

ISSUES RELATED TO THE USE OF SPRUTCAM IN WOOD PROCESSING

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Abstract

Computer-assisted use is a step forward in designing technically and economically competitive technological processes in the wood industry.

Preparing CNC machining programs for parts with three-dimensional complex surfaces would be extremely difficult without the techniques mentioned above. CAD / CAM products offer the possibility to develop processing programs for existing equipment on the market. These software packages allow, in addition to generate the tool center trajectory, a complex simulation of the machining process in which the movements of the machine elements required in the manufacturing process can be traced. An important branch of CAM methods is numerical control. This is a technique whereby the operations of a machine can be controlled by means of a program's instructions: cutting, milling, drilling, various surfaces of the blank can be carried out in such a way that at the end of the program the piece desired.

The simulation of the CNC 5-axis machining operation was carried out with the SPRUTCAM program, which was obtained from the "Hermann Oberth" Engineering Faculty of Sibiu in the Department of Machinery and Industrial Equipment.

Key words: SPRUTCAM, CAD-CAM ,CNC, . wood

INTRODUCTION

Steps to get the NC code into SPRUTCAM

Processing a complex wood piece on a CNC machine involves generating a CN code that contains, in a numerically coded form, the commands for moving the machine and / or tool trays on the trajectories required to obtain the shape of the finished part.(Ganea, M., 2010, Ganea, M., 2010, Ganea, M., 2000, Jain, A. K., 1989)

In computer-assisted processing (CAM), which involves the use of a SPRUTCAM program, the steps taken to obtain the CN code are as follows (summarized in figure 1):

Graphic representation of the piece (model)

- realization of the geometric 3D model of the part in an external assisted design / modeling (CAD) program (direct introduction of the model);

- geometry of the piece can also be done by scanning 2D (from drawing) or 3D (from an existing physical model of the piece using special scanners);

- importing the CAD model (DXF, IGES or other supported formats);

- As we can see, the geometric model of the piece is made indirectly outside the SPRUTCAM package, but there are also possibilities of direct modeling in the program.

At the end of this step, a graphical file containing complete piece geometry information (model) is obtained. (Derecichei et al., 2013, Derecichei et al., 2013, Derecichei, 2014)

MATERIAL AND METHOD

Define the tool trajectory by selecting the machining geometry

- contour selection;
- selecting island / pocket type entities;
- selecting holes structures;
- selecting surfaces;
- selecting volumes;

At the end of this stage, SPRUTCAM has information about the geometric elements to be processed. (Derecichei L. et al., 2014, Derecichei L. et al., 2015)

Define processing parameters

- technological information related to the tool (type, speed, advance);
- defining the shape of the blank;
- processing strategy (zigzag pocket processing, spiral machining, machining parameters, finishing machining parameters, etc.).

RESULTS AND DISSCUSIONS

Simulation of processing

1. a graphical representation of the displacement of the tools and of the machining carried out;
2. the simulator allows defining and viewing the used toolbars;
3. as a result of the simulation, the CL Data file is obtained containing all data related to the displacement of the tool and the processing sequences;
4. The simulation identifies possible collisions and provides the possibility to modify the generated CLDATA command file for the purpose of removing them. (Derecichei L. et al., 2015)

Modify processing sequences

1. the SprutCAM program allows you to make changes to the CL Data file.

Post-Processing

1. converting the CL Data file into a NC format specific to a particular type of device (the SprutCAM program includes a vast library of

- over 100 post-processors);
- 2. the program also allows the creation of post-processors, if they are not found in the default library;
- 3. the information is filtered and formatted according to the CN code accepted by the equipment, taking into account the specific parameters of the machine on which the machining is performed (workspace, speed and feed limitations, tools, etc.).(Marciniak K., 1991; Yoshimi I., 2008)

Figure 1 shows a graphical synthesis of the steps taken to process a piece, from the model phase to the final piece.

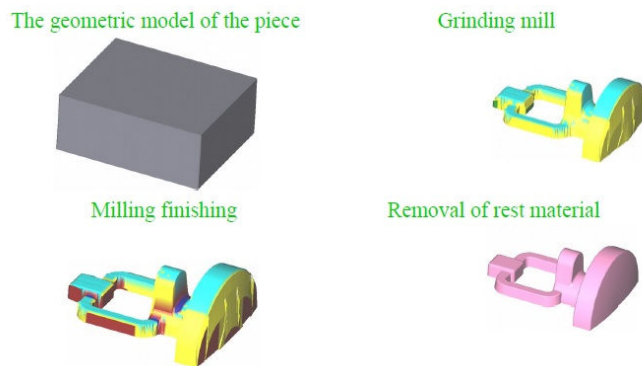


Fig. 1

Graphical synthesis of the stages in the processing of a piece

SPRUTCAM imports geometric patterns of IGES, DXF, 3DM, PostScript, Parasolid (text and binary), STL, STP, VRML, and other files. Enhanced integration with most existing CAD systems (Alibre, AutoCAD, Catia, CoCreate, Inventor, IronCAD, Mechanical Desktop, Rhinoceros, Pro / E, Solid Edge, SolidWorks, Top Solid, etc.) is ensured. (Derecichei L. et al., 2017, Lucaci, C. et al , 2017)

SPRUTCAM also has built-in CAD-assisted design tools for woodworking. The program includes a parameterized 2D CAD model that allows interventions on imported geometric models as well as the realization of models directly in SprutCAM.

For 2.5 D machining (80% of the milling process falls into this category) the geometry of the parts can be generated directly in SPRUTCAM.

Processing strategies in SPRUTCAM

The following processing strategies can be programmed in SPRUTCAM:

- ⤴ roughing and level curve finishing (in successive horizontal planes);
- ⤴ roughing and flat finishing (in successive vertical planes);
- ⤴ profiled roughing and finishing after various preset

- trajectories (along predefined curves, etc.);
- ▲ combined finishing;
- ▲ complex finishing;
- ▲ strategies to remove remaining material after finishing (the rest of the material is automatically identified);
- ▲ horizontal flat surface processing;
- ▲ processing vertical straight walls;
- ▲ machining of bevels;
- ▲ removal of material around defined areas (island and / or pocket-type processing);
- ▲ drilling, boring, threading;
- ▲ roughing and longitudinal and flat finishing.

The program offers the possibility to simulate the programmed processing with the help of a built-in simulator. SPRUTCAM also offers the ability to develop post-processors for any CNC system through the "Invariant Postprocessor" facility.(www.sprutcaml.com, 2018)

Use of the restriction areas

The first operation is to import the model "igs" (.stl), by clicking on the "Import" button in the "3D Model" menu, as shown in figure 2.



Fig. 2 The "Import" button

Select the model called "panda.stl" and click the "Open" button. After the import operation on the screen, the following picture should be displayed, as shown in figure 3. (www.gefanuc.com)

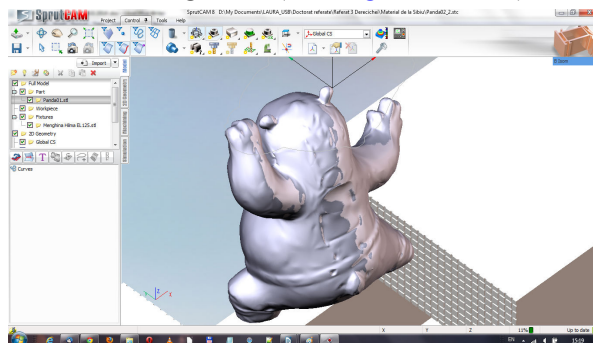


Fig. 3 The geometric model

Select the desired coordinate system position between the options in

figure 3. If the default option is XZ Middle and Z Max and then the "Apply" button is pressed, you can see the repositioning of the coordinate system.

If a click is made outside the model, somewhere in a free area of the model tree or anywhere in a free area of the screen, the pattern will be deselected and its color will change from red to gray. If the "Back Isometry" viewing mode (where the positioning of the axes corresponds to the positioning of the part on the machine) on the screen, the image in figure 4 should be obtained.

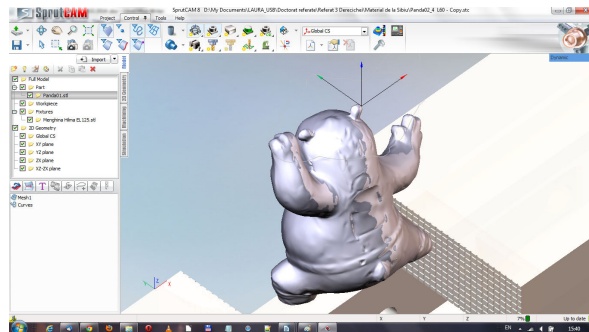


Fig. 4 The geometric model after changing the origin of the coordinate system

Before proceeding to defining processing strategies, some interventions on the geometric model of the piece are required. It should be taken into account that the implicit approach for many of the program's strategies is to process the whole model, while for this piece only cavity processing (roughing and finishing) is desired.

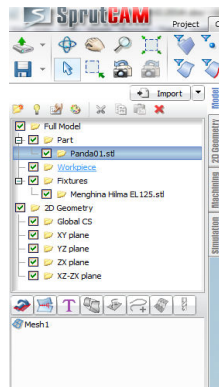


Fig. 5 Component surfaces of the model

There are several solutions to restrict processing areas. We'll still

show one of the most used, namely the use of a restriction curve, which will limit the processing area. It is possible to define these curves directly in the program, or there is the possibility of being imported as parts of the geometric model.

To create the curve directly in SPRUTCAM, double-click on the "matrita.igs" folder at the bottom of the "Model Tree" window. A list of all surfaces composing the model shown in figure 5 will appear in the window (www.sprutcam.com, 2018).

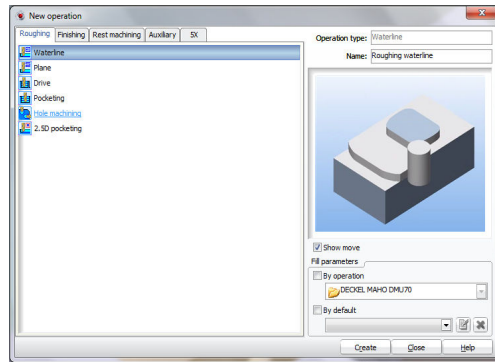
Select the top surface of the model either from the list in the "Model Tree" window or by selecting directly from the screen with the mouse cursor after switching to "Select" mode.

To start defining machining operations, select the "New" button from the "Machining" menu, as shown in figure 6.



Fig. 6 Define a processing operation

The first operation to be programmed is a waterline roughing (figure



7), which is probably the most used of the roughing operations.

Fig. 7 Selecting the Roughing Waterline ("Roughing Waterline")

The parameter change process can be run by selecting and changing from left to right the parameter groups in the dialog window that opens after clicking on the "Parameters" button. Walking from left to right is a recommended approach, but it is not mandatory, as the user can change the parameters in the desired order.

CONCLUSIONS

Movements of the Approach and Retraction tool are not important in this case, being automatically controlled by the program because the tool can execute them "out of the air", out of the model, so they are left unmodified.

It is important to keep in mind that "Top Level" and "Bottom Level" quotas are automatically calculated according to the size of the model, not the semi-fabric, so it must be modified when the Z-values of the semifabric are different from those of the model (definition of some processing additions).

To generate the CNC program, return to the "Machining" menu and click the "Postprocessor" button. This will result in the opening of a "NC-program generation" window. From this window you can select the type of the device and the file name in which you want to save the generated NC program. Then run the "Run" button to launch the program generation. The NC code will be displayed in the window and it will also be saved in an extension file specific to each type of equipment.

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