ASPECTS OF THE PLANING CROSS LAMINATED SOLID WOOD

Galis Ioan*, Lucaci Codruţa. Cheregi Gabriel

**University of Oradea. Faculty of Environmental Protection. 26 Gen. Magheru St.. 410048 Oradea. Romania*

Abstract: *This work paper is about the measurement of cross cutting by milling laminated solid wood witch requires some drilling conditions.*

Key words: Wood Milling. splintering. Cutting Power.

INTRODUCTION

Milling wood has the highest weight in the whole cutting operation. Further studies and research are extremely numerous. Studies and scientific work have treated different aspects of timber milling and cutting regimes and the construction and milling exploitation.

MATERIALS AND METHODS

For cutting power measurement using a power meter recorder (WATTREG) mounted in the electrical circuit of the main engine of the milling machine (Figure 1). This wattmeter allows the measurement of cutting power with precision of 5 watts. Each cutting value power represents the arithmetic mean value of five measurements performed on standard pieces in identical milling condition.

Fig. 1 - Wattmeter recorder (WATTREG)

Experiments were performed on a manual milling machine (MNF 10) with main features:

- Spindle speed n = 3000. 4500. 6000. 9000 rot/min
- Beating radial spindle mounting area mills $b_r \leq 0{,}004\,mm$
- Electric motor power 2.8 kW spindle drive

Fig. 2 - Manual milling machine (MNF 10) with automatic

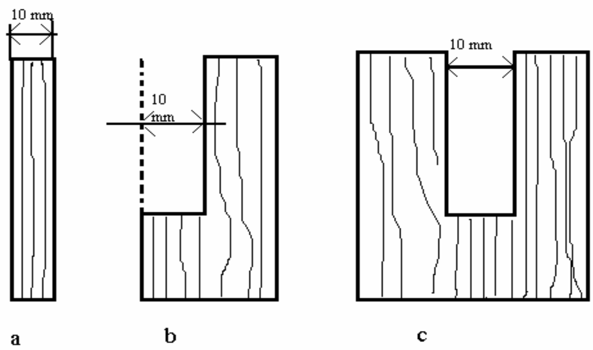

Fig. 3 - Types of Milling

We used milling and head milling cutters manufactured and maintained by plant Codlea About ASCO TOOLS SA. The cutters used in experiments with the following characteristics:

- 240 mm diameter
- 30 mm bore
- Blade width b = 10 mm
- edged carbide teeth with 20 K
- number of teeth z = 4
- angles $\alpha = 15\,°$. $\beta = 55\,°$. $\gamma = 20\,°$
- sharp and measured About ASCO TOOLS SA
- radius of rounding of cutting edges $\rho \leq 0{,}005\,mm$.

To be able to study and have used the following cross-cutting advances in tooth:
u_z = 0.1 mm; 0.2 mm; 0.4 mm; 0.6 mm; 0.8 mm; 1.0 mm; 1.2 mm; 1.6 mm
h milling and the following heights:
h = 1 mm; 5 mm; 10 mm; 15 mm; 20 mm; 25 mm; 30 mm; 35 mm; 40 mm; 45 mm; 50 mm.

RESULTS AND DISCUSSION

The first objective was to study experimentally and the dependence of the dynamic parameters of the cutting tool and the milling system of cross-tree wood. Thus the dependence of power consumption and the advance per tooth. depending on the depth of cut for the three types of milling (open. semi. closed) for sharp-edged.

Based on the values are determined:

Cutting K resistivity;

Average cutting force F_m;

Average and maximum cutting force per tooth F_{dm} . F_{dmax};

Table 1

Cutting power P in kW. Milling cross open / semi / closed-fir wood with U = 8 – 10%. cutter diameter D = 240 mm. cutter speed n = 4500 rot/min. number of teeth z = 4, teeth with sharp-edged of K = 20 (ρ≤0.005mm). Milling width b = 10 mm

Milling height	Advance per tooth in mm/ tooth. feed rate u in m/min							
h	0.1	0.2	0.4	0.6	0.8	1.0	1.2	1.6
	1.8	3.6	7.2	10.8	14.4	18	21.6	28.8
1 F.D.	0.03	0.03	0.035	0.038	0.04	0.045	0.047	0.057
F.S.D.	0.03	0.03	0.035	0.038	0.04	0.045	0.047	0.057
F.I.	0.03	0.03	0.035	0.038	0.04	0.045	0.047	0.057
5 F.D.	0.07	0.08	0.095	0.11	0.13	0.15	0.16	0.19
F.S.D.	0.07	0.08	0.1	0.11	0.13	0.16	0.17	0.2
F.I.	0.07	0.08	0.1	0.12	0.13	0.17	0.18	0.21
10 F.D.	0.1	0.11	0.14	0.17	0.21	0.25	0.29	0.34
F.S.D.	0.1	0.11	0.14	0.18	0.22	0.25	0.3	0.36
F.I.	0.1	0.11	0.15	0.2	0.24	0.27	0.32	0.38
15 F.D.	0.13	0.13	0.18	0.22	0.27	0.315	0.37	0.43
F.S.D.	0.13	0.14	0.19	0.23	0.28	0.34	0.4	0.47
F.I.	0.13	0.15	0.2	0.24	0.29	0.36	0.43	0.51
20 F.D.	0.14	0.16	0.2	0.25	0.31	0.36	0.43	0.48
F.S.D.	0.14	0.16	0.2	0.26	0.34	0.39	0.45	0.53
F.I.	0.15	0.17	0.24	0.29	0.36	0.42	0.48	0.59
25 F.D.	0.17	0.19	0.25	0.29	0.36	0.41	0.49	0.54
F.S.D.	0.17	0.2	0.27	0.31	0.39	0.45	0.5	0.6
F.I.	0.18	0.21	0.28	0.34	0.42	0.49	0.58	0.66
30 F.D.	0.19	0.22	0.29	0.35	0.43	0.5	0.58	0.65
F.S.D.	0.19	0.23	0.31	0.38	0.47	0.55	0.64	0.72
F.I.	0.2	0.24	0.32	0.43	0.5	0.6	0.68	0.79
35 F.D.	0.21	0.23	0.32	0.38	0.46	0.54	0.6	0.67
F.S.D.	0.21	0.24	0.34	0.41	0.50	0.58	0.67	0.72
F.I.	0.22	0.25	0.34	0.44	0.55	0.63	0.72	0.84
40 F.D.	0.23	0.24	0.34	0.43	0.53	0.6	0.68	0.77
F.S.D.	0.24	0.25	0.36	0.47	0.57	0.66	0.75	0.86
F.I.	0.24	0.26	0.38	0.5	0.62	0.72	0.85	0.96
45 F.D.	0.25	0.27	0.35	0.44	0.54	0.61	0.68	0.76
F.S.D.	0.26	0.28	0.40	0.49	0.60	0.68	0.78	0.87
F.I.	0.27	0.30	0.42	0.54	0.67	0.78	0.92	1.08
50 F.D.	0.28	0.30	0.39	0.50	0.60	0.68	0.78	0.88
F.S.D.	0.29	0.31	0.42	0.54	0.66	0.75	0.85	0.96
F.I.	0.30	0.33	0.45	0.58	0.72	0.83	0.99	1.2

Table 2

Cutting power P in kW. Milling cross open / closed-fir wood with U = 8 – 10%. cutter diameter D = 240 mm. cutter speed n = 4500 rot/min. number of teeth z = 4. teeth with sharp-edged of K = 20 (ρ≤0.005mm). Milling width b = 10 mm. the amount of material milled (milled length) L1 = 1 m. L2 = 200 m. 400 m L3 =. L4 = 600 m

Milling height h Milled length L	Advance per tooth in mm. feed rate u in m/min				
	0,1 / 1,8	0,2 / 3,6	0,4 / 7,2	0,8 / 14,4	1,2 / 21,6
1 L1 = 200 L2 = 400 L3 = 600	0.024/0.024 0.027/0.027 0.029/0.029	0.0375/0.0375 0.04/0.04 0.043/0.043	0.04/0.04 0.046/0.046 0.05/0.05	0.05/0.05 0.055/0.055 0.06/0.06	0.055/0.055 0.06/0.06 0.065/0.065
10 L1 = 200 L2 = 400 L3 = 600	0.125/0.125 0.135/0.135 0.145/0.145	0.14/0.15 0.15/0.16 0.16/0.17	0.17/0.18 0.18/0.2 0.2/0.21	0.26/0.26 0.29/0.31 0.31/0.34	0.30/0.32 0.33/0.35 0.35/0.38
20 L1 = 200 L2 = 400 L3 = 600	0.175/0.19 0.19/0.21 0.21/0.22	0.2/0.21 0.22/0.23 0.23/0.25	0.26/0.29 0.29/0.31 0.31/0.33	0.37/0.43 0.4/0.47 0.44/0.5	0.54/0.6 0.57/0.63 0.61/0.65
30 L1 = 200 L2 = 400 L3 = 600	0.24/0.25 0.26/0.27 0.28/0.29	0.275/0.3 0.3/0.32 0.32/0.34	0.35/0.38 0.38/0.42 0.41/0.45	0.51/0.60 0.56/0.65 0.6/0.7	0.65/0.78 0.70/0.85 0.77/0.91
40 L1 = 200 L2 = 400 L3 = 600	0.29/0.3 0.31/0.32 0.33/0.35	0.3/0.32 0.32/0.35 0.35/0.38	0.41/0.46 0.44/0.49 0.48/0.53	0.64/0.74 0.69/0.81 0.74/0.87	0.74/0.96 0.81/1.05 0.87/1.12
50 L1 = 200 L2 = 400 L3 = 600	0.35/0.375 0.365/0.4 0.42/0.435	0.35/0.41 0.41/0.45 0.43/0.48	0.47/0.54 0.51/0.59 0.55/0.63	0.72/0.87 0.78/0.94 0.84/1.01	0.87/1.2 0.94/1.29 1.01/1.38

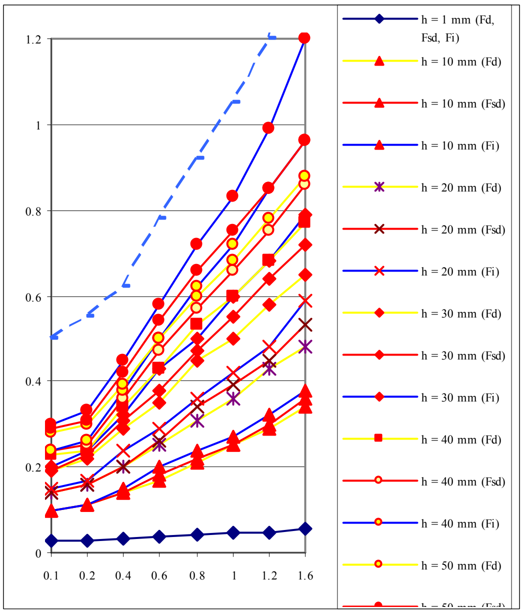

Fig. 4 - Power cut on the number of teeth and the depth of milling

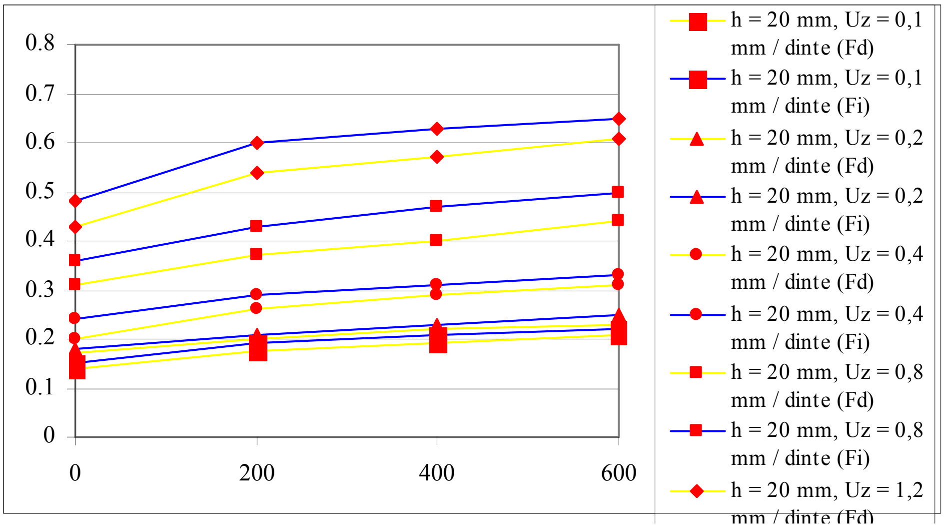

Fig. 5 - Cutting power depending on the length of milling for h = 20 mm

CONCLUSIONS

Analyzing the values in tables 1 and 2 and the diagrams in Figures 4 and 5 and the multitude of experimental data processing. the following main conclusions:

1. The advance cutting power per tooth increases with increasing use. so the feed speed u and the height (depth) h milling as an equation of type: $P = au^2 + bu + c$. The coefficients a. b and c depend on the depth of drilling and milling type (open. closed and semi).
2. Cutting power increases with increasing height (depth) as an equation milling type: $P = a_1h + b_1$. The a_1 and b_1 coefficients depend on the advance per tooth u_z. That relationship allows the determination of cutting power for other heights h milling than those who performed experiments.
3. Cutting power increases by increasing the cutting edges wear teeth. so the increase of milling length L. according to the diagrams of figure.

The analysis of values in Table 2 and diagrams from figure and P cut power. regardless the advance per tooth. depth of drilling and milling type. varies as follows:

- for an initial period of length L = 0 - 100 ml milling. cutting power to grow rapidly. causing the so-called initial wear (accommodation);
- the period length L = 100 - 600 ml milling cutting power increases almost linearly. with a trend higher in the $L \geq 600$ ml;
- power milling cutting lengths L> 600 ml. increased stress. are therefore required mandatory re-sharpness of the teeth cutting edges;
- by generalizing the experimental data shows that the power is cut at a time is $P = c_\rho \cdot P_0$. P_0 is the original and cutting power c_ρ. ρ is the coefficient of wear. which has values:

Length milled L.ml	1	200	400	600
Value c_ρ	1	1.15-1.20	1.25-1.30	1.4-1.45
Size range of roundness of the cutting edges of teeth ρ.µm	0.005	20-25	35-40	≥50

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