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SOFTWARE FOR DRILLING TOOL DESIGN AND MANUFACTURING

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Abstract: The paper presents a software that allows the design and manufacturing of cutting tools for boring. The methodology contains several steps that can be taken only by using the software modules. The main stages are the geometrical and dimensional design of the cutting tool, the design and generation of the abrasive profiled disks, the management of abrasive disks and disk package, the generation of the manufacturing technology, the verification of the cutting tool using virtual simulation, testing the manufacturing process using virtual simulation, generating the CNC files and finally the transmission of the CNC files in real time to the CNC machine tool so that the tools can be manufactured.

Keywords: computer application, software, computer-aided design, computer aided manufacturing, manufacturing process.

1. INTRODUCTION

Cutting tools for boring manufacturing have complex shapes; thus, the corresponding manufacturing technology is generally difficult to establish, solid mathematical and engineering knowledge being necessary (Brindasu, 1986; Voicu, *et al*., 2002).

Adequate, modular software was elaborated in order to offer a useful tool for establishing the manufacturing technology and virtual testing of the manufacturing result before the production launch of these complex products.

2. METHODOLOGY FOR DRILLING TOOLS DESIGN AND MANUFACTURING

Thus, with regard to the manufacturing of cutting tools for boring there are several necessary steps to be taken, as well as a couple of auxiliary modules, designed for visualising results as well as for applying changes if these results reveal errors. These aspects will be detailed, as follows (fig.1).

The first step is the installation of software modules on the CNC machine tool computer.

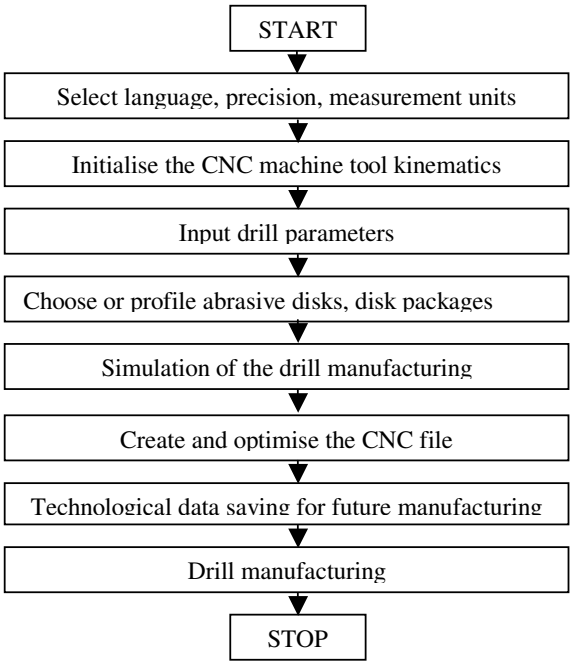

Fig.1. Stages for drilling tool design and manufacturing

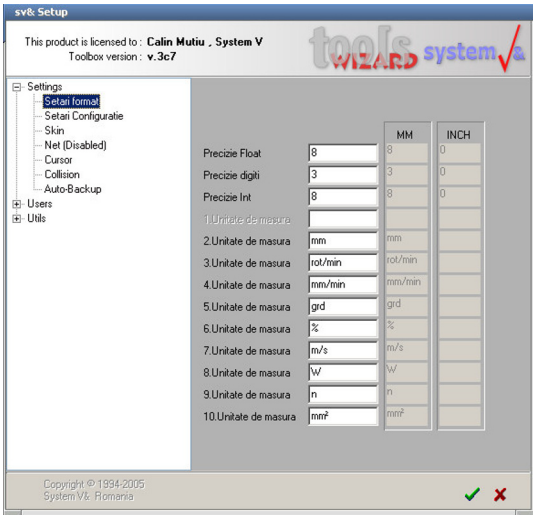

Fig. 2. Setting the installing configuration

Firstly, the information for the software modules that assist the whole manufacturing process must be completed. The actions are (fig.2):

- language selection. The option remains definitive;
- selecting the computing precision and measurement units. These two actions are only performed once, at the first installation;

The second stage refers to the CNC machine tool kinematics initialisation and contains the following actions:

- particularisation of the machine tool kinematics using a specific software module (specification of the machine tool "zero point", coordinates system, minimal increment for axial and radial movement of each axis and maximal displacement for each axis) (fig.3);
- establishing the initial relative position of the clamping device of the semi-manufactured product and of the cutting tool, relative to the zero point of the machine tool;

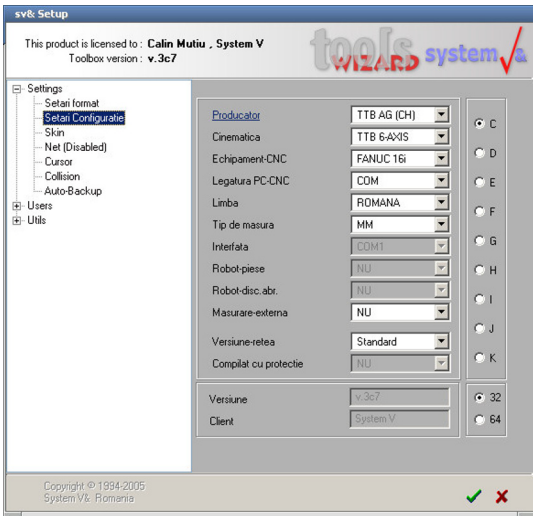

Fig. 3. Window for initialisation of CNC machine tool kinematics

- choosing the size of the clamping device and of the holding taper where the shaft with the abrasive disks is fixed (either ISO 50 or another one), from the existing database of the semi-manufactured product;
- initialisation of the displacement velocity range on each axis and of the maximum power of the machine tool.

The following stages have the role of generating the helical drill (with one or more diameters) technology.

The third stage allows definition of the cutting tool (helical drill) parameters. The inputs are:

- the material of the cutting tool that must be manufactured;
- the geometry of the tool and its dimensions;

This information is saved within the geometrical database and allows future use, avoiding the repetition of data input (Ebner,1998).

The fourth stage consists of choosing one of the abrasive disks that will be used in the manufacturing process from the abrasive disks database of the company storehouse (dependent on the previous conditions). If none of them corresponds geometrically, there is the possibility of profiling an existing abrasive disk depending on the necessities. In this stage, packages of abrasive disks are chosen to be assembled on a special shaft that will enter the cone of the principal spindle of the machine tool (with the help of bushings of standard sizes), in order to avoid collisions with the adjacent disks during the manufacturing process. One or more packages contain all the abrasive disks that are necessary for a complete manufacturing process and are assembled on the machine tool before the beginning of the manufacturing process.

The fifth stage is the simulation of the machine tool movement during the manufacturing process and the prediction of the tool surfaces that result from the interactions with the abrasive disks. Afterwards, the shape of the resulted piece is analysed with the help of graphical modules that allow a perfect visualization of the three-dimensional piece, or with the help of graphical two-dimensional modules in which the desirable sections can also be seen to larger scales.

In the sixth stage the CNC file is created, which, once launched on the numerical command system existent on the CNC machine, will determine the obtaining of the cutting tool (helical drill) that was analysed in the graphical analysing modules. The program generates this file automatically. There is the possibility for a specialist to operate modifications in the CNC file, in order to intensify the chip removal process towards maximal values so as to improve the productivity. It is important to supervise the increase in the manufacturing parameters since the chip removals can create problems when using machine tools with lower characteristics.