Qualitative Challenges Facing the Hard Wood Processing, Using the 5 Axis Turning-Milling Center

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Summary

- This publication discusses the qualitative challenges which arise when processing hard wood, using 5 axis turning – milling machine.
- The right tool and tool's path should be chosen for the machining of the workpiece. Otherwise, the intensive tool's wear and the decrease of the quality appear.
- The mechanical and anatomical characteristics of hard wood, the workpiece's quality demand the accurate selection of cutting conditions to achieve desired wooden product quality.
- It is important to take into the consideration the correct use of CAM software, especially taking in account the workpiece's fixature

Introduction

During production of these components certain challenges can arise such as:

- relevance of technology,
- solid wood surface quality,
- tool wear during process of milling,
- workpiece factors for machining,
- the influence of technological processing regimes.

Hard wood processing: challenges and examples

- Nowadays in most industry manufacturing processes CNC (computer numerically control) centers with 3-5 axis is often used to obtain various curved surfaces, 3D forms and other surfaces which require high precision.
- It is important to attain as smooth surface as possible so that further surface improvement operations would not be necessary.

Workpiece's quality

To gain higher coefficient of usage it is necessary to connect a few workpieces into one and only when the machining process can begin, as it is displayed in **Fig. 1 a)**.

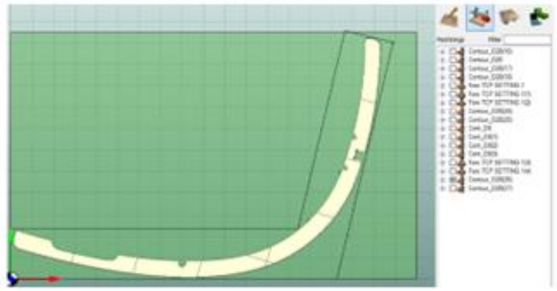

Fig. 1 a) Example of connected parts in CAM

To avoid unwanted oscillations, one solution is to model two machining contours, as shown in **Fig. 1 b)**.

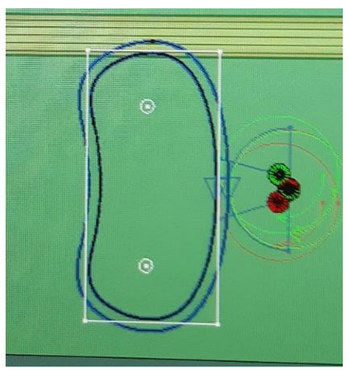

Fig. 1 b) Example of machining strategy

Tool's wear

Factors that can be found during experimental stage of machining is [1]:

- the direction of machining
- feed speed rotation frequency of the tool
- type of wood used for the workpiece
- the wear of tool

To achieve the required demand and quality it is necessary to use more advanced tools such as: specific body shape tools with exchangeable cutting inserts **Fig.2.**

Fig. 2 cutting tool with exchangeable cutting inserts

The reason why tool may lose its sharpness is friction between workpiece and the cutting edge [2].

Cutting conditions

The most important technological processing regimes are:

- Cutting direction
- Cutting mode
- Feed speed
- Depth of cut

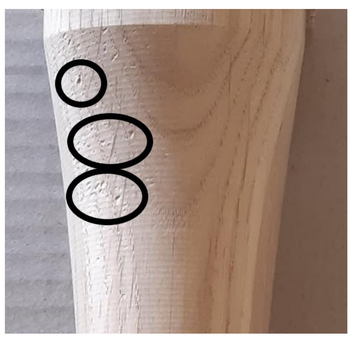

Fig. 3 Defects caused by improper machining regimes

The fixature of workpieces

Depending on the shape, size, technology or processing method of the parts, the workpieces could be mounted in different devices as we can see in **Fig. 4**:

a) spindle b) vacuum fixing device c) clamps

Fig. 4 Examples of workpiece fixature

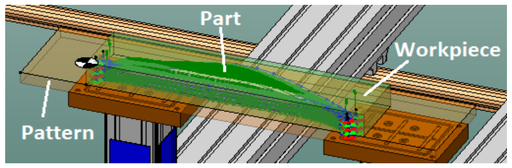

Fig. 5 Examples of constraining 3D shaped part

Conclusions

To conclude, it is important to not only to properly operate the tools and the machinery but also take into consideration geometry of the tool, feed settings, shape of the workpiece, wear of the tool, technological regimes of processing.

References

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2. KETURAKIS, G., et al. Tool wear evolution and surface formation in milling various wood species. BioResources [online]. 2017, 12(4) [viewed 13 march 2022]. 2