

MILLING AND ENGRAVING TECHNOLOGY USING THE CNC HIGH ZS-400 MACHINE TOOL

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Abstract:

The technical paper presents some specified aspects concerning the milling and engraving technology using CNC High ZS-400 machine tool. For CNC program was choose the imagine of Machine Manufacturing Technology Department from Faculty of Machine Manufacturing, Technical University “Gh. Asachi” of Iasi.

Keywords: milling, engraving, CNC machine tool

1. GENERAL CONSIDERATIONS

The Computer Numerical Control (CNC) was developed on the end of the 1940 year and beginning of the 1950 by John T. Parson in collaboration with MIT Servomechanism Laboratory. The CNC represents a tester which read the instructions received in G code and order the machine tool. The CNC realize the numerical interpolation of tool into the manufactured material by machine tool. The files with G code are usually with .NC extension.

The CNC machine tools convert the whole machine manufacturing industry. Thus any curve could be achieved easily like straight manufacturing. The complex models 3D are easy to copier. Also the operator intervention was meaningful down.

With the automatization introducing into the manufacturing process was increase the quality of the products and production achieved also.

Into the series production a number of CNC machine tools could be combinated into the one cell for manufacturing progressive of pieces parts.

Nowadays this machine tools are controled by computers with CAM software, thus any piece could be moved directly from design area to production area.

The CNC machine tools are a special segment from automatised industry system . G code is the any command name which is beginning with G letter and could send to the machine tools the following actions types such as:

- fast feed;
- manufacturing feed following a line or arc circle;
- feed manufacturing series for different processes;
- changing the trajectory;
- informations about wear tools.

The comune characteristics of each code type are presented on the table 1.

Tabelul 1 Comune characteristics of G codes

Nr. crt.	Characteristics
1	X absolute position
2	Y absolute position
3	Z absolute position
4	A position (X rotation)
5	B position (Y rotation)
6	C position (Z rotation)
7	U relative axis parallel with X
8	V relative axis parallel with Y
9	W relative axis parallel with Z
10	F work feed
11	S speed tool

12	N number of lines
13	R arc radius or optional move command to cycle
14	P Dwell time or optional move command to one cycle
15	T tool selection
16	D diameter of tool
17	H length of tool

The usual commands of High ZS-400 CNC Machine tools are presented on the table 2.

Table 2 Usual commands of High ZS-400

Nr.crt.	Command	Description
1	G00	Fast positioning
2	G01	Linear interpolation
3	G02	Circular interpolation on inverse trigonometric way
4	G03	Circular interpolation on trigonometric way
5	G04	Dwell
6	G10/G11	Data writing/Canceled data writing
7	G17	X-Y plan selection
8	G18	X-Z plan selection
9	G19	Y-Z plan selection
10	G20	Inch programming
11	G21	Mm programming
12	G28	Return to 0 point
13	G40	Tool stop radius compensation
14	G41	Tool radius compensation on the left
15	G42	Tool radius compensation on the right
16	G90	Absolute co-ordinates programming
17	G91	Incremental programming
18	G96/G97	Constant cutting speed /Constant rotation speed

The main characteristics of the machine tool are:

-for engines Nanotech with 1600 steps/rotation;

-two engines for constant pressure during the milling process along the X axis;
 -fast feed 1500 mm/min;
 -repositioning error 0,0187mm;
 -dimension of the work table 730 x 400mm;
 -work races X=400mm; Y=300mm; Z=110mm;

-dimensions including the engines: LxWxH = aprox. 650x500x500mm;

-software PC-NC or WIN PCNC Light.

The general view of the machine tool is presented on the figure 1.

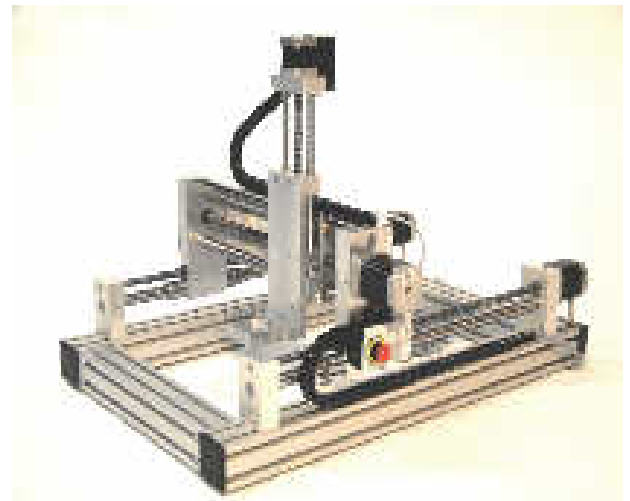


Fig. 1 General view of the High ZS-400 machine tool

The figure 2 presents some pieces which were manufactured using the High ZS-400 machine tool.

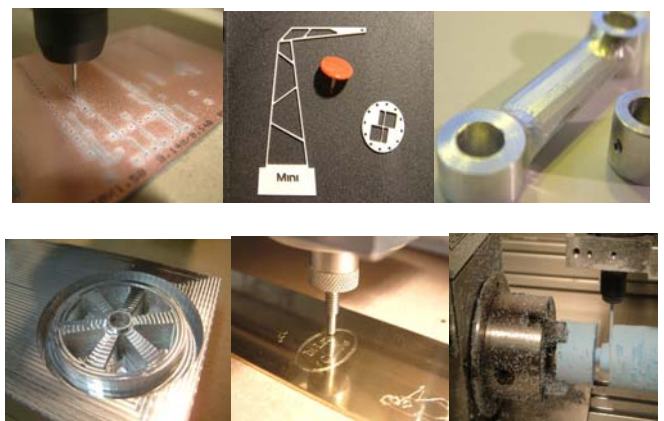


Fig. 2 Manufactured pieces with High ZS400 machine tool

2. TECHNICAL CONSIDERATIONS

The main steps to be followed are as follow:
 -the achieve of CAD model of piece using the CAD-CAM software. Was choose the TCM imagine (figure 3-Department of Machine Manufacturing Technology);
 -the G code programme using the CNC High ZS-400 software (table 3);
 -the establish of cutting parameters;
 -sending the G code programme to the machine tool;
 -process achieving;
 On the figures 4, 5, 6 and 7 are shortly presented the manufacturing steps of imagine from figure 3.

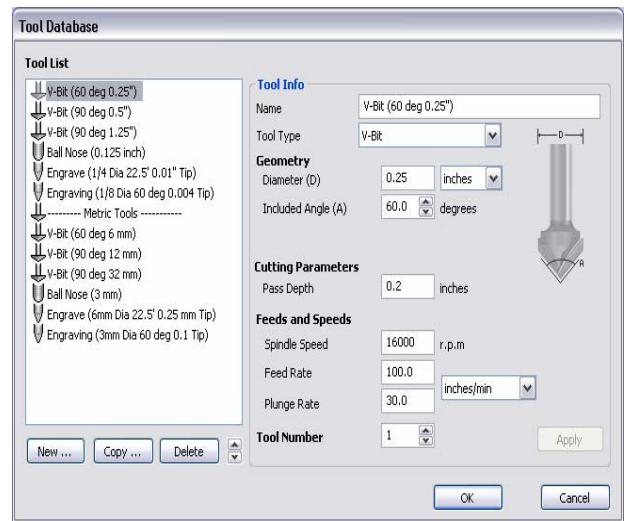


Fig. 5 Cutting parameters and tool establish

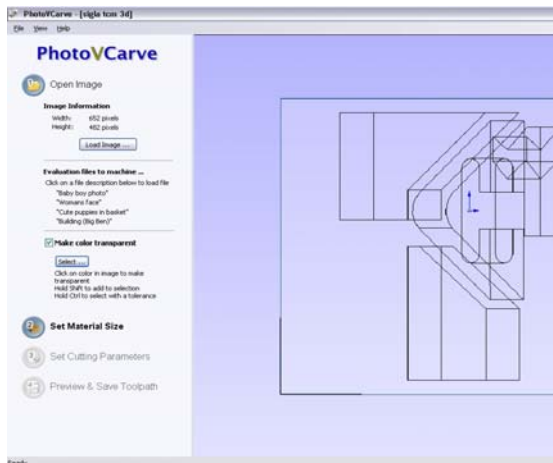


Fig. 3 TCM imagine

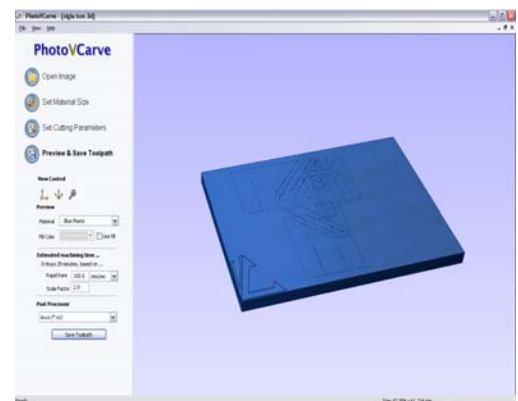


Fig. 6 Simulation of Manufacturing Imagine

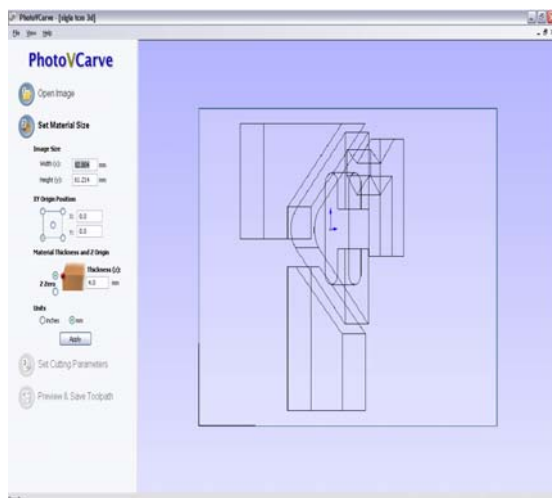


Fig. 4 Selection of imagine size

Table 3 G code of TCM imagine

Line number	Command
1	T1M6
2	G17
3	G0Z1.524
4	G0X0.000Y0.000S16000M3
5	G0X128.373Y0.053Z1.524
6	G1Z-0.721F2540.0
7	X128.749Y0.298Z-0.657
8	X128.875Y0.379Z-0.657
9	X129.126Y0.542Z-0.752
10	Z1.524
11	G0X128.928Y1.673
12	G1Z-0.866F2540.0
13	X128.802Y1.591Z-0.762
14	X128.677Y1.510Z-0.748
15	X128.551Y1.428Z-0.674
16	X128.426Y1.346Z-0.698

17	X128.174Y1.183Z-0.617
18	X127.923Y1.020Z-0.653
19	X127.797Y0.938Z-0.736
20	X127.044Y0.449Z-0.743
21	X126.792Y0.286Z-0.659
22	X126.415Y0.041Z-0.698
23	Z1.524
24	G0X124.458Y0.029
25	G1Z-0.698F2540.0
26	X125.086Y0.437Z-0.750
27	X125.589Y0.763Z-0.698
28	X126.468Y1.334
29	X126.845Y1.579Z-0.759
30	X127.097Y1.742Z-0.745
31	X127.474Y1.987Z-0.629
32
33	G1Z-0.852F2540.0
34	X36.064Y113.864Z-0.762
35	X48.628Y122.023Z-0.754
36	X48.754Y122.105Z-0.725
37	X49.005Y122.268Z-0.750
38	X49.633Y122.676Z-0.726
39	X49.759Y122.758Z-0.755
40	X49.884Y122.839Z-0.672
41	X50.261Y123.084Z-0.702
42	X50.387Y123.166Z-0.626

43	X50.513Y123.247Z-0.742
44	X51.895Y124.145Z-0.752
45	X52.020Y124.226Z-0.719
46	X52.523Y124.553Z-0.751
47	X52.774Y124.716Z-0.662
48	X53.528Y125.205Z-0.760
49	X61.946Y130.672Z-0.762
50	Z1.524
51	G0X57.350Y128.947
52	G1Z-0.910F2540.0
53	Z1.524
54	X56.596Y128.457
55	Z-0.864
56	Z1.524
57	X56.094Y128.131
58	Z-0.762
59	X39.384Y117.279
60	Z1.524
61	G0Z1.524
62	G0X0.000Y0.000
63	M30

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