The logo for Analytix Cams 21 features a stylized mechanical cam-follower mechanism. It consists of a large grey cam disk with a profile, a smaller grey follower disk, and a green connecting link. The cam disk has a small white circle labeled 'D' at its top edge, a larger green circle labeled 'C' on its profile, and a smaller green circle labeled 'A' at its center. The follower disk has a small white circle labeled 'B' at its top edge. Lines connect the labels to their respective parts.

# **Analytix Cams 21<sup>TM</sup>**

**Cam/Follower Design Software**

## *Reference Manual*



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## Welcome

Welcome, and thank you for purchasing *Analytix Cams 21*. This design and analysis software has the flexibility to allow you to start your design process with follower requirements, or with an existing cam profile.

## Features Overview

Using *Analytix Cams 21*, you can focus on optimizing your cam and follower design rather than spending time on tedious manual calculations.

*Analytix Cams 21* also increases the reliability and performance of your cam and follower designs by providing the tools to analyze critical aspects of a design before physical prototyping or production.

During the design process, *Analytix Cams 21* immediately provides graphical and numerical analysis of critical data, such as cam profile, displacement, velocity, pressure angle, radius of curvature, acceleration and jerk.

*Analytix Cams 21* supports convenient data input from external sources through simple copy and paste commands or with a text file. You can also copy graphic illustrations in the main window and paste them into other applications for generating reports and presentations.

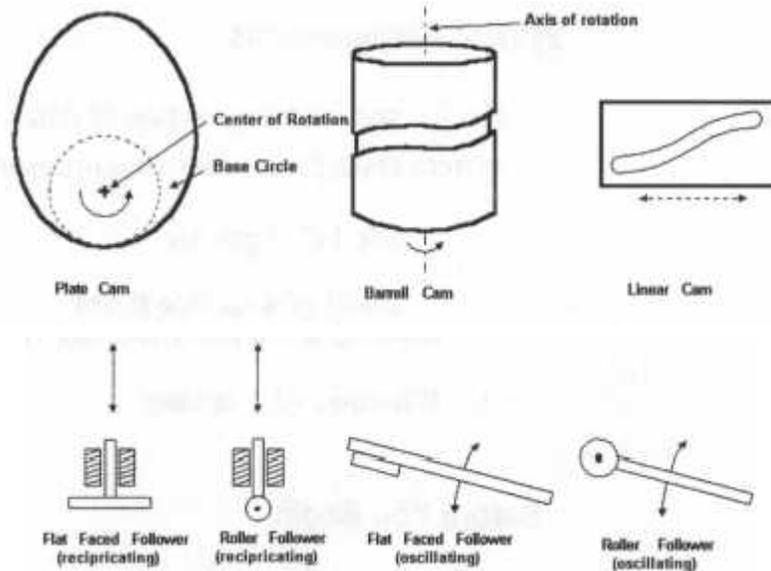
## Cams / Followers Supported

*Analytix Cams 21* supports the following basic cam and follower types:

	Plate	Linear	Barrel
Flat / Reciprocating	✓		
Flat / Oscillating	✓		
Roller / Reciprocating	✓	✓	✓
Roller / Oscillating	✓	✓	✓

Plate cams with roller followers may be either external or internal. With linear and barrel cams, either the top or bottom cam surface may be

modeled.



## System Requirements

Windows XP or later.

Processor - 1GHz

RAM - 512 MB

Disk Space - 600MB (32 bit)

1.5 GB (64 bit)

## Planning Your Design

Before you begin your project, make sure you do the following:

- Decide whether your design approach is based on an existing cam, or based on follower requirements.
- Determine the general size of the cam and follower parameters, such as base circle radius, offset or follower radius.

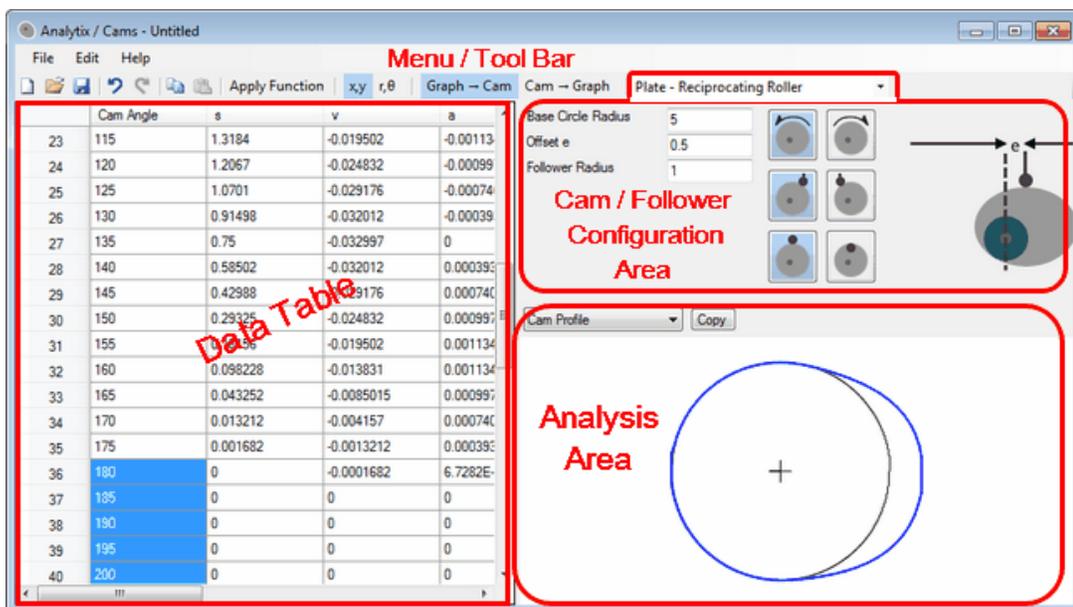
This guide is written with the assumption that you have knowledge of mechanical design and cam / follower design principles in particular.

To learn more, consult the following recommended books, which contain informative chapters on cam/follower design:

- *Design of Machinery*, Robert L. Norton, McGraw Hill, 1992.
- *Kinematics and Dynamics of Machinery*, Charles E. Wilson, J. Peter Sadler, Walter J. Michels, Harper & Row, 1983.
- *Theory of Machines & Mechanisms*, J.E. Shigley & J.J. Uicker, McGraw Hill, 1980

## The Display

Here we outline the program elements used to create your Cam design.. A brief description of each section of the display is provided below.



- **Tool Bar** - A strip across the top of the window contains the standard file handling icons, Undo / Redo, Cut / Paste, and file configuration buttons which relate to the Data Table, Function dialog and Cam/Follower Configuration area.
- **Cam/Follower Configuration Area** - This allows you to select from a drop-down menu the combination of cam and follower you are designing. An illustration representing the cam and follower combination appears as you select from the menu. Further specifications for each cam and follower type are identified with a selection of icons. Refer to the following information about the Cam/Follower Configuration Area:  
Cam/Follower Configuration Area Data Fields

### Cam/Follower Configuration Area Buttons

- **Function** dialog - The Apply Function button on the tool bar opens this dialog for selecting the cam profile curve.
- **Data Table** - Provides numerical data on cam profile, displacement, velocity, acceleration and jerk (abbreviated in the Data Table as s, v, a, j). This also provides a way to enter a cam profile when in the cam-to-graph mode.
- **Analysis** - Examine various graphs while defining the values and parameters for the cam and follower.

## Cam/Follower Configuration Area

The Cam/Follower Configuration Area allows you to select from a drop-down menu the combination of cam and follower you are designing.

An illustration representing the cam and follower combination appears as you select from the menu. Any special considerations for different cam and follower types are identified.

Refer to the following information in the Reference section about the Cam/Follower Configuration Area:

Cam/Follower Types and Data Fields

Cam/Follower Description Buttons

## Examples

Analytix Cams presents you with two approaches to designing cams.

**Follower-to-Cam** - With this method you can quickly and easily create cam profiles based on existing follower requirements. In this mode, you can design a cam from scratch. Once you have designed the cam, you may want to investigate the follower motion resulting from using the cam with a different follower configuration. Any changes you make to the follower geometry parameters (such as follower offset, follower radius, and follower arm length) affect only the cam profile. The follower motion stays the same.

In the follower-to-cam mode, you can use the Function window to piece together a desired follower motion, or you can paste values for follower

displacement directly into the Data Table and *Analytix Cams 21* will automatically derive the cam profile for you.

**Cam-to-Follower** - If you have an existing cam and want to design or derive the follower motion, this design method lets you input the cam's coordinates and manipulate parameters of the follower, such as follower offset, follower radius, and follower arm length. Follower kinematics are derived by the program.

## Example 1 - Plate Cam

### The Specs

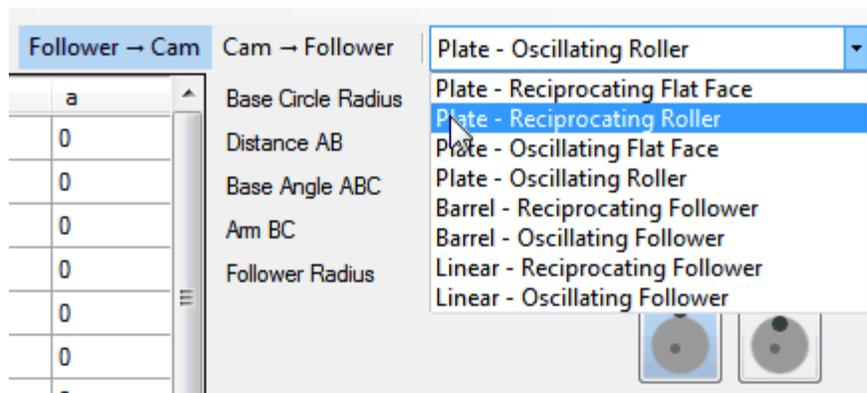
In this example, we design a plate cam with an external reciprocating roller follower. Due to design constraints, such as clearances, the base circle radius is 5, the roller offset is .5 and the follower radius is 1. The cam rotates counter-clockwise and the follower offset is to the right. Between cam angle of 0 and 90 degrees the follower has a full cycloidal rise to a displacement of 1.5; between 90 and 180, a dwell and from 180 to 270 degrees a full cycloidal fall back to 0.

Note: You may use any units of length (meters, inches, feet, etc.) as long as they are used consistently throughout the input process. Angles are always measured in degrees.

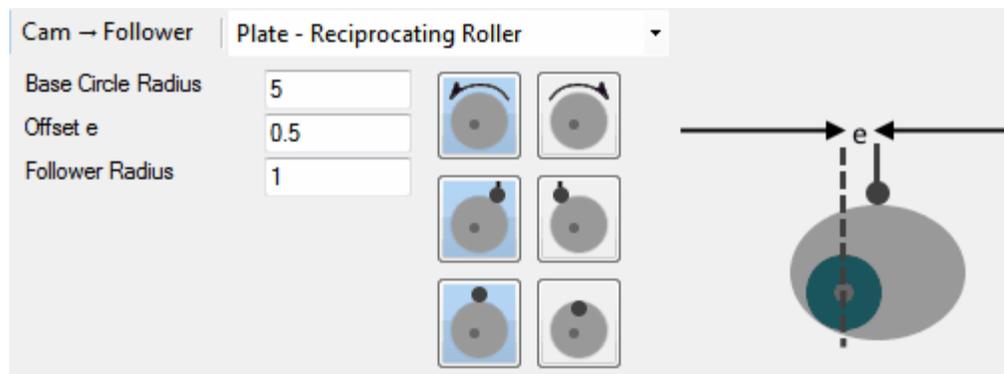
### Setting the Design Parameters

You can perform the following steps in any order, but you must define each before you begin the "Entering Data" section.

1. Click **Follower-to-Cam** on the Tool Bar.
2. In the drop-down menu select the combination of cam and follower you are using. For this example, select **Plate-Reciprocating Roller**



3. Fill in the input parameters.
4. Click the buttons describing the geometric parameters of the cam. In this case we are using the default values.

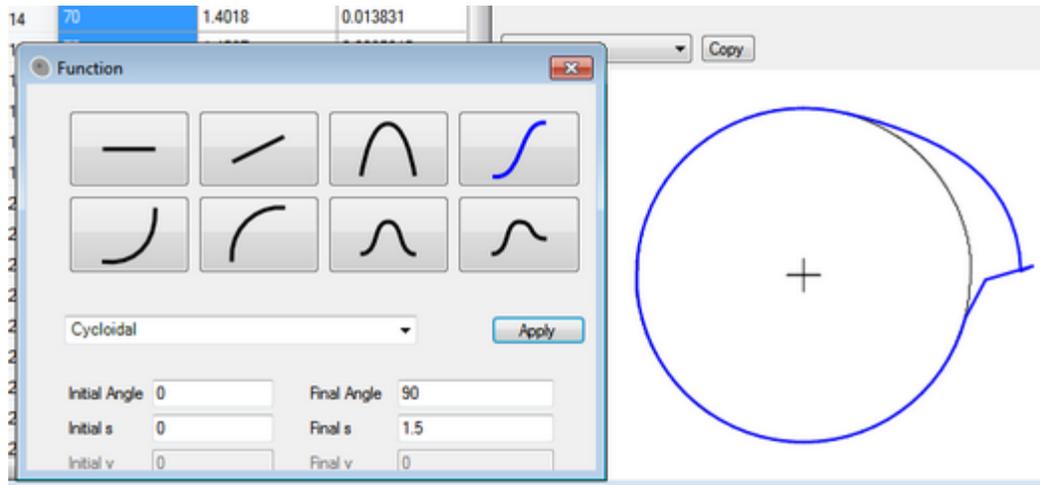


## Entering Data

1. In the **Edit / Options** the default number of **Data Points** is set to 72. This is evenly divided to display data for every 5° of Cam Angle. You can change this value to get more or less precision.
2. In the Data list box click and select Cam Angle values for input from 0 to 90.
3. Click the **Apply Function** button to bring up the **Function** dialog.
4. The Initial Angle and Final Angle should match your selection above.
5. In the drop-down menu select **Cycloidal** and click the **Full Rise** icon .
6. Enter 0 for Initial s and 1.5 for Final s.
  - For **Oscillating** followers displacement will be in degrees.

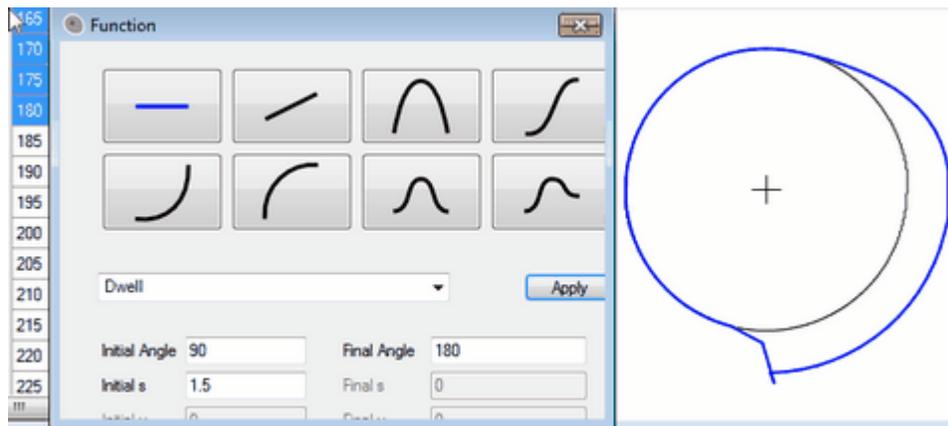
- For **Reciprocating** followers displacement units are consistent with base circle radius and follower radius.

7. Click the **Apply** button to see the first quarter of your cam.

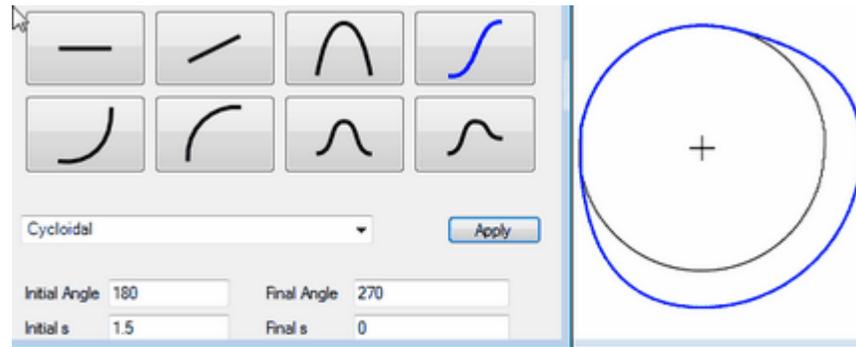


You can modify the data in the table by highlighting the appropriate cells and typing the new values into the table. Then, click **Apply** again.

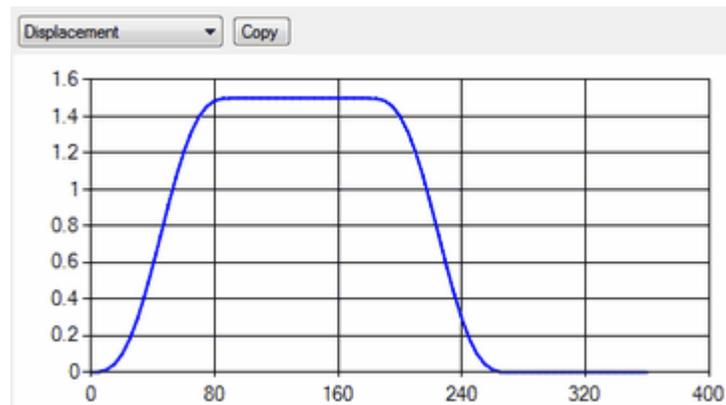
8. The next section is the Dwell. Select the next section, highlight the Cam Angle field from 90 to 180 and click **Apply Function** to register the new range in the **Function** dialog. Select **Dwell** in the drop-down window. (The first and final displacements are equal.) Type 1.5 in the Initial s field. Click **Apply** again.



9. In the next section, for a Cam Angle range from 180 to 270, we return to the **Cycloidal** function (the **Full Rise** icon should be highlighted). The Final s field should be 0.
10. After selecting **Apply** we should see the final cam.



As you are defining the cam, you can examine graphs of the cam's Displacement, Velocity, Acceleration, Jerk, Pressure Angle and Radius of Curvature. For example, select **Displacement** from the drop-down window above the drawing to display the graph:



See the Analysis Area topic below for more details. The corresponding data for these graphs is listed in the **Data Table**. Resize the data window and use the scroll bars for a better view.

**Save** your file  for use in further examples below.

## Example 2 - Barrel Cam

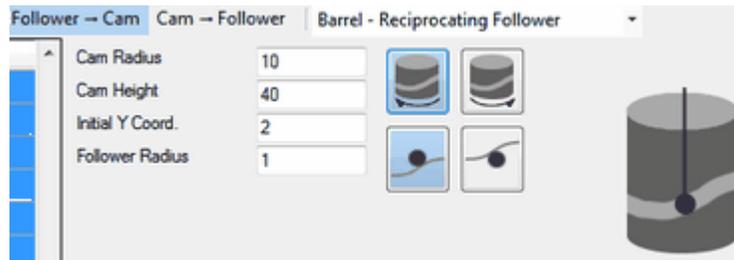
### The Specs

In this example, a barrel cam drives a reciprocating follower at a constant velocity of 0.2 inches / degree between 50 and 200 degrees. Between 0 and 50 a half rise cycloidal function smoothly blends in to the constant velocity portion of the cam. Between 200 and 330 degrees, a 3-4-5 polynomial function brings the displacement back to 0. If you have been working on another example, select **File / New** to begin a new model.

### Setting the Design Parameters

You can perform the following steps in any order, but you must define each before you begin the "Entering Data" section.

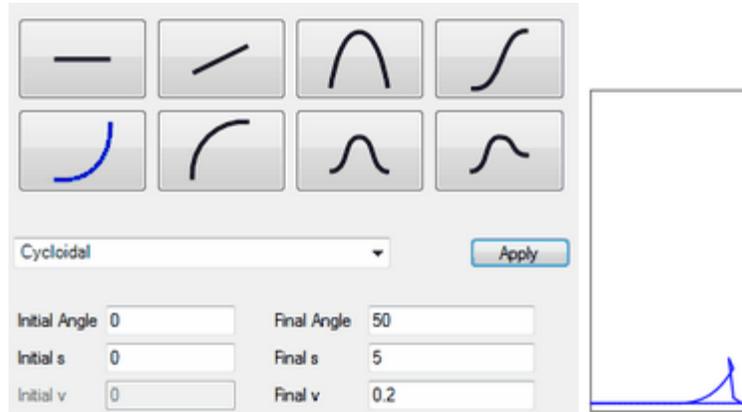
1. Click the Follower-to-Cam button in the Tool Bar.
2. In the drop-down menu select the combination of cam and follower you are using. For this example, select **Barrel-Reciprocating Follower**.
3. Use the defaults for the rotation of the barrel and the position of the cam surface. Fill in the numeric specifications shown below:



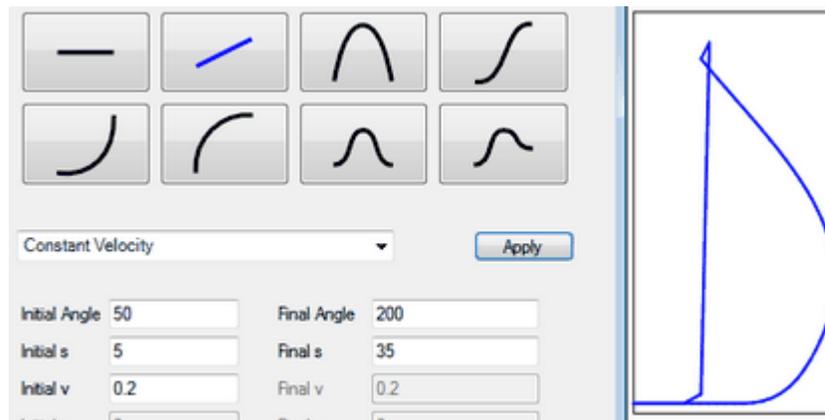
### Entering Data

1. As in the last example, we will use 72 data points, so no need to change the default (**Edit / Options**).
2. Click and select cam angle values for input from 0 to 50.
3. Click the **Apply Function** button to bring up the **Function** dialog.
4. Click the **First Half Rise** icon . The **Cycloidal** function will appear in the drop-down menu.

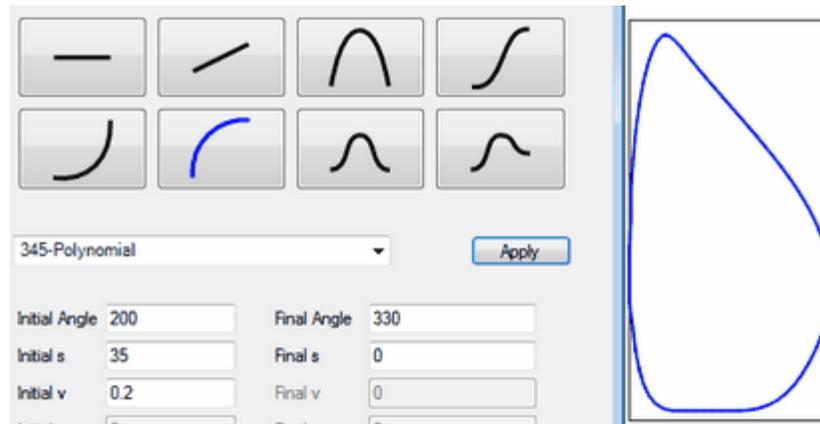
5. Check the Initial and Final Angle values.
6. Enter the rest of the data and click **Apply**.



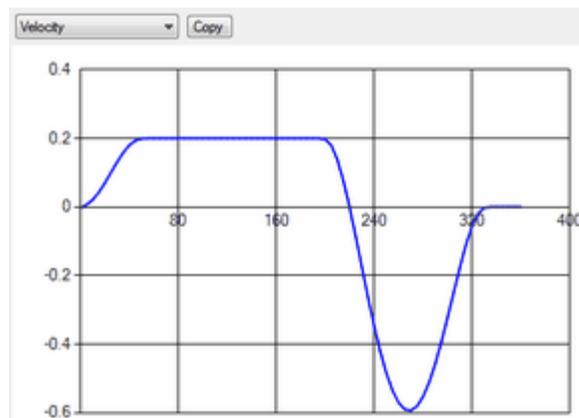
7. Select the next range from the Data Table, 50 to 200.
8. Enter the Initial s and Initial v. Analytix Cams calculates the Final s.



9. The final segment between 200 and 330 uses the **345-Polynomial** function, **Second Half Rise** .
10. After entering the Initial s and Initial v, here's how it should look:



11. Here is the graph of the velocity:



12. Remember to **Save**  your work for future reference.

## Example 3 - Redesigning the Follower

In this example we assume you have manufactured the cam designed in example 1 above. Now you want to redesign the follower system to meet new requirements and see the effects on the follower motion.

In the **Cam-to-Follower** mode, you can change the x and y coordinates. Other than this, any modifications you make to the cam/follower parameters will cause the follower motion to change, but will not affect your defined cam.

If you have not saved the previous two examples, find them in the **Examples** subdirectory of your installation. Alternatively you can use data from a text file or Excel.

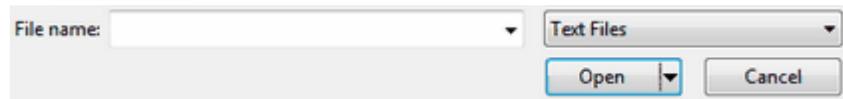
## Setting the Design Parameters

1. If you are using a previously saved file, ex1 for example, open it .
2. Click the **Cam-to-Follower** button on the toolbar. The cam coordinate columns will appear first in the Data Table.
3. If you are using other data from a file or cutting and pasting, you must configure the cam properties. See examples 1 and 2 and Cam Types and Description in the Reference section.

## Entering Data $\theta$

If you are reading in a text file -

1. Select the region in the Data Table where the coordinate pairs will be deposited.
2. Select the **File / Open** menu and find the file type window to select Text Files.



3. Proceed as usual to select and open the file.

If you are copying and pasting data, make sure the source file is free of any extra characters, such as commas or other punctuation. The x,y or r, $\theta$  data must be in tab-delimited format with a return at the end of each line. This is the default when copying and pasting from a spreadsheet program.

If you already opened a *Analytix Cams* file, the data is in the table and the **Analysis** window displays the **Cam Profile**.

You can fine-tune cam coordinates by:

- modifying the data in the Data Table and viewing the resulting profile in the Analysis window

- modifying parameters in the Cam/Follower Configuration area.

Modifying follower parameters does not alter the cam profile in this mode. It only modifies the follower kinematics.

## Integrating Cams Into Analytix

*Analytix 21*, the parent program of *Analytix Cams 21*, is a fully featured mechanism design package which will import your cam diagram for analysis in the context of a larger mechanism. You could add linkages, springs, dampers, masses, forces, *etc.* and analyze resultant forces, torques, tolerance stack-up, trace follower paths by animating the mechanism and more. If you don't yet own a copy, you can try a demo.

Here are the simple steps to import your cam into *Analytix 21*:

1. Save your Analytix Cams file and exit the program.
2. Open *Analytix 21* and select **Add Cam** from the **Analysis** menu. This opens a new copy of *Analytix Cams*.
3. In *Analytix Cams* open your .cam file and select **Follower-to-Cam** or **Cam-to-Follower**.
  - If you select the Follower-to-Cam mode, any changes you make in Analytix to follower parameters (such as follower arm length, follower offset, etc.) will modify the cam profile. The follower kinematics are preserved.
  - If you select the Cam-to-Follower mode, changing follower parameters in Analytix will preserve the same cam profile and adjust the follower motion.
4. You can return to Analytix Cams 21 and make more extensive modifications to the cam by double clicking the cam profile.
5. Exit *Analytix Cams 21* and return to *Analytix 21*.

If you'd like to see more about *Analytix 21's* capabilities, you can take a look at the manual [here](#).

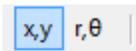
# Reference Section

Here follows a detailed description of the design tools by topic:

- Tool Bar
- Cam / Follower Types and Data Fields
- Cam / Follower Description Buttons
- Data Table
- Analysis Area
- Menus
  - File
  - Edit
  - Help

## Tool Bar

The Tool Bar contains these four independent buttons:



**Coordinates Buttons:** select whether the cam profile is in Cartesian or polar coordinates.

Apply  
Function

**Function Window:** Click this button to select the cam profile curve types.

**Function Window:**

Allows you to choose the type of curve between points when in the follower-to-cam mode. The buttons at the top of the Function window are:



**Dwell**



**Constant Velocity**



**Constant Acceleration**

**Full Rise****First Half****Second Half****Single Dwell****Polynomial Spline****Follower → Cam****Follower-to-Cam Button:** Click to indicate your design approach is follower-to-cam.**Cam → Follower****Cam-to-Follower Button:** Click to indicate your design approach is cam-to-follower.

## Cam - Follower Types and Data Fields

### Plate

- Reciprocating Flat Face
- Reciprocating Roller
- Oscillating Flat Face
- Oscillating Roller

### Barrel

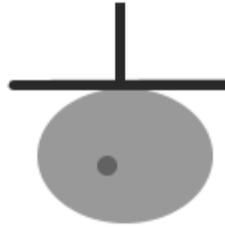
- Reciprocating Follower
- Oscillating Follower

### Linear

- Reciprocating Follower
- Oscillating Follower

## Plate

### Reciprocating Flat Face



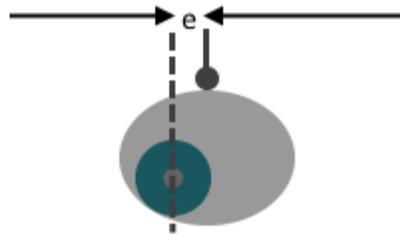
**Base Circle Radius** - This is the radius of cam's base circle. (The follower has 0 displacement when it is lying on the base circle.)

**Velocity Units** - degrees/length

**Buttons:**

Clockwise / Counter Clockwise

### Reciprocating Roller



**Base Circle Radius** - This is the radius of cam's base circle. (The follower has 0 displacement when it is lying on the base circle.)

**Offset e** - The distance the follower is offset from the line going through the axis of the cam.

**Follower Radius** - The radius of the follower roller.

**Velocity Units** - degrees/length

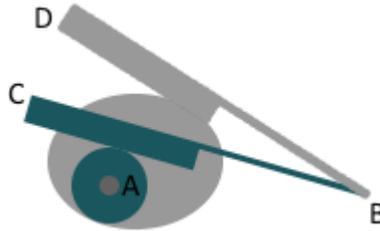
**Buttons:**

Clockwise / Counter Clockwise

Left / Right Follower Offset

Internal / External Cam

## Oscillating Flat Face



**Base Circle Radius** - This is the radius of cam's base circle. (The follower has 0 displacement when it is lying on the base circle.)

**Distance AB** - The distance from the cam axis to the pivot point of the follower.

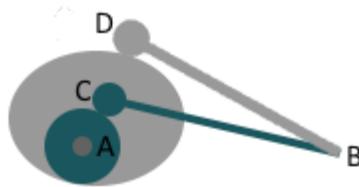
**Base Angle ABC** - The angle between the follower and the line between the cam axis and the follower pivot when the follower lies on the base circle.

**Offset** - The distance of the contact face of the follower from the pivot arm. Positive offset is in a direction toward the cam. Negative offset is in a direction away from the cam.

**Velocity Units** - degrees/degrees

- Note: Changing the base radius of the cam automatically changes the base angle.

## Oscillating Roller



**Base Circle Radius** - This is the radius of cam's base circle. (The follower has 0 displacement when it is lying on the base circle.)

**Distance AB** - The distance from the cam axis to the pivot point of the follower.

**Base Angle ABC** - The angle between the follower and the line between the cam axis and the follower pivot when the follower lies on the base circle.

**Arm BC** - The distance from the follower pivot to the center of the roller.  
Follower Radius - The radius of the follower roller.

**Velocity Units** - degrees/length

- Note: Changing the base radius of the cam automatically changes the base angle.

## Barrel

### Reciprocating Follower

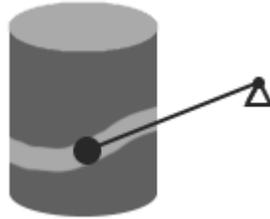


**Cam Radius** - The radius of the barrel cam.

**Follower Radius** - The radius of the follower roller.

**Velocity Units** - degrees/length

- Note: The x coordinate is the angle on the barrel cam measured in degrees.

**Oscillating Follower**

**Cam Radius** - The radius of the barrel cam.

**Follower Radius** - The radius of the follower roller.

**Follower Arm** - The length of the follower arm from the pivot point to the center of the roller.

**Pivot X Coord.** - The x coordinate of the pivot point. (The leading edge of the rectangle representing the cam is assumed to start at x coordinate 0.) A positive value for x positions the pivot to the right of the cam. A negative value positions the pivot to the left of the cam.

**Pivot Y Coord.** - The Y coordinate of the pivot point. Y is measured from the base of the cam.

**Initial Angle** - The initial angle of the follower arm (measured counter-clockwise from the positive x axis). Angular displacements are measured with the initial angle as 0. Positive displacements represent counter-clockwise rotation of the follower.

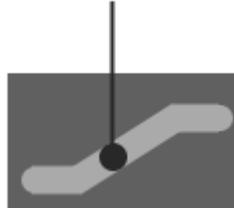
**Velocity Units** - degrees/length

- Note: The x coordinate is the angle on the barrel cam measured in degrees. The pivot x coordinate can be positive or negative. The initial angle is the initial angle of the follower measured from the

positive x axis.

## Linear

### Reciprocating Follower



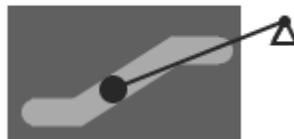
**Cam Width** - The width of the cam.

**Follower Radius** - The radius of the follower roller.

**Velocity Units** - degrees/length

- Note: Instead of cam angle, you see cam displacement.

### Oscillating Follower



**Cam Width** - The width of the cam.

**Follower Radius** - The radius of the follower roller.

**Follower Arm** - The length of the follower arm from the pivot point to the center of the roller.

**Pivot X Coord.** - The x coordinate of the pivot point. (The leading edge of the rectangle representing the cam is assumed to start at x coordinate 0.) A positive value for x positions the pivot to the right of the cam. A negative value positions the pivot to the left of the cam.

**Pivot Y Coord.** - The Y coordinate of the pivot point. Y is measured from the base of the cam.

**Initial Angle** - The initial angle of the follower arm (measured counter-clockwise from the positive x axis). Angular displacements are measured with the initial angle as 0. Positive displacements represent counter-clockwise rotation of the follower.

**Velocity Units** - degrees/length

- Note: Instead of cam angle, you see cam displacement. The pivot x coordinate can be positive or negative. The initial angle is the initial angle of the follower measured from the positive x axis.

## Cam / Follower Description Buttons

	<b>Button Type</b>	<b>Applies to Cam / Follower Type</b>
	Clockwise / Counter Clockwise	All Plate Cams
	Follower Orientation Below / Above	Plate Cams - Oscillating Follower
	Internal / External Cam	Plate Cams - Roller Follower
	Offset Left / Right	Plate Cams - Reciprocating Roller Follower
	Barrel Rotating Left / Right	All Barrel Cams
	Upper / Lower Cam Surface	All Barrel and Linear Cams
	Linear Sliding Left / Right	Linear Cams

## Clockwise / Counter Clockwise

Specifies the direction of the cam rotation.



Clockwise



Counter Clockwise

## Follower Orientation Below / Above

Specifies the orientation of the follower.



Follower is below the cam.



Follower is above the cam.

## Internal / External Cam

Specifies that the follower is internal or external to the surface of the cam.



Internal to the cam



External to the cam

## Offset Left / Right

Specifies the side of the roller offset to the cam axis.



Roller is offset to the left.



Roller is offset to the right.

## Barrel Rotating Left / Right

Specifies the direction of the cam rotation. This rotation is the direction that the active surface of the barrel cam is moving.



The barrel is rotating left.



The barrel is rotating right.

## Upper / Lower Cam Surface

Indicates position of the cam surface relative to the follower.



The cam surface is on top of the follower.



The cam surface is below the follower.

## Linear Sliding Left / Right

Specifies the direction the cam moves.



Cam slides to the left.



Cam slides to the right.

## Data Table

The Data Table provides numerical data on displacement, velocity, acceleration and jerk (abbreviated in the Data Table as  $s$ ,  $v$ ,  $a$ ,  $j$ ). You can enter  $x / y$  or  $r / \theta$  data manually into each cell. You can cut, copy and paste from a text editor, spreadsheet or other Windows data, or you can have the cam profile data synthesized by the application, using the Function dialog and the Cam/Follower Configuration options.

The Data Table contains vertical and horizontal scroll bars for viewing data. The columns in the table allow you to expand or reduce the width of a column by clicking and dragging the horizontal bar separating each column.

In the **Edit / Options** dialog the default number of **Data Points** is set to 72. You can change this value to get more or less precision.

The items below appear as column headings in the Data Table.

- Cam Angle
- $s$  (Displacement)
- $v$  (Velocity)
- $a$  (Acceleration)
- $j$  (Jerk)
- $x$  (Cam Profile Coordinate)
- $y$  (Cam Profile Coordinate)
- $r$  (Cam Profile Polar Coordinate)
- $\theta$  (Cam Profile Polar Coordinate)
- r.o.c. (Radius of Curvature)
- Pressure Angle

### Cam Angle / Displacement

Each row of the table represents the relationship between the cam and the follower at a specific moment in the motion of the cam. The **Cam Angle** gives the number of degrees the cam has rotated at that moment. In the

case of linear cams, this column displays the **Cam Displacement**.

## s (Displacement)

This is the displacement of the follower away from the base displacement. (The base displacement is the location of the follower relative to the base circle.)

## v (Velocity)

The velocity of the follower expressed in terms of cam angle. (Example: if the cam angle is theta,

$$v = \frac{ds}{d\theta} .)$$

## a (Acceleration)

The acceleration of the follower again in terms of cam angle  $a = \frac{dv}{d\theta}$  .

## j (Jerk)

The jerk (derivative of acceleration) again in terms of cam angle  $j = da/d(\text{theta})$ .

## x (Cam Profile Coordinate)

Contact point x coordinate. This is the point of contact between the cam and the follower at the given cam angle. For a barrel cam, the x coordinate column gives the angle of the contact point on the cam surface.

» Note: The contact points define the profile of the cam.

## y (Cam Profile Coordinate)

Contact point y coordinate. This is the point of contact between the cam and the follower at the given cam angle.

» Note: The contact points define the profile of the cam.

## **r (Cam Profile Polar Coordinate)**

Contact point r coordinate. This is the distance (for a given cam angle) from the point of contact between the cam and follower and the center of the cam base circle.

» Note: The contact points define the profile of the cam.

## **theta (Cam Profile Polar Coordinate)**

Contact point theta coordinate. This is the orientation (for a given cam angle) of the line from point of contact between the cam and follower and the center of the base circle.

» Note: The contact points define the profile of the cam.

## **r.o.c. (Radius of Curvature)**

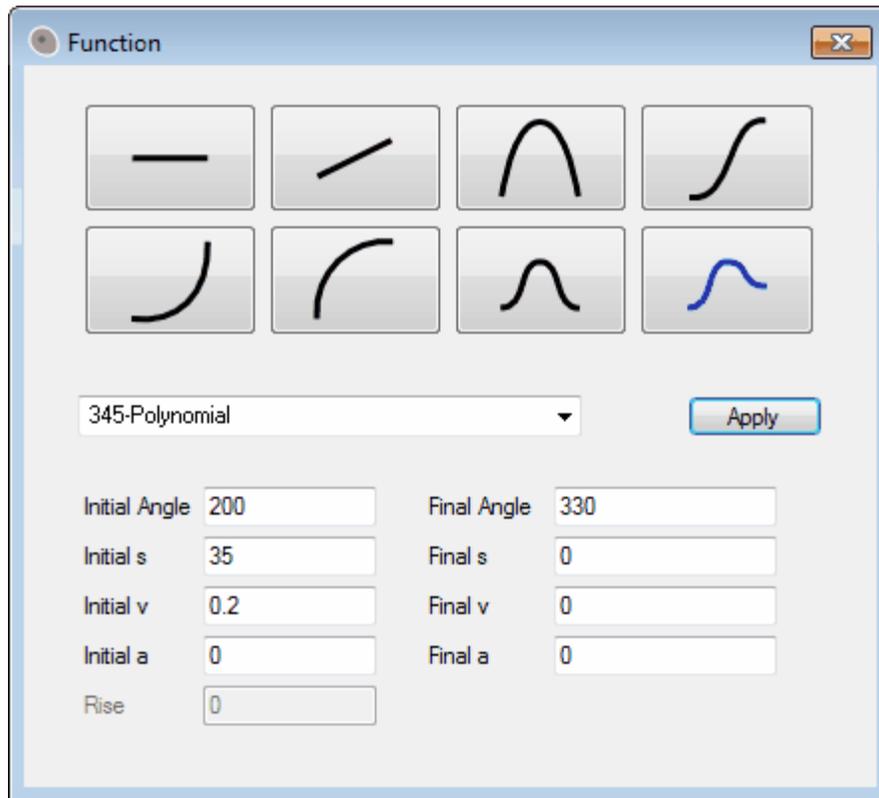
r.o.c. gives the radius of curvature of the cam at the contact point.

## **Pressure Angle**

Gives the angle between the direction of motion of the follower and the direction of the axis in transmission. For flat face followers, the pressure angle is 0.

## **Function Selection**

The Function dialog allows you to choose the type of curve between points when in the Follower-to-Cam mode.



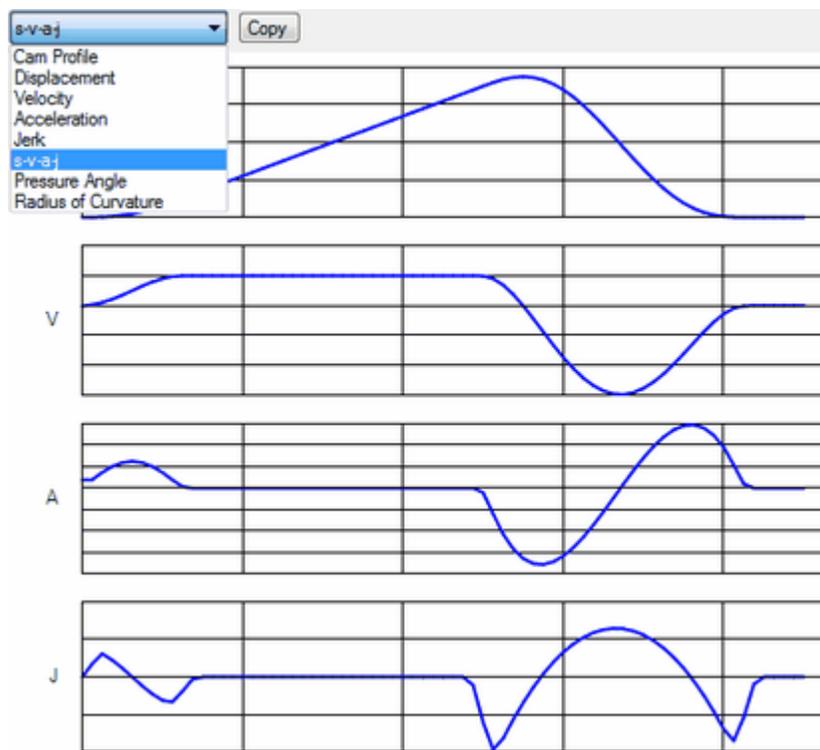
Most of the function types are associated with only one curve shape, but some of the shapes are quite versatile as you can see in the table below. You can select a shape and the appropriate function types will be highlighted in the drop-down menu. Or, you can select a function type and an associated shape will turn blue. You can then select another appropriate shape if one exists. (As you can see from the table, only the Cycloidal and Polynomial functions have multiple shape associations.)

Function Type	Curve Shape
Dwell	
Constant Velocity	 <b>Dwell</b>
Constant Acceleration	 <b>Constant Velocity</b>
Cycloidal	 <b>Full Rise</b>  <b>1st Half Rise</b>  <b>2nd Half Rise</b>
Modified Harmonic	 <b>Modified Harmonic</b>
Modified Trapezoid	 <b>Full Rise</b>
Modified Sine	 <b>Full Rise</b>
345-Polynomial	 <b>Full Rise</b>  <b>1st Half Rise</b>  <b>2nd Half Rise</b>  <b>Polynomial Spline</b>
4567-Polynomial	 <b>Full Rise</b>  <b>1st Half Rise</b>  <b>2nd Half Rise</b>  <b>Polynomial Spline</b>

## Analysis Area

At any time while defining the values and parameters for the cam and follower, you can examine various graphs in the Analysis area. (This appears in the lower right portion of the main window.)

The drop down menu in the Analysis area provides views of the following properties: Cam Profile, Displacement, Velocity, Acceleration, Jerk, s-v-a-j (shown together on the screen for comparison), Pressure Angle, and Radius of Curvature.



» Note: In the case of an oscillating follower type, displacement is angular.

The **Copy** button lets you copy these graphs to the Windows Clipboard for pasting into other applications.

## File Menu

New

Open  
Save  
Save As  
Exit

## New

Displays a new Analytix Cams 21 window where you can create a new design.

## Open

Displays an Open dialog box where you can select a design to open or data from a text file. Formats you can open include Analytix Cams 21 files (\*.cam), or comma- or tab-delimited ASCII. If you open an ASCII file with x,y or r,theta pairs separated by carriage returns, the data will be automatically inserted into the data table.

## Save

Saves the current document using a name you've previously defined.

## Save As

Opens the Save As dialog box, which allows you to name the document and determine the format in which to save it. Formats include DXF, CAM and tab-delimited ASCII.

## Exit

Quits Analytix Cams 21. If you have made modifications to a previously saved document or have not yet saved the document, you are given that option.

## Edit Menu

Undo  
Redo  
Copy  
Paste  
Options

## Undo

Reverses the last action to its previous state.

## Redo

Works in conjunction with Undo to reverse the Undo command.

## Copy

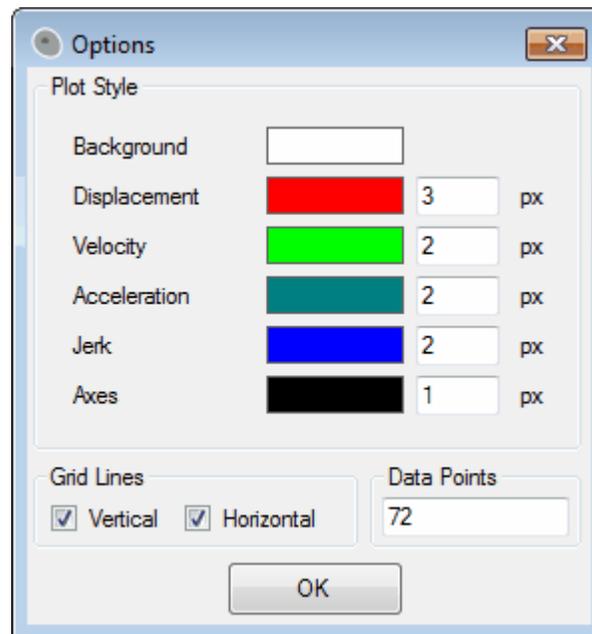
Leaves the selected text in the document and places a copy on the Clipboard for later pasting.

## Paste

Places the items on the Clipboard at the insertion point in the document.

## Options

Allows you to change the display properties in the Analysis area.



**Displacement, Velocity, Acceleration, Jerk, Axes and Background.**

**Colors** - Click the color box to change the color of the corresponding selection. Choose a Basic color from the Color pallet or click the Define Custom Colors button to build your own special color.

**Line Thickness** - Next to the color box is the data entry box for line thickness. A value of 1 is the thinnest.

**Grid Lines** - Click the appropriate toggle box to display Vertical and Horizontal grid lines.

**Data Points** - The default is 72. You can change this value by entering the desired number.

Click **OK** to save your changes. To cancel any changes you just made, click the red X box  in the upper right corner of the dialog.

## Help Menu

Use the Help menu to electronically access reference information about *Analytix Cams 21*.

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