

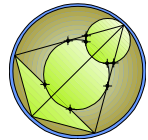
The CEDRA Corporation's COMMAND OF THE MONTH

A monthly information bulletin

June 2007

FEATURED COMMAND

Creating and Editing
Spline Curves



Application Description

From time to time there arises an application where a user needs to create a smooth, free flowing, polyline. This polyline could represent a ditch or a stream. In creating this polyline the user generally wishes to establish a series of curves in conjunction with lines to create an accurate depiction of whatever item is being represented. In the CEDRA world, we refer to this type of polyline as a spline curve.

Obviously, the user could use conventional line and curve generation commands, but this would prove to be too time consuming. What is needed is a specialized command for creating lines and curves in a single operation.

Complicating the task of creating such a polyline is the fact that once the polyline has been established, it is more than likely that the user will want to modify or edit the existing polyline to make some sort of alteration. Therefore, a specialized command is also needed for editing an existing polyline.

The CEDRA Solution

To address the application of creating and editing a spline curve, the user can activate the CEDRA-SpecialCurves-Tools toolbar, see Figure 1. This toolbar is available only for ArcGIS® users and is found in the CEDRA-AVcogo and CEDRA-AVland software. Specifically, the [Spline Curve] tool, which is the right-most tool within this toolbar, is the command which we will be discussing.

Spline Curve - Overview

The basic concept behind the operation of the [Spline Curve] tool is that the user will either:

- create a new spline curve, or
- edit an existing polyline feature.

A spline curve, which in the ArcGIS world is nothing more than a polyline feature, is defined in terms of:

- a variable number of keynodes and
- a specific curve generation method.

Command Of The Month bulletin

This month's issue discusses the process of creating and editing spline curves using a variety of curve generation methods.

The curve generation method denotes the type of curve that is drawn at a keynode. Presently, the [Spline Curve] tool supports four curve generation methods.

Upon activation of the tool, the user will specify which curve generation method is to be employed, after which, the user:

- selects an existing polyline feature to be modified, or
- makes a pick denoting the first keynode comprising the new spline curve.


Using the pick made by the user, the command determines if an existing polyline feature was selected or not. If an existing polyline feature can not be



Figure 1
CEDRA-AVcogo-SpecialCurve Tools
Toolbar

found, based upon the user's pick, the command assumes that the user wishes to create a new spline curve. If the command, using the user's pick, finds an existing polyline feature, the command assumes that an existing feature is to be modified. Using this approach, a single tool can be used to create new spline curves, as well as, modify existing polyline features.

Spline Curve - Operation

Upon activation of the [Spline Curve] command, , the multi-input dialog box of Figure 2 will appear. Figure 3 contains a list of the available curve generation methods. Note that the Circular Arcs method of curve generation requires the additional specification of a rounding factor. This factor controls the radius value at a keynode.

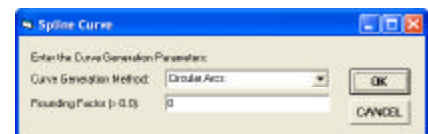


Figure 2 - Command Initial Selection
Multi-Input Dialog Box

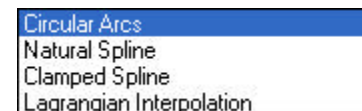
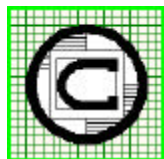


Figure 3 - Curve Generation Method
Choice List



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Phone: 585-232-6998
Fax: 585-262-2042

151 Sully's Trail - Suite 6
Pittsford, New York 14534

E-mail: cedra@cedra.com
URL: <http://www.cedra.com>

1. Enter the desired curve generation method and rounding factor, if need be, click at the:
 - *Cancel* button to terminate the command, or the
 - *OK* button to continue with the processing.

If the Circular Arcs method is selected, a nonzero rounding factor must be specified. If an invalid value is specified for the rounding factor an error message similar to that shown in Figure 4 will be displayed. Note that the rounding factor can be a large value such as 500, 1000, etc.

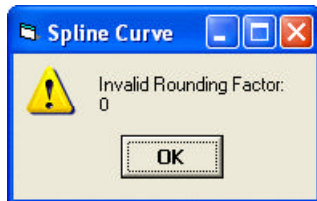


Figure 4 - Invalid Rounding Factor Error Message

Once the user has successfully specified the curve generation method, the following message in the status bar area will appear.

Pick the start point of the curve or the polyline to be modified

2. Make a pick in the map area to either:
 - (a) identify an existing polyline feature to be modified, or
 - (b) denote the first keynode in a new spline curve to be created.

Depending upon whether the command can find an existing polyline feature or not, there are two possible modes of operation:

Mode 1 - Create New Spline Curve

3. Continue making picks denoting the remaining keynodes comprising the new spline feature. As the user makes a pick a red plus sign will appear denoting the keynode, see Figure 5. In addition, a message similar to that shown below will appear in the status bar area.



Figure 5 - Selection of Spline Curve Keynodes

Pick point X of the curve, Pick the last point a second time to terminate

The X character in the message denotes the keynode number (2, 3, 4, 5, etc.).

The keynode definition process is terminated by picking the last keynode a second time.

Once the keynode definition process is terminated a spline curve will be displayed, see Figure 6. In addition, the message shown below will appear in the status bar area.

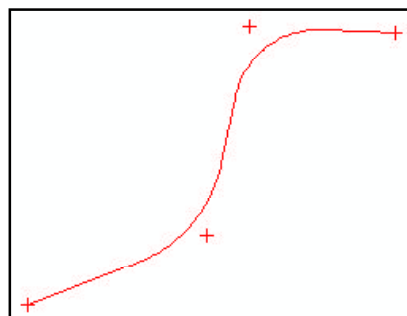


Figure 6 - Initial Display of Spline Curve upon completion of Keynode Definition

Select a keynode and drag to reshape, the I key to insert a keynode, the X key to delete a keynode, the ESC key to terminate

From the message it can be seen that the user can:

- a. Reshape the spline curve by selecting one of the defined keynodes,

dragging the keynode to a new location.

- b. Insert a keynode by selecting or depressing the I character on the keyboard.
- c. Delete a keynode by selecting the X character on the keyboard.
- d. Terminate the definition of the spline curve by selecting the ESC key on the keyboard.

4. Modify the shape of the spline curve using one of the methods mentioned above.

To reshape the spline curve, the user single-clicks on a keynode and holds the left mouse button down. At this point, the user moves the cursor. As the cursor is moved the shape of the spline curve is updated to reflect the new position of the keynode. Release the left mouse button to terminate the reshaping of the spline curve.

Figure 7 illustrates how the keynodes can be relocated to modify the shape of the spline curve.

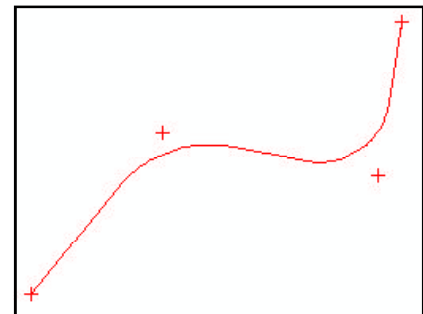


Figure 7 - Modified Shape of Spline Curve as a result of relocating Keynodes

To insert a keynode, the user moves the cursor so that it is positioned slightly behind the keynode that is to precede the inserted keynode and selects the I key on the keyboard. A keynode is always inserted after an existing keynode. The existing keynode that is used is the one which is closest to the current cursor location.

To delete a keynode, the user moves the cursor so that it is positioned on top of the keynode to be deleted and selects the X key on the keyboard.

5. Terminate the reshaping of the spline curve by depressing the ESC key on the keyboard.

The new spline curve is stored in the current active layer.

Mode 2 - Modify Existing Polyline

If an existing polyline feature can be found based upon the pick made in Step 2, the user will be asked to enter the number of keynodes that are to be used in modifying the shape of the existing polyline, see Figure 8.

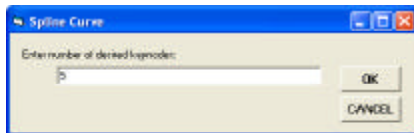


Figure 8 - Number of Keynodes Dialog Box

3. Enter the number of keynodes, click at the:
 - *Cancel* button to terminate the command, or the
 - *OK* button to continue with the processing.

If a keynode is to be introduced at every vertex comprising the polyline, the user should enter a very large number. When the user enters a value that exceeds the number of vertices comprising the selected polyline feature, the command interprets this as indicating that a keynode is to be inserted at every vertex location in the polyline.

Once the OK button is selected, the command displays a red plus sign at each of the keynodes as well as the spline curve, see Figure 9.

Figure 8 is then re-displayed enabling the user to specify a different number of keynodes, if so desired.

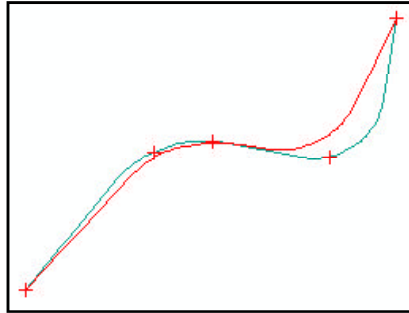


Figure 9 - Default Spline Curve Display

4. Enter the number of keynodes, click at the:
 - *Cancel* button to terminate the definition of the number of keynodes, or the
 - *OK* button to continue with the definition of the number of keynodes.

Once the keynode definition process is terminated the user is able to reshape the spline curve using the same methodology described in creating a new spline curve. In the status bar area, the following message will appear.

Select a keynode and drag to reshape, the I key to insert a keynode, the X key to delete a keynode, the ESC key to terminate

From the message it can be seen that the user can:

- a. Reshape the spline curve by selecting one of the defined keynodes, dragging the keynode to a new location.
 - b. Insert a keynode by selecting or depressing the I character on the keyboard.
 - c. Delete a keynode by selecting the X character on the keyboard.
 - d. Terminate the definition of the spline curve by selecting the ESC key on the keyboard.
5. Modify the shape of the spline curve using one of the methods mentioned above.

To reshape the spline curve, the user single-clicks on a keynode and holds the left mouse button down. At this point, the user moves the cursor. As the cursor is moved the shape of the spline curve is updated to reflect the new position of the keynode. Release the left mouse button to terminate the reshaping of the spline curve.

To insert a keynode, the user moves the cursor so that it is positioned slightly behind the keynode that is to precede the inserted keynode and selects the I key on the keyboard. A keynode is always inserted after an existing keynode. The existing keynode that is used is the one which is closest to the current cursor location.

To delete a keynode, the user moves the cursor so that it is positioned on top of the keynode to be deleted and selects the X key on the keyboard.

6. Terminate the reshaping of the spline curve by depressing the ESC key on the keyboard.

Upon selection of the ESC key, the shape of the selected polyline feature will be replaced with that of the spline curve, as defined by the user.

Summary

Shown in Figures 10(a) through 10(d) are examples of the available curve generation methods given the same keynodes. These figures illustrate the difference between the various methods.

Users who have a need to creating smooth free flowing polylines will find the [Spline Curve] tool extremely useful. As always, if there are any requests for additional functionality in transferring attribute values, please feel free to let us know.

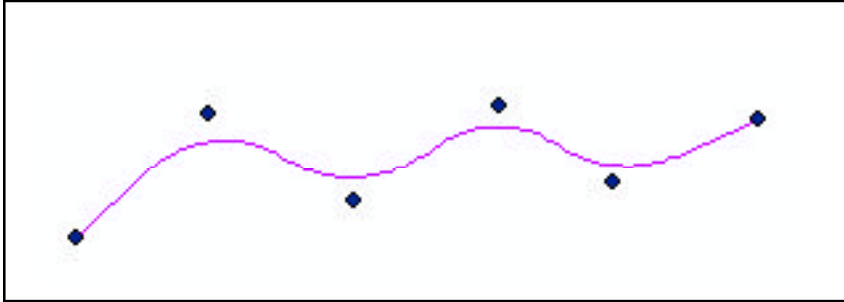


Figure 10(a) - Circular Arcs with a Rounding Factor of 1000

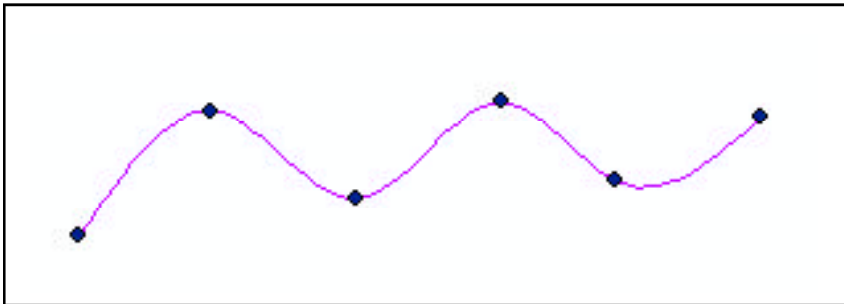


Figure 10(b) - Natural Spline

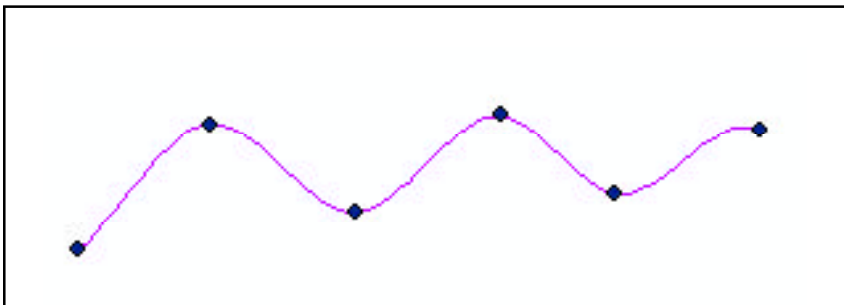


Figure 10(c) - Clamped Spline

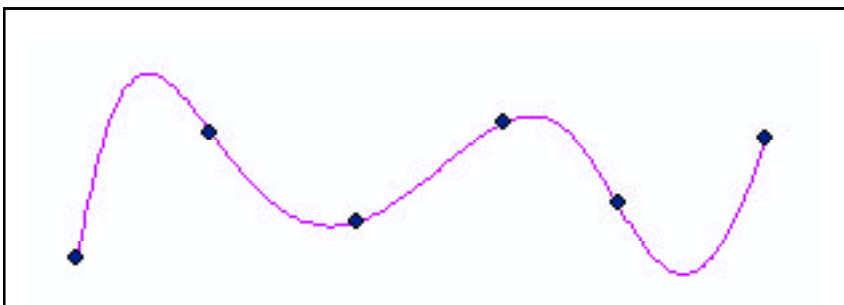


Figure 10(d) - Lagrangian Interpolation

If you have a request for Command Of The Month, feel free to phone, fax or e-mail your request to The CEDRA Corporation.