

Software development for 3D visualization of G-Code when working with CNC machines

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CNC machine

Any CNC machine essentially consists of the following components:

- part processing program;
- a device for data input;
- a drive mechanism;
- a machine tool for controlling the movement of the machine along the X and Y axes in the plane and along the Z axis vertically;
- a feedback system (measuring system);
- machine control device.

G-CODE

The G-CODE teams themselves are divided into groups:

- * G - Preparatory (core) teams;
- * M - Auxiliary (technological) teams.

These commands have parameters:

- * X - The coordinate of the trajectory point along the X axis [G0 X100 Y0 Z0];
- * Y - The coordinate of the trajectory point along the Y axis [G0 X0 Y100 Z0];
- * Z - The coordinate of the trajectory point along the Z axis [G0 X0 Y0 Z100];
- * E - The coordinate of the extrusion point of the plastic [G1 E100 F100];
- * P - Parameter of the command [M300 S5000 P280];
- * S - Command parameter [G04 S15];
- * F - Command parameter, feed (speed) [G1 Y10 X10 F1000].

Emulation of the G-Code sweep

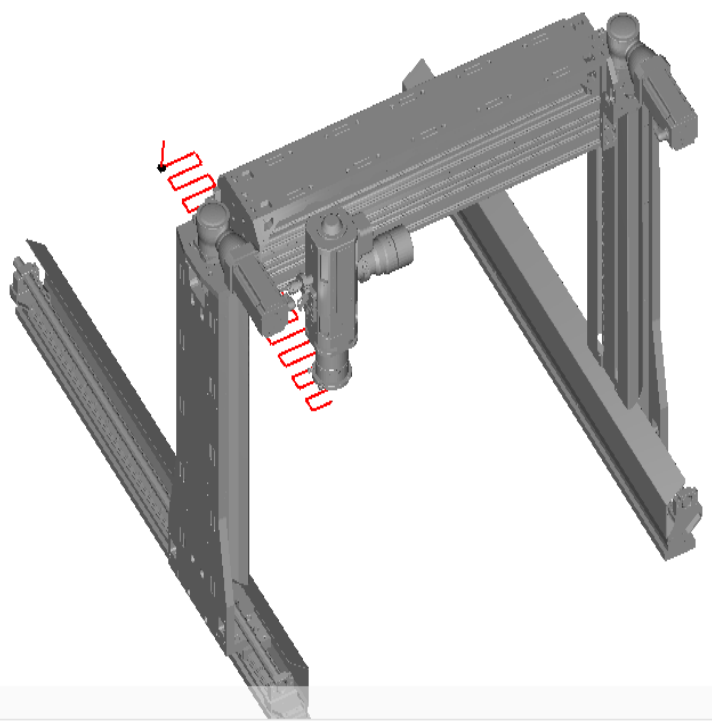
Beckhoff Application

BECKHOFF

TwincAT 19.02.2020
PLC 14:25:01

FPS:20.6

Test 1



X=1100
Y=73.6795
Z=0
A=-14.1
C=283.5086

Z
Y
X

Children: 11

Administrator Level: Admin

F1 F2 F3 F4 F5 F6 F7 F8 F9 F10 F11 F12

back

14:25
19.02.2020

ENG

The image shows a Beckhoff TwincAT software interface for PLC simulation. The main window displays a 3D CAD model of a mechanical assembly. Red wavy lines are overlaid on the model, representing a G-code sweep path. The interface includes a top menu bar with 'BECKHOFF', 'TwincAT', and 'PLC' information. A right sidebar shows simulation controls (Sim, Act, FileSir, Par) and coordinate data (X=1100, Y=73.6795, Z=0, A=-14.1, C=283.5086). A bottom toolbar contains function keys (F1-F12) and a 'back' button. The Windows taskbar is visible at the bottom, showing the time as 14:25 on 19.02.2020 and the language set to ENG.

Beckhoff TwinCat HMI Shell

Beckhoff Application

BECKHOFF

TwinCAT 30.10.2019
PLC 13:29:11

AxisName	McCurrentPosition McEndPosition	AcCurrentPosition AcEndPosition	AcPositionLag AcActiveFeedrate
X _{mm}	-28.25 -28.25	-28.25 -28.25	0.00 0.00
Y _{mm}	9.75 9.75	9.75 9.75	0.00 0.00
Z _{mm}	61.00 61.00	61.00 61.00	0.00 0.00
A _{mm}	85.80 85.80	85.80 85.80	0.00 0.00
C _{mm}	0.00 0.00	0.00 0.00	0.00 0.00

FRO - mm/min
0 0
F 100%

Power - W
0 0
P

EBeam
BC 0 A AV 0 V FC1 0 A FC2 0 A FC 0 A WV 0 V
Beam current, A: 0 Set

Technologie Daten Kanal 1 V3.01.3083.6400
M
G G1 G17 G40 G52 G54 G90 G150 G12
H
T T0 D0
N N0

Blocksearch Syntax Check TeachIn StopConditions Variables HSC diagnostics

```

# C:\cnc\test-1.nc
G54
;N1G40G49G80
;Setup 1
;5 Axis Surface Normal Machining
;N2(Tool Diameter = 5.0 Length = 90.0 )
;N3G21T2M6
;N4 S10000M3
N5 G1 X-2.2356 Y2.0445 Z61. A19.3 F3000.
N6 A19.3
N7 X-1.8334 Y1.9239 Z59.7987 A19.3
N8 G0 X-1.8711 Y1.933 Z59.7852 A19.3
N9 X-2.2387 Y1.9533 Z59.659 A19.3
N10 X-2.5981 Y1.8554 Z59.546 A19.3
    
```

Administrator Level: Admin

F1 Automatic F2 Manual F3 MDI F4 Mode F5 Start F6 Stop F7 Reset F8 EBEAM F9 Extruders F10 Path 3d F11 Zerooffsets F12 back