



Specific Cutting Force

STEM4inclusive schools
WP2 – Toolbox

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Determination of the main component of the cutting force

- Analytical method

$$F_Z = C_{Fz} \cdot t^{x_{Fz}} \cdot s^{y_{Fz}}$$

- Quasi-empirical method

$$F_Z = p_s \cdot t \cdot s$$



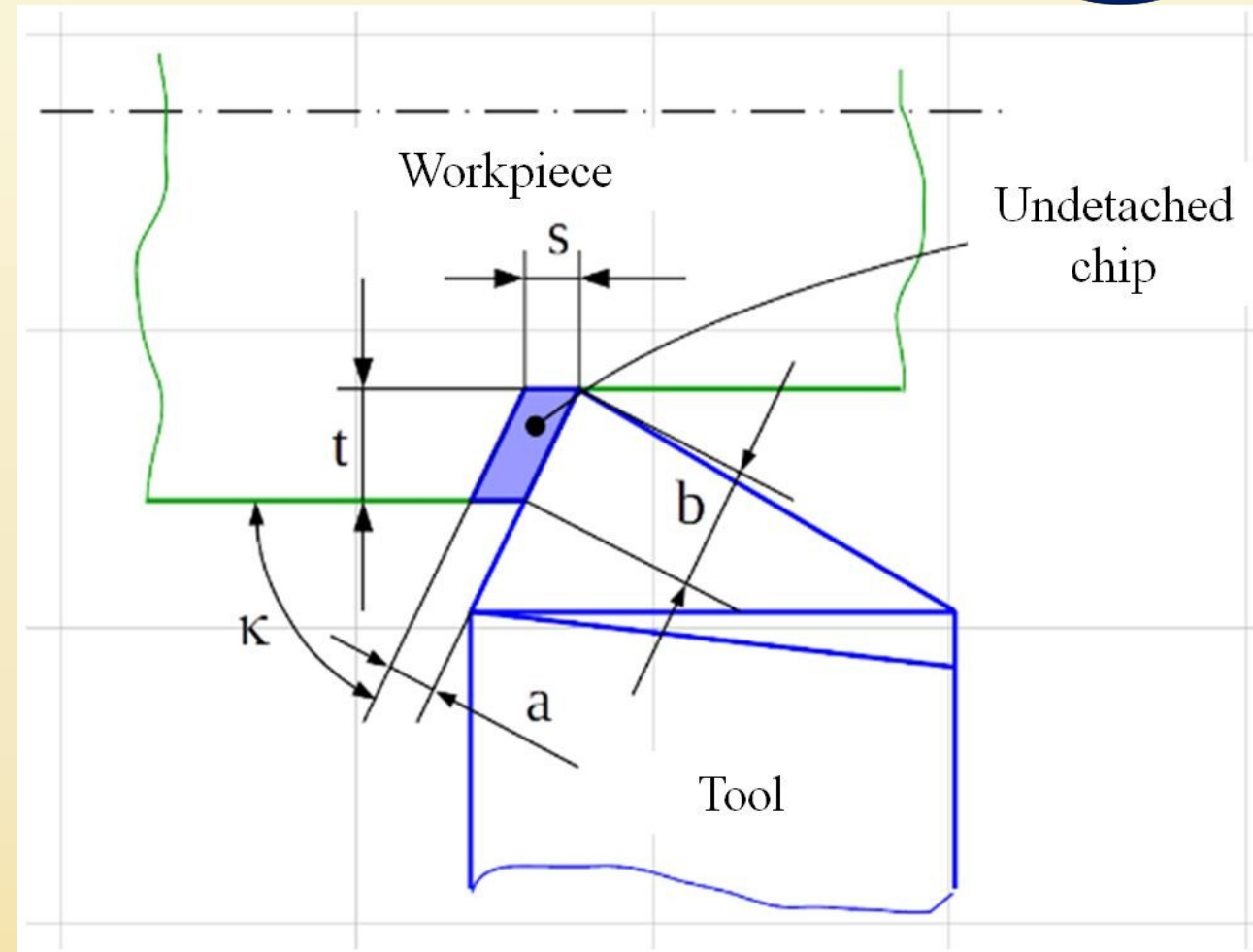


$$A = t \cdot s = a \cdot b$$

$$a = s \cdot \sin \kappa$$

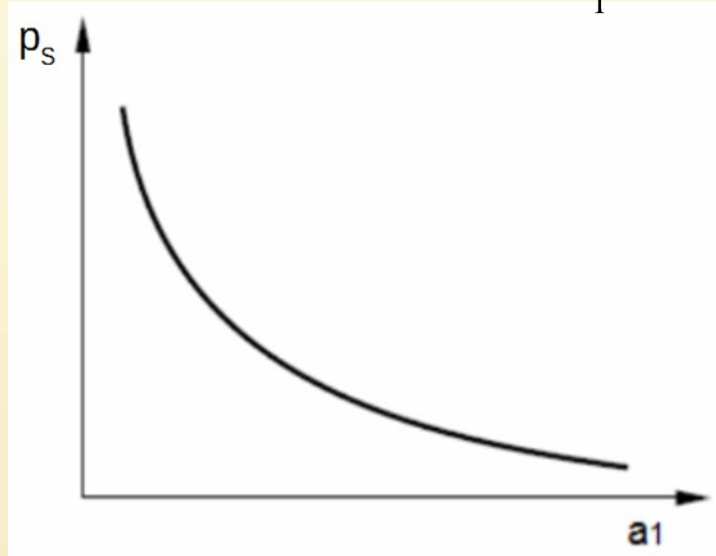
$$b = \frac{t}{\sin \kappa}$$

$$F_Z = p_s \cdot a \cdot b$$

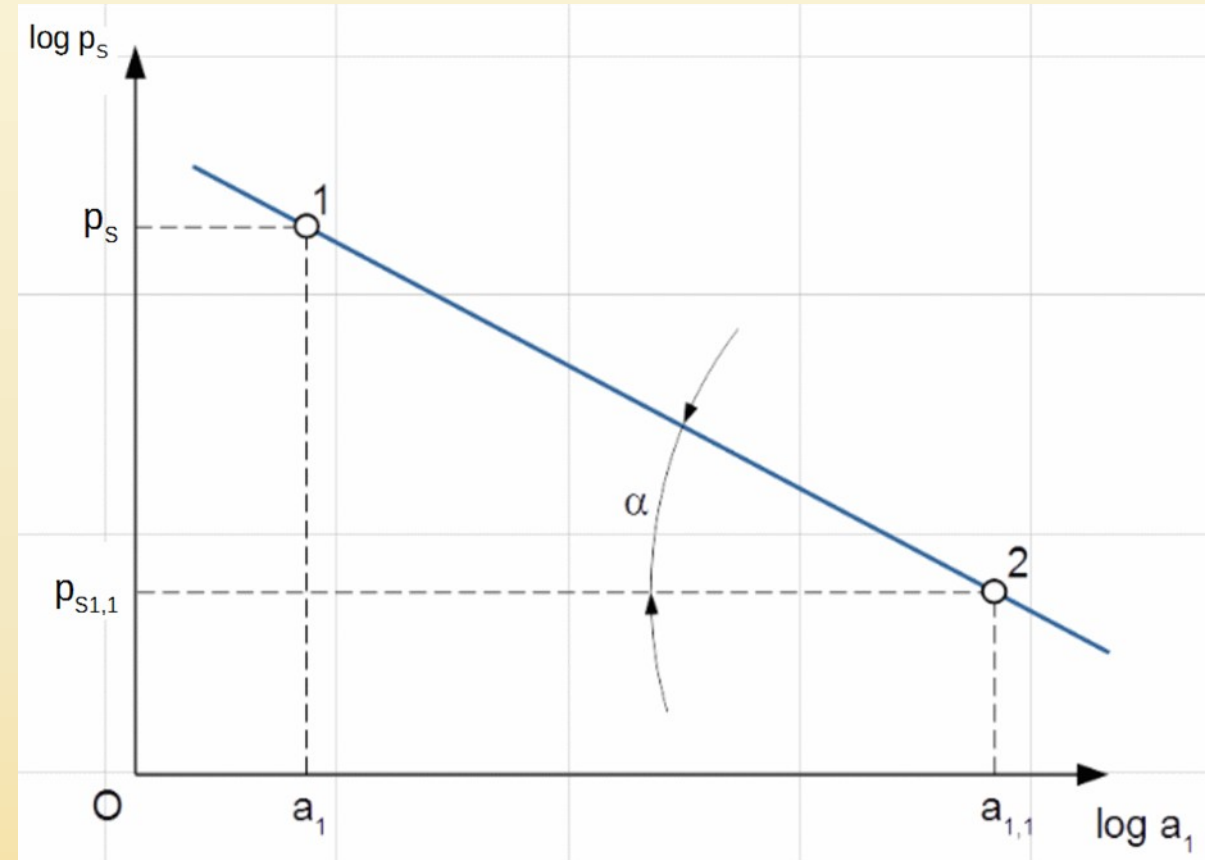




$$p_S = \frac{(1 \text{ mm})^z}{a_1^z} \cdot p_{S1,1}$$



$$\tan \alpha = \frac{\log p_S - \log p_{S1,1}}{\log a_{1,1} - \log a_1}$$





Cutting force

$$p_S = \frac{(1\text{mm})^z}{a_1^z} \cdot p_{S1,1} \cdot K_\gamma \cdot K_v \cdot K_C \cdot K_U$$

$$K_\gamma = 1 - \frac{\gamma_r - \gamma_0}{100};$$

$$K_v = 1,03 - \frac{3 \cdot v_{as}}{10^4};$$

$$K_C = 1 \div 1,1;$$

$$K_U = 1,3 \div 1,5.$$

$$F = A \cdot p_S = t \cdot s \cdot p_S$$





Specific cutting force

$$p_s = \frac{F_{as} \cdot v}{t \cdot s \cdot v} = \frac{L_0}{V} \left[\frac{\text{daN} \cdot \text{mm}}{\text{mm}^2} \right]$$

v – cutting speed [m/min.];

V – volume of chip removed in one minute [mm³/min.];

L_0 – the cutting work consumed when removing a cutting layer with a section of 1 mm², in one minute.

$$p_s = \frac{G \cdot L \cdot (\sin \alpha_0 - \sin \alpha_{med})}{a \cdot b \cdot l}$$

$G=100$ daN;

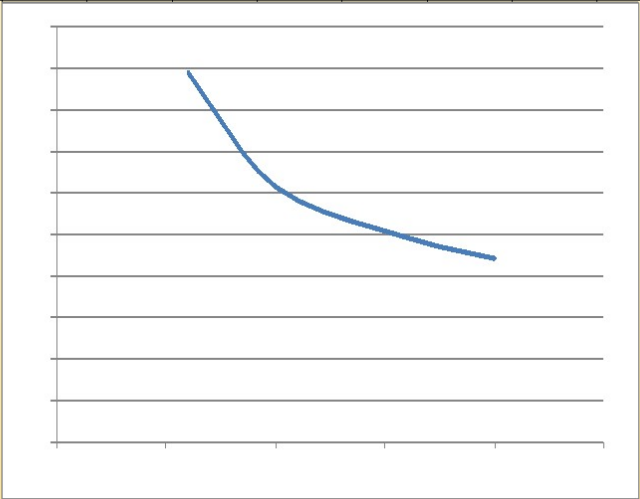
$L=400$ mm.





Bronze

Nr. Crt.	a	Alfa 0	Alfa 0 ra	Alfa	Alfa med	Alfa m ra	G	L	b	l	pz
1	0.06	28	0.488692	13	11.66667	0.203622	10	400	10	10	178.1693
				11							
				11							
2	0.1	28	0.488692	11	9.333333	0.162897	10	400	10	10	122.9175
				7							
				10							
3	0.16	28	0.488692	6	4.333333	0.075631	10	400	10	10	98.47818
				3							
				4							
4	0.2	28	0.488692	2	1.666667	0.029089	10	400	10	10	88.07737
				1							
				2							



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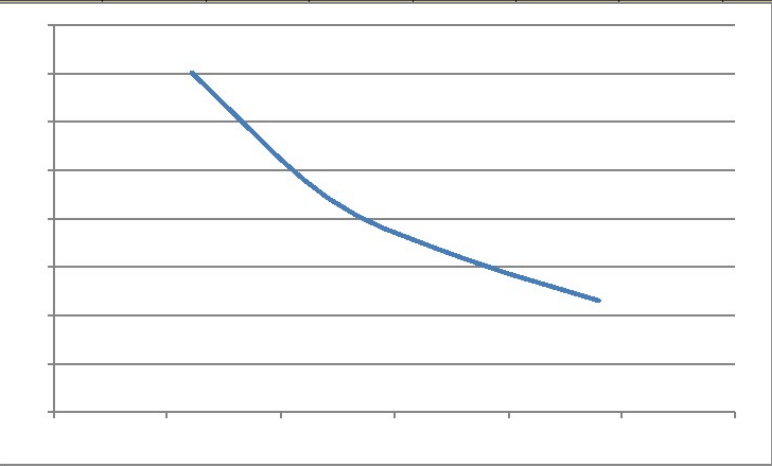


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Brass

Nr. Crt.	a	Alfa_0	Alfa_0_ra	Alfa	Alfa_med	Alfa_m_ra	G	L	b	l	pz
1	0.06	28	0.488692	21	21.33333	0.372337	10	400	10	20	35.22612
				22							
				21							
2	0.12	28	0.488692	20	19.66667	0.343248	10	400	10	20	22.15401
				19							
				20							
3	0.18	28	0.488692	19	19	0.331613	10	400	10	20	15.98927
				19							
				19							
4	0.24	28	0.488692	20	19.33333	0.33743	10	400	10	20	11.53401
				20							
				18							





Aluminum

Nr. Crt.	a	Alfa_0	Alfa_0_ra	Alfa	Alfa_med	Alfa_m_ra	G	L	b	l	pz
1	0.1	28	0.488692	16	14.66667	0.255982	10	400	10	20	43.25528
				14							
				14							
2	0.2	28	0.488692	13	11.66667	0.203622	10	400	10	20	26.7254
				12							
				10							
3	0.3	28	0.488692	10	10.66667	0.186168	10	400	10	20	18.95844
				12							
				10							
4	0.4	28	0.488692	9	6	0.10472	10	400	10	20	18.24715
				4							
				5							

