SIMULATION OF SCULPTURAL SURFACE PROCESSING IN WOOD IN 5 AXIS CNC WITH SPRUTCAM PROGRAM

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Abstract

Simulation of the CNC 5-axis machining operation was carried out with the SprutCam program, which was obtained from the "Hermann Oberth" Engineering Faculty, Sibiu, in the department of MACHINERY AND INDUSTRIAL EQUIPMENT. The processing of some pieces of the wood industry and wood musical instruments can be done with CAM programs. The CAM can generate programs for milling machine tools (CNC machining centers) with up to 5 numerically controlled axes (3 translation axes and 2 axes of rotation). For complex model processing, it is recommended to use the "Waterline" finishing for the 3D model of the piece. Artificial intelligence elements involved in this process of interpretation of the geometrical configuration of the parts or the manual entry of characteristics or by taking them from a CAD module. The use of computer assisted manufacturing is a step forward in designing technologically and economically competitive technological processes. Preparing CNC machining programs for parts with three-dimensional complex surfaces would be extremely difficult without the techniques mentioned above.

Key words: CAD-CAM, drawing, CNC, Sprutcam, sculptures surfaces

INTRODUCTION

CAM – Computer Aided Manufacturing, computer-assisted manufacturing, a concept that is not yet well-defined for the time being, or in other words, consistency is still unclear. Some use the term to define computer assisted processing, others include CAM production control functions. Most often, CAM designates computer assisted manufacturing. In essence, it involves the development of NC programs, processing and assembly technologies, computer assisted technology in the planning, management and control of production operations through direct or indirect monitoring of production resources (Ganea, 2010; Ganea, 2010; Ganea, 2000; Jain, 1989).

For typical wood processing cases, monolithic surfaces, fragile surfaces and other technological cases, we have more types of semi-finished products:

· boards with thicknesses of 50-80 mm;

· cupboards with thicknesses of 80 to 200 mm;

· semifinished products in the form of cubes, parallelepiped with thicknesses greater than 200 mm (Lustun et al., 2012).

Wood used for sculptural surfaces has the following properties: it is homogeneous, without late wood and early wood, it is soft. The wood

species used in this case are: cherry, maple, lime, oak, the latter being more used for manual processing.

MATERIAL AND METHOD

The results of simulation of the CNC 5-axis machining operation were carried out with the SprutCam program, in 2017, in the laboratory of the University of Oradea (Derecichei et al., 2013; Derecichei et al., 2013; Derecichei, 2014).

Step 1: Define the operation

Select the Machining environment. Creating the operation using the Create icon (Derecichei et al., 2014, Derecichei et al., 2015).

The New operation window will appear on the screen, where the 5 axis multi surface of Fig. 1 is selected. Confirm the selection by clicking the Create button. Running the Run button. Returns to the simulation menu. It is necessary to simulate the operation by using the button. Run simulation with the button (www.sprutcam.com, 2016; www.sprutcam.com, 2016).

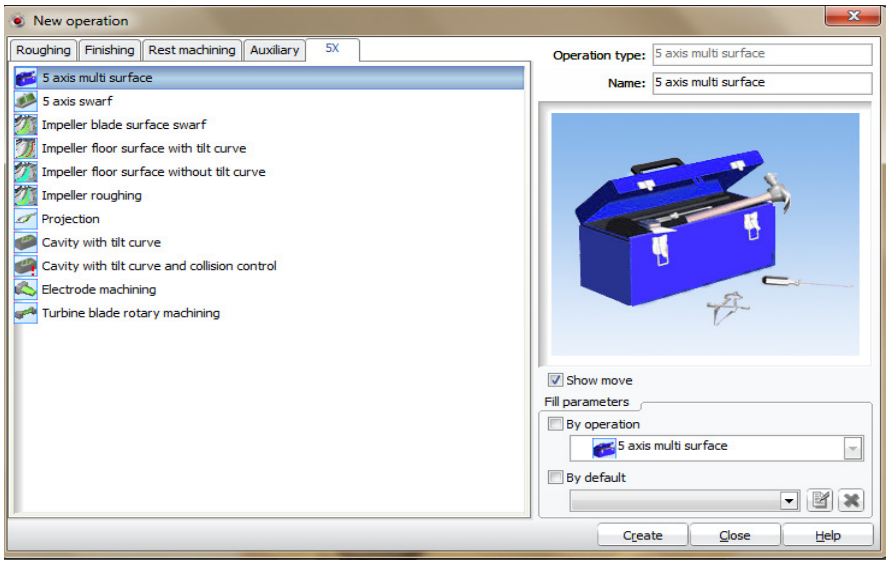

Fig. 1. Selecting the finishing type "5 axis multi surface"

RESULTS AND DISSCUSION

Step 2: Choose the tool

A cylindrical cutter with a 20mm diameter spherical head is selected from the menu. Click Select (Derecichei et al., 2013; Derecichei et al., 2013, Lucaci, 2013; Lucaci, 2015).

Change tool length L = 80 mm in Fig. 2. Click Ok.

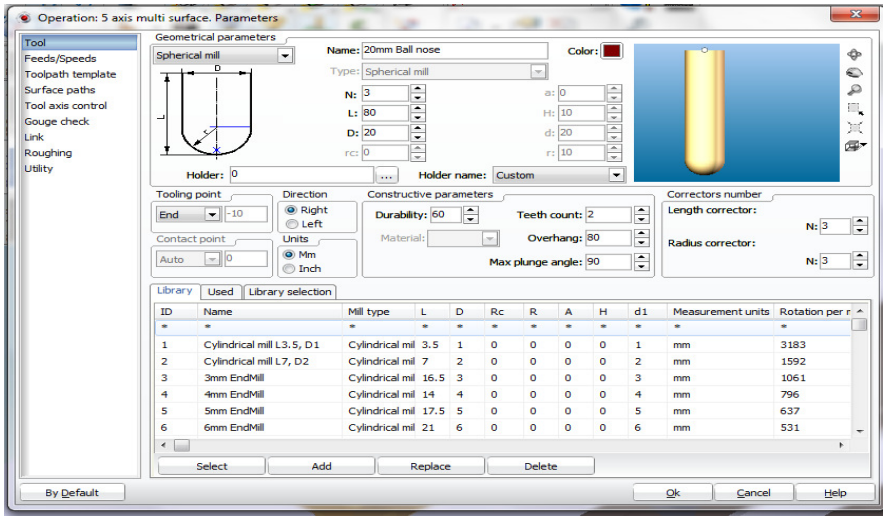

Fig. 2. Define tool parameters for “5 axis multi surface”

Step 3: Select the processed area

Due to the fact that no mode of engagement has been established there are collisions. Returns to Machining. The parameters of the operation are selected, the default parameters proposed by the program: cutting speed of 18.85 m/min, which will lead to a speed of 200 rpm and a feed rate of 200 mm/min in Fig. 3. The key operation is running Run (Derecichei, 2014; Derecichei et al., 2016).

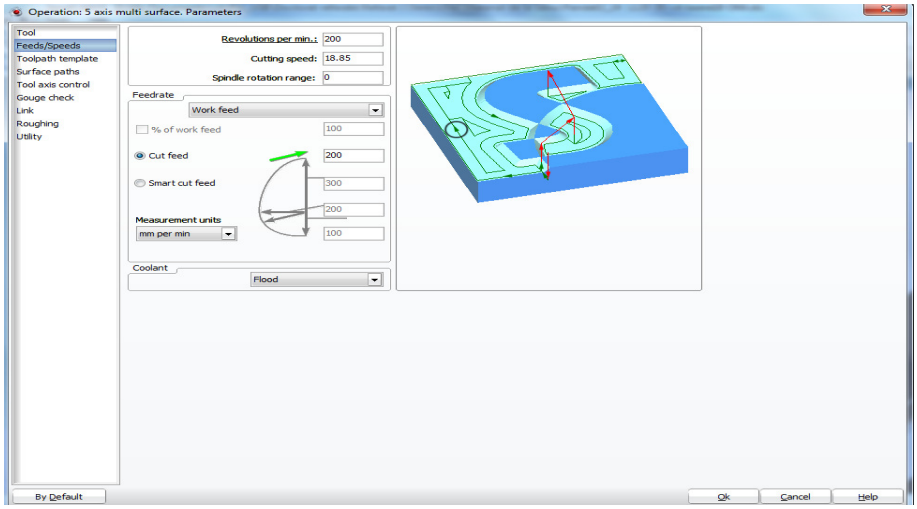

Fig. 3. Parameters of the cutting regime at “5 axis multi surface”

Step 4: Improve surface roughness

To achieve a higher surface roughness, select the Scallop option (the height of the areas left unprocessed at the intersection of the cutter

trajectory) and assign a value of 0.01. It can be seen that the tool trajectories are more numerous in Fig. 4. Running the Run button.

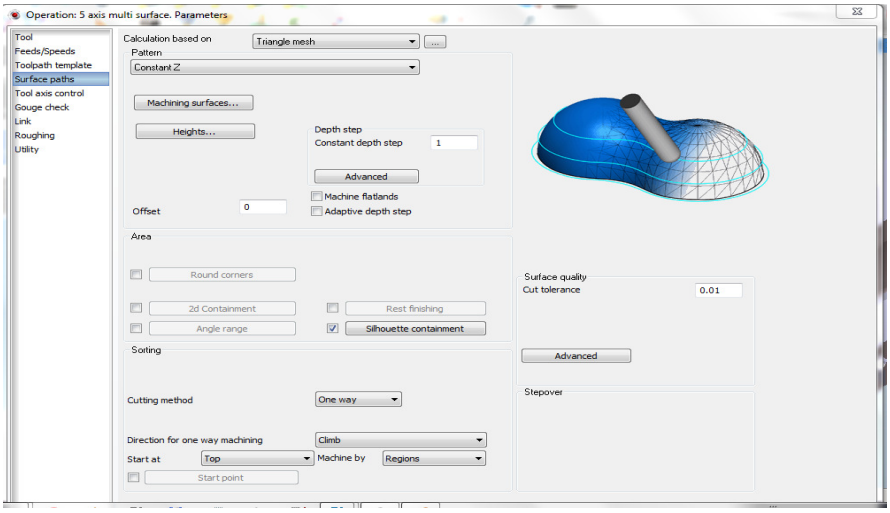

Fig. 4. Improving the surface roughness

In Fig. 5, 6, 7 show sequences from the 5 axis machining simulation with the SprutCam program in the order of execution.

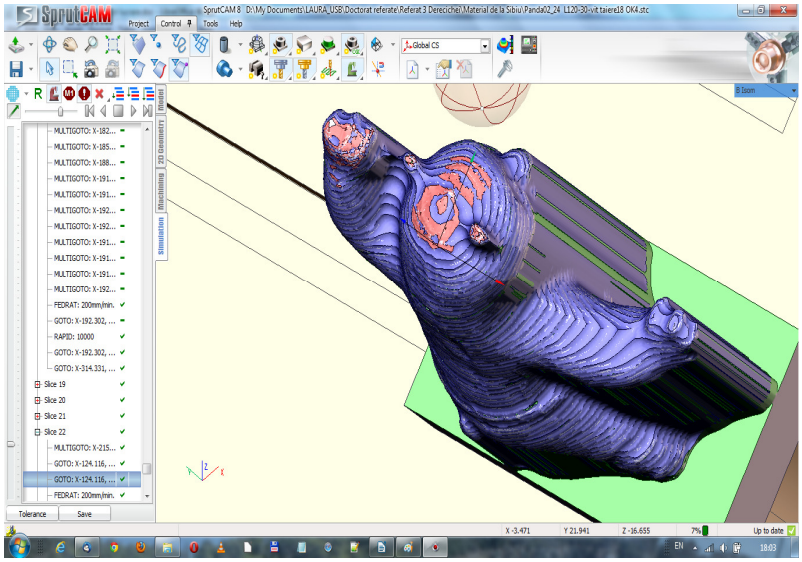

Fig. 5. Image from the 5 axis machining simulation with the SprutCam program

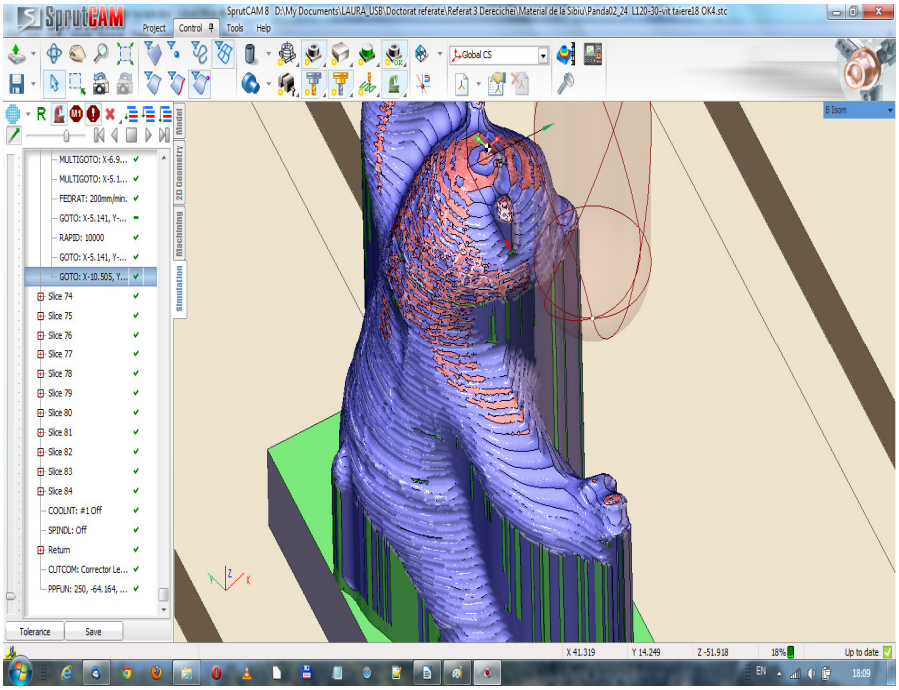

Fig. 6. Image from the 5 axis machining simulation with the SprutCam program

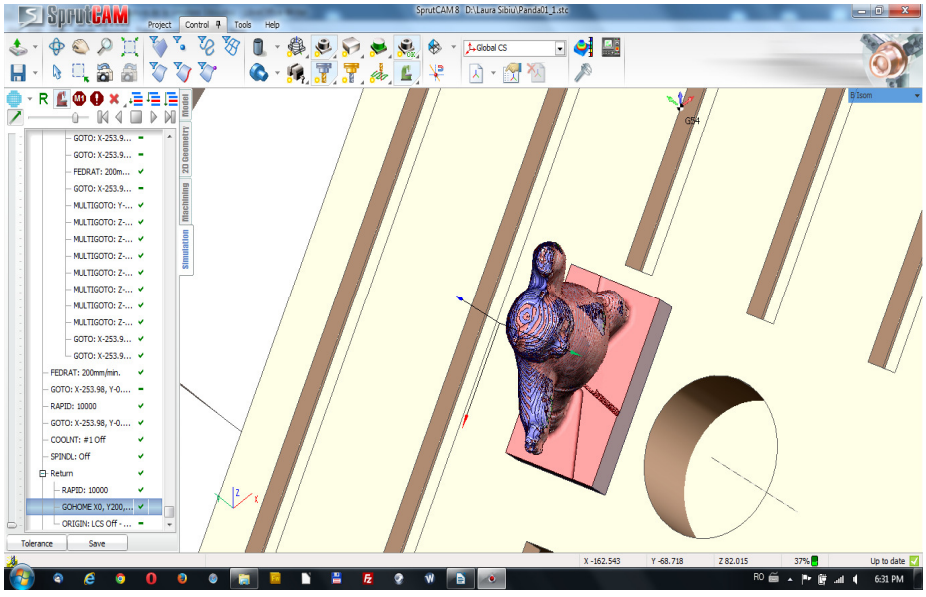

Fig. 7. Image from the 5 axis machining simulation with the SprutCam program

The program is very efficient, allowing the software to choose the cutting regimes. (www.gefanuc.com)

Below are the postprocessing sequences obtained with the Sprutcam program for the simultaneous 5 CNC machining operations

(www.sprutcam.com, 2017).

PANDA02_17
(GENERATED BY SprutCAM)
(DATE: 27.01.2017)
.....
(5 AXIS MULTI SURFACE)
G53Z0.
G53X0.Y0.
T3M6 (20MM BALL NOSE)
G54
G68.2X0.Y0.Z0.I0.J0.K360.
G53.1
S200M3
G00G43H3X-136.628Y46.707Z126.323B-22.376C-84.484
X-86.471Z4.491
Z-5.509
M8
G01Z-15.509F200
X-87.508Y47.006Z-15.971B-22.216C-82.205
X-89.294Y47.242Z-16.693B-22.25C-80.059
.....
X-113.933Y-2.133Z-136.924B-54.873C6144.336
X-114.024Y-2.027Z-137.005B-54.919C6144.679
….....
X-162.231Y23.642Z-228.66B-88.492C6187.248
X-162.569Y23.127Z-230.068B-89.141C6186.303
Z-220.068
G00Z-210.068
X-399.393Z-206.516
M9
M5
G28G91X0.Y0.Z0.B0.
G90
G69
G49
M30
%

CONCLUSIONS

It should be noted that SprutCam can simulate only the machines in the library to which it is connected, respectively DMU 70 (DMG). The

TMA-AL-550 machine can not be simulated in SprutCam until it completes the virtual model library.

SprutCam does not have a postprocessor and as a result the simulation and programming in the Siemens NX 7.5 program, in which the experimental processing was performed, was executed in parallel. This will be the subject of a future scientific papers.

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