

Chestnut Pens



G Code Wrapper Program Help

Introduction

This help file is intended to explain the behaviour of the Chestnut Pens G Code Wrapper Program.

Contents

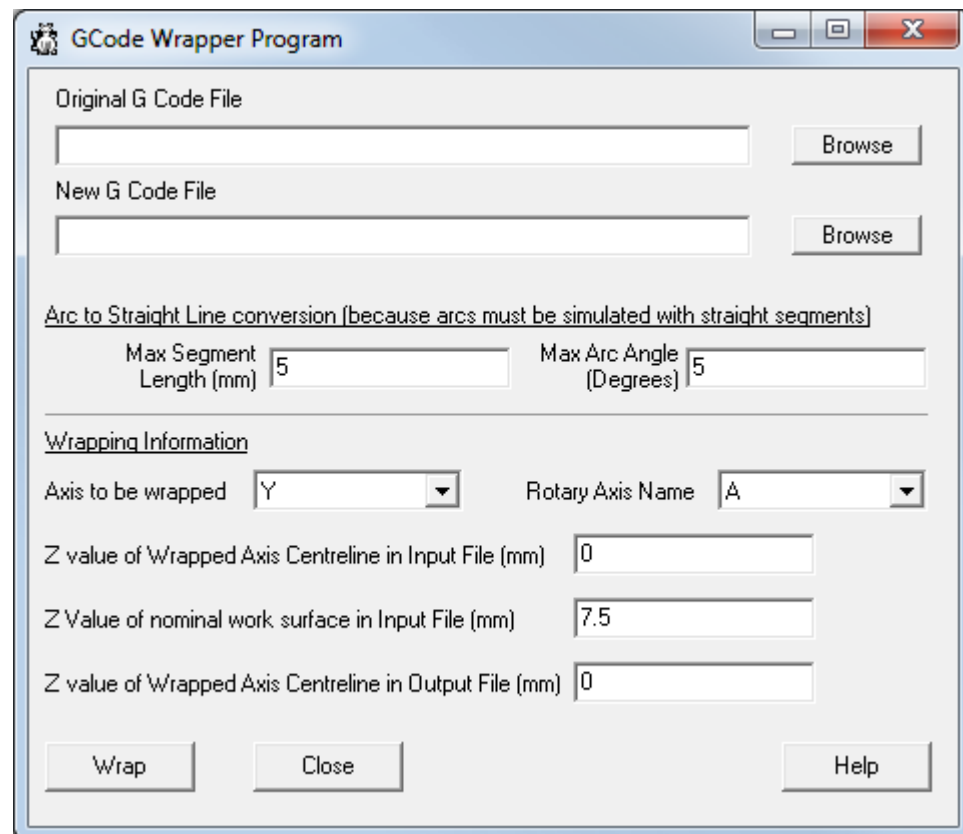
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Program Overview

The program does the fairly simple task of opening the input toolpath file, understanding it, breaking every arc into short straight segments and then converting the X or Y axis into rotary co-ordinates. Finally a new toolpath file is written to disc.

How To Use the Program

When you open the program you see the following window:



File Names

Use the 'Browse' button to the right of the 'Original G Code File' edit box, and search for the file you wish to convert. When you open a file, a suggested filename is made for the 'New G Code File', which is the old filename with ' wrapped' tacked on to the end. If this is default name is not what you want for the output name, please edit it or use the lower 'Browse' button.

Note: The program will not let you overwrite any files when it runs, so please be aware of this.

Arc Conversion

The next job is to enter the necessary accuracy for arc conversion into straight lines. There is no equivalent to the G2/G3 codes when the arc has been wrapped around a surface, so to simulate arcs they have to be converted to short straight segments. The shorter the segment, the more accurate the simulation of the arc. The downside of high accuracy is large file size and the probability that the CNC machine will not reach full feed speed. In many cases a simulation using 0.1mm segment length & a 1 degree maximum arc angle will be adequate.

GCode Wrapper Program

Original G Code File

New G Code File

Arc to Straight Line conversion (because arcs must be simulated with straight segments)

Max Segment Length (mm) Max Arc Angle (Degrees)

Wrapping Information

Axis to be wrapped Rotary Axis Name

Z value of Wrapped Axis Centreline in Input File (mm)

Z Value of nominal work surface in Input File (mm)

Z value of Wrapped Axis Centreline in Output File (mm)

Wrapping information.

This is the most important information that you enter.

The supplied G code must be in the XY plane, which means that either the X or Y directions can be wrapped. The rotary axis that can be wrapped to is, at the moment, limited to the A axis. [The reason for this is that I cannot seem to be able to force my version of Mach3 to consider the B or C rotary axes, I don't want to break it's control of my cnc machine's A axis by fiddling too much, and I do not want to release software I've not adequately tested.]

Z Value of Wrapped Axis Centreline in Input File

When you convert a G Code file to be wrapped, there is no information about what height the axis is. Normally you'd expect it to be at Z=0, but if you wish to change the radius of the work, set it at a different value.

Z Value of nominal work surface in Input file

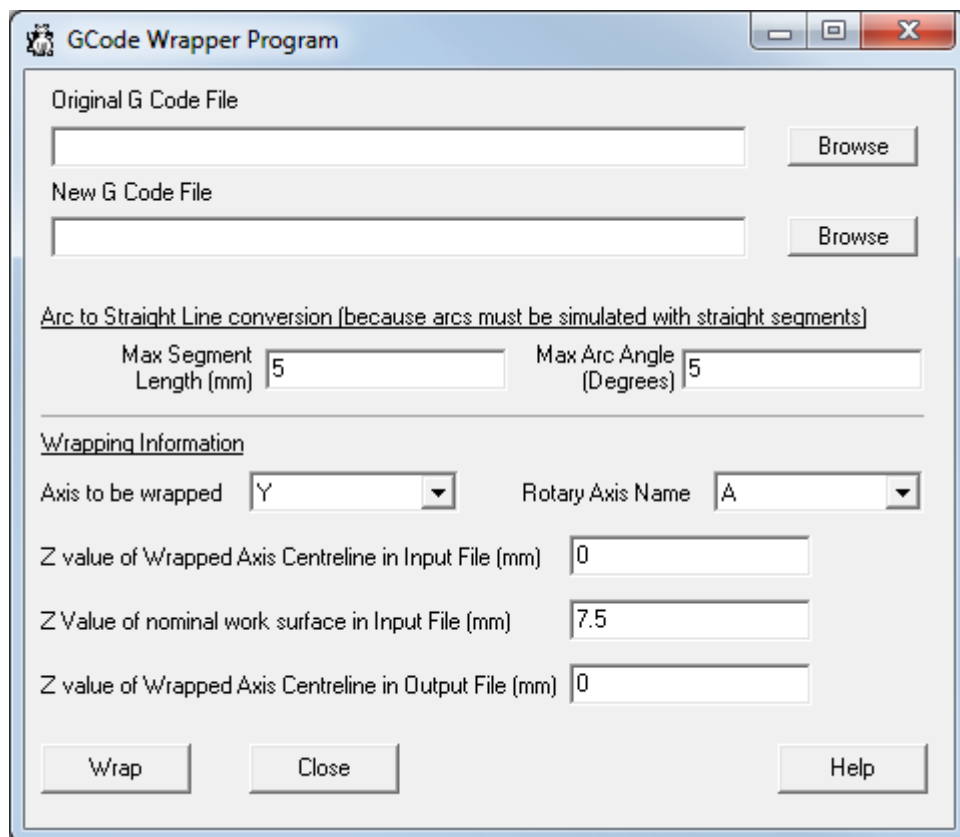
This value sets where the nominal worksurface, and the difference between this value and the previous value sets the radius of the work. It also sets the length of the perimeter of the wrapped axis. In the example above the radius of the work is 7.5mm, so if any Y values exceed 47.1239mm ($2 \times \pi \times 7.5$), then the resultant 'A' axis rotation will exceed 360 degrees.

When the X Axis is wrapped:

- The X = 0 line is at A = 0°
- The + X values give +A rotations
- The Y values are mapped onto the X axis.

When the Y axis is wrapped:

- The Y=0 line is at A = 0°
- The -Y values give +A rotations.
- The X values remain the same.



The screenshot shows the 'GCode Wrapper Program' dialog box. It has a title bar with a standard Windows icon and window controls. The main area contains several sections: 'Original G Code File' and 'New G Code File' each with a text input field and a 'Browse' button. Below these is a section titled 'Arc to Straight Line conversion (because arcs must be simulated with straight segments)' containing two input fields: 'Max Segment Length (mm)' with the value '5' and 'Max Arc Angle (Degrees)' with the value '5'. The next section is 'Wrapping Information', which includes a dropdown for 'Axis to be wrapped' set to 'Y', a dropdown for 'Rotary Axis Name' set to 'A', and three input fields for Z values: 'Z value of Wrapped Axis Centreline in Input File (mm)' set to '0', 'Z Value of nominal work surface in Input File (mm)' set to '7.5', and 'Z value of Wrapped Axis Centreline in Output File (mm)' set to '0'. At the bottom are three buttons: 'Wrap', 'Close', and 'Help'.

Z value of Wrapped Axis Centreline in Output file

This feature allows you to specify the Z value of the centreline of the A axis in the output file – in effect, in the previous example, you can specify the worksurface as being Z=0, even though the radius is 7.5mm.

'G Codes' Converted

The 'G Codes' converted are as listed below:

The program is not capable of understanding all the 'G codes', the ones it understands are as below:

(Comment)
F[Feed Rate]
G0 + X, Y, Z qualifiers
G1 + X, Y, Z, F, G53 qualifiers
G2 + I, J, K, X, Y, Z, F, G53 qualifiers. Up to 360 degrees per arc.
G3 + I, J, K, X, Y, Z, F, G53 qualifiers. Up to 360 degrees per arc.
G4 + P qualifier
G17
G18 All code between a G18 and G17 instruction is ignored and (with exceptions noted below) does not pass to the output file.
G19 All code between a G19 and G17 instruction is ignored and (with exceptions noted below) does not pass to the output file.
G20, but converts all the new file to mm. Inches are old fashioned. Stop using them.
G21
G40
G41 + D, P qualifiers
G42 + D, P qualifiers
G43 + H qualifier
G44 + H qualifier
G49
G50
G51 + A, B, C, X, Y, Z qualifiers
G52 + A, B, C, X, Y, Z qualifiers
G54
G55
G56
G57
G58
G59 + P qualifier
G61
G64
G68 + A, B, R, I qualifiers
G69
G70, but converts all the new file to mm. Inches are old fashioned. Stop using them.
G71
G90
G90.1
G91
G91.1
G92
G93
G94
G98 + R qualifier
G99 + R qualifier
M0
M1
M2
M3
M4
M5
M6
M7
M8
M9

M30
M47
M48
M49
M60
N[Line No]
O[Label]
P[Time]
R[Distance]
S[Spindle Speed]
T[Tool No]

A ROUGH estimate of the machining time is made and added to the file as a comment. This will not be terribly accurate as the rapid feedrate is unknown and the ability of the machine to move fast enough is not guaranteed. Also, if there are G51 scaling or G52/G68/G92 offsets added in the program, these will not be catered for in the time calculation.

The program will ignore all instructions except the G20, G21, G70, G71, M0, M1, M2, M5, M30, M47 or M60 instructions when the working plane is the XZ or YZ plane.

G2 & G3 conversion: If the end point is the same as the start point, then one full circle will be created (with perpendicular movement to working plane as required). This interpretation of the code is the same as that of Mach 3 and matches Mach3's toolpath illustration. Arc centre format is assumed, as for Mach 3.

The output is specified to 4 decimal places - if that is insufficient, contact me to get the output precision increased.

Limitations

Beyond the limitations already specified, it must be noted that the program discards all toolpath instructions when the XZ or YZ planes are specified. There WILL be a problem if the XZ or YZ planes are specified.

If the input file already contains A, B or C axis movements, there will be an error report and the output file may contain unexpected problems. The A, B or C axis instructions are all ignored.

The Canned cycles (G12, G13, G73, G80-89) are all removed from the program.

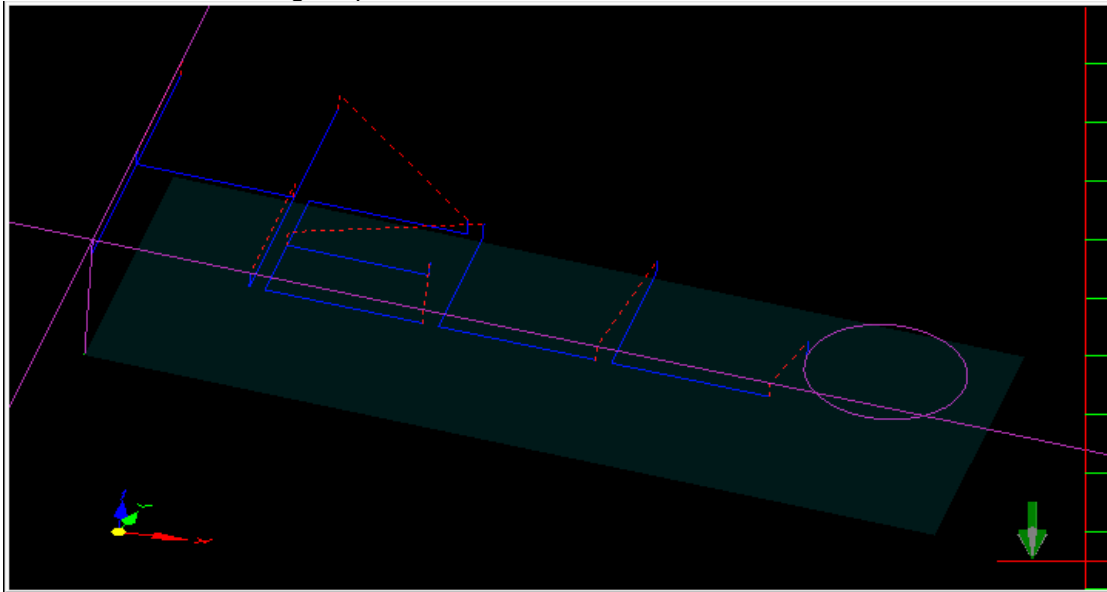
I think I understand the meaning of the G53 qualifier in the G1/G2/G3 codes, but it would be better not to include it if you can, because I may be wrong.

Example

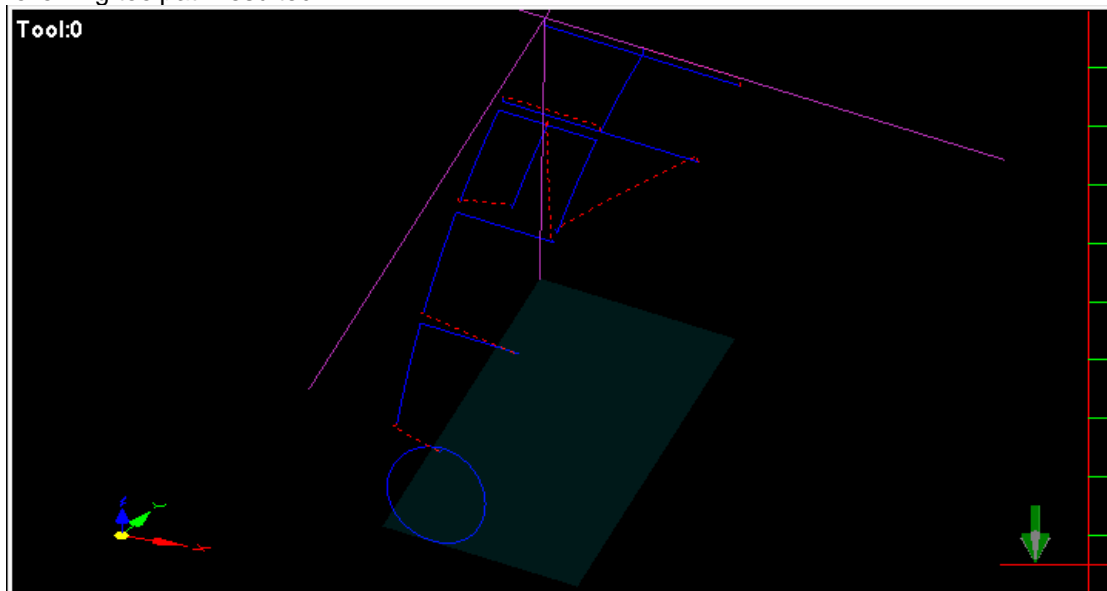
The following G Code was used:

```
(TEST WRAPPER SAYS 'HELLO')
G17 G21 G90 G90.1
F100
G0 X0 Y0 Z8.5
G1 Z7.5
G1 Y20
G0 Z8.5
G0 Y10
G1 Z7.5
G1 X10
G0 Z8.5
G0 Y0
G1 Z7.5
G1 Y20
G0 Z8.5
G0 X21 Y10
G1 Z7.5
G1 X11
G1 Y0
G1 X21
G0 Z8.5
G0 X20 Y5
G1 Z7.5
G1 X11
G0 Z8.5
G0 X22 Y10
G1 Z7.5
G1 Y0
G1 X32
G0 Z8.5
G0 X33 Y10
G1 Z7.5
G1 Y0
G1 X43
G0 Z8.5
G0 X44 Y5
G1 Z7.5
G2 X44 Y5 I49 J5
G0 Z8.5
M30
```

This created the following toolpath in Mach3:



When the X axis was wrapped around the A Axis and based on a 75mm work diameter, the following toolpath resulted:

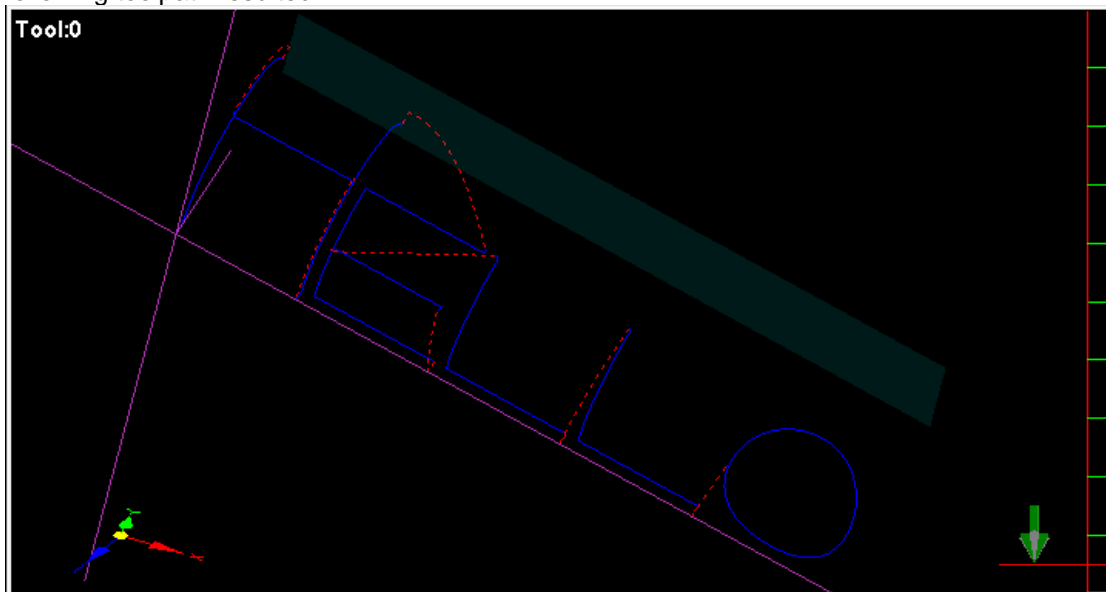


You will see that all Y values are converted to X, and all X values are converted to A axis rotations. Y = 0 maps on to X = 0, and X = 0 maps on to A = 0 with +ve X mapping onto +ve A rotations.

The above conversion was done with the following settings:

- Z Value of Wrapped Axis Centreline in Input File = -30
- Z Value of nominal work surface in Input File = 7.5
- Z Value of Wrapped Axis Centreline in Output File = 0

When the Y axis was wrapped around the A Axis based on a 15mm work diameter, the following toolpath resulted:



You will see that all X values remain the same, while, and all Y values are converted to A axis rotations. $Y = 0$ maps on to $A = 0$, and +ve Y values are obtained by -ve A rotations.

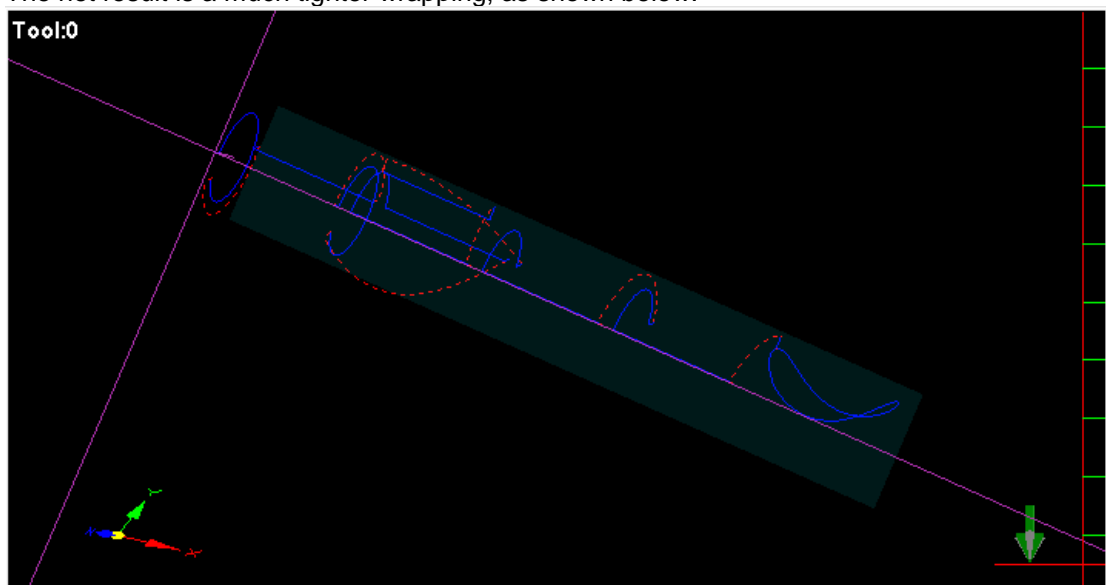
The above conversion was done with the following settings:

- Z Value of Wrapped Axis Centreline in Input File = 0
- Z Value of nominal work surface in Input File = 7.5
- Z Value of Wrapped Axis Centreline in Output File = 0

When the values are tweaked as below, the work radius is reduced to 3.5mm (7.5-4) and hence assumed to be a 7mm diameter work.

- Z Value of Wrapped Axis Centreline in Input File = 4
- Z Value of nominal work surface in Input File = 7.5
- Z Value of Wrapped Axis Centreline in Output File = 0

The net result is a much tighter wrapping, as shown below:



Problems/ Suggestions

If you have problems with the program, or suggestions, please send them in an e-mail to:
richardandtracy@yahoo.com

Mark the subject line with something sensible to do with the program, otherwise they'll get deleted unread.