Chapter 7

Editing Tools-I

Learning Objectives

After completing this chapter, you will be able to:

- *Duplicate and combine curves.*
- *Add fillet between curves.*
- *Add points to a curve.*
- *Transform a curve.*
- *Stretch curves.*
- *Break curves.*
- *Intersect and detach curves.*
- *Rebuild curves.*
- *Planarize curves.*
- *Section curves.*

EDITING CURVES

In the previous chapter, you learned about advanced surface modeling tools. In this chapter, you will learn about curve and surface editing tools. These editing tools are used for editing features of an object/component. Editing curves and surfaces give you the flexibility while creating models with desired parameters. These editing tools are discussed next.

DUPLICATING A CURVE

Palette:	Curve Edit > Duplicate curve

You can create a duplicate curve of an existing curve by using the **Duplicate curve** tool. To do so, choose the **Duplicate curve** button from the **Curve Edit** tab in the **Palette**; you will be prompted to select the curve(s) to be duplicated. Select the existing curve(s) from the active window; the duplicate copy of the selected curve will be created at the position of the original curve. You can move this duplicate copy of the curve to a desired location by using the **Move** tool of the **Transform** tab in the **Palette**.

To set the parameters of the **Duplicate curve** tool, double-click on the **Duplicate curve** button; the **Duplicate Curve** dialog box will be displayed, as shown in Figure 7-1.

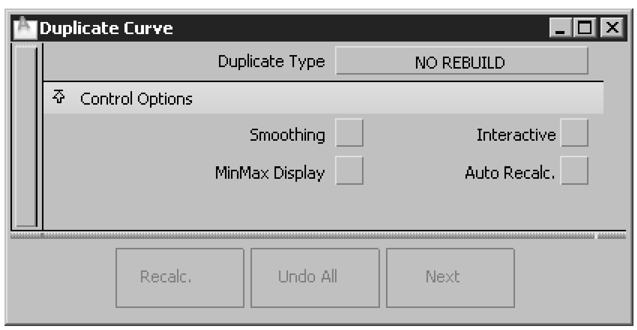


Figure 7-1 *The* ***Duplicate Curve*** *dialog box*

The options in this dialog box are discussed next.

Duplicate Type

The **Duplicate Type** area is used to specify the type of the duplicate curve that you want to create. The options in this area are used to create duplicate copy with increased or decreased curvature, spans, uniform knots, and so on. With this tool, you can also create a duplicate curve with knots matching the original curve's knots. The options in this area are discussed next.

NO REBUILD

The **NO REBUILD** button is chosen by default and is used to create a duplicate curve without changing its attributes.

CURVATURE

Choose this button to create a duplicate copy of the curve such that you can control its attributes such as maximum number of spans, degrees, tolerance, and so on. You can add edit points into the curve segments with high curvature. When you choose this button, you will be prompted to select the curve that you want to duplicate. Select the required curve; the **Go** button will be displayed at the lower right corner of the active window. Next, choose the **Go** button; the duplicate copy of the curve will be created on the original curve. As this curve is created exactly on the original curve, you need to transform the duplicate curve to view it, as shown in Figure 7-2. This curve differs from the original curve in number of spans, degrees, and so on, based on the settings of different areas associated with this button.

REDUCE SPANS

Choose this button to create a duplicate copy of the curve such that the number of spans in the duplicate curve are reduced in comparison to the original curve. Using this button, the curve gets simplified by removing extraneous edit points. Figure 7-3 shows the duplicate copy of a curve created by choosing the **REDUCE SPANS** button.

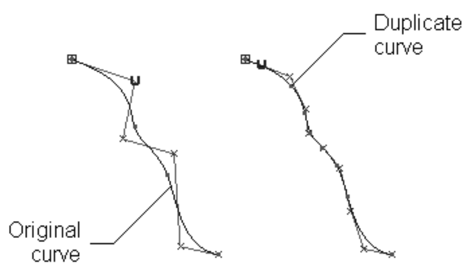


Figure 7-2 *Duplicate curve*

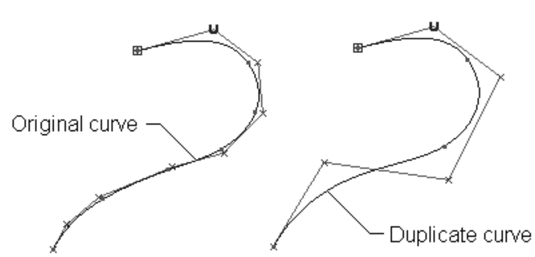


Figure 7-3 *Duplicate curve with reduced spans*

DEL MULTI-KNOTS

Choose this button to create a duplicate copy of the curve by removing multi-knots, if present. Multi-knots are created when you attach curves of different degrees. Multi-knots are undesirable as they do not support creating the rail surface, performing boolean operations, or exporting files from other CAD packages.

UNIFORM KNOTS

Choose this button to create a duplicate copy of the curve with uniform parameterization, as shown in Figure 7-4. In other words, the curve created by using this button has uniform knots. You can specify the number of spans and degree of the duplicate curve in the **Number of Spans** and **Degree** edit boxes, respectively. The geometry of the curve changes with the change of values in these edit boxes.

MATCH KNOTS

Choose this button to create a duplicate copy of the curve such that the number of spans and degrees of the duplicate curve matches with the number of spans and degrees of the other curve. On choosing this button, you will be prompted to select the curve(s) to duplicate. Select the required curve; you will be prompted to select the curve with which the spans and degrees of the duplicate curve will be matched. Select the second curve from the active window; the duplicate copy of the first curve with knots matching with the knots of the second curve will be created, as shown in Figure 7-5.

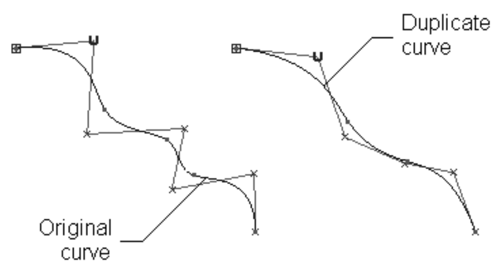


Figure 7-4 *Duplicate curve with uniform knots*

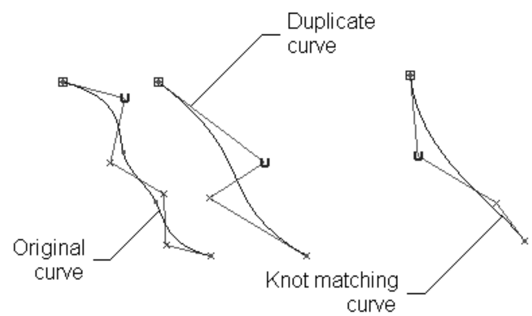


Figure 7-5 *Duplicate curve with knots matching with the knots of the second curve*

Tolerance

The amount of deviation allowed between the duplicate curve and the original curve is known as tolerance. The **Tolerance** edit box will be available only when you choose the **CURVATURE** or **REDUCE SPANS** button from the **Duplicate Type** area. This edit box is used to specify the tolerance of the duplicate copy of the curve. Alternatively, you can specify the tolerance by using the slider bar given on the right of this edit box. By default, 0.01 is displayed in this edit box. Low tolerance means the deviation between the original curve and the duplicate curve will be less and therefore, more points are inserted into the duplicate curve. High tolerance means the deviation between the two curves will be more and the curves will not match properly. Also, less number of points will be inserted into the duplicate curve.

Max Spans Type

The **Max Spans Type** area is used to specify the mode of insertion of spans into a duplicate curve. These modes are discussed next.

RELATIVE

This button is chosen by default and is used to create duplicate curve such that the number of spans in it does not exceed the numbers of spans in the original curve times the maximum spans factor. In other words, this button is used to control the maximum number of spans in the duplicate curve. The number of spans in the duplicate curve depends upon the specified tolerance and degree. The number of spans in a duplicate curve cannot exceed the number of spans in the original curve.

ABSOLUTE

Choose this button to create a duplicate curve with the number of spans equal to the maximum number of spans set in the **Max Spans** edit box. The number of spans in the duplicate curve depends upon the specified tolerance and degree. The number of spans in a duplicate curve cannot exceed the number of maximum spans set in the **Max Spans** edit box.

Max Spans Factor

This edit box will be available only when you choose the **RELATIVE** button from the **Max Spans Type** area. This edit box is used to specify the multiplication factor that is used to specify the number of spans in the duplicate curve. You can also specify the maximum spans factor by using the slider bar given on the right of this edit box.

Max Spans

This edit box will be available only when you choose the **ABSOLUTE** button from the **Max Spans Type** area. This edit box is used to specify the maximum number of spans that a duplicate curve can accommodate. You can also specify the maximum number of spans by using the slider bar given on the right of this edit box.

Change Degree

This check box is used to change the degree of the new duplicate curve. When you select this check box, the **Degree** edit box will be displayed. In this edit box, you can specify a new degree for the duplicate curve. You can also change the degree of the duplicate curve by using the slider bar given on the right of the **Degree** edit box.

Note

The duplicate copy of a curve is created exactly on the original curve. To view changes in its profile, move it to other location. To view changes in attributes such as degrees, spans, parameterization, and so on, you can use the ***Query edit*** *tool that will be discussed in Chapter 8.*

Number of Spans

This edit box will be available only when you choose the **UNIFORM KNOTS** button from the **Duplicate Type** area. This edit box is used to specify the number of spans in the duplicate copy of the curve. By default, 3 is displayed in this edit box. You can also change this value by using the slider bar given on the right of the **Number of Spans** edit box.

Control Options

The **Control Options** area is used to control the appearance of the curve while rebuilding it. The options in this area are discussed next.

Smoothing

Select this check box to smoothen the curve after rebuilding it. Drag the cursor with the left mouse button to smooth the rebuilt curve interactively. Press the middle or right mouse button to smooth or unsmooth the rebuilt curve in steps.

Interactive
Select this check box to create the duplicate copy of an arbitrary isoparametric curve. You can move this duplicate curve by dragging and then placing it anywhere on the surface before rebuilding it. You can create this type of duplicate copy on surfaces only. If you clear this check box, the isoparametric curve will be duplicated and placed at the position of the original isoparametric curve.

MinMax Display
Select this check box to create a comb that displays the minimum, maximum, and mean deviations between the original and duplicate curves, as shown in Figure 7-6. If you move the original or duplicate curve, these deviations will change accordingly, as shown in Figure 7-7.

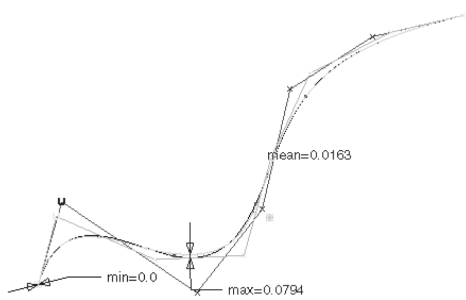


Figure 7-6 *Minimum, maximum, and mean deviations between two curves*

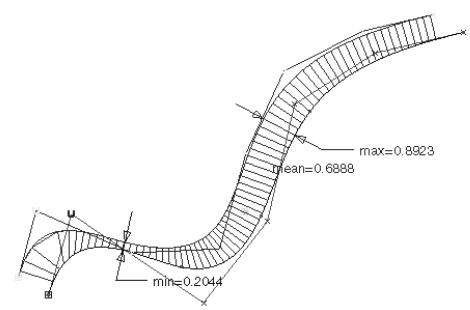


Figure 7-7 *Deviations changed after moving the duplicate curve*

Auto Recalc.
Select the **Auto Recalc.** check box to update duplicate curve automatically when parameters in the **Duplicate Curve** dialog box are changed.

Recalc.
This button will be available only when you clear the **Auto Recalc.** check box and change the settings for the duplicate curve. By default, the **Auto Recalc.** check box is cleared. As a result, the duplicate curve will not update automatically. In such a case, choose the **Recalc.** button to update the duplicate curve.

Undo All
The **Undo All** button is used to cancel the effect of the **Duplicate curve** tool and restores the original condition of the curve.

Next
The **Next** button is used to create a new duplicate curve by resetting the parameters of the **Duplicate curve** tool. After choosing the **Next** button, specify the setting for the new curve to create its duplicate copy.

Tip: *Sometimes, the duplication of the curve fails. In such a case, you need to change settings such as tolerance, number of spans, or degree in the* ***Duplicate Curve*** *dialog box.*

COMBINING CURVES

Palette: Curve Edit > Duplicate curves > Combine curves

You can create a 3D curve from two planar curves by using the **Combine curves** tool. This tool creates a 3D curve by projecting two planar curves in 3D space. To create a 3D curve, choose the **Combine curves** button from the **Curve Edit** tab in the **Palette**; you will be prompted to select the first profile curve. Select one of the curves from the active window; you will be prompted to select the second profile curve. Select the second curve; the 3D curve will be created, as shown in Figure 7-8. Sometimes, the **Combine curves** tool is unable to figure out the projection directions for two curves. In such a case, you will be prompted to specify the projection directions for the two planar curves. Also, the **Combine curves** tool may find out more than one solution and create the corresponding number of 3D curves. Delete the unwanted 3D curves after you exit this tool.

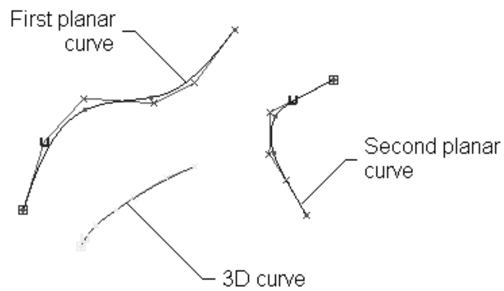


Figure 7-8 *3D curve created by combining two curves*

To set the parameters of the **Combine curves** tool, double-click on the **Combine curves** button; the **Combine Curves Options** dialog box will be displayed, as shown in Figure 7-9.

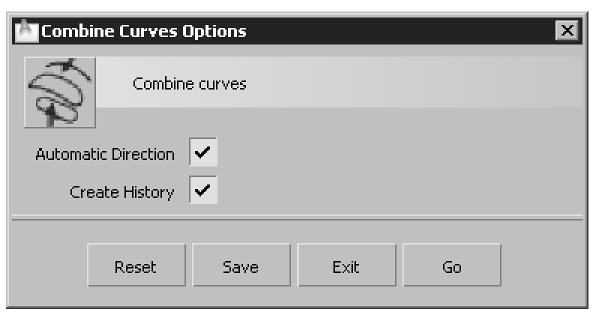


Figure 7-9 *The* ***Combine Curves Options*** *dialog box*

The options in this dialog box are discussed next.

Automatic Direction

This check box is selected by default and is used to figure out the projection direction of two planar curves, automatically. If this check box is cleared, you need to specify the projection directions for the two curves.

Create History

This check box is selected by default and is used to save the history of the 3D curve so that it can be updated while editing the profile curves.

Note

The profile curves that are used for creating 3D curves should be planar curves. If the curves are non-planar, use the ***Curve planarize*** *tool (discussed later in this chapter) to make them planar.*

Even if the ***Automatic Direction*** *check box is selected and the profile curves are drawn on the same plane, you need to specify the projection direction of the two profile curves manually.*

ADDING FILLET BETWEEN CURVES

Palette: Curve Edit > Duplicate curves > Fillet curves

You can add a fillet between two intersecting or non-intersecting curves by using the **Fillet curves** tool. To invoke this tool, click and hold the left mouse button on the **Duplicate curves** button in the **Palette**; a flyout will be displayed. Choose the **Fillet curves** button from this flyout; you will be prompted to select the primary filleting curve. Select the first filleting curve from the active window; you will be prompted to select the secondary filleting curve. Select the second curve from the active window; the fillet with default radius will be created between the two selected curves. Also, the **Accept** button will be displayed at the lower right corner of the active window. Choose the **Accept** button to create the fillet with current settings. If you want to change the radius of fillet, enter the required value in the promptline or drag the cursor before choosing the **Accept** button. Figures 7-10 and 7-11 show the lines before and after adding fillet, respectively.

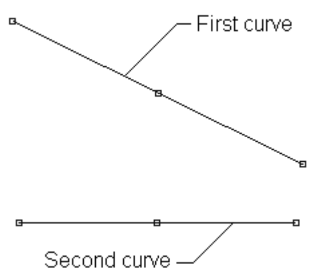


Figure 7-10 *Lines before adding fillet*

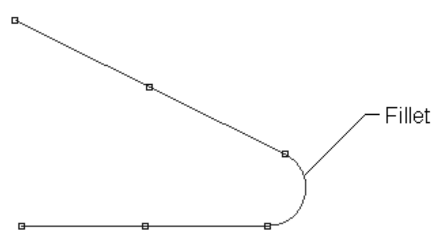


Figure 7-11 *Lines after adding fillet*

To set the parameters of the **Fillet curves** tool, double-click on the **Fillet curve** button; the **Curve Fillet Options** dialog box will be displayed, as shown in Figure 7-12.

The options in this dialog box are discussed next.

Construction

The **Construction** area is used to specify the type of the fillet to be added between curves. The radio buttons in this area are discussed next.

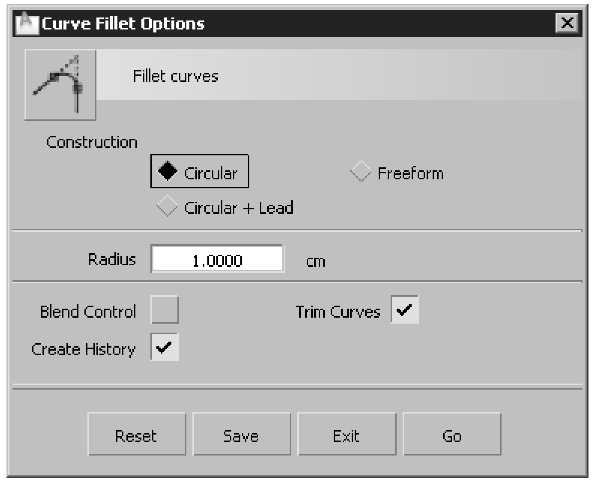


Figure 7-12 *The **Curve Fillet Options** dialog box*

Circular

This radio button is selected by default and is used to create a fillet with circular profile of specified radius.

Freeform

Select this radio button to create a freeform fillet between two curves, as shown in Figure 7-13. The fillet will be created between two curves at the points you click. These points are known as contact points. You can move these contact points by dragging locators with the left mouse button. These locators are displayed when you click on the second curve. The profile of the fillet curve depends upon the radio button selected from the **Freeform Type** area that will be discussed later.

Circular+Lead

Select this radio button to create a fillet of circular profile with control on its lead ratio and knee ratio. The lead radius and knee ratio have already been discussed in Chapter 4. Figure 7-14 shows the circular+lead fillet.

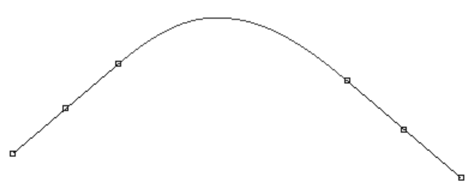


Figure 7-13 *Freeform profile fillet created*

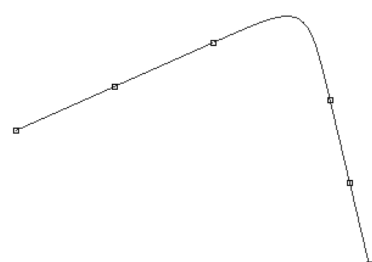


Figure 7-14 *Circular+lead fillet created*

Radius

The **Radius** edit box is used to specify the radius of the fillet curve. This edit box will be available only when you select the **Circular** or **Circular+Lead** radio button from the **Construction** area.

Calculate

The **Calculate** area is used to specify the parameter that needs to be calculated. This area will be displayed only when you select the **Circular+Lead** radio button from the **Construction** area. The two radio buttons in this area are discussed next.

Lead Radius

This radio button is used to calculate the lead radius of the fillet curve. Select this radio button and then enter the required value in the **Knee Ratio** edit box; the lead radius value will be displayed automatically in the **Lead Radius** edit box. The radius of the fillet curve is equal to lead radius times the knee ratio.

Knee Ratio

This radio button is selected by default and is used to calculate the knee ratio of the fillet curve. Enter the required value in the **Lead Radius** edit box; the knee ratio will be displayed automatically in the **Knee Ratio** edit box.

Freeform Type

This area will be available when you select the **Freeform** radio button from the **Construction** area of the **Curve Fillet Options** dialog box. Also, this area will be available when you select the **Circular** or **Circular+Lead** radio button after selecting the **Blend Control** check box. The radio buttons in this area are discussed next.

Tangent

If you extend tangents at contact points on the fillet curve, they will intersect at a point. Selecting the **Tangent** radio button enables you to create the fillet curve that stretches in the direction of the point of intersection of tangents. After selecting this radio button, select the primary and secondary filleting curves; the preview of the fillet curves with curve locators will be displayed. Also, the **Go** button will be displayed at the lower right corner of the active window. You can move locators placed at contact points along profile curves. By moving these locators, you can change the positions of contact points. Choose the **Go** button to create the fillet curve.

Blend

This radio button is selected by default and is used to create a fillet curve by calculating the average position of two contact points. Unlike the tangent fillet, the blend fillet curve does not stretch outside. As a result, the blend fillet curve will be shallower than the tangent fillet curve.

Figures 7-15 and 7-16 show the difference between the fillet curves created by selecting the **Tangent** and **Blend** radio buttons, respectively. The radii locators displayed in both the figures have been created by using the **Measure radius** tool of the **Locators** tab in the **Palette**. The tools of the **Locators** tab will be discussed in Chapter 10.

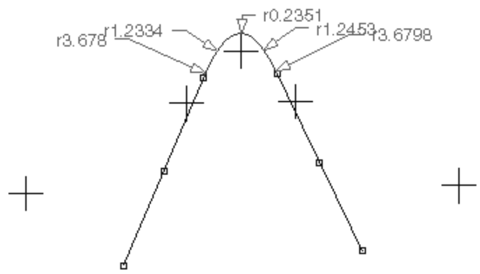


*Figure 7-15 Freeform fillet curve created with the **Tangent** radio button selected*

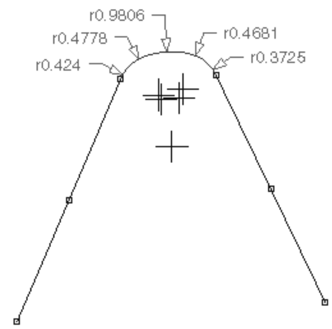


*Figure 7-16 Freeform fillet curve created with the **Blend** radio button selected*

Blend Control

Select this check box to change the type of fillet after its creation. On selecting this check box, the **Freeform Type** area will be available in the **Curve Fillet Options** dialog box that has been discussed earlier.

Trim Curves

This check box is selected by default and is used to trim the original curves automatically at contact points with fillet curve. If you clear this check box, the fillet curve will be created without trimming the original curves.

Create History

This check box is selected by default and is used to save the history of the fillet curve so that it can be modified later.

ADDING POINTS TO AN EXISTING CURVE

Palette:	Curve Edit > Add points to a curve

You can extend an exiting curve by adding more control points (CVs or edit points) to it by using the **Add points to a curve** tool. To add edit points to an existing curve, select the curve and then choose the **Add points to a curve** button from the **Curve Edit** tab in the **Palette**; you will be prompted to specify the position of the new CV. Specify the position of the new CV in the promptline or click in the active window. Using this tool, you can add any number of control points into the endpoint of an existing curve. You can add points to all types of curves except circle, ellipse, text, and sweep curves. You can add CVs or edit points to a curve at its endpoints only.

To add CVs to a curve, choose the **Pick CV** button from the **Pick** tab in the **Palette** and then select the first or last CV of the curve; the selected CV will get highlighted. Next, choose the **Add points to a curve** button from the **Curve Edit** tab in the **Palette**; you will be prompted to specify the position of the new CV. Click in the active window or enter the position of the CV in the promptline; the CV will be added to the curve resulting in its extension.

TRANSFORMING A CURVE

Palette: Curve Edit > Add points to a curve > transform curve

Transforming a curve implies moving, rotating, and scaling a curve. You can transform a curve by using the **transform curve** tool. This tool is generally used for intersecting the curves in rail surfaces. By moving, scaling, or rotating a curve, you can intersect it with other curves. To do so, choose the **transform curve** button from the **Curve Edit** tab in the **Palette**; you will be prompted to select the curve to be transformed. Select the required curve from the active window; the curve will get highlighted and handles will be displayed on it, as shown in Figure 7-17. Also, the **Translate**, **Rotate**, and **Rotate & Scale** buttons will be displayed at the lower right corner of the active window, refer to Figure 7-17. To intersect the selected curve with other curves, select and drag the handle to the endpoint of one of the curves. Make sure the **Snap to CV/Edit point** button is chosen from the interface screen. Next, choose the **Rotate** button from the active window; the circular manipulator (dotted circle) will be displayed. Click at the endpoint of the second curve; the curve intersects with the second curve. Make sure the **Snap to CV/Edit point** button is chosen. Figure 7-18 shows the curve after intersecting with the two curves.

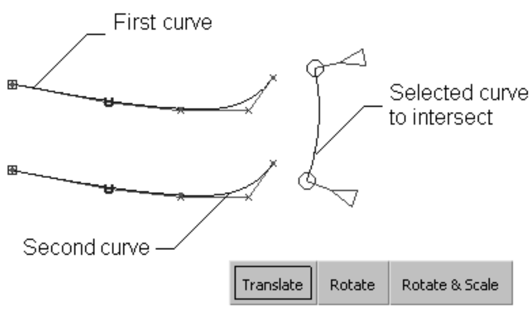


Figure 7-17 Curve selected to intersect with two curves

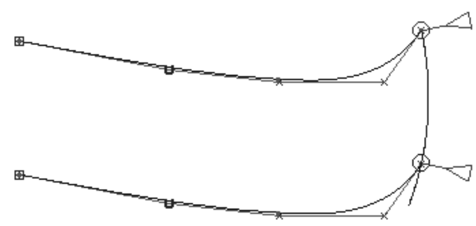


Figure 7-18 Curve after intersecting with two curves

Note

The second handle of the curve in Figure 7-18 has been moved by using the triangular manipulator.

The two methods of positioning and intersecting a curve with two rail curves are discussed next.

Rocking/Rotating

Rocking/rotating involves positioning a curve by translating and rotating it. Before rocking or rotating a curve, you need to intersect one of the handles with one of the curves by moving it. Choose the **Snap to CV/Edit** tool while moving the handle. Next, choose the **Rotate** button available at the lower right corner of the active window; the circular, triangular, and rotational manipulators will be displayed on the first control handle, as shown in Figure 7-19. The circular manipulator is used to rotate the selected curve around the first control handle. The triangular manipulator is used to move handle to any position along the curve. The rotational manipulator is used to specify the plane of rotation of the curve. A dotted circle with the control handle as its center is also displayed in the active window. This circle has radius equal to the distance between two endpoint handles. If you slide the triangular handle along the curve, the radius of the circle will change accordingly. By default, the curve rotates on its own plane. You can change the plane of rotation by clicking on the required rotational handle in the window. Next, adjust the handle such that it intersects with the second curve when it is slid along the curve or moved along the dashed circle. Choose the **Snap to CV/Edit point** button from the interface while rotating the handle.

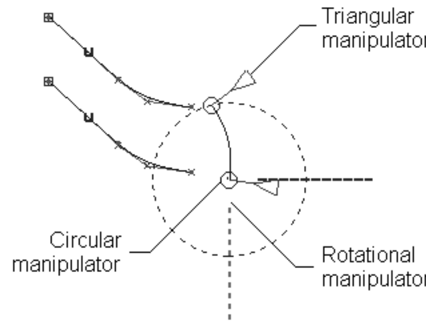


Figure 7-19 *The rotational, circular, and triangular manipulators*

Dilating

This method is used to intersect the selected curve with two curves without changing its shape characteristics. To transform a curve by using this method, intersect one of the handles of the selected curve with one of the curves. Next, choose the **Rotate & Scale** button from the lower right corner of the active window and drag the second handle to the second curve. Choose the **Snap to CV/Edit point** button while rotating the handle. The change in the shape characteristics of the curve will be nil and can be verified by checking its curvature comb.

To set the parameters of the **transform curve** tool, double-click on the **transform curve** button; the **Curve Transform Options** dialog box will be displayed, as shown in Figure 7-20.

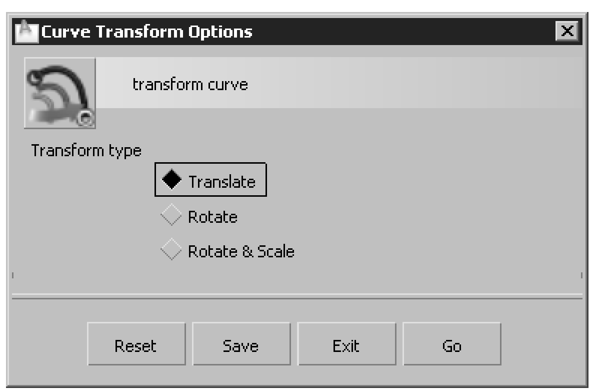


Figure 7-20 *The **Curve Transform Options** dialog box*

The options of this dialog box have been discussed earlier.

STRETCHING A CURVE

Palette: Curve Edit > Add points to a curve > Stretch curve

You can stretch or reshape an existing curve by using the **Stretch curve** tool. To stretch or reshape a curve, press and hold the left mouse button on the **Add points to a curve** button of the **Curve Edit** tab in the **Palette**; a flyout will be displayed. Choose the **Stretch curve** button from this flyout; you will be prompted to select the curve to stretch. Select an existing curve; two handles will be displayed at the endpoints of the selected curve. These handles consist of circular and triangular manipulators. These manipulators have been discussed earlier. Next, drag the handle to the required position. When you select a curve, three buttons will be displayed. These buttons are discussed next.

+Handles

Choose this button to add extra handles to the curve, as shown in Figure 7-21. The number of handles in a curve cannot exceed the degree of the curve plus 1.

-Handles

Choose this button to remove extra handles from curve. The minimum number of handles in a curve is 2.

Tangent On

Choose this button to place the tangent manipulator on the selected handle. This manipulator consists of three mutually perpendicular axes, as shown in Figure 7-22. You can change the direction of stretch by selecting the corresponding axis. Also, you can stretch or reduce the length of the curve by clicking and then dragging the cursor along the selected axis. After choosing the button, the button will change to **Tangent Off**. Choose the **Tangent Off** button to hide the manipulator.

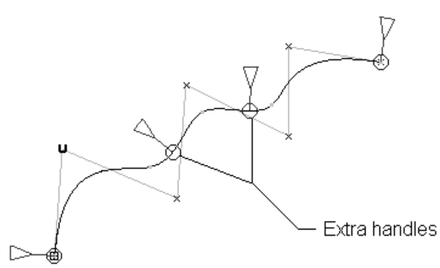


Figure 7-21 *Extra handles added to curve*

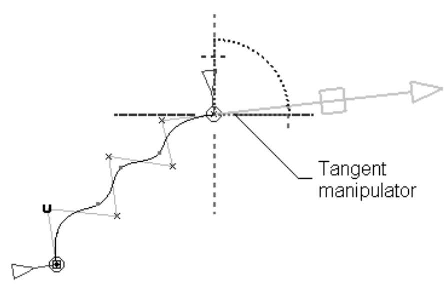


Figure 7-22 *Tangent manipulator*

To change the tangency of the curve, select the square icon from thee tangent manipulator and drag the cursor; the tangency of the curve will be modified. To relocate a particular point, move the manipulator to that point, click on the arrow and then drag it. To rotate the tangent around an axis, click on the corresponding dotted arc. To orient the tangent along an axis, click on the corresponding axis (dotted line).

To set the parameters of the **Stretch curve** tool, double-click on the **Stretch curve** button; the **Stretch Curve Options** dialog box will be displayed, as shown in Figure 7-23.

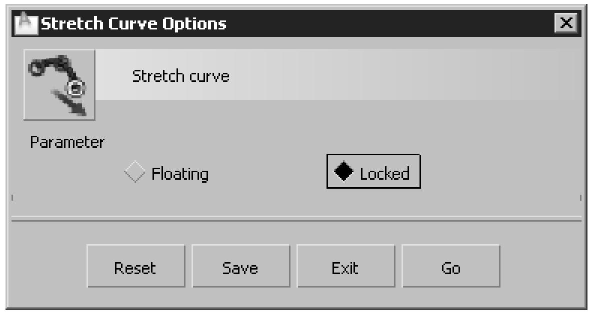


Figure 7-23 *The* ***Stretch Curve Options*** *dialog box*

The options in this dialog box are discussed next.

Parameter

This area is used to specify whether to keep parameters of handles locked or floating. The radio buttons in this area are discussed next.

Floating

Select this radio button to move the handles such that they slide along the curve. As a result, the changes made in the curve while stretching it will be minimum. Note that you can change parameters for extra handles only. In other words, first and last handles remain fixed to their parameters.

Locked

This radio button is selected by default and is used to fix handles to their parameters while moving them.

BREAKING A CURVE AT INFLECTIONS

Palette: Curve Edit > Break curve at inflections

Inflection points on a curve are the points where curvature changes its direction. Inflection points are also known as Ogees. You can split curves at inflection points by using the **Break curve at inflections** tool. To break a curve at its inflection point, choose the **Break curve at inflections** button from the **Curve Edit** tab in the **Palette**; you will be prompted to select the curve to be broken. Select the curve; the **Go** button will be displayed at the lower right corner of the active window. Also, arrows pointing toward inflection points will be displayed on the selected curve, as shown in Figure 7-24. Choose the **Go** button; the curve will break at inflection points, as shown in Figure 7-25. As a result, new curves will be created with inflection points as their endpoints.

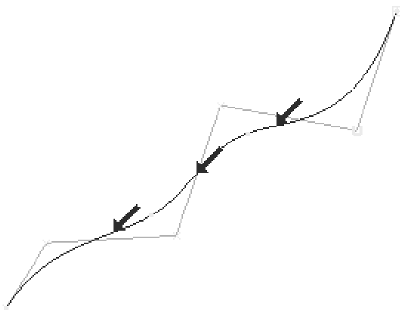


Figure 7-24 Arrows displayed at inflection points on the selected curve

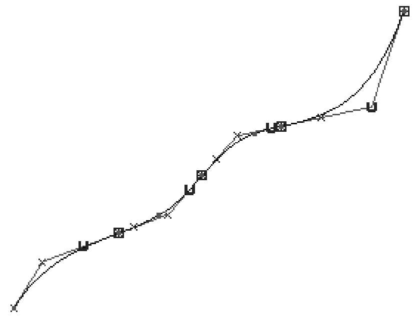


Figure 7-25 Curve broken at inflection points

INTERSECTING AND DETACHING CURVES

Palette: Curve Edit > Break curve at inflections > Intersect Curves and Detach

In AliasStudio, you can intersect the selected curves and detach them into segments at the intersection point by using the **Intersect Curves and Detach** tool. To intersect and detach curves, select the curves that are crossing each other. Next, choose the **Intersect Curves and Detach** button from the **Curve Edit** tab in the **Palette**; the **Go** button will be displayed at the lower right corner of the active window. Choose the **Go** button; the curves will intersect and detach resulting in the creation of new curve segments with new CVs and edit points. You can move, rotate, or scale these curve segments individually. Figure 7-26 shows two curves crossing each other and Figure 7-27 shows the curves after intersecting and detaching.

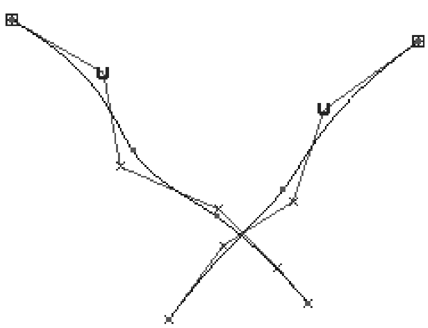


Figure 7-26 Curves before intersecting and detaching

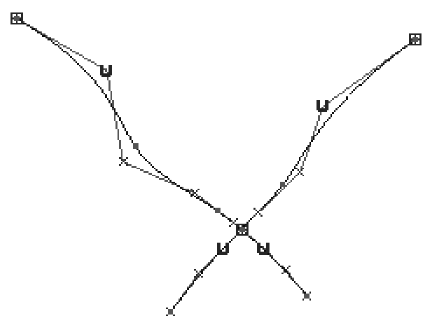


Figure 7-27 Curves after intersecting and detaching

REBUILDING A CURVE

Palette:	Curve Edit > Rebuild curve

The **Rebuild curve** tool is used to reconstruct an existing curve with different mathematical properties such as spans, degree, and so on. Rebuilding a curve is necessary for simplifying it. For example, you can remove multi-knots in a curve by rebuilding it. However, you cannot change the shape features of the curve by using this tool. To rebuild a curve, choose the **Rebuild curve** button from the **Curve Edit** tab in the **Palette**; you will be prompted to select the curve(s) to rebuild. Select the curve(s) from the active window; a new curve will be created with different mathematical properties. Figure 7-28 shows the original and rebuilt curves.

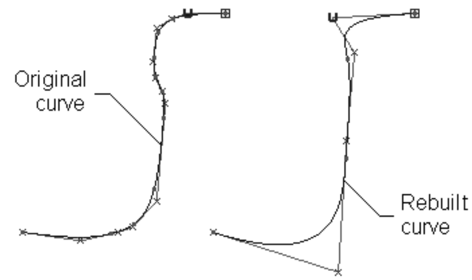


Figure 7-28 *Original and rebuilt curves*

Note

The rebuild curve lies on the original curve. You can move the rebuilt to other position to distinguish it from the original curve, refer to Figure 7-28. The change in mathematical properties of a rebuild curve can be viewed by checking the number of spans and degrees in the ***Control Panel****. Also, you may need to adjust the tolerance value for analyzing the effect of the* ***Rebuild curve*** *tool, as discussed in the* ***Duplicate curve*** *tool.*

To set the parameters of the **Rebuild curve** tool, double-click on the **Rebuild curve** button; the **Rebuild Curve** dialog box will be displayed, as shown in Figure 7-29.

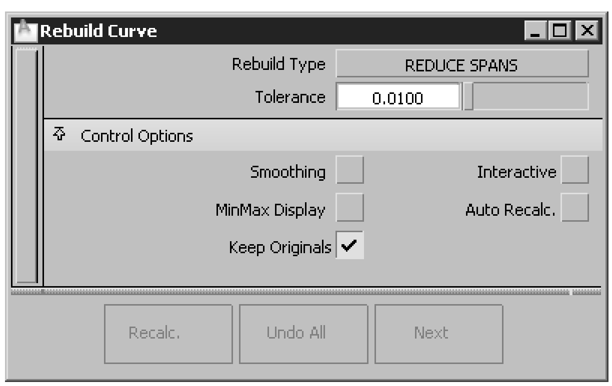


Figure 7-29 *The* ***Rebuild Curve*** *dialog box*

Some of the options in this dialog box are the same as those discussed in the **Duplicate curve** tool. The other options in this dialog box are discussed next.

Change Number of CVs

This check box will be available only when you choose the **UNIFORM KNOTS** button from the **Rebuild Type** area. This check box is used to change the number of CVs of the rebuilt curve. Select this check box to display the **Number of Spans** edit box and enter the required values in this edit box. You can also change the number of spans by using the slider bar given on the right of the **Number of Spans** edit box. The change in the number of spans changes the number of CVs in the selected curve accordingly.

Keep Originals

This check box is available in the **Control Options** area of the **Rebuild Curve** dialog box. This check box is selected by default and is used to retain the original curve after rebuilding the curve. If you clear this check box, only the rebuilt curve will be displayed in the window.

PLANARIZING A CURVE

Palette:	Curve Edit > Curve planarize

Sometimes points on a curve or a surface edges lie on different planes. You can modify these curves and surface edges such that points lie on the same plane. Planarizing a curve is important for creating a planar surface or preparing these curves to use as profile curves for other tools. To do so, choose the **Curve planarize** button from the **Curve Edit** tab in the **Palette**; you will be prompted to select the first curve. Select the non-planar curve; you will be prompted to select the next curve and the **Go** button will be displayed at the lower right corner of the active window. Choose the **Go** button; the non-planar curve(s) will get planarized.

To set the parameters of the **Curve planarize** tool, double-click on the **Curve planarize** button; the **Curve Planarize Options** dialog box will be displayed, as shown in Figure 7-30.

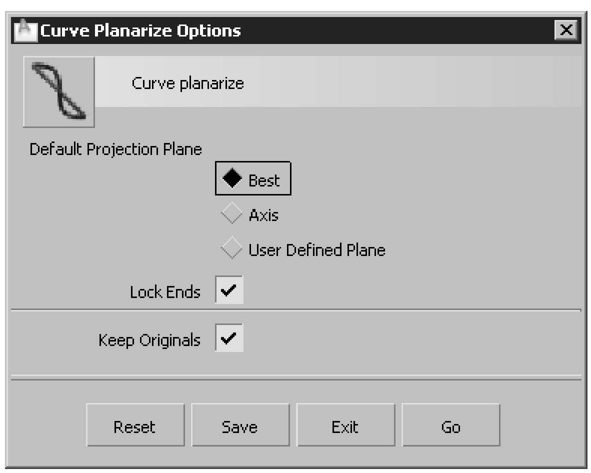


Figure 7-30 *The **Curve Planarize Options** dialog box*

The options in this dialog box are discussed next.

Default Projection Plane

This area is used to specify the projection plane of the planarized curve. The radio button in this area are discussed next.

Best

This radio button is selected by default and is used to specify the best fitting plane for the curve. On this plane, the curve gets planarized with least modifications.

Axis

Select this radio button to planarize the curve on a specific plane, defined by three axes.

User Defined Plane

Select this radio button to planarize a curve on the construction plane. Next, select the curve from the active window; the **Go** button will be displayed at the lower right corner of the active window. Choose the **Go** button; you will be prompted to select the construction plane. Select an existing construction plane; the curve will get planarized on the construction plane. The creation of the construction plane has been discussed in Chapter 3. Figure 7-31 shows the curve projected on the construction plane after planarizing it.

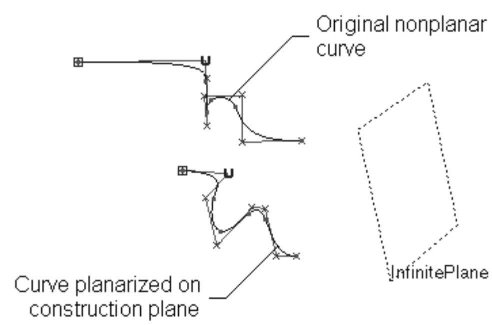


Figure 7-31 *Curve projected on the construction plane after planarizing it*

Lock Ends

This check box is selected by default and is used to constrain endpoints of the planarized curve to endpoints of the original curve. This check box will be available only when the **Best** radio button is selected from the **Default Projection Plane** area.

Principal Plane

This area is used to select a projection plane specified by axes. This area will be available only when you select the **Axis** radio button from the **Default Projection Plane** area. The three radio buttons available in this area are **XY**, **YZ**, and **ZX**. Select any of these radio buttons to planarize the curve on the respective plane. Figures 7-32 and 7-33 show a non-planar curve planarized on YZ and XY planes, respectively.

Keep Originals

This check box is selected by default and is used to retain the original curve after planarizing it. If you clear this check box, only the planarized curve will be displayed in the window.

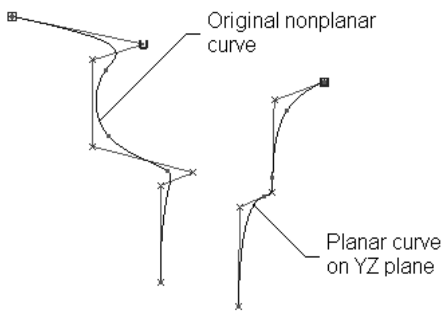


Figure 7-32 *Curve projected on YZ plane after planarizing it*

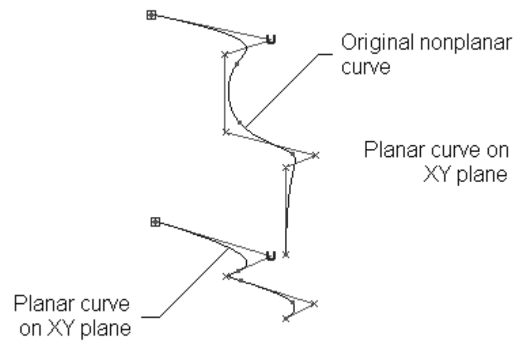


Figure 7-33 *Curve projected on XY plane after planarizing it*

SECTIONING A GROUP OF CURVES

Palette: Curve Edit > Section a group of curves

Sectioning curves include operations such as trimming, detaching, adding edit points, and so on. You can section a group of curves by using the **Section a group of curves** tool. This tool has different options to section curves. You can section curves by trimming, segmenting, or slicing at specified locations. These locations are specified by another geometry, parameters on curve to be sectioned, or distance along curve to be sectioned. The options of sectioning curves are available in the **Curve Section Options** dialog box, as shown in Figure 7-34. This dialog box is invoked by double-clicking on the **Section a group of curves** button from the **Curve Edit** tab in the **Palette**. Different sectioning operations are discussed next.

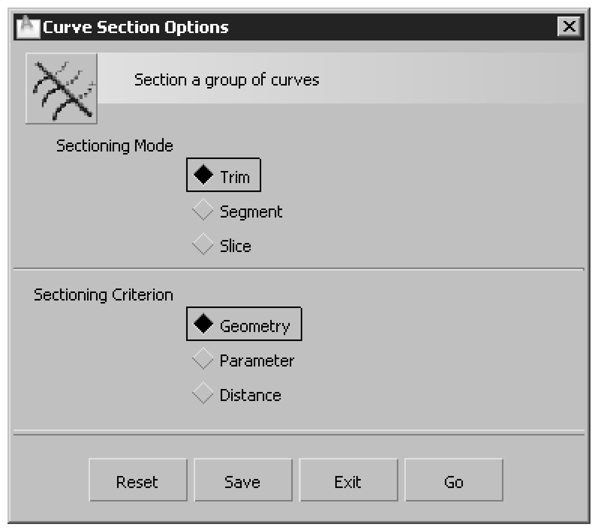


Figure 7-34 *The **Curve Section Options** dialog box*

Trimming Curves

Trimming is a process of removing parts of curves. You can trim curves by selecting the **Trim** radio button from the **Sectioning Mode** area of the **Curve Section Options** dialog box. You can trim a curve in different ways depending upon the radio buttons selected in the **Sectioning Criterion** area of the **Curve Section Options** dialog box. The methods of trimming a curve are discussed next.

Trimming Curves by Specifying Intersecting Geometry

To trim a curve by specifying the intersecting geometry, select the **Geometry** radio button from the **Sectioning Criterion** area. Next, choose the **Go** button from the **Curve Section Options** dialog box; you will be prompted to select/drag-select the curve(s) to section (trim). Select the curves to be trimmed from the active window; the **Go** button will be displayed at the lower right corner of the active window. Also, a red arrow will be displayed on the selected curve, as shown in Figure 7-35. Choose the **Go** button; you will be prompted to select the geometry to section (trim) the selected curve. Select the intersecting curve; the first curve will be trimmed at the intersection point. Note that the part of the curve on which the red arrow is displayed will be retained after sectioning, as shown in Figure 7-36.

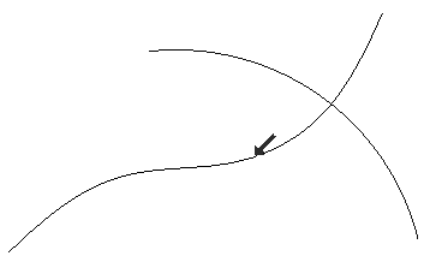


Figure 7-35 *Arrow displayed on the selected curve*

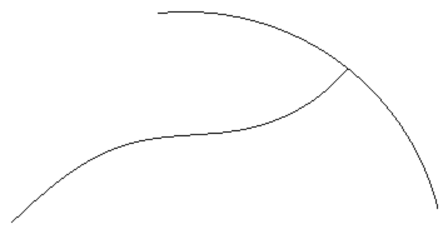


Figure 7-36 *Trimmed curve*

Trimming Curves by Specifying Parameters

You can trim a curve by specifying a parameter. To do so, select the **Parameter** radio button from the **Sectioning Criterion** area. Next, choose the **Go** button and select the curve to be trimmed; a red arrow along with a locator will be displayed on it. Select the locator and then drag it to specify the parameter. Alternatively, select the locator and then enter a value in the promptline to specify the parameter. Next, choose the **Go** button; the curve will get trimmed at the specified parameter. You can continue trimming the curve, or exit the **Section a group of curves** tool by choosing the **Pick nothing** button from the **Pick** tab in the **Palette**. Figure 7-37 shows the untrimmed and trimmed curve.

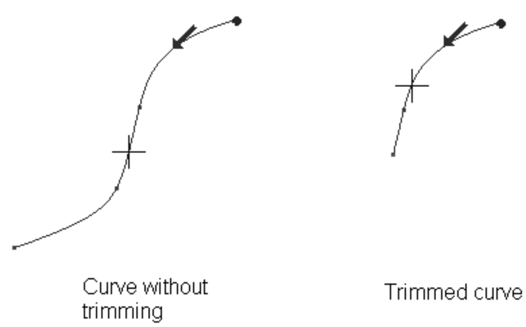


Figure 7-37 *Curve before and after trimming*

Trimming Curves by Specifying Length

You can also trim a curve by specifying its length. To do so, select the **Distance** radio button from the **Sectioning Criterion** area. Next, choose the **Go** button and select the curve to be trimmed; a red arrow along with a locator will be displayed on it. Select the locator and then drag it to specify the distance. Alternatively, select the locator and then enter a value in the promptline to specify the distance. Next, choose the **Go** button; the curve will get trimmed at specified distance. You can continue trimming the curve, or exit the **Section a group of curves** tool by choosing the **Pick nothing** button from the **Pick** tab in the **Palette**.

Segmenting Curves

You can detach or segment curves by selecting the **Segment** radio button from the **Sectioning Mode** area of the **Curve Section Options** dialog box. You can detach or segment curves in different ways depending upon the radio buttons selected from the **Sectioning Criterion** area of the **Curve Section Options** dialog box. The methods of segmenting a curve are discussed next.

Segmenting Curves by Specifying Intersecting Geometry

To detach a curve by specifying intersecting geometry, select the **Geometry** radio button from the **Sectioning Criterion** area. Next, choose the **Go** button from the **Curve Section Options** dialog box; you will be prompted to select/drag-select the curve(s) to section (segment). Select one of the curves from the active window; the **Go** button will be displayed at the lower right corner of the active window. Choose the **Go** button; you will be prompted to select the geometry to section (segment) with the selected curve. Select the intersecting curve; the first curve will get detached (segmented) at the intersection point. Figure 7-38 shows the curve to be segmented and the geometry curve. Figure 7-39 shows the curve after detaching (segmenting).

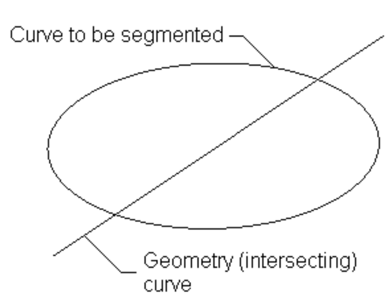


Figure 7-38 *Elliptical curve and geometry curve*

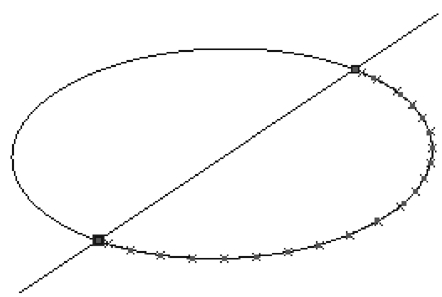


Figure 7-39 *Elliptical curve after detaching*

Segmenting Curves by Specifying Parameters

You can detach a curve at a specific parameter. To do so, select the **Parameter** radio button from the **Sectioning Criterion** area. Next, choose the **Go** button and select the curve to be detached; a locator will be displayed on it, as shown in Figure 7-40. Select the locator and then drag it to specify the parameter. Alternatively, select the locator and then enter the required value in the promptline to specify the parameter. Next, choose the **Go** button; the curve will be trimmed according to the specified parameter value, as shown in Figure 7-41. You can continue detaching the curve, or exit the **Section a group of curves** tool by choosing the **Pick nothing** button from the **Pick** tab in the **Palette**.

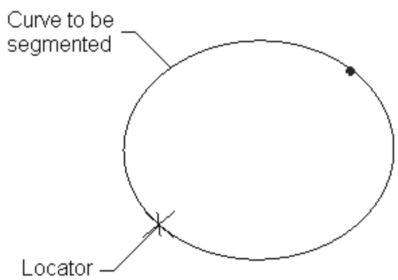


Figure 7-40 Locator displayed on curve

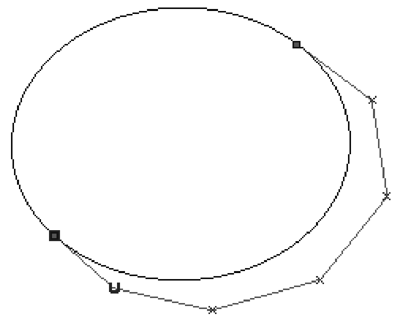


Figure 7-41 Curve after detaching

Segmenting Curves by Specifying Length

You can also detach a curve at specified length/distance from the start point. To do so, select the **Distance** radio button from the **Sectioning Criterion** area. Next, choose the **Go** button and select the curve to be detached; a locator will be displayed on it. Select the locator and then drag it to specify the distance. Alternatively, select the locator and then enter the required value in the promptline to specify the distance. Next, choose the **Go** button; the curve will get detached at specified length. You can continue detaching the curve, or exit the **Section a group of curves** tool by choosing **Pick nothing** button from the **Pick** tab in the **Palette**.

Slicing Curves

Slicing is a process in which curves are sectioned such that new curves with new edit or reference points are created. You can slice curves by selecting the **Slice** radio button from the **Sectioning Mode** area of the **Curve Section Options** dialog box. You can slice curves in different ways depending upon the radio buttons selected from the **Sectioning Criterion** area of this dialog box. Also, the slicing operation depends upon the radio buttons selected from the **Slice Creation Mode** area of the **Curve Section Options** dialog box. The methods of slicing a curve are discussed next.

Slicing Curves by Specifying Intersecting Geometry

To slice a curve by specifying intersecting geometry, select the **Geometry** radio button from the **Sectioning Criterion** area. Next, choose the **Go** button from the **Curve Section Options** dialog box; you will be prompted to select the first curve to slice. Select one of the curves from the active window; you will be prompted to select the next curve to slice. Select the second curve; the **Go** button will be displayed at the lower right corner of the active window. Choose the **Go** button; you will be prompted to select the geometry to slice with the selected curve. Select the curve that intersects the first two curves; the two curves will get sliced and a new curve will be created between the two curves. Figure 7-42 shows two curves before and after slicing.

If you select the **Create Curve** radio button from the **Slice Creation Mode** area, a new curve will be created between two curves at its intersection with the geometry curve, refer to Figure 7-42. If you select the **Insert Edit Points** radio button from the **Slice Creation Mode** area, edit points will be inserted at the intersection of the selected curve with the geometry curve. Figure 7-43 shows a curve to be sliced with geometry curve and Figure 7-44 shows an edit point inserted into the curve at its intersection with the geometry curve after slicing. If you select the **Insert Points** radio button from the **Slice Creation Mode** area, reference points will be inserted at the intersection of the selected curve with the geometry curve, as shown in Figure 7-45.

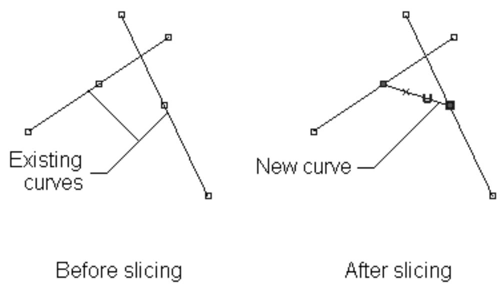


Figure 7-42 *Curves before and after slicing*

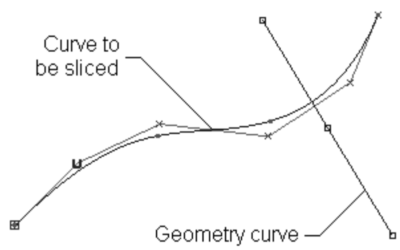


Figure 7-43 *Curves to be sliced*

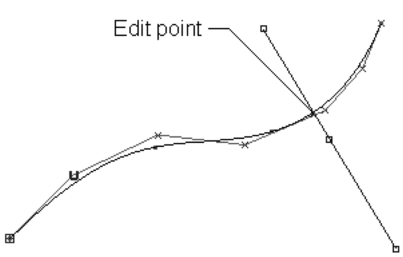


Figure 7-44 *Edit point inserted into the curve at its intersection with geometry curve*

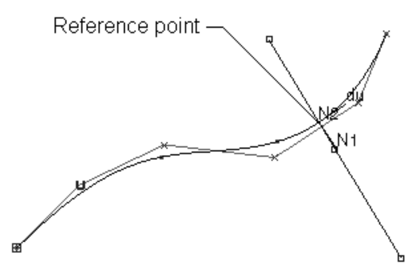


Figure 7-45 *Reference point inserted into the curve at its intersection with geometry curve*

Slicing Curves by Specifying Parameters

You can slice a curve by specifying parameters. To do so, select the **Parameter** radio button from the **Sectioning Criterion** area of the **Curve Section Options** dialog box. Next, choose the **Go** button and select the curve to be sliced; a locator will be displayed on it. You can move the locator along the curve to change the parameter value. Select the other curve; a new locator will be displayed on the second curve. Select the locator and then drag it to specify the parameter. Alternatively, select the locator and then enter the required value in the promptline to specify the parameter. Next, choose the **Go** button; a new curve will be created between two curves at specified parameter values. If you select the **Create Curve** radio button from the **Slice Creation Mode** area, a new curve will be created between two curves at specified parameters. Figure 7-46 shows the locators displayed on two lines and Figure 7-47 shows a new curve created between two lines at the specified parameters. If you select the **Insert Edit Points** radio button from the **Slice Creation Mode** area, the edit points will be inserted into the selected curve at the specified parameter value, as shown in Figure 7-48. If you select the **Insert Points** radio button from the **Slice Creation Mode** area, a reference point will be inserted into the selected curve at specified parameter value, as shown in Figure 7-49.

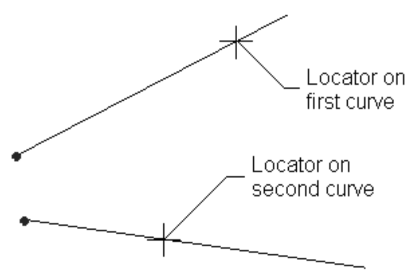


Figure 7-46 *Locators displayed on lines*

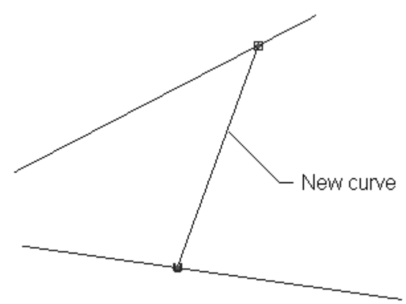


Figure 7-47 *New curve created between two curves after slicing*

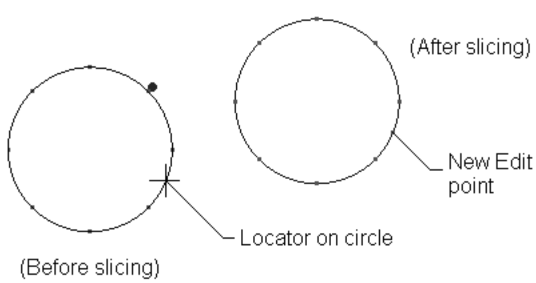


Figure 7-48 *Edit point inserted into the circle at the specified parameter value*

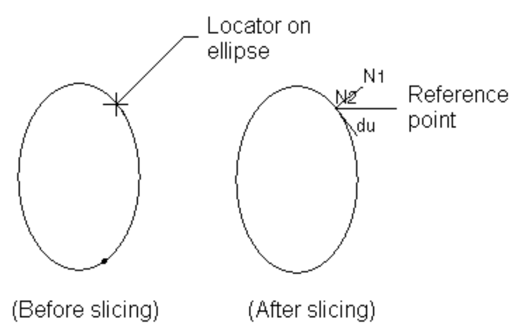


Figure 7-49 *Reference point inserted into the ellipse at the specified parameter value*

Slicing Curves by Specifying Length

You can slice a curve by specifying its length. To do so, select the **Distance** radio button from the **Sectioning Criterion** area. Next, choose the **Go** button and select the curve to be sliced; a locator will be displayed on it. Select the locator and then drag it to specify the distance. Alternatively, select the locator and then enter the required value in the promptline to specify the distance. Select the other curve; a new locator will be displayed on the second curve. Select the locator and then drag it to specify the distance. Alternatively, select the locator and then enter the required value in the promptline to specify the distance. Next, choose the **Go** button; a new curve will be created between two curves at specified length. If you select the **Create Curve** radio button from the **Slice Creation Mode** area, a new curve will be created between two curves at specified length. If you select the **Insert Edit Points** radio button from the **Slice Creation Mode** area, an edit point will be inserted into the selected curve at specified length. If you select the **Insert Points** radio button from the **Slice Creation Mode** area, a reference point will be inserted into the selected curve at specified length.

TUTORIALS

Tutorial 1

In this tutorial, you will create the model of a web camera, as shown in Figure 7-50.

(Expected time: 1 hr)

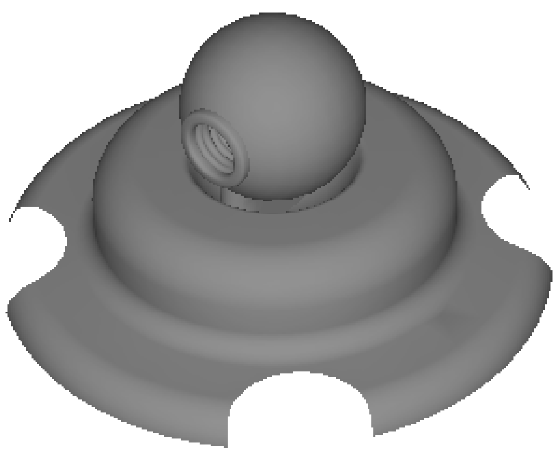


Figure 7-50 *Model of web camera for tutorial 1*

The following steps are required to complete this tutorial:

a. Start a new wire file.
b. Create the base feature by using the **Revolve** tool.
c. Turn the visibility off of the profile used in creating the base feature by using layers.
d. Generate curves-on-surface on the base feature by using the **Project** tool.
e. Turn off the visibility of the curves used in creating curves-on-surface on the base feature by using layers.
f. Trim unwanted surface portions on the base feature by using the **Trim** tool.
g. Create the camera by using the **Sphere** tool.
h. Generate curves-on-surface on the camera by using the **Project** tool.

i. Create an aperture opening and cut feature on the camera and the base feature, respectively, by using the **Trim** tool.
j. Create the aperture by using the **Revolve** tool.
k. Create the stand by using the **profile blend** tool.
l. Save the model.

Starting a New Wire File

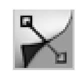
1. Choose **File > New** from the menu bar; a new Studio wire file gets started and four windows are displayed on the screen. You can change the window display by choosing the **Layouts** option from the menu bar and then selecting the required window.

Creating Base Feature

The base feature is created by using the **Revolve surface** tool. Before creating the base feature, you need to create a profile for it.

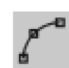
1. Choose **WindowDisplay > Toggles > Grid** from the menu bar; grids are displayed in view windows.

2. Next, choose the **Keypoint curve toolbox** button from the **Curves** tab in the **Palette**; the **Keypoint Curves Toolbox** is displayed.



3. Choose the **Line-arc** button from the **Keypoint Curve Toolbox** and create the profile, as shown in Figure 7-51.

4. Choose the **Arc (three point)** button from the **Keypoint Curve Toolbox** and create the profile, refer to Figure 7-51.



5. Press and hold the left mouse button on the **Duplicate curve** button; a flyout is displayed.

6. Next, double-click on the **Fillet curves** button in the flyout; the **Curve Fillet Options** dialog box is displayed.

7. Enter a suitable value in the **Radius** edit box of this dialog box and then choose the **Go** button; you are prompted to select the primary filleting curve.

8. Select linearc from the active window; you are prompted to select the secondary curve.

9. Select three point arc from view window; the fillet curve is created between linearc and three point arc, as shown in Figure 7-52.

10. To create a single profile, choose **Break curve at keypoint > Join curves** from the **Keypoint Curve Toolbox**; you are prompted to select keypoints or edit points to join at.

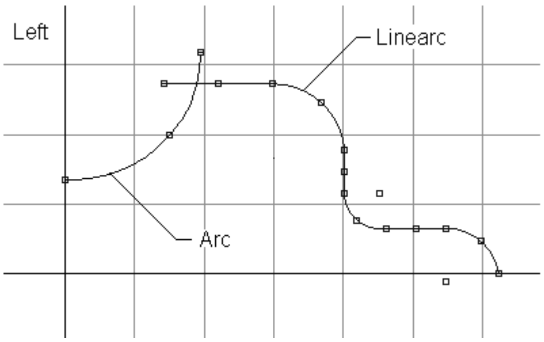


Figure 7-51 Profiles for creating base feature

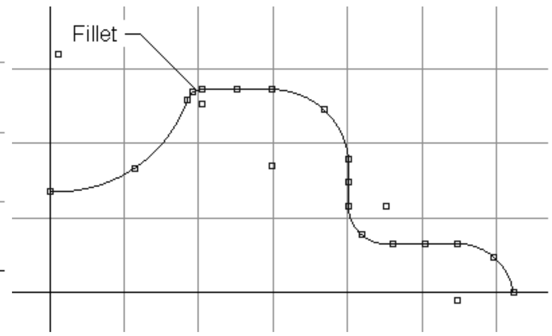


Figure 7-52 Fillet curve created

11. Select the keypoint that is common to linearc and fillet curve; the two curves are joined.

12. Similarly, join three point arc with fillet curve; a single profile is created between linearc, fillet curve, and three point arc.

13. Choose the **Revolve surface** button from the **Surfaces** tab in the **Palette**; you are prompted to select a curve to revolve.

14 Select the joined profile; the base feature is created, as shown in Figure 7-53.

15. Turn the visibility of grids off by choosing **WindowDisplay > Toggles > Grid** from the menu bar.

16. To exit the **Revolve surface** tool, choose the **Pick nothing** button from the **Pick** tab in the **Palette**.

Turning the Visibility of Profile off

To turn the visibility of the joined profile off, you need to create a layer.

1. Choose **Layers > New** from the menu bar; a layer L1 is displayed in the Layers bar.

2. Double-click on the layer L1; the layer text edit field is displayed.

3. Enter **Base Curve** in this field and press ENTER; the layer L1 is renamed to Base Curve.

4. Next, choose the **Pick object** button from the **Pick** tab in the **Palette** and select the profile that is used in creating base feature; the selected curve gets highlighted.

5. Press and hold the left mouse button on the Base Curve layer; a layer flyout is displayed.

6. Choose the **Assign** option from this flyout; the curves are assigned to the layer Base Curve.

7. Press and hold the left mouse button to display the layer flyout again.

8. Choose the **Visible** option from the layer flyout; the visibility of the curve assigned to the Base Curve layer is turned off.

Generating Curves-on-surface on the Base Feature

Next, you need to generate curves-on-surface on the base feature. These curves-on-surface can be used to trim the base feature later on.

1. Choose the **Plane** button from the **Construction** tab in the **Palette**; five buttons, **View**, **Slice**, **3 Pt**, **Geom**, and **World** are displayed at the bottom of the active window.

2. Choose the **View** button from the active window; you are prompted to enter the center position or geometry position of the plane.

3. Enter **0** in the promptline; the plane along with manipulators is displayed at the origin of view window. Also, the two buttons, **Next Plane** and **Set Construction Plane** are displayed at the lower right corner of the active window.

4. Drag different manipulators of the plane to change the size and position of the plane. The construction plane with the changed size and position is displayed, as shown in Figure 7-54. The elevation of the construction plane above the base feature is viewed in the **Left** window, as shown in Figure 7-55.

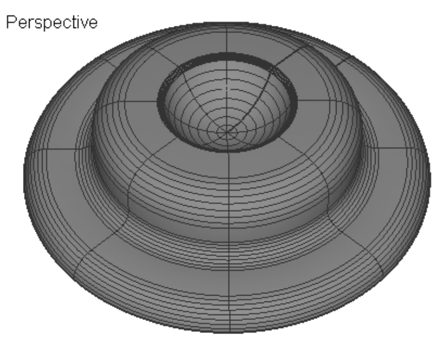


Figure 7-53 *Base feature created*

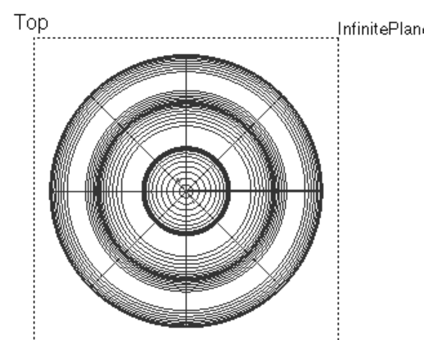
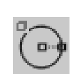


Figure 7-54 *Modified construction plane*

5. Next, choose the **Set Construction Plane** button from the active window; the plane is set as the construction plane.

6. Choose the **Line-arc** button from the **Keypoint Curve Toolbox** and create profile, as shown in Figure 7-56.

7. Choose the **Circular arc** button from the **Keypoint Curve Toolbox** and create one of the profiles, refer to Figure 7-56.



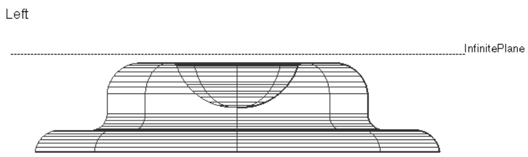


*Figure 7-55 Elevation of the construction plane in the **Front** window*

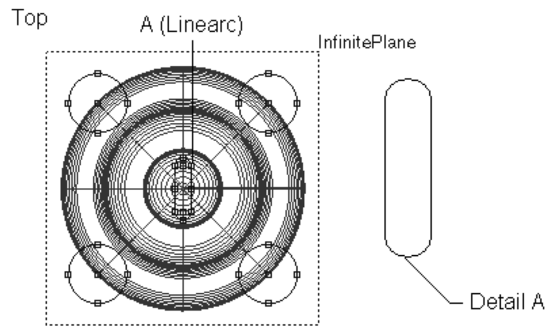


Figure 7-56 Profiles created for generating curves-on-surface

Note
*You need to use the **Mirror** option (**Edit > Duplicate**) to create other profiles.*

8. Choose the **Project** button from the **Surface Edit** tab in the **Palette**; you are prompted to select surfaces or projection vector.

9. Activate the **Top** window by clicking on its title bar and then select the base feature; the **Go** button is displayed at the lower right corner of the active window.

10. Choose the **Go** button; you are prompted to select the projecting curves or projection vector.

11. Select all circles and the linearc; the **Go** button is displayed again at the lower right corner of the **Top** window.

12. Choose the **Go** button; the selected curves are projected on the base feature and curves-on-surface are generated, as shown in Figure 7-57.

13. Exit the **Project** tool by choosing the **Pick object** button from the **Pick** tab in the **Palette**.

Turning the Visibility of the Profile off

To turn the visibility of the joined profile off, you need to create a layer.

1. Choose **Layers > New** from the menu bar; a layer L2 is displayed in the Layers bar.

2. Double-click on the layer L2; the layer text edit field is displayed.

3. Enter **Base COS** in the layer text edit field and press ENTER; the layer L2 is renamed to Base COS.

4. Next, select the circles used in generating curves-on-surface on the base feature; the selected circles get highlighted.

5. Press and hold the left mouse button on the layer Base COS; a layer flyout is displayed.

6. Choose the **Assign** option from the layer flyout; circles are assigned to the Base COS layer.

7. Press and hold the left mouse button on the layer Base COS to display the layer flyout again.

8. Choose the **Visible** option from the layer flyout; the visibility of the circles assigned to the Base COS layer is turned off.

Trimming the Base Feature

Next, you need to remove the unwanted portions from the base feature by using the **Trim** tool.

1. Choose the **Trim** button from the **Surface Edit** tab in the **Palette**; you are prompted to select surfaces to trim. 

2. Select the base feature from the active window; you are prompted to select more surfaces to trim. Also, the **Keep**, **Discard**, and **Divide** buttons in inactive state are displayed at the lower right corner of the active window.

3. Click on the unwanted portions of the base feature; crosshairs are displayed on the base feature, as shown in Figure 7-58. Also, the **Keep**, **Discard**, and **Divide** buttons are displayed in the active state.

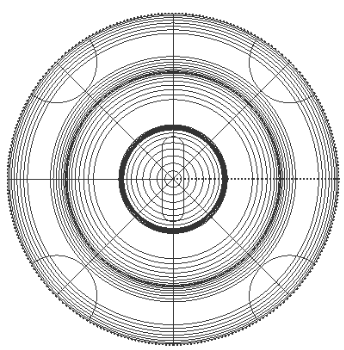


Figure 7-57 *Curves-on-surface generated on the base feature*

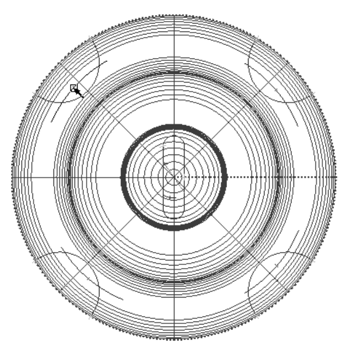


Figure 7-58 *Crosshairs displayed on the base feature*

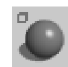
4. Next, choose the **Discard** button from the active window; the selected portions of the surface are trimmed, as shown in Figure 7-59.

5. Exit the **Trim** tool by choosing the **Pick object** button from the **Pick** tab in the **Palette**.

Creating the Camera

After trimming unwanted portions of the surface, you need to create the body of the camera by using the **Sphere** tool. To specify the location of the body of the camera, you need to turn the grid display on.

1. Click on the Show button given on the title bar of the **Left** window; a flyout is displayed.
2. Choose the **Grid** option from this flyout; grids are displayed in the **Left** window.
3. Choose the **Sphere** button from the **Surfaces** tab in the **Palette** and create the body of the camera above the base feature, as shown in Figure 7-60.



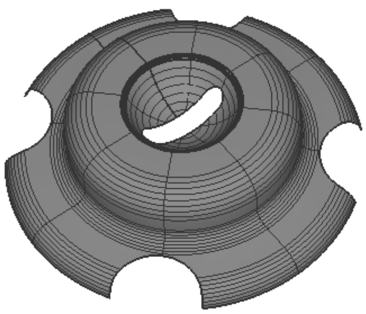


Figure 7-59 *Base feature after trimming*

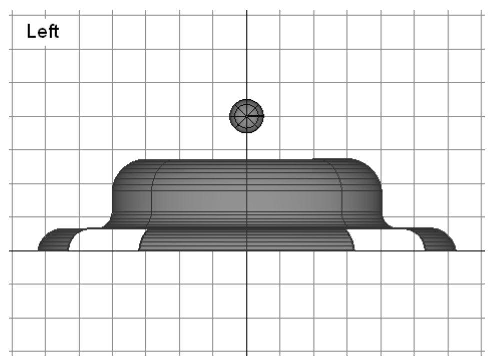


Figure 7-60 *Body of the camera*

4. Choose the **Scale** button from the **Transform** tab in the **Palette** and scale the body of camera with a suitable scale factor. The body after scaling what is displayed, as shown in Figure 7-61.

5. Exit the **Move** tool by choosing the **Pick nothing** button from the **Pick** tab in the **Palette**.

Generating curves-on-surface on the Camera

Next, you need to generate curves-on-surface on the camera. Before generating curves-on-surface, you need to turn the display of base feature and grids off.

1. Click on the Show button given on the title bar in the **Left** window; a flyout is displayed.
2. Choose the **Grid** option from this flyout; the display of grids in the **Left** window is turned off.
3. Create a new layer and name it as Base Feature, and then assign the trimmed base feature to this layer. Turn the visibility of this layer off, as discussed earlier.
4. Next, choose the **Plane** button from the **Construction** tab in the **Palette**; you are prompted to select the plane construction method. Also, five buttons, **View**, **Slice**, **3 Pt**, **Geom**, and **World** are displayed at the lower right corner of the active window.

5. Choose the **World** button; you are prompted to specify the center position or the geometry point of the plane.

6. Click in the **Left** window; the plane with the manipulator is displayed. Also, the **Next Plane** and **Set Construction Plane** buttons are displayed at the lower right corner of the active window.

7. Drag the move handle (green colored) of the plane such that it is placed at center of the sphere. Alternatively, activate the **Perspective** window and then drag the handle to keep the plane perpendicular to the linearc.

8. Drag the scale handles (green and red colored) to scale the plane, as shown in Figure 7-62.

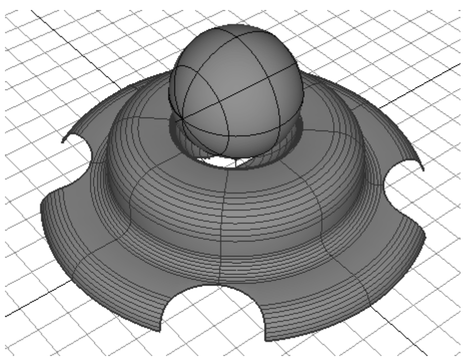


Figure 7-61 *Body of the camera scaled*

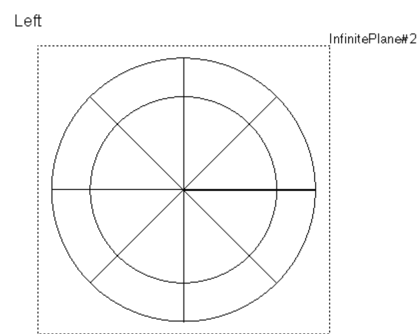


Figure 7-62 *Plane after moving and scaling*

9. Next, choose the **Set Construction Plane** button from the active window; the reference plane created is set as the construction plane.

10. Choose the **Circular arc** button from the **Keypoint Curve Toolbox** and create the circular arc, as shown in Figure 7-63.

11. Next, choose the **Project** button from the **Surface Edit** tab in the **Palette**; you are prompted to select the surface.

12. Activate the **Left** window by clicking on its title bar and then select the camera; you are prompted to select the projecting curves or projection vector.

13. Select the circle from active window; the circle gets projected on the body of camera and curves-on-surface are generated.

14. Similarly, activate the **Top** window and project the linearc on the camera; curves-on-surface are generated along all four sides of the camera, as shown in Figure 7-64.

15. Choose the **Pick curve-on-surface** button from the **Pick** tab in the **Palette** and select the curves-on-surface that are generated on top and right of the camera.

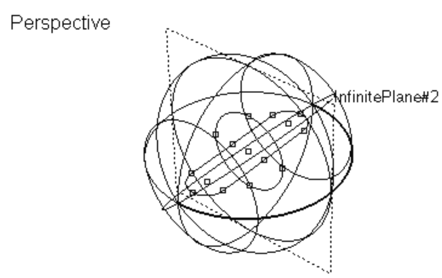


Figure 7-63 Circles created on the construction plane

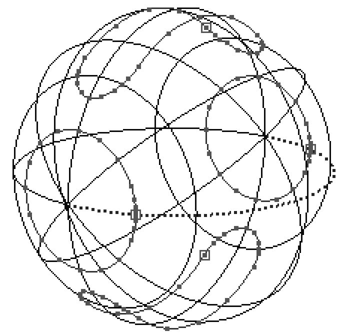


Figure 7-64 Curves-on-surface generated on the camera

16. Next, press the DELETE key; the **confirm** message box is displayed.

17. Choose the **Yes** button from the **confirm** message box; the selected curves-on-surface are removed from the window, as shown in Figure 7-65.

Creating Aperture Opening and Cut Feature

Next, you need to create aperture and a cut feature on the camera by using the **Trim** tool.

1. Choose the **Trim** button from the **Surface Edit** tab in the **Palette**; you are prompted to select the surface(s) to trim.

2. Select the camera; you are prompted to select more surfaces by using the SHIFT key. Also, you are prompted to select regions, and the **Keep**, **Discard**, and **Divide** buttons in inactive state are displayed at the lower right corner of the active window.

3. Click on the regions defined inside the projected curves; the **Keep**, **Discard**, and **Divide** buttons in active state are displayed at the lower right corner of the active window.

4. Choose the **Discard** button; the body of the camera gets trimmed and also the opening of the aperture as well as the cut feature is created, as shown in Figure 7-66.

5. Next, exit the **Trim** tool by choosing the **Pick object** button from the **Pick** tab in the **Palette**.

Note

*You need to turn the hardware shading of the camera on for getting a realistic view of the camera. To do so, choose **WindowDisplay > Hardware Shade** from the menu bar. You may need to toggle between the visible and invisible states of hardware shading at different stages of tutorial.*

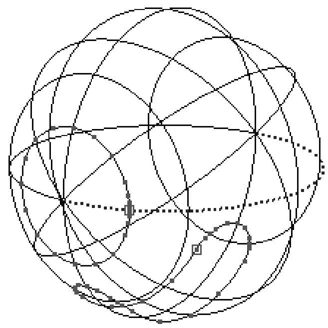


Figure 7-65 Curves-on-surface removed from top and right of the camera

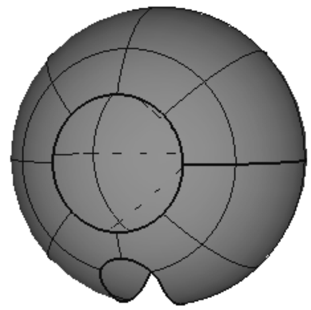
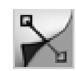


Figure 7-66 Body of the camera after trimming

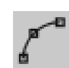
Creating the Aperture

Next, you need to create an aperture by using the **Revolve surface** tool. Before creating the revolve feature, you need to create a profile for it.

1. Choose the **Keypoint curve toolbox** button from the **Curves** tab in the **Palette**; the **Keypoint Curves Toolbox** is displayed.



2. Choose the **Arc (three point)** tool from the **Keypoint Curve Toolbox** and create the profiles, as shown in Figure 7-67.



3. Choose the **Line-arc** button from the **Keypoint Curve Toolbox** and create the profile, refer to Figure 7-67.

Tip: *You can create a linearc by using the **Snap to Curve** tool available on the right of the promptline. You need to snap the lower endpoint of the linearc to the trimmed edge on the aperture opening.*

4. Next, double-click on the **Fillet curves** button from the **Curve Edit** tab in the **Palette**; the **Curve Fillet Options** dialog box is displayed.

5. Enter a suitable value in the **Radius** edit box and then choose the **Go** button; you are prompted to select the primary filleting curve.

6. Select linearc from the active window; you are prompted to select the secondary filleting curve.

7. Select the three point arc adjacent to linearc; a fillet curve is created between linearc and three point arc, as shown in Figure 7-68.

8. Next, choose the **Join curves** button from the **Keypoint Curve Toolbox**; you are prompted to select keypoints or edit points to join at.

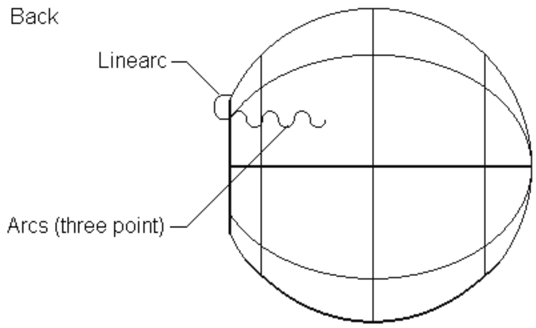


Figure 7-67 *Profiles for creating aperture opening*

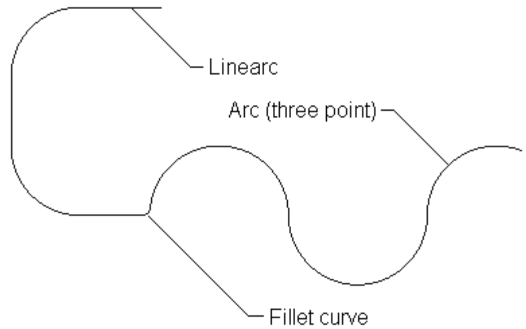


Figure 7-68 *Fillet curve created between linearc and three point arc*

9. Select the keypoint that is common to linearc and fillet curve; the two curves are joined.

10. Similarly, join other curves with each other to create a single profile.

11. Select the joined curve and then double-click on the **Rebuild curve** button of the **Curve Edit** tab in the **Palette**; the **Rebuild Curve** dialog box is displayed. Also, the **Go** button is displayed at the lower right corner of the active window.

12. Clear the **Keep Original** check box and then choose the **Go** button; the joined curves are rebuilt, as shown in Figure 7-69.

13. Choose the **Next** button from the **Rebuild Curve** dialog box.

14. Exit the **Rebuild curves** tool by choosing the **Pick nothing** button from the **Pick** tab in the **Palette**.

15. Choose the **Set pivot** button from the **Transform** tab in the **Palette** and then select the rebuilt curve; the selected curve is highlighted and its pivot point is displayed.

16. Drag the pivot point of the curve to the center of the camera.

17. Next, double-click on the **Revolve surface** button of the **Surfaces** tab in the **Palette**; the **Revolve Options** dialog box is displayed.

18. Select the **Y** radio button from the **Revolution Axis** area and then choose the **Go** button; you are prompted to select a curve.

19. Select the curve; the aperture of the camera is created; as shown in Figure 7-70.

20. Exit the **Revolve surface** tool by choosing the **Pick nothing** button from the **Pick** tab in the **Palette**.

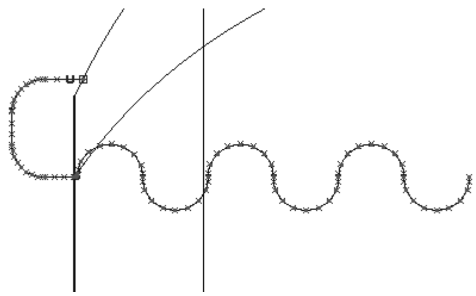


Figure 7-69 Joined curves after rebuilding profile

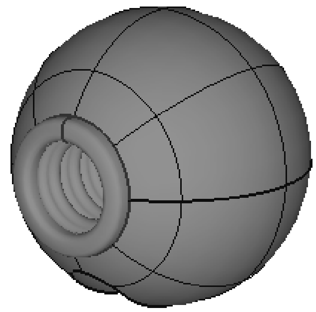


Figure 7-70 Aperture of the camera created

21. Choose the **Pick object** button from the **Pick** tab in the **Palette** and then select the profile used for creating aperture; the profile gets highlighted.

22. Create a new layer and name it as Aperture Curve. Assign the highlighted profile to this layer and then turn the visibility of this layer off, as discussed earlier.

Creating the Stand

Next, you need to create the stand for the body of the camera by using the **freeform blend** tool. Before creating the stand, you need to turn the visibility of the base feature on.

1. Press and hold the left mouse button on the Base Feature layer; the layer flyout is displayed.

2. Choose the **Visible** option from the layer flyout; the visibility of the trimmed base feature assigned to the Base Feature layer is turned on. The model, after turning the display of the base feature on is shown in Figure 7-71.

3. Select entire model and clear the **Isoparm U** and **V** check boxes in the **Display** area of the **Control Panel**; the display of isoparametric curves is turned off, as shown in Figure 7-72.

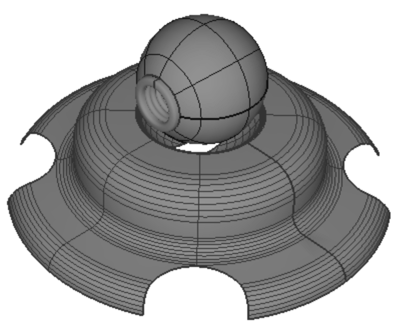


Figure 7-71 Model after tuning the display of the base feature on

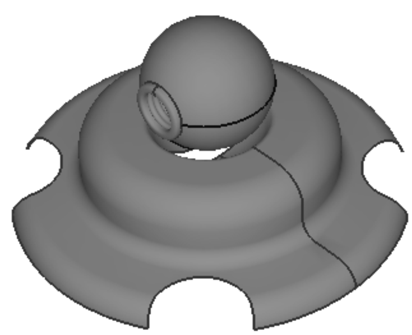
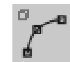


Figure 7-72 Model after turning the display of isoparametric curves

4. Turn the shading of the model off by choosing **WindowDisplay > Hardware Shade** from the menu bar.

5. Choose the **Arc (three point)** button from the **Keypoint Curve Toolbox** and then create the profile, as shown in Figure 7-73. Note that the start point and endpoint of the arc need to be snapped to the trimmed edges of the camera and the base surface, respectively. Figure 7-74 shows the profile with entire model.



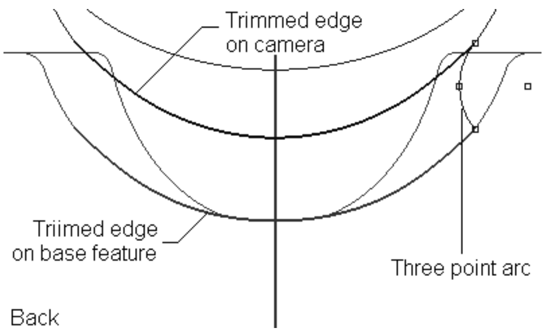


Figure 7-73 Profile of the profile blend surface

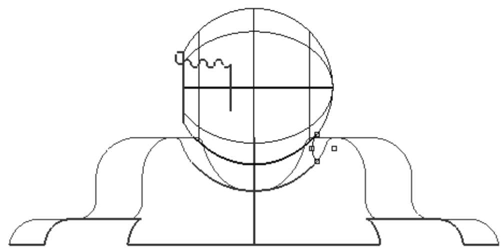


Figure 7-74 Model with the profile

6. Next, double-click on the **profile blend** button of the **Surfaces** tab in the **Palette**; the **Profile Blend Control** dialog box is displayed.

7. Press and hold the left mouse button on the **TANGENT** button in the **Side 1 Continuity** area; a flyout is displayed.

8. Choose the **POSITION** button from this flyout; the positional continuity is set for side 1.

9. Similarly, set the positional continuity for side 2 by choosing the **POSITION** button from the **Side 2 Continuity** area.

10. Click on the down-arrow on the left of the **Control Options** area; the options are displayed in this area.

11. Select the **Chain Select** check box and then select the trimmed edges created by linearc on the camera and the base feature; the **Go** button is displayed at the lower right corner of the active window.

12. Select the **Go** button; you are prompted to select input profile curves.

13. Select three point arc; the stand of the camera with the set continuities is created, as shown in Figure 7-75.

14. Next, exit the **profile blend** tool by choosing the **Pick nothing** button from the **Pick** tab in the **Palette**.

15. Turn the shading of entire model on by choosing **WindowDisplay > Hardware Shade** from the menu bar.

16. Select the stand and then clear the **Isoparm U** and **V** check boxes from the **Display** area of the **Control Panel**; the display of isoparametric curves is turned off and the model is displayed, as shown in Figure 7-76.

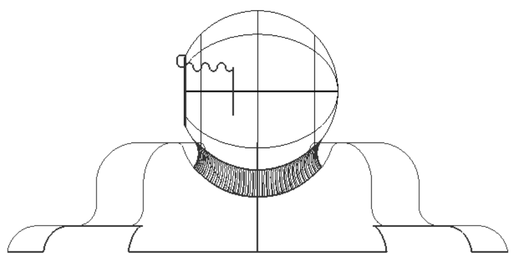


Figure 7-75 *Stand of the camera created*

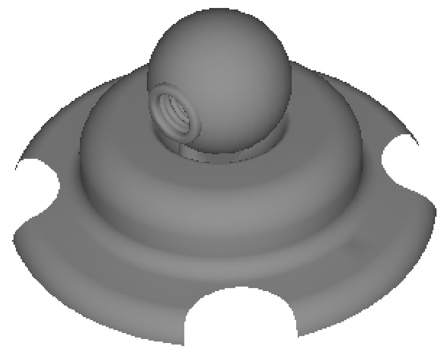


Figure 7-76 *Model after turning the display of the isoparametric curves off*

Saving the Model

To save the model, you need to create the *c07_tutorials* folder.

1. Choose **File > Save as** from the menu bar; the **Save Wire** dialog box is displayed.

2. Browse to the folder *aliasstudio_2009* and then create a new folder, named *c07_tutorials,* as discussed in the tutorials of earlier chapters.

3. Enter *c07_tut01* in the **Object name** edit box and press ENTER; AliasStudio saves the file as *c07_tut01.wire* in the *c07_tutorials* project.

   The location of this file is given below.

   \aliasstudio_2009\c07_tutorials\c07_tut01.wire

4. Choose **File > Exit** from the menu bar to exit the application.

Tutorial 2

In this tutorial, you will create the model of a tyre, as shown in Figure 7-77. The front view of the tyre is shown in Figure 7-78. **(Expected time: 1 hr)**

Figure 7-77 Model of the tyre for Tutorial 2

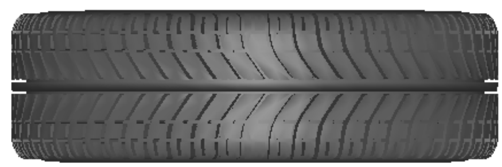


Figure 7-78 Front view of the tyre

The following steps are required to complete this tutorial:

a. Start a new wire file.
b. Create the base feature of the tyre by using the **Revolve surface** tool.
c. Create the profile of tread by using different curves.
d. Section the tread profile by using the **Section a group of curves** tool.
e. Rebuild the tread profile by using the **Rebuild curve** tool.
f. Project the rebuilt tread profile on the base feature by using the **Project** tool.
g. Create the tread by using the **Extrude** and **Set planar** tools.
h. Create duplicate copies of the tread by using the **Object** and **Mirror** options of the **Edit** menu.
i. Create the tube by using the **Rail surface** tool.
j. Save the model and exit the application.

Note
The display of isoparms, CVs, edit points, and so on in the model shown in Figures 7-77 and 7-78 have been turned off for getting a realistic view.

Starting a New Wire File

1. Choose **File > New** from the menu bar; a new Studio wire file gets started and four windows are displayed on the screen. You can change the window display by choosing the **Layouts** option from the menu bar and then selecting the required window.

Creating the Base Feature

The base feature is created by using the **Revolve surface** tool.

1. Choose **WindowDisplay > Toggles > Grid** from the menu bar; grids are displayed in the active window.

2. Choose the **New curve (CVs)** button from the **Curves** tab in the **Palette** and create two profiles, as shown in Figure 7-79.

3. Choose the **Revolve surface** button from the **Surfaces** tab in the **Palette**; you are prompted to select a curve to revolve.

4. Select profiles; the base feature of the tyre is created, as shown in Figure 7-80.

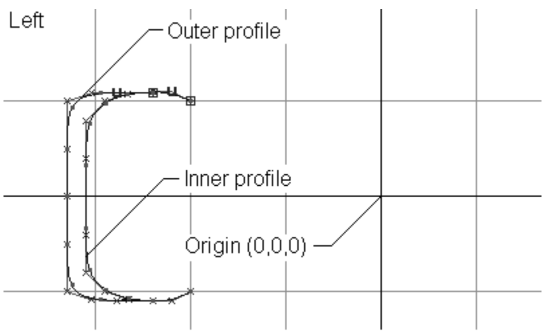


Figure 7-79 *Profiles for creating base feature*

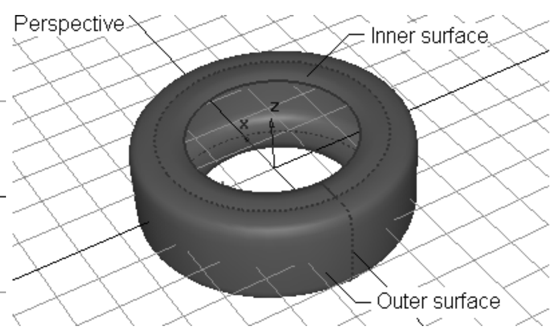


Figure 7-80 *Base feature of the tyre created*

Note
You need to select both profiles one after the other for creating base feature. The tread will be created on the outer surface of the base feature later in this tutorial.

5. Create a new layer and name it as Base Curve and then assign the profile used for creating base feature to this layer. Turn the visibility of this layer off, as discussed in Tutorial 1. Create another layer and name it as Inner Surface and then assign the inner revolved feature to this layer. Turn the visibility of this layer off.

Creating the Tread Profile

After creating the base feature, you need to create the tread profile.

1. Choose the **New curve (CVs)** button from the **Curves** tab in the **Palette** and create the profile, as shown in Figure 7-81.

2. Double-click on the **Duplicate curve** button of the **Curve Edit** tab in the **Palette**; the **Duplicate Curve** dialog box is displayed.

3. Choose the **NO REBUILD** button from the **Duplicate Type** area, if it has not been chosen already, and then select the curve; the duplicate copy of the curve is created.

4. Next, choose the **Move** button from the **Transform** tab in the **Palette** and drag the duplicate curve to a new position, as shown in Figure 7-82.

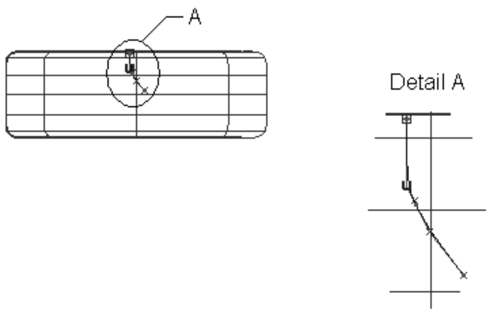


Figure 7-81 First curve of the tread profile created

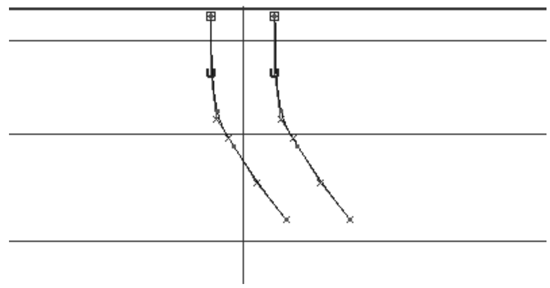
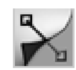


Figure 7-82 Duplicate copy of the first curve after moving it to a new position

5. Choose the **Keypoint curve toolbox** button from the **Curves** tab in the **Palette**; the **Keypoint Curves Toolbox** is displayed.



6. Choose the **Line** button from the **Keypoint Curve Toolbox** and create two lines, as shown in Figure 7-83.

7. Choose the **Polyline** button from the **Keypoint Curve Toolbox** and create polylines, as shown in Figure 7-84.

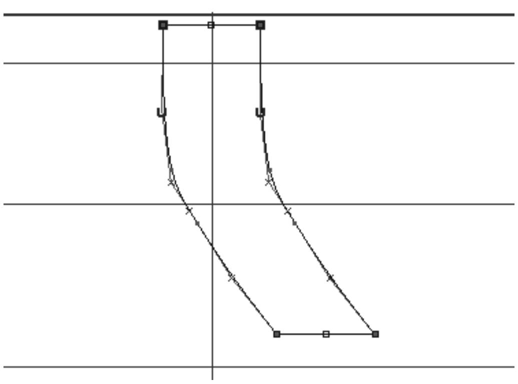


Figure 7-83 Lines for the tread profile

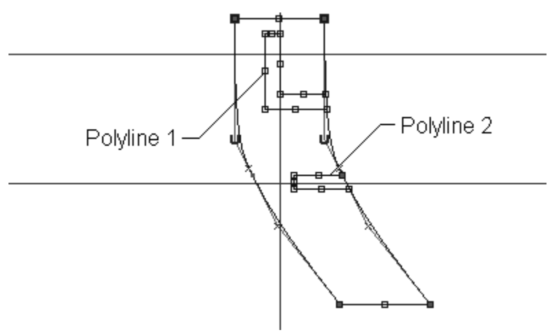


Figure 7-84 Polylines for the tread profile

8. Press and hold the left mouse button on the **Duplicate curve** button; a flyout is displayed.

9. Double-click on the **Fillet curves** button in this flyout; the **Fillet Curves** dialog box is displayed.

10. Enter **0.1** or any suitable value in the **Radius** edit box and then choose the **Go** button; you are prompted to select the primary filleting curve.

11. Select the line a top of the profile; you are prompted to select the secondary filleting curve.

12. Select the duplicate curve; the **Accept** button is displayed at the lower right corner of the active window.

13. Choose the **Accept** button; the fillet curve is created between the two curves, as shown in Figure 7-85.

14. Similarly, create the fillet curve between the line at the bottom of profile and the original curve. The profile after adding fillet curves is displayed, as shown in Figure 7-86.

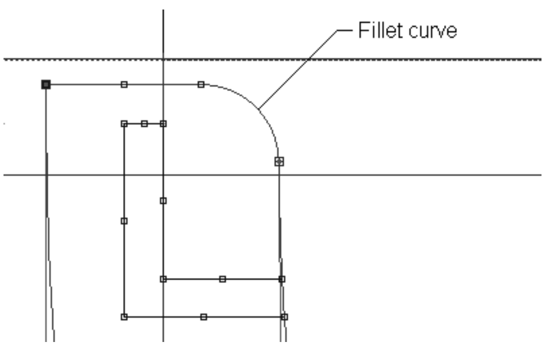


Figure 7-85 *First fillet curve created between line and curve*

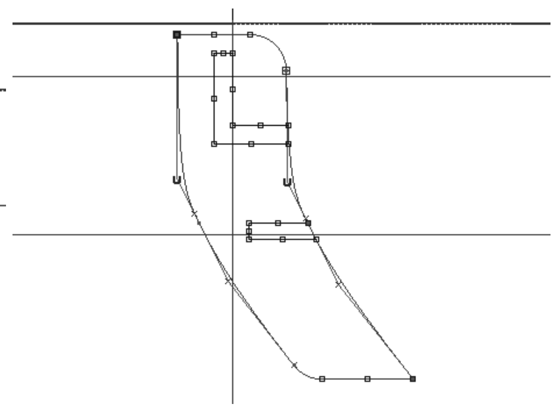


Figure 7-86 *Profile after adding fillet curves*

Sectioning the Profile

After creating the profile, you need to section it by using the **Section a group of curves** tool.

1. Double-click on the **Section a group of curves** button of the **Curve Edit** tab in the **Palette**; the **Curve Section Options** dialog box is displayed.

2. Select the **Segmen**t and **Geometry** radio buttons from the **Sectioning Mode** and **Sectioning Criterion** areas, respectively.

3. Next, choose the **Go** button from the **Curve Section Options** dialog box; you are prompted to select/drag-select the curves(s) to section.

4. Select the duplicate curve (curve on the right of profile); the **Go** button is displayed at the lower right corner of the active window.

5. Choose the **Go** button; you are prompted to select the geometry to section with.

6. Select the two polylines; the duplicate curve gets sectioned at intersection points with polylines. As a result, new curve sections are created in the duplicate curve at its intersection with polylines, as shown in Figure 7-87.

7. Select the curve sections; the curves get highlighted.

8. Press the DELETE key; the selected curve sections are removed from the profile and the complete profile after sectioning is displayed, as shown in Figure 7-88.

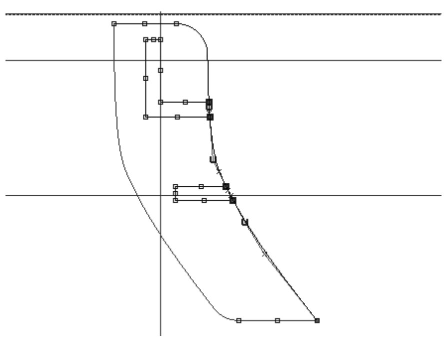


Figure 7-87 *New curve sections*

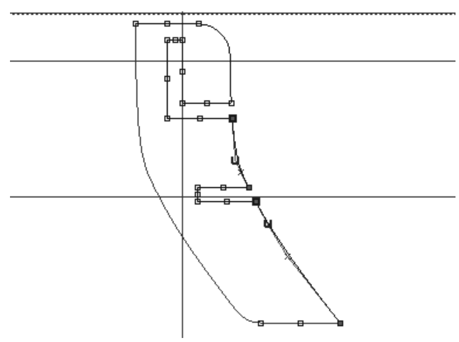


Figure 7-88 *Profile after removing curve sections*

Rebuilding the Profile

You can rebuild the entire profile by using the **Rebuild curve** tool. Before rebuilding the profile, you need to join curves into a single profile.

1. Choose the **Join curves** button from the **Keypoint Curve Toolbox**; you are prompted to select keypoints or edit points to join at.

2. Select the keypoint, as shown in Figure 7-89; the two curves sharing this keypoint join with each other.

3. Similarly, join other curves to get the profile, as shown in Figure 7-90.

Note

The display of keypoints, edit points, CVs, and hulls of the joined profile in Figure 7-90 has been turned off by using the ***DisplayControl*** *window. To invoke this window, click on the box on the right of the* ***Control*** *option in the flyout that is displayed when you choose the* ***ObjectDisplay*** *option from the menu bar.*

4. Next, double-click on the **Rebuild curve** button of the **Curve Edit** tab in the **Palette**; the **Rebuild Curve** dialog box is displayed.

5. Choose the **REDUCE SPANS** button from the **Rebuild Type** area of this dialog box, if not chosen already.

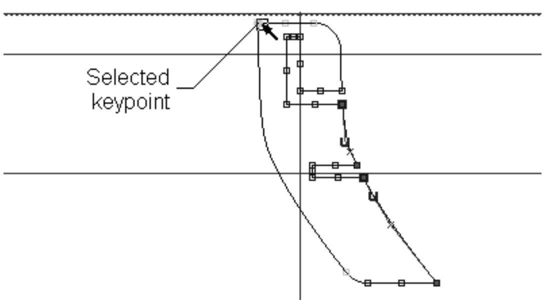


Figure 7-89 Selected keypoint

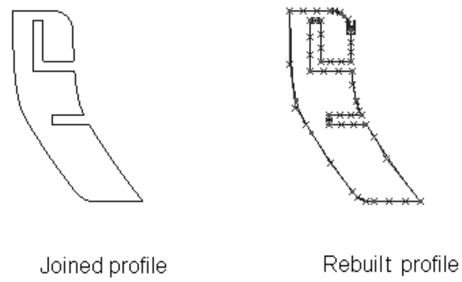


Figure 7-90 Joined profile and rebuilt profile

6. Clear the **Keep Originals** check box and then select the joined profile; the profile is highlighted and the **Go** button is displayed at the lower right corner of the active window.

7. Choose the **Go** button; the joined profile is rebuilt, refer to Figure 7-90.

Projecting the Rebuilt Profile on the Base Feature

After rebuilding the profile; you need to project it on the base feature by using the **Project** tool.

1. Choose the **Project** button from the **Surface Edit** tab in the **Palette**; you are prompted to select the surface(s) or the projection vector.

2. Select the base feature; the **Go** button is displayed at the lower right corner of the active window.

3. Choose the **Go** button; you are prompted to select the projecting curves or the projection vector.

4. Select the rebuilt profile; the selected profile is projected on the base feature, as shown in Figure 7-91. You can notice that the rebuilt curve is projected on the base feature at two positions.

5. Choose the **Pick curve-on-surface** button from the **Pick** tab in the **Palette** and select one of the projected profiles.

6. Next, press the DELETE key; the selected curve-on-surface is deleted.

Creating the Tread

You can create the tread by extruding the projected curve.

1. Choose the **Line** button from the **Keypoint Curve Toolbox** and create a line, as shown in Figure 7-92.

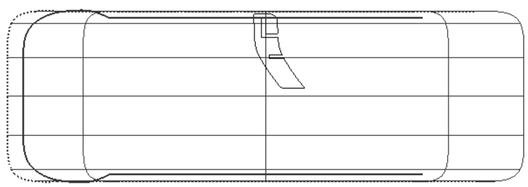


Figure 7-91 *Rebuild profile projected on the outer surface of the base feature*

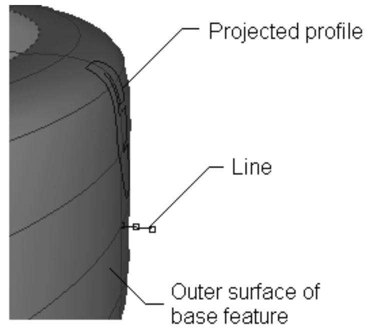


Figure 7-92 *Line created as extrusion path*

2. Next, choose the **Extrude** button from the **Surfaces** tab in the **Palette**; you are prompted to select the curve(s) to extrude.

3. Select the projected curve from the base feature; the **Go** button is displayed at the lower right corner of active window.
4. Choose the **Go** button; you are prompted to select the extrude path.
5. Select the line; the tread is created, as shown in Figure 7-93.
6. Next, choose the **N-sided surface** button from the **Surfaces** tab in the **Palette**; you are prompted to select the first boundary curve.

7. Select the outer edge of the tread; the **Go** button is displayed at the lower right corner of the active window.
8. Choose the **Go** button; the tread gets capped with the n-sided surface, as shown in Figure 7-94.

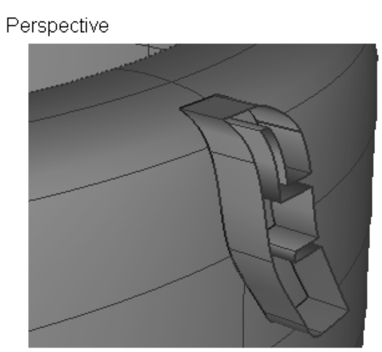


Figure 7-93 *Tread created on the base feature*

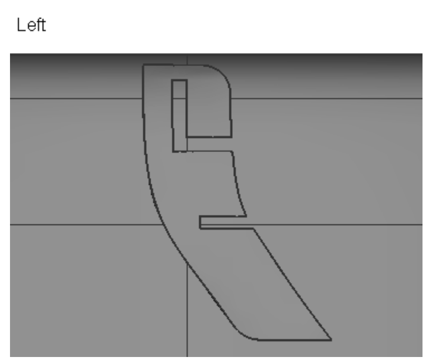


Figure 7-94 *Tread capped by the n-sided surface*

Creating Duplicate Copies of Tread

After creating the tread, you need to create its duplicate copies.

1. Select the tread along with its n-sided cap and then choose **Edit > Group** from the menu bar; the selected objects are grouped together.

2. Choose the **Set pivot** button from the **Transform** tab in the **Palette** and drag the pivot point to the origin (0,0,0) of the base feature, if the pivot is not at the origin.

3. Next, choose **Edit > Duplicate** from the menu bar; a flyout is displayed.

4. Click on the box given on the right of the **Object** option in the flyout; the **Duplicate Object Options** dialog box is displayed.

5. Enter **60** or any suitable value in the **Number** edit box and press ENTER.

6. Enter **0**, **0**, and **6** in the respective **Rotation** edit boxes and then choose the **Go** button; duplicate copies of grouped objects are created, as shown in Figure 7-95.

7. Click on the box given on the right of the layer, named Inner surface; the visibility of the inner revolved feature is turned on.

8. Next, select all copies of the tread including the original tread and then choose **Edit > Duplicate** from the menu bar; a flyout is displayed.

9. Click on the box given on the right of the **Mirror** option in the flyout; the **Mirror Options** dialog box is displayed.

10. Select the **XY** radio button from the **Mirror Across** area and then choose the **Go** button from the **Mirror Options** dialog box; mirror copies of the tread are created, as shown in Figure 7-96.

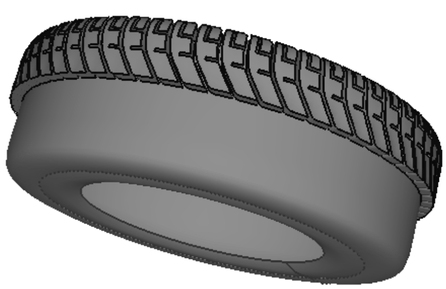


Figure 7-95 *Duplicate copies of the grouped objects*

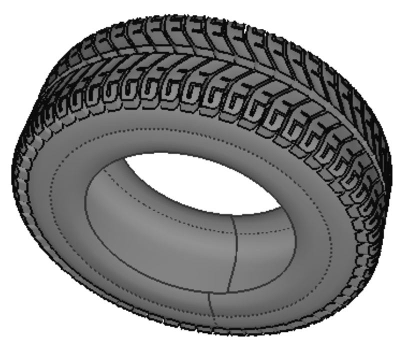


Figure 7-96 *Mirror copies of all treads*

Creating the Central Tube

After creating duplicate copies of tread, you need to create the central tube that passes between treads on either sides.

1. Create a new layer and name it as Tread and then assign all treads and their planar caps to this layer. Turn the visibility of this layer off by clicking on the box given on the right of this layer. Also, turn the visibility of the Inner Surface layer off, as discussed earlier in the tutorial.

2. Choose the **Circular arc** button from the **Keypoint Curve Toolbox** and create the path curve, as shown in Figure 7-97.

3. Choose the **Polyline** button from the **Keypoint Curve Toolbox** and create the profile curve, refer to Figure 7-97. The two profiles in the **Front** window are displayed, as shown in Figure 7-98.

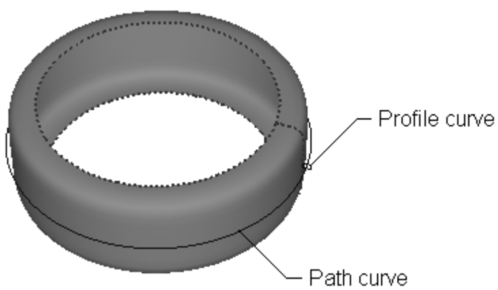


Figure 7-97 *Profile curve and path curve*

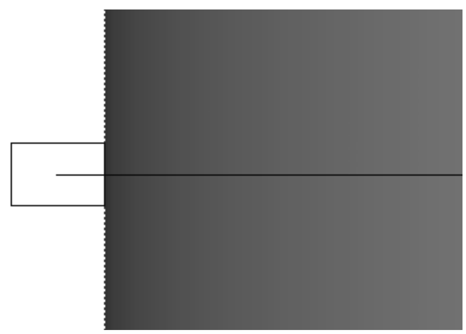


Figure 7-98 *Profile curve and path curve in the **Front** window*

4. Next, double-click on the **Rail surface** button; the **Birail I Gen. Control** dialog box is displayed.

5. Choose the **Advanced** tab from this dialog box; the advanced options are displayed in the dialog box.

6. Select the **1** radio button from the **Rail Curves** area; the title of the dialog box changes to **Monorail I Gen. Control**.

7. Choose the **PARALLEL** and **ON CURVE** buttons from the **Sweep Mode** and **Sweep Pivot** areas, respectively.

8. Select the **GEN.** radio button from the **Fixed Curve** area of the **Monorail I Gen. Control** dialog box.

9. Select the polyline and the circular arc as the generation and rail curves, respectively; the central tube is created, as shown in Figure 7-99.

10. Turn the visibility of the Inner Profile layer and Tread layer on by clicking on the box given on the right of the corresponding layers.

11. Next, choose **WindowDisplay > Toggles > Model** from the menu bar; the display of isoparametric curves, CVs, and hulls is turned off and the tyre is displayed, as shown in Figure 7-100.

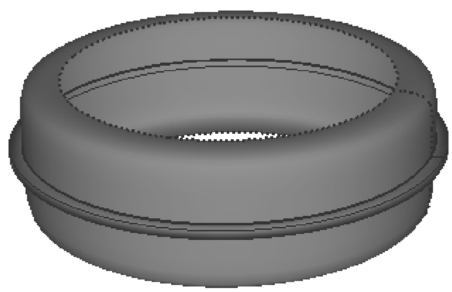


Figure 7-99 *Central tube*

Figure 7-100 *Final model of the tyre*

Saving the Model

You need to save the model created in the *c07_tutorials* folder with the name *c07_tut02*. As you have already created the *c07_tutorials* folder in *Tutorial 1* and set it as the current project, there is no need to create a new folder for saving this tutorial.

1. Choose **File > Save as** from the menu bar; the **Save Wire** dialog box is displayed. You can also invoke this dialog box by pressing ALT+S keys.

2. Click on the down-arrow given on the right of the **Go** field to display the list and choose the **Current Project** option from this list.

3. Enter *c07_tut02* in the **Object name** edit box and then choose the **Save** button; AliasStudio saves the file as *c07_tut02.wire*.

   The location of this file is given below:

   \aliasstudio_2009\c07_tutorials\c07_tut02.wire

4. Choose **File > Exit** from the menu bar to close the application.

Self-Evaluation Test

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

1. In the **Duplicate curve** tool, low tolerance indicates less deviation between the original curve and the duplicate curve. (T/F)

2. The **MATCH KNOTS** button of the **Duplicate curve** tool is used to create duplicate copy of a curve with the number of spans and degrees matching the number of spans and degrees of the other curve. (T/F)

3. To create a fillet between two curves with a freeform profile, select the **Circular** radio button from the **Construction** area of the **Curve Fillet Options** dialog box. (T/F)

4. While creating a freeform fillet between two curves, the blended fillet curve is shallower than the tangent fillet curve. (T/F)

5. The dilating method to transform a curve intersects the curve with the rail surface with change in the shape characteristics. (T/F)

6. You can create a curve that intersects two rail curves by using the __________ tool.

7. The number of handles in a curve cannot exceed the __________ of the curve plus 1.

8. The __________ tool is used to split curves at inflections.

9. You can trim, __________, or slice curves by using the **Sectioning a group of curves** tool.

10. You can create a 3D curve from two planar curves by using the __________ tool.

Review Questions

Answer the following questions:

1. Which of the following options is used to duplicate a curve with the reduction in extraneous edit points?

   (a) **NO REBUILD** (b) **CURVATURE**
   (c) **REDUCE SPANS** (d) **DELETE MULTI-KNOTS**

2. Which of the following radio buttons is selected to create a fillet of circular profile with control on its lead ratio and knee ratio?

   (a) **Circular** (b) **Profile**
   (c) **Circular+Lead** (d) None of the above

3. While planarizing a curve, which of the following radio buttons is selected to specify the plane on which modifications on the curve are the least?

   (a) **Best** (b) **Axis**
   (c) **User Defined Plane** (d) None of the above

4. Which of the following operations is not included in the sectioning of curves?

   (a) Trimming (b) Detaching
   (c) Adding control points (d) Breaking

5. You can add points to the existing curves such as circle, ellipse, text, and sweep curves by using the **Add points to a curve** tool. (T/F)

6. While stretching a curve, you can change the parameter of extra handles but not the handles displayed at its endpoints. (T/F)

7. The **Create Curve** radio button is selected to create a curve while slicing curves. (T/F)

8. The trimming of curves enables you to remove the part of curves that lie __________ the intersection point.

9. The __________ points are the points on a curve at which curvature changes its direction.

10. After selecting the **Smoothing** check box from the **Duplicate Curve** dialog box, you need to drag the cursor with the __________ mouse button to smoothen the rebuilt curve interactively.

Exercises

Exercise 1

Create the model of a knife, as shown in Figure 7-101. Figure 7-102 shows the other view of the knife. **(Expected time: 45 min)**

Figure 7-101 *Model of knife for Exercise 1*

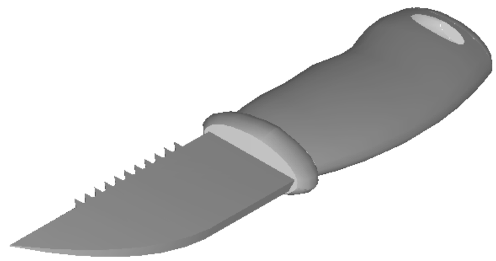


Figure 7-102 *Other view of the model*

Exercise 2

Create the model of a washbasin, as shown in Figure 7-103. Figure 7-104 shows the other view of the model. **(Expected time: 30 min)**

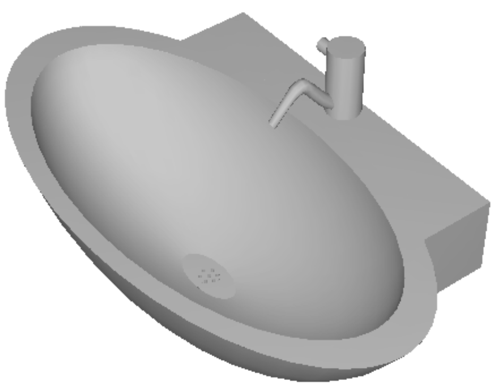


Figure 7-103 *Model of washbasin for Exercise 2*

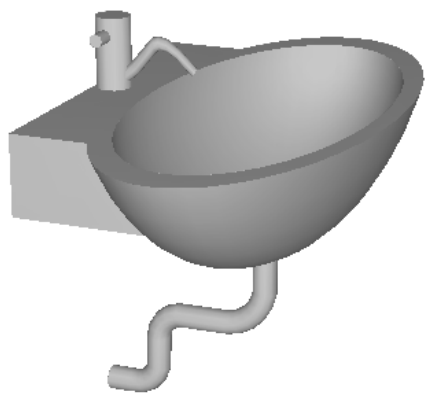


Figure 7-104 *Other view of the model*

Answers to Self-Evaluation Test

1. T, **2.** T, **3.** F, **4.** T, **5.** F, **6. transform curve**, **7.** degree, **8. Break curve at inflections**, **9.** segment, **10. Combine curves**