Cam 1.1
Analysis and Visualization

CAM v1.0
Analysis and Visualization

Developed at Purdue University By
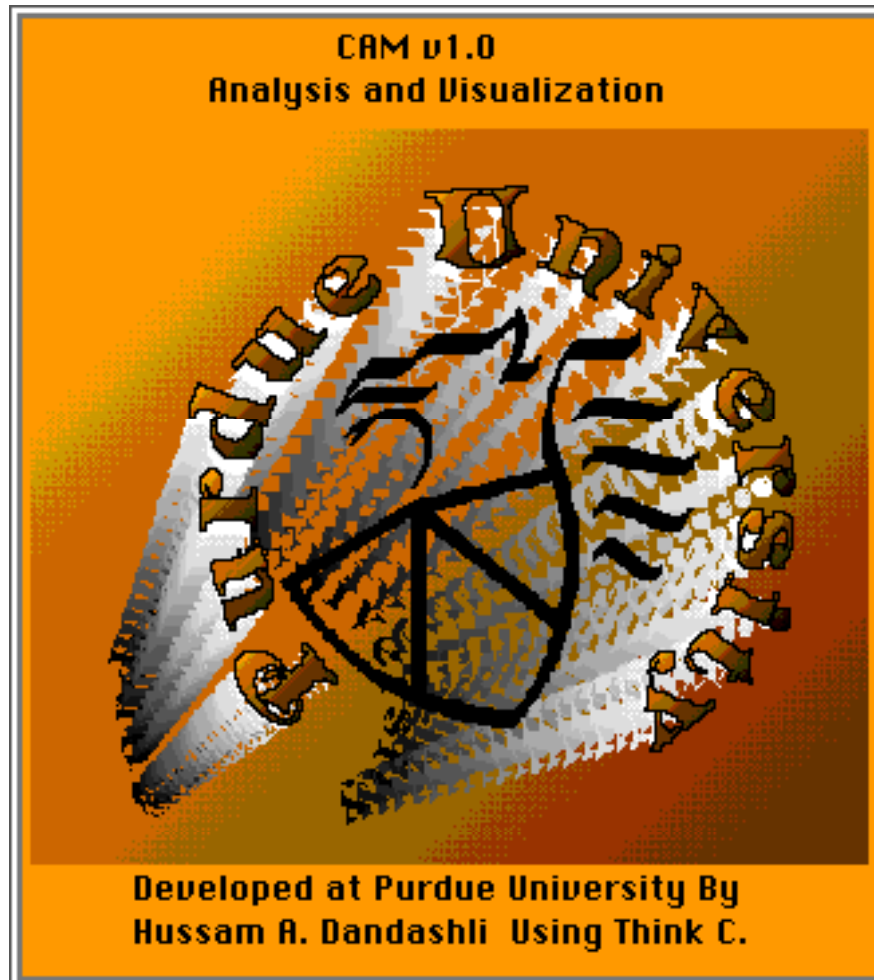Hussam A. Dandashli Using Think C.

programmed by:

Hussam Dandashli

Mechanical Engineering
Purdue University

1. Introduction

A cam is a mechanical element used to drive another element, called the follower, through a specified motion by direct contact. Cam-and-follower mechanisms are simple and inexpensive, have few moving parts, and occupy a very small space.

Cam mechanisms are used extensively in modern machinery. This software was written in an attempt to understand, design, and animate a cam with simple harmonic, cycloidal, and modified harmonic motions.
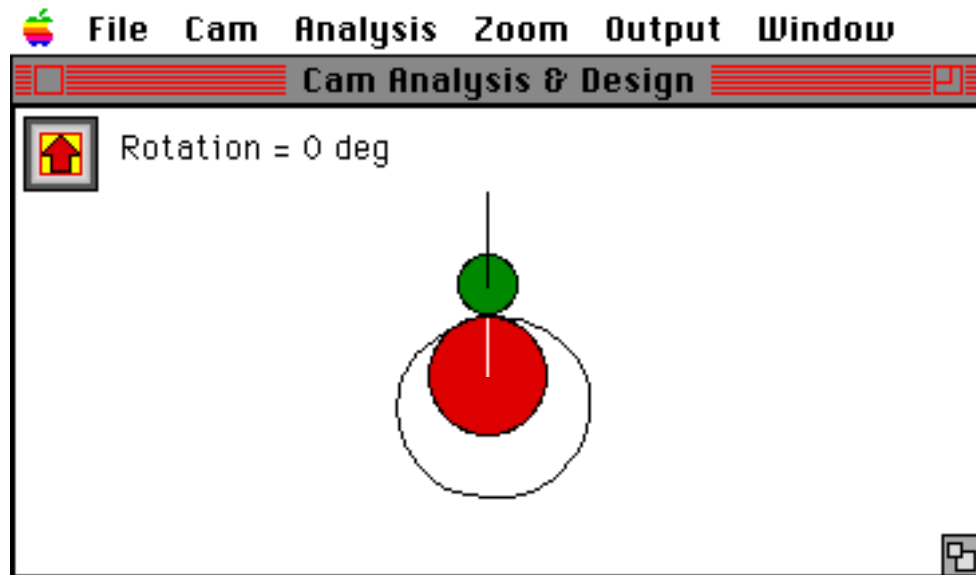
2. Starting Up

Double-click on the application icon to start Cam 1.0.

The program will start with the default settings:

* In-line roller follower with a radius, $R_f = 1$;
* Base circle radius, $R_b = 2$;
* Simple harmonic rise and return:
    * $0 \leq q \leq 160$ --> rise,
    * $160 \leq q \leq 180$ --> dwell,
    * $180 \leq q \leq 340$ --> return,
    * $340 \leq q \leq 360$ --> dwell.
* Lift, $L = 2$;
* Input angle increment = 10 degrees;
* Starting angle = 0 degrees;
* Analysis w.r.to input angle (units/rad);
* Animation duration is 1 cycle, no delay;
* Cam input parameters:
    * velocity = 10 rad/sec,
    * acceleration = 100 rad/sec^2,
    * jerk = 0 rad/sec^3.

The starting window will look like Figure 1.

Figure 1. Starting window with default settings.

3. Menu Description

Apple Menu:

About Cam 1.0... -> Displays the author and credits.
Help... -> Start an on-line help.

File Menu:

Load Input... -> Open a saved input file.
Show Input Format... -> Read an input file and see the contents.
Save as Input... -> Save the current settings as an input file.
Invert Screen -> Toggle the background between black and white.
Quit -> Exit the application.

Cam Menu:

Draw Cam -> Refresh the screen.
Animate -> Start the animation of the cam.
Cam Variables... -> Open a dialog box to edit the path profile:

Figure 3. Path variables dialog box.

Path Profile... -> Choose rise and return path profiles:

Figure 4. Path profile dialog box.

Animation Variables... -> Shows animation parameters dialog box:

Animation Parameters

Angle Increment: `10` (Deg)

Delay: `0` (1/60 sec)

Cycles: `1`

Starting angle: `0` (Deg)

`Cancel` `OK`
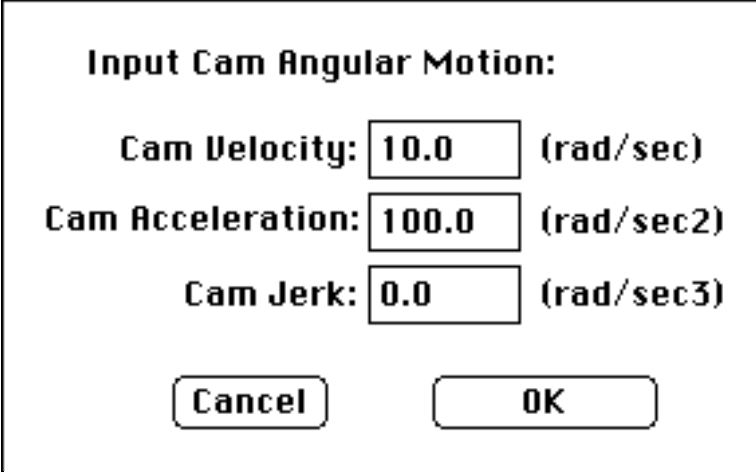
Figure 5. Animation dialog box.

Kinematics Input... -> Displays the cam kinematics input dialog:
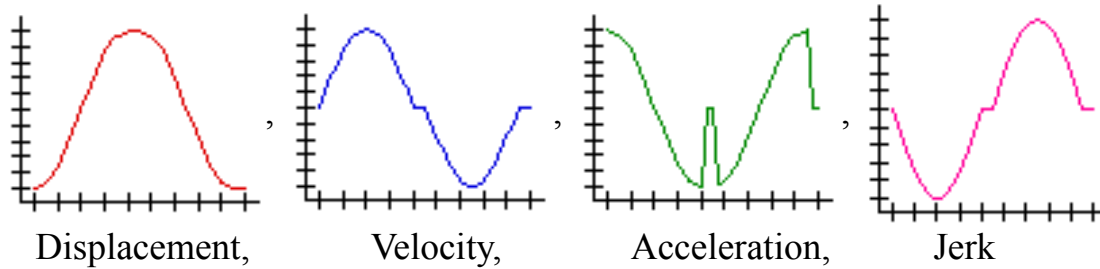
Input Cam Angular Motion:

Cam Velocity: `10.0` (rad/sec)

Cam Acceleration: `100.0` (rad/sec2)

Cam Jerk: `0.0` (rad/sec3)

`Cancel` `OK`

Figure 6. Kinematics input dialog box.

Analysis Menu:

The menu items would display :

Displacement,   Velocity,   Acceleration,   Jerk
Figure 7. Kinematics analysis in graphical form

and Pressure Angle (similar to velocity plot) of the cam follower subject to the input parameters. The kinematics analysis could be performed vs. time or vs. input angular properties.
Note that during animation or incrementing the input angle, a small cross hair will appear on the curve pointing to the current analysis result. This is especially helpful when correlating a certain position of the cam versus its kinematics properties.

Zoom Menu:

Adjusts the size of the cam mechanism for a clear view (IN, OUT, or Initial Zoom). The Zoom Rectangle option allows the user to select a rectangle in the window to zoom and fill the screen. Just select the menu option and click the mouse button and drag it producing the rectangle outline. When the mouse button is released the screen will display the contents of the zoom rectangle.

Output Menu:

Send the numerical results of the analysis to the screen (console) or to a file. An output file could be read by using menu item Read Output...

Window Menu:

Helps bring a certain window to the front especially when the screen gets cluttered with all the analysis windows.

4. Designing a Cam Mechanism

The use of this application is straight forward. The parameters could be modified with the help of the dialog boxes from the Cam menu. The analysis window will be automatically updated after each change. One thing to keep in mind is that the pressure angle should not exceed 30 or 35 degrees.