Equations, Data, Diagrams You May Find Useful

$$\log x^p = p\log x, \quad \log xy = \log x + \log y, \quad \log\frac{x}{y} = \log x - \log y$$

$$\tan\phi = \frac{r\cos\alpha}{1 - r\sin\alpha} \Rightarrow r = \frac{t_0}{t_c} = \frac{\sin\phi}{\cos(\phi - \alpha)} \qquad \alpha_e = \sin^{-1}\left(\sin^2 i + \cos^2 i \sin\alpha_n\right)$$

$$r = \frac{t_0}{t_c} = \frac{V_c}{V}$$

$$\gamma = \frac{AB}{OC} = \frac{AO}{OC} + \frac{OB}{OC} \Rightarrow \gamma = \cot\phi + \tan(\phi - \alpha)$$

$$\text{Shear Stress} = \frac{F_s}{\text{Area of the shear plane}}$$

$$\frac{V}{\cos(\phi - \alpha)} = \frac{V_s}{\cos\alpha} = \frac{V_c}{\sin\phi}$$

$$VT^n d^x f^y = C$$

$$\phi = 45° + \frac{\alpha}{2} - \frac{\beta}{2} \text{ (when } \mu = 0.5 \sim 2)$$
$$\Rightarrow \phi = 45° + \alpha - \beta$$

$$T = C^{1/n} V^{-1/n} d^{-x/n} f^{-y/n}$$

$$T \approx C^7 V^{-7} d^{-1} f^{-4}$$

$$\sigma_s = \frac{F_n \sin\emptyset}{t_0 w} \qquad \sigma = \frac{N}{t_c w}$$

$$\text{Power} = F_c V$$

$$\text{Power for friction} = FV_c$$

$$\text{Power for shearing} = F_s V_s$$

$$R_t = \frac{f^2}{8R}$$

$$\tau_s = \frac{F_s \sin\emptyset}{t_0 w} \qquad \tau = \frac{F}{t_c w}$$

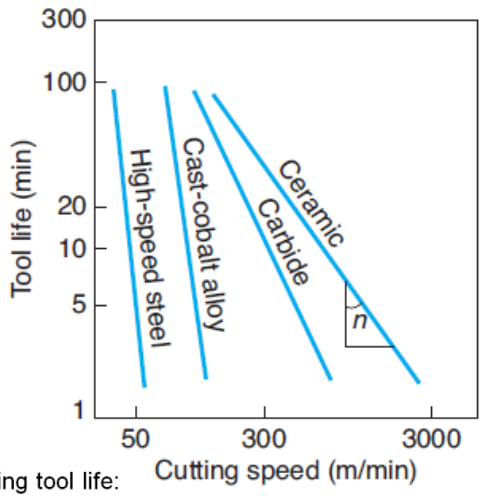
$$u_t = u_s + u_f \qquad u_s = \frac{F_s V_s}{w t_0 V}$$

$$u_f = \frac{FV_c}{wt_0 V} = \frac{Fr}{wt_0}$$

$$\eta_{mech} = \frac{Power_c}{Power_{source}}$$

Ranges of n Values for the Taylor Equation (21.20a) for Various Tool Materials

High-speed steels	0.08–0.2
Cast alloys	0.1–0.15
Carbides	0.2–0.5
Coated carbides	0.4–0.6
Ceramics	0.5–0.7

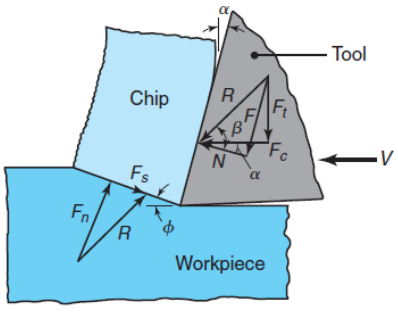


$$\mu = \tan\beta = \frac{F}{N} = \frac{F_t + F_c\tan\alpha}{F_c - F_t\tan\alpha}$$

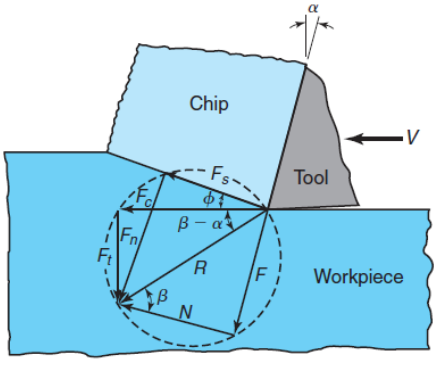
$$F_s = F_c\cos\phi - F_t\sin\phi$$
$$F_n = F_c\sin\phi + F_t\cos\phi$$

- Recommended cutting speed is one producing tool life:
  - 60-120 min: high-speed steel tools
  - 30-60 min: carbide tools

$$F_t = R\sin(\beta - \alpha) \text{ or } F_t = F_c\tan(\beta - \alpha)$$



(a)



(b)

Approximate Range of Energy Requirements in Cutting Operations at the Drive Motor of the Machine Tool (for Dull Tools, Multiply by 1.25)

Material	Specific energy W · s/mm³
Aluminum alloys	0.4–1
Cast irons	1.1–5.4
Copper alloys	1.4–3.2
High-temperature alloys	3.2–8
Magnesium alloys	0.3–0.6
Nickel alloys	4.8–6.7
Refractory alloys	3–9
Stainless steels	2–5
Steels	2–9
Titanium alloys	2–5