces** option is used to set the maximum number of faces that

the original surface can have, such that it can be successfully converted into a subdivision surface.

Maximum edges per vertex

The **Maximum edges per vertex** option is used to set the maximum number of edges that each vertex can have in the original surface, such that it can be successfully converted into a subdivision surface.

Keep original

Select the **Keep original** check box to keep the original object, while creating the new subdivision surface.



Note

The options in other tessellation methods are similar to those discussed in the previous topics.

TUTORIALS

Tutorial 1

In this tutorial, you will create the model of a cowboy hat, as shown in Figure 7-34, using the NURBS modeling. **(Expected time: 15 min)**

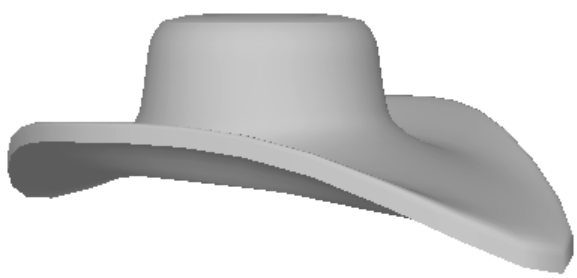


Figure 7-34 *The model of cowboy hat*

The following steps are required to complete this tutorial:

a. Create a project folder.
b. Create a NURBS cylinder.
c. Add details to the hat.

Creating the Project Folder

Before starting a new file, it is recommended that you create the project folder.

1. Create a project with the name *c07_tut1* in the folder *Maya_Tutorials*.

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Creating a NURBS Cylinder

In this section, you need to create a NURBS cylinder to form the basic structure of the cowboy hat.

1. Choose **Create > NURBS Primitives > Cylinder** from the main menubar and click in the active viewport; a cylinder is created in the viewport. Next, choose **Display > UI Elements > Channel Box/Layer Editor** from the main menubar; the channel box/layer editor is displayed on the right in the viewport.

2. Enter a value in the **INPUTS** node of the **Channel box**, as shown in Figure 7-35.

3. Activate the front viewport and press 5 to change it to shaded mode. Press and hold the right mouse button on the NURBS cylinder and choose **Control Vertex** to switch to the vertex mode. Now, select the vertices, as shown in Figure 7-36. Next, invoke the **Scale Tool** from the toolbox and scale the vertices uniformly in the perspective viewport, as shown in Figure 7-37.

INPUTS	
makeNurbCylinder1	
Radius	4
Start Sweep	0
End Sweep	360
Degree	Cubic
Sections	8
Spans	6
Height Ratio	6

Figure 7-35 *The **INPUTS** node*

4. Select the green handle of the **Scale Tool** and scale the selected vertices along the Y axis; the mesh gets modified, as shown in Figure 7-38.

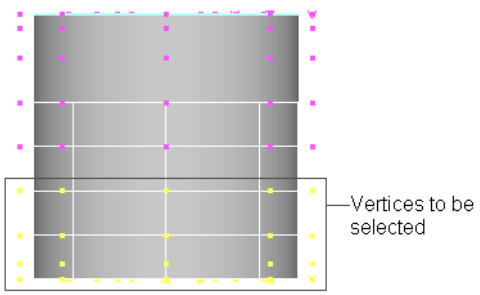


Figure 7-36 *Selecting vertices*

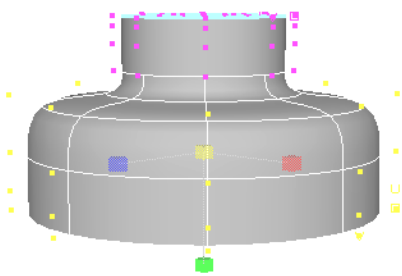


Figure 7-37 *Scaling the selected vertices uniformly*

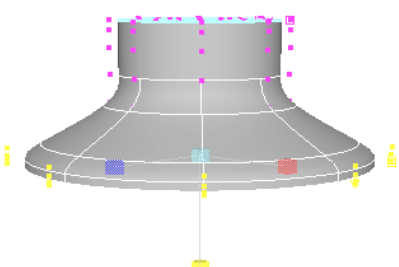


Figure 7-38 *Scaling the selected vertices along the Y axis*

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Adding Details to the Hat

In this section, you need to add details to the hat to give it a cowboy hat look.

1. Activate the Top viewport and select the vertices, as shown in Figure 7-39 (vertices to be selected are numbered for your reference). Next, invoke the **Scale Tool** from the toolbox, if it is not already invoked, and scale the selected vertices along the Z axis using the blue handle; the mesh gets scaled, as shown in Figure 7-40.

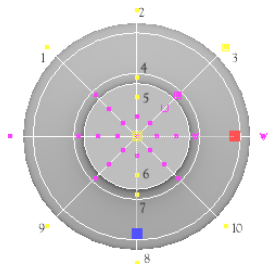


Figure 7-39 *Selecting vertices*

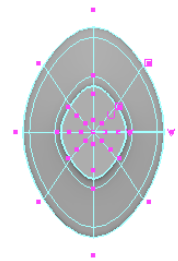


Figure 7-40 *Scaled mesh*

2. Activate the Side viewport and select the vertices, as shown in Figure 7-41 (the vertices to be selected are encircled for your reference). Next, invoke the **Move Tool** and move the vertices along the -Y direction, as shown in Figure 7-42.

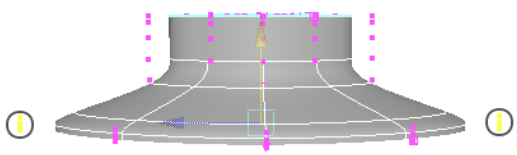


Figure 7-41 *Selecting vertices*

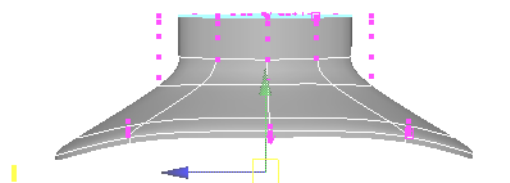


Figure 7-42 *The modified mesh after moving the vertices*

3. Press the F8 key to convert the object from the component mode to the object mode. Alternatively, press and hold the right mouse button over the cowboy hat model and choose **Object Mode** from the marking menu.

4. Select the model in the viewport. Then, press and hold the right mouse button over the cowboy hat model and choose **Isoparm** from the marking menu.

5. Activate the Perspective viewport and select an isoparm, as shown in Figure 7-43. Drag the isoparm outward and choose **Edit NURBS > Insert Isoparms** from the main menubar; a new isoparm is created, as shown in Figure 7-44.

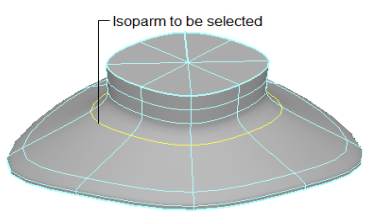


Figure 7-43 *Selecting an isoparm*

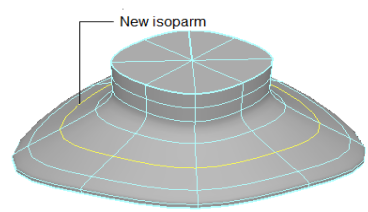


Figure 7-44 *A new isoparm created*

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6. Press the F8 key to into enter the object mode. Select the model and choose **Edit > Delete All by Type > History** from the main menubar; the history of all actions performed on the model is deleted.

7. Again, select the model. Next, press and hold the right mouse button on the lower part of the hat and then choose **Control Vertex** from the marking menu. Next, select the vertices of the object in the side viewport, as shown in Figure 7-45 (the vertices to be selected are encircled for your reference). Next, move the vertices up along the Y axis to change the shape of the cowboy hat, as shown in Figure 7-46.

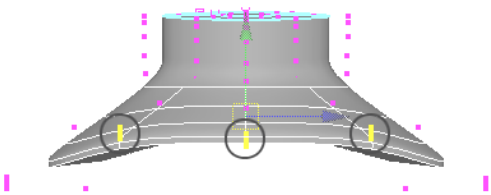


Figure 7-45 *Selecting vertices*

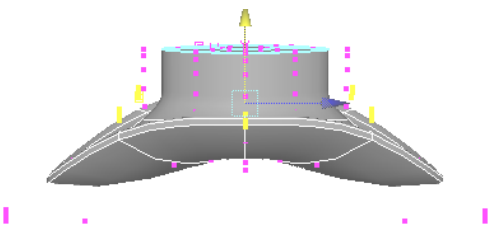


Figure 7-46 *The modified mesh*

8. Press F8 to enter the object mode. Choose **View > Predefined Bookmarks > Bottom** from the **Panel menu**; the bottom viewport is activated.

9. Insert two new isoparms into the viewport, as shown in Figure 7-47. Press F8 again to switch back to the object mode.

10. Press and hold the right mouse button over the cowboy hat model and choose **Control Vertex** from the marking menu. Next, press and hold the SHIFT key and select the vertices, as shown in Figure 7-48 (vertices to be selected are encircled for your reference).

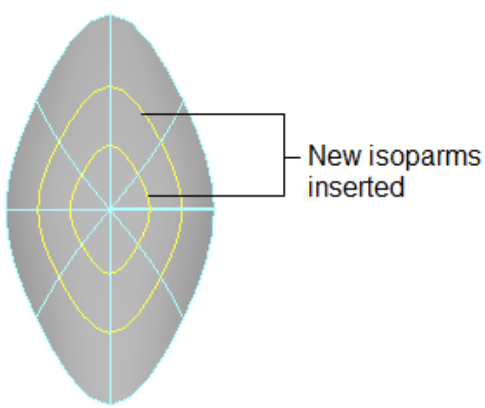


Figure 7-47 *Inserting two new isoparms*

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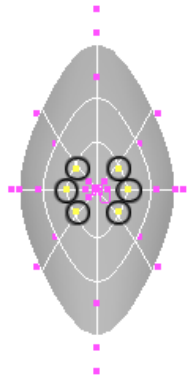


Figure 7-48 *Selecting vertices*

11. Choose **View > Predefined Bookmarks > Perspective** from the **Panel menu**; the Perspective viewport is activated. Invoke the **Move Tool** from the toolbox and move the selected vertices up along the Y axis to get the final output, as shown in Figure 7-49.

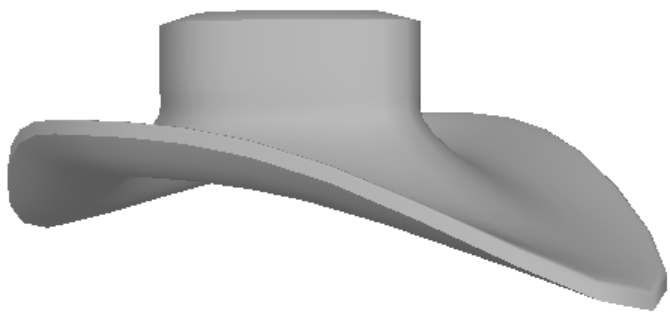


Figure 7-49 *The final model*

Saving the File

In this section, you need to save the wine glass model that you have created.

1. Choose **File > Save Scene** from the main menubar; the **Save As** dialog box is displayed.

   As the project folder is already set, by default the path *\Documents\Maya_Tutorials\c07_tut1\scenes* is displayed in **Look In** text box of the dialog box.

2. Enter **c07_tut1** in the **File name** text box and then select **Maya Binary** from the **Files of type** drop-down list. Next, choose the **Save As** button.

You can view the final rendered image of the model by downloading the *c07_Maya_2012_render.zip* file from *http://www.cadcim.com*.

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Tutorial 2

In this tutorial, you will create the model of a ship, as shown in Figure 7-50, using the combination of NURBS and polygonal modeling. **(Expected time: 30 min)**

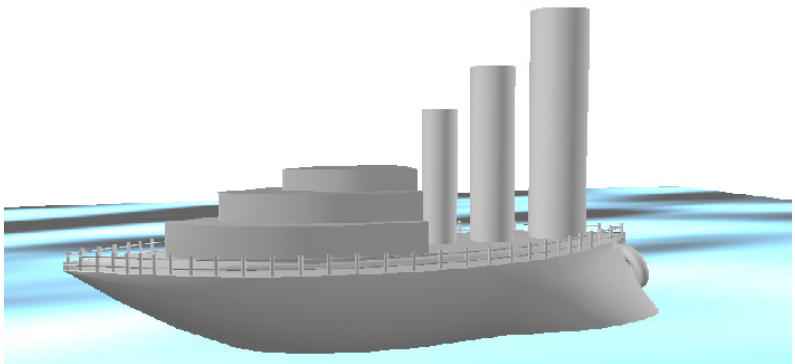


Figure 7-50 *Model of a ship*

The following steps are required to complete this tutorial:

a. Create a project folder.
b. Create the base of the ship.
c. Create railings.
d. Create deck.
e. Create chimney.
f. Save the file.

Creating the Project Folder

Before starting a new file, it is recommended that you set the project folder.

1. Create a project with the name *c07_tut2* in the folder *Maya_Tutorials*.

Creating the Base of the Ship

In this section, you need to create the base of the ship using the NURBS curves and the loft method.

1. Activate the Side viewport and choose **Create > EP Curve Tool** from the main menubar. Next, create a curve for the base of the ship in the Side viewport. Press and hold the d key and move the manipulators to set the pivot point at one end of the curve.

2. Choose **Edit > Duplicate Special > Option Box** from the main menubar; the **Duplicate Special Options** dialog box is displayed in the viewport. Enter required values in the dialog box, refer to Figure 7-51, and then choose the **Duplicate Special** button; duplicate curves are created in the viewport.

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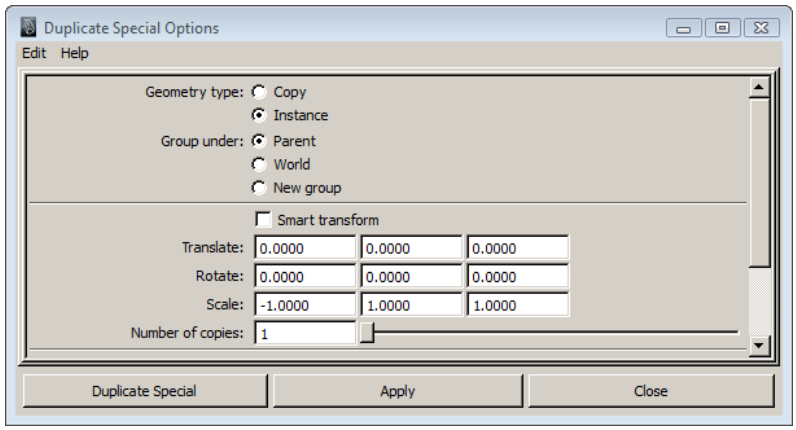


Figure 7-51 *The* ***Duplicate Special Options*** *dialog box*

3. Activate the Perspective viewport. Press and hold the SHIFT key and then select all the curves in the viewport one-by-one. Next, choose **Surfaces > Loft** from the main menubar; a surface is created defining half part of the ship base. Press 5 to change the view to shaded mode.

4. Select the loft surface, repeat the step 2, and then enter values in the dialog box, as shown in Figure 7-52. Next, choose the **Duplicate Special** button to make a duplicate copy of the surface such that the model looks like the complete base of the ship.



Note

Press 4 for wireframe mode, 5 for shaded mode, 6 for viewing texture, and 7 to view the light effect in the viewport.

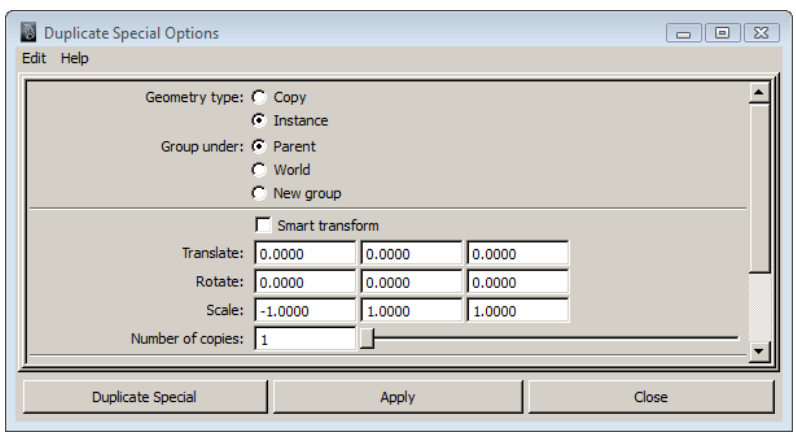


Figure 7-52 *Partial view of the* ***Duplicate Special Options*** *dialog box*

5. Select all curves and surfaces in the viewport. Press and hold the SHIFT key and click on the surface; all curves are selected. Next, choose **Display > Hide > Hide Selection** from the main menubar; the selected curves get hidden. Activate the Side viewport and select

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the NURBS surface. Now, choose **Edit NURBS > Rebuild Surfaces > Option Box** from the main menubar; the **Rebuild Surface Options** dialog box is displayed. Set the values in this dialog box, refer to Figure 7-53, and then choose the **Rebuild** button to rebuild the surface.

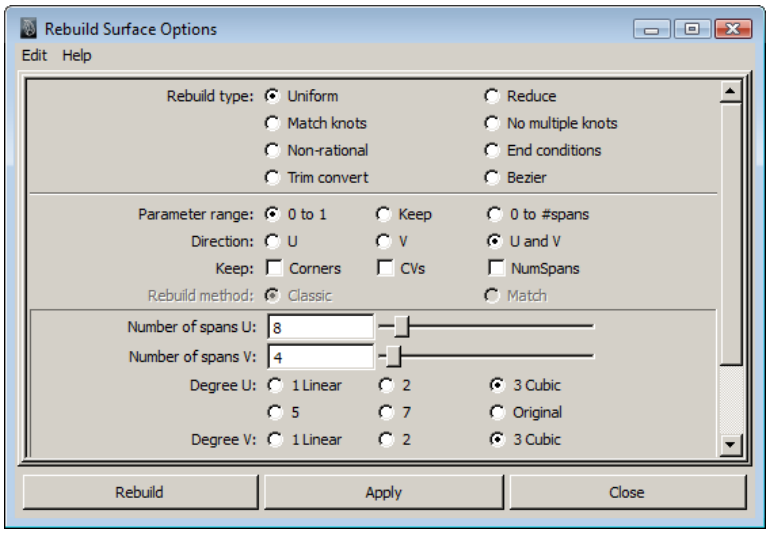


Figure 7-53 *The* ***Rebuild Surface Options*** *dialog box*

6. Press and hold the right mouse button over the model and choose **Control Vertex** from the marking menu. Next, press and hold the SHIFT key and select the vertices, as shown in Figure 7-54. Invoke the **Move Tool** from the toolbox and move the vertices downward to create the tail of the ship, as shown in Figure 7-55.

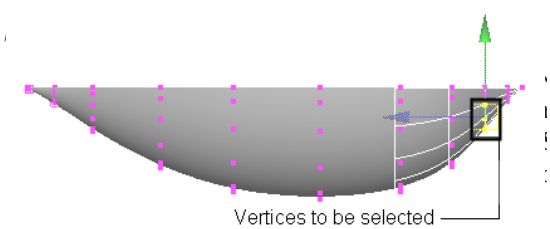


Figure 7-54 *Selecting vertices*

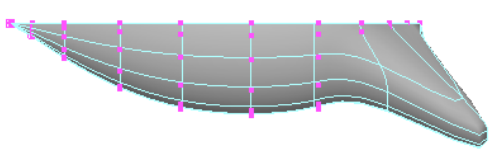


Figure 7-55 *Moving the vertices to create the tail of the ship*

8. Select one half of the ship base. Press and hold the right mouse button over the ship, choose **Isoparm** from the marking menu, and then select the topmost isoparm.

9. Press the SHIFT key and choose another half of the base ship and repeat step 8; two isoparms are selected, as shown in Figure 7-56. Next, choose **Surfaces > Loft** from the main menubar to create a surface between the selected isoparms.

10. Select the newly created surface and choose **Edit NURBS > Rebuild Surfaces > Option Box** from the main menubar; the **Rebuild Surfaces Options** dialog box is displayed. Enter

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8 and **4** in the **Number of spans U** and **Number of spans V** edit boxes, respectively. Next, choose the **Rebuild** button.

11. Activate the Top viewport. Select the newly created surface, press and hold the right mouse button on the selected surface, and then choose **Isoparm** from the marking menu. Insert the two isoparms at the positions shown in Figure 7-57. Now, choose **Edit NURBS > Insert Isoparms** from the main menubar; two new isoparms are created.

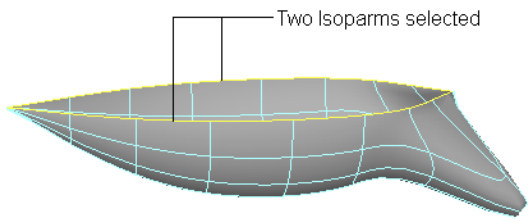


Figure 7-56 *The two isoparms selected*

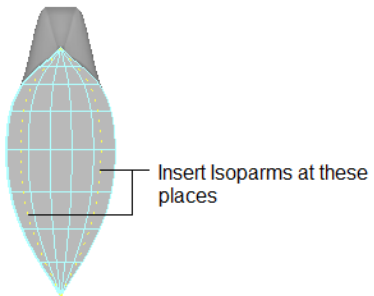


Figure 7-57 *Inserting isoparms*

12. Press and hold the right mouse button over the new surface and choose **Hull** from the marking menu. Now, select all hulls, except those that lie on the border of the surface, as shown in Figure 7-58.

13. Activate the Perspective viewport. Invoke the **Move Tool** from the toolbox and move the hulls up along the Y axis so that they do not touch the base of the ship. Next, invoke the **Scale Tool** from the toolbox, select the red handle, and scale the hulls along the X axis, as shown in Figure 7-59.

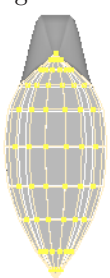


Figure 7-58 *Selecting hulls*



Figure 7-59 *Scaling the hulls along the X axis*

Creating Railings

In this section, you need to create railings for the ship by using the NURBS cylinder. There are two ways to create railings: by creating cylinders and aligning them manually, or aligning the cylinders on a curve. In this section, you need to align the cylinders on a curve.

1. Activate the Top viewport. Choose **Create > EP Curve Tool** from the main menubar and create a curve, taking the boundary of the ship as reference, refer to Figure 7-60. Now, move this curve using the **Move Tool**.

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2. Activate the Perspective viewport and choose **Create > NURBS Primitives > Cylinder** from the main menubar. Now, create a cylinder in the viewport. Next, delete the upper cap and the lower cap of the cylinder.

3. Choose **Display > UI Elements > Channel Box/Layer Editor** from the main menubar; the **Channel box** is displayed at the right of the viewport. Change the parameters of the cylinder in the **INPUTS** node of the **Channel box**, as given next.

   Radius: **0.1** Sections: **10** Height Ratio: **10**

4. Choose the **Animation** menuset from the status line and select the curve. Next, press and hold the SHIFT key and select the cylinder. Choose **Animate > Motion Paths > Attach to Motion Path** from the main menubar; the cylinder gets attached to the curve.

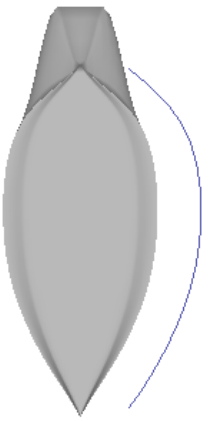


Figure 7-60 *Creating the NURBS curve*

5. Choose **Animate > Create Animation Snapshot > Option Box** from the main menubar; the **Animation Snapshot Options** dialog box is displayed in the viewport. Enter **30** in the **End Time** edit box, **2** in the **Increment** edit box, and then choose the **Snapshot** button; the cylinders are aligned on the curved surface, as shown in Figure 7-61.

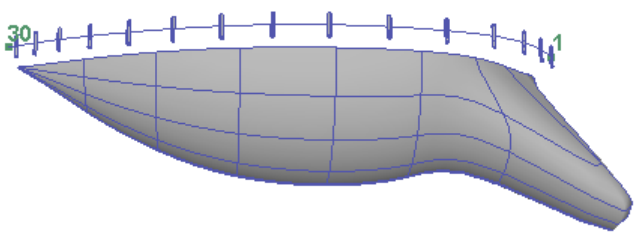


Figure 7-61 *The cylinders aligned on the curve surface*

Note

*The value in the **End Time** edit box may vary depending on the size of the NURBS surface created.*

6. Activate the Front viewport and choose **Create > NURBS Primitives > Circle** from the main menubar and create a circle in the viewport. Next, choose **Display > UI Elements > Channel Box/Layer Editor** from the main menubar; the **Channel box** is displayed. In the **Channel box**, adjust the radius of the circle to 0.1.

7. Choose the **Surfaces** menuset from the status line. Now, select the circle and then the curve from the viewport. Choose **Surfaces > Extrude** from the main menubar; the circle is extruded and the handrail is created.

8. Select the extruded surface. Choose **Display > UI Elements > Attribute Editor** from the main menubar; the **Attribute Editor** is displayed. Choose the **extrude1** tab and enter values in the **Attribute Editor**, as shown in Figure 7-62. Invoke the **Move Tool** from the toolbox and align the handrail over the cylinders.

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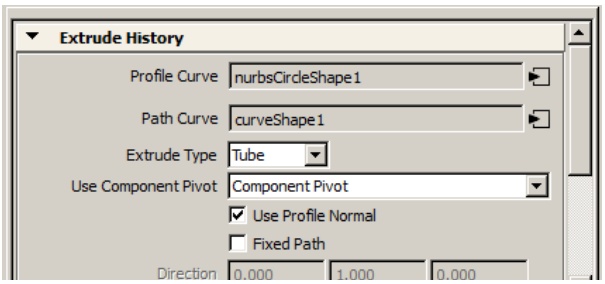


Figure 7-62 *Setting the parameters in the* ***extrude1*** *tab*

9. Activate the Perspective viewport. Select the curve and choose **Display > Hide > Hide Selection** from the main menubar to hide the curve. Make a duplicate copy of the railing and move it down, as shown in Figure 7-63. Next, select the complete railing and press CTRL + g to group them. Then, align the railings on the base of the ship.

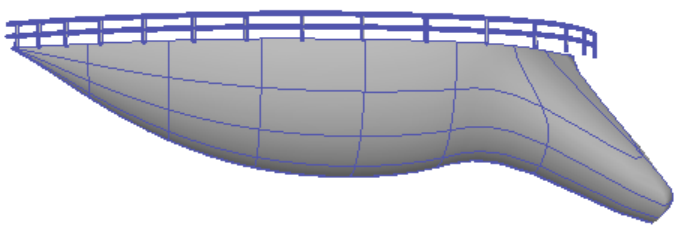


Figure 7-63 *The railings aligned on half part of the ship*

10. Select the railing group and choose **Edit > Duplicate Special** from the main menubar to make a duplicate of the railings to create another half part of the railing. Next, invoke the **Move Tool** from the main menubar and align the duplicate pair of the railings with the ship, as shown in Figure 7-64.

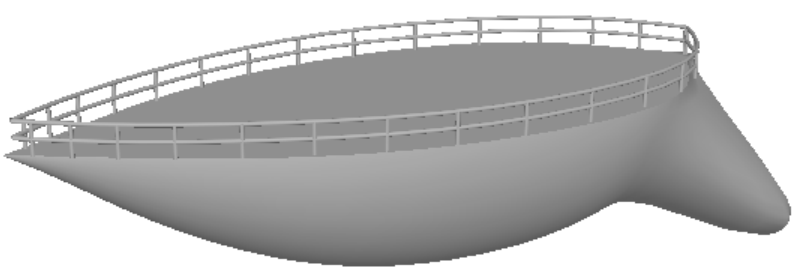


Figure 7-64 *The final railings*

Creating the Deck

In this section, you need to create the deck of the ship using the polygon modeling method.

1. Activate the Top viewport. Choose **Create > Polygon Primitives > Cube** from the main menubar to create a cube in the viewport. Choose **Display > UI Elements > Channel**

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Box/Layer Editor from the main menubar; the **Channel box** is displayed. Modify the parameters of the cube in the channel box as given next:

Width: **10**	Height: **5**	Depth: **10**
Subdivisions Width: **2**	Subdivisions Height: **1**	Subdivision Depth: **4**

2. Press and hold the right mouse button on the cube; a marking menu is displayed. Choose **Vertex** from the marking menu. Next, invoke the **Move Tool** from the toolbox and adjust the vertex of the cube to form the shape as shown in Figure 7-65.

3. Select the cube and choose **Edit > Duplicate** from the main menubar to make the duplicate of the cube in the viewport. Similarly, create one more duplicate of the deck. Invoke the **Move Tool** and then the **Scale Tool** to align the duplicated decks on the ship, as shown in Figure 7-66.

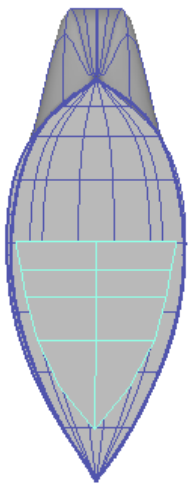


Figure 7-65 *The shape of the deck created*

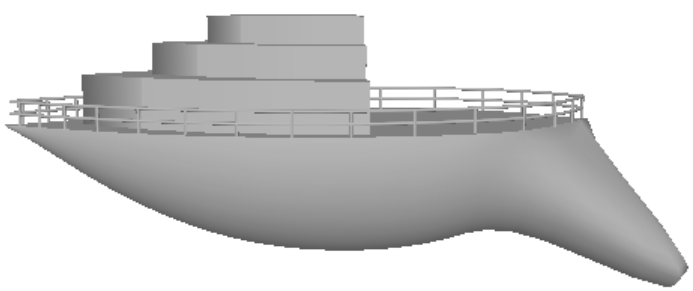


Figure 7-66 *The duplicate decks aligned together*

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Creating the Chimney

In this section, you need to create the chimney for the ship using the polygon cylinder tool.

1. Activate the Top viewport. Choose **Create > Polygon Primitives > Cylinder** from the main menubar to create three cylinders in the viewport. The cylinders will act as chimneys for the ship. Choose **Display > UI Elements > Channel Box/Layer Editor**; the **Channel box** is displayed. Adjust the parameters in the channel box as given below:

Cylinder	Radius	Height
Cylinder1	2	20
Cylinder2	1.5	15
Cylinder3	1	10



Note

The radius and height of the cylinders may vary depending upon the size of the ship. Therefore, you need to set the respective values accordingly.

2. Activate the Perspective viewport and align the cylinders to create chimneys, as shown in Figure 7-67.

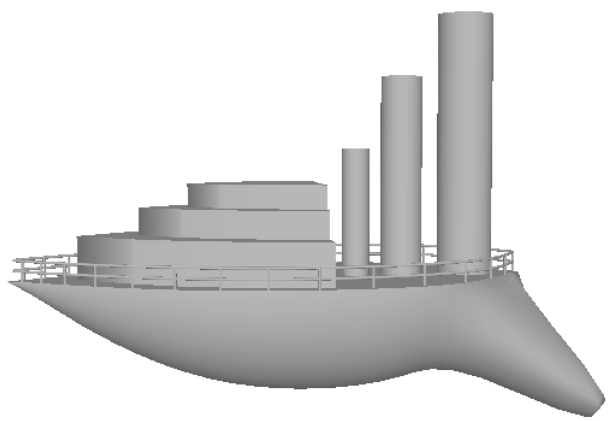


Figure 7-67 *The chimneys created*

Saving the File

In this section, you need to save the ship model that you have created.

1. Choose **File > Save Scene** from the main menubar; the **Save As** dialog box is displayed.

   As the project folder is already set, by default the path *\Documents\Maya_Tutorials\c07_tut2\scenes* is displayed in **Look In** text box of the dialog box.

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2. Enter **c07_tut2** in the **File name** text box and then select **Maya Binary** from the **Files of type** drop-down list. Next, choose the **Save As** button.

You can view the final rendered image of the model by downloading the file *c07_Maya_2012_render.zip* from *http://www.cadcim.com*.

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 create a new segment at the intersection of two surfaces?

(a) **Intersect Surfaces** (b) **Untrim Surfaces**
(c) **Attach Surfaces** (d) None of these

2. Which of the following tools is used to paint a mesh to give it a smoother look?

(a) **Pull** (b) **Push**
(c) **Smooth** (d) **Relax**

3. The _____ tool is used to rebuild the U and V spans.

4. The _____ tool is used to untrim a trimmed area.

5. The _____ tool is used to reverse the U and V directions of a selected surface.

6. More the number of patches on an object, better you can operate on it using the _____ **Geometry Tool**.

7. The **NURBS to Subdiv** conversion tool is used to convert a NURBS mesh into a subdiv mesh. (T/F)

8. The process of converting an object from one mesh to another is known as mesh conversion. (T/F)

9. The **Offset Surfaces** tool is used to create a copy of a selected surface at a particular distance. (T/F)

10. The **Insert Isoparms** tool is used to insert an isoparm into an existing NURBS surface. (T/F)

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Review Questions

Answer the following questions:

1. Which of the following operations is used to relax bumps over a surface?

   (a) **Push** (b) **Pull**
   (c) **Relax** (d) **Erase**

2. Which of the following tools is used to align the selected surface?

   (a) **Offset Surface** (b) **Attach Surface**
   (c) **Align Surface** (d) None of these

3. The _____ tool is used to extend a NURBS surface.

4. The _____ **knots** radio button is used to remove the extra knots formed while rebuilding a surface.

5. The _____ tool is used to create the copy of a selected surface.

6. The **Pinch** tool is used to pull selected vertices toward each other. (T/F)

7. The tessellation method is used to set the initial and secondary tessellation controls for an object. (T/F)

8. Tessellation is a method, which is used to convert a NURBS mesh into a set of polygons. (T/F)

9. The **Erase** operation is used to push the NURBS mesh inside a surface. (T/F)

10. The **Extend Surfaces** tool is used to rebuild a NURBS surface. (T/F)

Exercises

Exercise 1

Use various modeling techniques to build the model of a handbag, shown in Figure 7-68. You can view the final rendered image of this model by downloading the file *c07_maya_2012_render.zip* from *http://www.cadcim.com.* The path of file is as follows:

Textbooks > Animation and Visual Effects > Maya > Autodesk Maya 2012: A Comprehensive Guide

(Expected time: 45 min)

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Figure 7-68 *The model of a handbag*

Exercise 2

Use various modeling techniques to create the model of a chair, as shown in Figure 7-69. You can view the final rendered image of this model by downloading the *c07_maya_2012_render.zip* file from *http://www.cadcim.com*. The path of the file is mentioned in Exercise 1.

(Expected time: 30 min)



Figure 7-69 *The model of a chair*

Answers to Self-Evaluation Test

1. a, **2.** c, **3. Rebuild Surface**, **4. Untrim Surface**, **5. Reverse Surface Direction**, **6. Sculpt**, **7.** T, **8.** F, **9.** T, **10.** T

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