ASPECTS OF CNC PROGRAMMING IN THE WOOD INDUSTRY

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RESEARCH ARTICLE

Abstract
The programming of CNC machine tools in the woodworking industry is ensured by the improved simulation performance and the use of a multi-touch panel ensures an intuitive graphical operation. Moving, zooming in/out, scaling and rotating 3D models, as well as displaying lists of tool parameters, programs and other information can be easily done with the same feeling as using a smart mobile.
This intelligent machining infrastructure ensures high precision and high productivity, achieving the best results of each machine with no thermal distortion, no collisions, no mechanical disturbances and automatic optimization of the cutting tool path at the best machining conditions.

INTRODUCTION

Programming – An NC program is a list of instructions (commands) that completely, sequentially describe each operation to be performed by the machine. The form that program instructions can take, and how programs are stored or loaded into the machine, depends on the machine/control system.

In programming, before describing the motion of any machine component, it is necessary to establish a coordinate system as a frame of reference for identifying the type and direction of motion. The geometry of the parts is programmed with references to the same axes that are used to describe the movements.

The operator answers a series of questions describing the part, material, part, machine settings, and machining operations by typing numbers that identify the material, blank dimensions and thickness or diameter, tool definition, and other requested information. Depending on performance, some controllers can choose the required spindle speed and feed automatically using a table of materials, other systems require input of spindle speed and feed. The movements of the tool required for the processing of the part are described by selecting a programming mode of linear or rotational movements and by entering the endpoint and the coordinates of the intersection of the lines, radii, diameters, points of tangency and the direction of arcs of circles and circles (on some controllers, the points of intersection and tangency are calculated automatically.

Computer-assisted part programming (CAPP), uses a computer to help prepare detailed instructions for using a CNC machine. The more complicated the part, the more the benefits of computer-aided programming increase and if the number of parts to be programmed is greater, even if they are simple parts, the benefits of a computer-aided programming system are substantial. (Ganea M., 2009).

Revised files must be run and post-processed again for part changes to be included in the part program (Ganea M., 2010, Jain, A. K., 1989).

A postprocessor is software that contains a set of instructions developed by a computer programming language to meet the requirements of a particular machining tool/machine combination. The research for the present paper was carried out at a company in the field of wood processing in Maramureş.

MATERIAL AND METHOD

A block of data that could be used to generate the cycle functions is also shown above each illustration. The blocks shown are illustrative examples of fixed cycles and do not represent the fixed cycles of any particular system manufacturer. (Derecichei L. et al., 2013, Derecichei L. et al., 2017, Derecichei L. et al., 2018, Lucaci C., et al., 2013, Lucaci C., et al., 2016).

The G81 block is for a simple drilling cycle.

```
        N____ G81
X____Y____C____D____F____EOB
N____X____Y____EOB
```
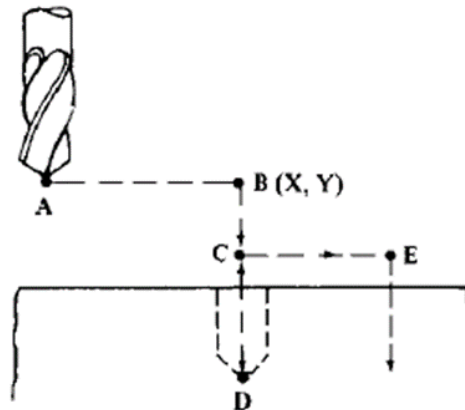

Figure 1. **Simple drilling cycle (**Ganea M., 2010**)**

The G81 drilling cycle will move the drill from position A to position B and then down to position C at rapid feed rate; the drill will be moved from point C to point D at the programmed feed and then returned to position C at the rapid feed rate. If the cycle is to be repeated at point E in the drawing, it is only necessary to specify the X and Y coordinates.

This possibility of repetition is specific to closed cycles (Ganea M., 2010, Derecichei L., 2020, Derecichei L., 2019).

Block G82 is also for drilling cycles.
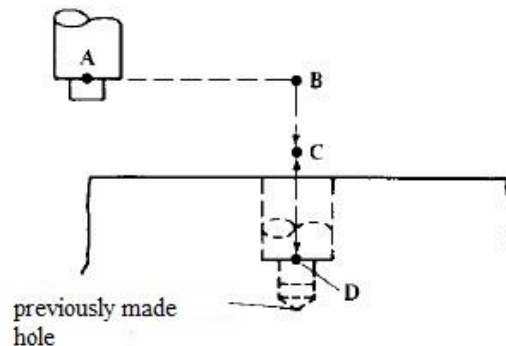
```
        N____G82
X____Y____C____D____T____F____EOB
```


Figure 2 **Drilling cycles with the previously made hole (**Ganea M., 2010**)**

The G82 code performs a cycle similar to the cycle generated by the G81 code except for the waiting time at point D. The waiting time at point D allows machines to finish the newly created formwork. The waiting time is denoted as a T word. (Ganea M., 2010, Derecichei L.,

2013, Derecichei L. et al., 2014, Derecichei L. et al., 2015)
G87 is a retraction drilling cycle chipper manual.

```
        N____G87 X____Y____C____D____F____EOB
```
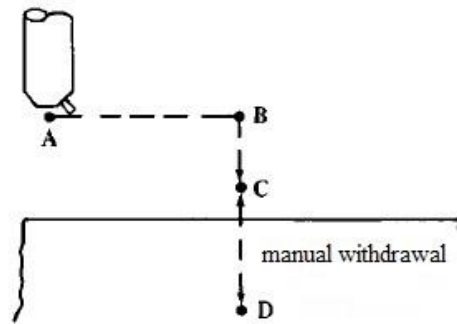
Figure 3 **Drilling cycle with manual retraction of the cutting tool (**Ganea M., 2010**)**

RESULTS AND DISSCUSION

The main program they work with is E-lab, which is a program of the latest generation and which is updated every day according to the requirements of customers and their needs. Choosing the area to work on

You can choose to work with both tables at the same time (it is used for large landmarks such as table tops) and work on each table with a different landmark (on table 1A with the front-left leg and on table 2A with the back-right leg) according to the figure 4 (hwlibre.com, pade.it, cnc-3d.ro, Ganea, M., 2010).
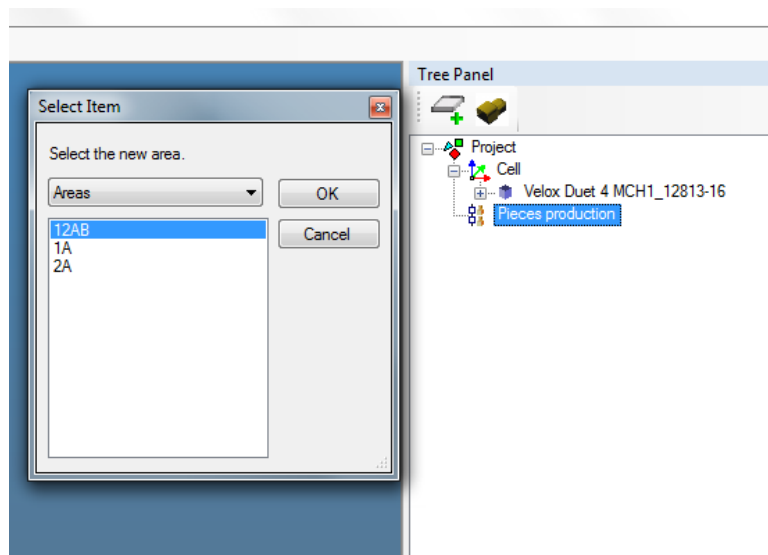

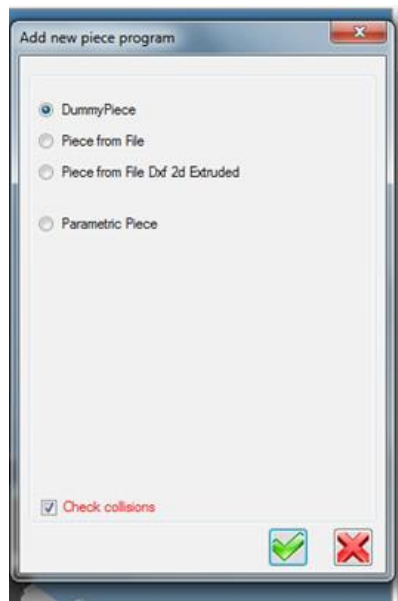Figure 4 **Choice of working mode (woodworking company)**

Figure 5 **We choose the type of track (woodworking company)**

The steps to be followed for choosing the part are shown in figure 6. DummyPiece → an invisible virtual piece

Piece from File → a track from the E-lab file

Piece From File Dxf 2d Extruded → A 2D DXF outline to be extruded

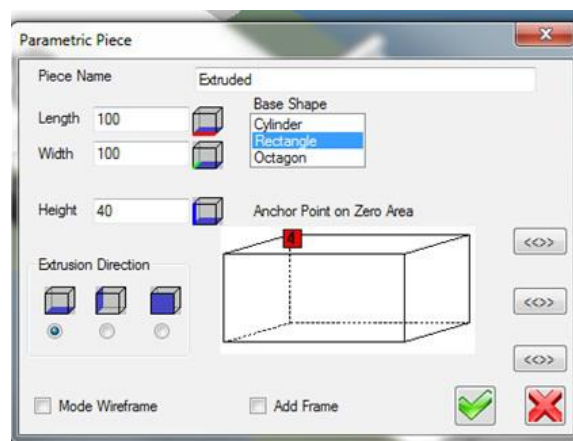Parametric Piece→ A rectangular cylindrical or hexagonal piece with the dimensions we want

Figure 6 **Choosing the size of the piece (woodworking company)**

The motors and tools with which we want to work are chosen (maximum rotation and direction of rotation of the motors, dimensions of the tools) (Derecichei L. et al., 2018, Derecichei L. et al., 2020).

In this situation we have 3 types of tools figure 7 on one head.

a. Cutter with a diameter of 20 mm, direction of rotation to the right;

b. Profile milling cutter with a diameter of 30mm, direction of rotation to the right;

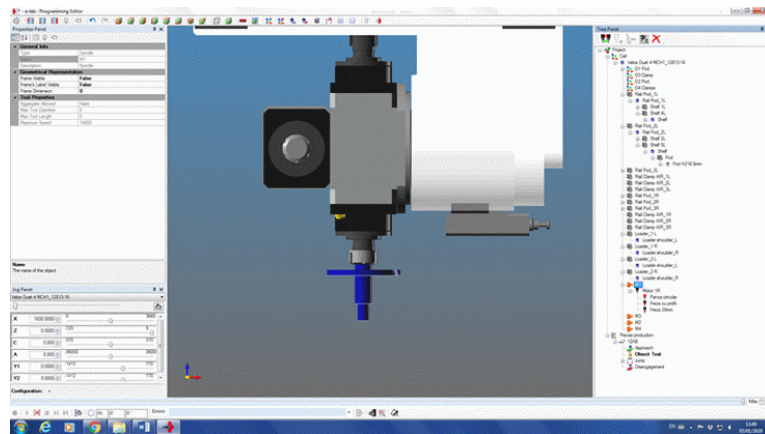c. Circular cloth diameter 130, direction of rotation to the left.

98

Figure 7 **Choosing the motors parameters (woodworking company)**

Below are the obtained post-processing sequences: (sprutcam.com)
%

(GENERATED BY SprutCAM)

(DATE: 18.05.2023)
(TIME: 10:01:02)

(TOOLS LIST)
(T1 CYLINDRICAL_MILL D18)
(T2 SPHERICAL_MILL D6)
(T3 SPHERICAL_MILL D24)

G00G21G40G49G69G80G90G17
G53Z0.
G53B0.C0.

(ROUGHING WATERLINE)
G53Z0.
G53X0.Y0.
T1M6 (20MM ENDMILL)
G54
G68.2X0.Y0.Z0.I0.J0.K360.
G53.1
G17
S200M3
G00G43H1X64.429Y-32.402Z10.B0.C0.

....

G02X-14.619Y-40.396I12.108J50.42
X-17.972Y-42.392I-27.256J41.97
G01X-55.08
G02X-64.332Y-33.922I0.643J9.99
G03X-52.076Y-38.045I21.148J42.577
X-45.81Y-38.698I7.451J41.13

CONCLUSIONS

The capabilities of CNC lathes, CNC milling centers and industrial robots can be continuously improved by developing the software used.

Today every manufacturer of CNC electronic control equipment offers and supports its own version of the CNC machine tool programming language. By changing the operating parameters, CNC machines can be quickly programmed to perform very diverse operations, with varying degrees of complexity. CNC machines allow the simulation of the machining process at high speed, thus avoiding possible problems that can interrupt the cutting and later changes can be made in the program lines.

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