THE QUALITY OF THE CUT SURFACES OF WOOD

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Abstract: *This paper presents an analysis of the quality of machined wood surfaces. They are characterized by precision dimensional geometric shape and degree of smoothness, namely by cutting surface roughness.*

Key words: milling, sanding, scratching.

INTRODUCTION

The quality of the cut surfaces of wood is characterized through the geometrical precision (degree of accuracy) and through the smoothness degree, respectively through the roughness of the cut surface.

When cutting wood on the cutting surfaces result irregularities, generated by the wood structure, but mainly by different factors of the cutting process. The irregularities due to the cutting process, in the dependence of their nature and size may be: macro-irregularities, micro-irregularities and undulations (knife marks) as shown in fig. The macro-irregularities are shape deviations and position deviations, as the ovality, convexity, concavity, taper, etc.

These don't characterize the quality of the cut surfaces, but the geometrical precision of their shape and thus the degree of processing accuracy.

The quality of cut surfaces is therefore formed by micro-irregularities and undulations (knife marks).

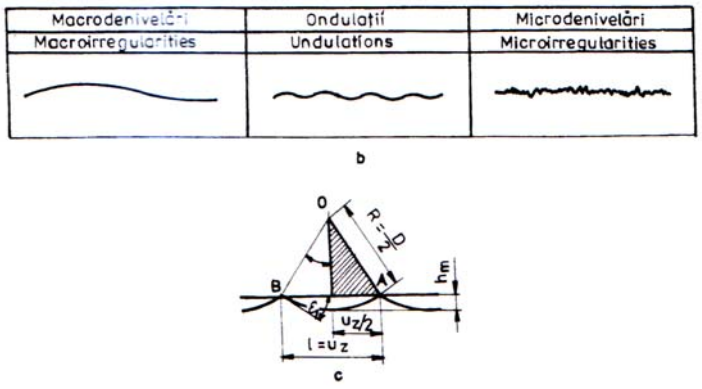

Fig. 1- Irregularities of the cut surfaces of wood

MATERIALS AND METHODS

Cinematic undulations are specific to the kinematics of the cutting process. They have regular shape, which repeats at almost the same pitch. For example, with rotary milling, the shape of the undulations is the one presented in fig. These are characterized by:

Following are the results of numerical simulation of the process of microwave heating plant humectants potato flakes where the guide was introduced several radiating slots;

According to material taken from literature values of relative permittivity and loss factor for humectants potato flakes at a temperature of 20^0 C are $\varepsilon' = 0{,}62 \;\; tg\delta = 0{,}354.$

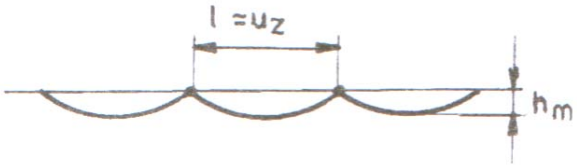

Fig. 2 Kinematic waves

- the length of the cinematic undulations

where uz is feed per tooth (tooth bite) in mm/tooth; u- feed speed in m/min; n – rotation speed of cutter in rot/min and z – number of theeth of cutter.

Height of undulations

$$l \approx u_z = \frac{1000u}{n \cdot z}$$

where R is the cutter radius.

RESULTS AND DISCUSSION

As result of the previous consideration, the roughness (quality) of the cut surfaces of wood is defined as the sum of small-pitch irregularities of a surface which are not shape deviations.

The (estimation) evaluation of the quality of cut surfaces

It is made through the following three parameters:

- average roughness R_a(fig.a)Average roughness is the arithmetic mean of the distances between the points of the profile relative to the center line throughout the sample length:

$$R_a = \frac{\sum_{i=1}^{i=n} y_y}{n}$$

- Average height of irregularities R_z(fig b).Is the average distance between the five highest peaks and the five lowest peaks, measured relative to a parallel line to the center line of the profile

$$R_z = \frac{(R_1 + R_3 + R_5 + R_7 + R_9) - (R_2 + R_4 + R_6 + R_8 + R_{10})}{5}$$

- arithmetic mean (average) of the highest peaks of irregularities H_m(fig c),represents the arithmetic mean of the maximum irregularities, measured from the top to the gullet of the profile.

$$H_m = \frac{H_{max1} + H_{max2} + \cdots + H_{max\,n}}{n}$$

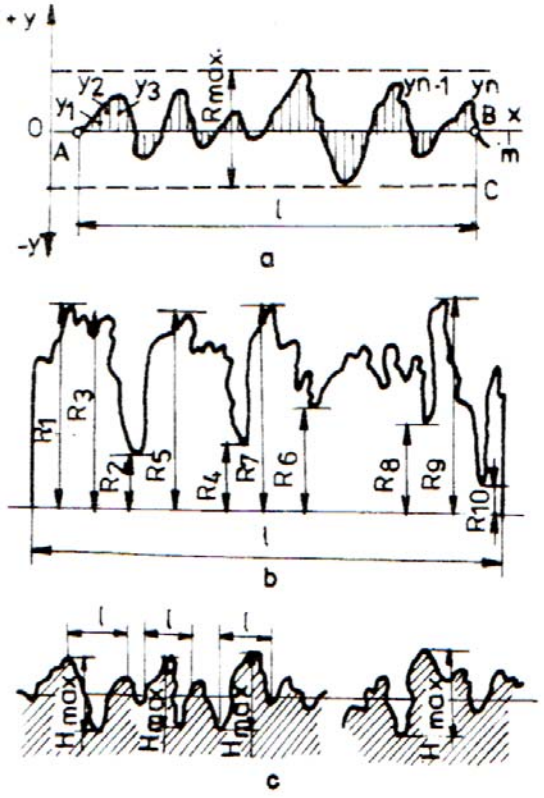

Fig. 3 Estimation of the quality of cut surfaces

CONCLUSIONS

Table 1

Roughness degrees obtained through different cutting operations

Cutting operations	Group	Roughness degree	Atihmetic mean of the maximum irregularitie
Sawing with circular saw blades	rough Half fine Fine	3-4 5-6 7-8	800-315 315-100 100-30
Milling	Rough Half fine Fine	5-6 7-8 9	315-100 100-30 30-16
Sanding	Rough Half fine Fine	7-8 9 10	100-30 30-16 16
scratching	Half fine Fine	9 10	30-16 16

- fine milling: quality degrees(classes) 8-9 at which tooth bite is u_z=0,3-0,8 mm/tooth
- half-fine (semi-fine) milling: quality degrees 6-7,at which tooth bite is u_z=0,8-2,5 mm/tooth
- rough milling: quality degrees 4-5,at which tooth bite is u_z=2,5-5,0 mm/tooth

The lower values are for softwoods and waste tools and the higher values are for hardwoods and well-sharpened tools.

Example: the cutting conditions are to be established for a rotary milling process of resinous wood, in order to obtain a roughness of the surfaces corresponding to the ninth quality degree (class).The rotation speed of the cutter: n = 6000 rpm; the number of cutting teeth z = 4: half-worn, are known. Solution: according to the expression of tooth bite

$$u_z = \frac{1000\,u}{n \cdot z}$$

The value corresponding to the nine quality class for softwoods and half-worn tools is chosen u_z=0,5 mm/tooth. There results:

$$u = \frac{u_z \cdot z \cdot n}{1000} = \frac{0{,}5 \cdot 6000 \cdot 4}{1000} = 12\ m/min$$

Thus, the milling machine is adjusted for a feed speed u=12m/min.

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