Formulas sheet

Turning process

$$r = \frac{t_0}{t_c} = \frac{V_c}{V} \qquad \tan\phi = \frac{r\cos\alpha}{1 - r\sin\alpha} \Rightarrow r = \frac{t_0}{t_c} = \frac{\sin\phi}{\cos(\phi - \alpha)} \qquad \frac{V}{\cos(\phi - \alpha)} = \frac{V_s}{\cos\alpha} = \frac{V_c}{\sin\phi}$$

$$n = \frac{V}{\pi D} \qquad time = \frac{L}{f \times n}$$

$$F_s = P_s\cos\phi - P_t\sin\phi \qquad F = P_s\sin\alpha + P_t\cos\alpha \qquad \mu = \tan\beta = \frac{F}{N}$$
$$F_n = P_s\sin\phi + P_t\cos\phi \qquad N = P_s\cos\alpha - P_t\sin\alpha$$

Cuttting power $= P_s V$ Power for friction $= FV_c$ Power for shearing $= F_s V_s$

$$K_s = u_t = u_s + u_f$$

$$u_s = \frac{F_s V_s}{w t_0 V}$$

$$u_f = \frac{FV_c}{w t_0 V} = \frac{Fr}{w t_0}$$

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

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

Tool life and tool wear

$$VT^n = C \qquad T_m = \frac{L}{fN} \qquad T_{opt} = \left[(1/n) - 1\right]T_c \qquad V_{opt} = \frac{C}{\left\{\left[(1/n) - 1\right]T_c\right\}^n}$$

Drilling

$$P_s = K_s A \qquad \text{A} = (\text{D*f})/4 \qquad M = P_s \times D/2 \qquad M = Ks \times \frac{D^2 \times f}{8}$$

$$CuttingPower = P_s \times V \text{ ,} \qquad P_{motor} = \frac{P_s \times V}{\eta_{mech}} \text{ ,} \qquad t_m = \frac{L + (D/4)}{f \times N} \text{ ,} \qquad MRR = \frac{\pi D^2 \times f \times N}{4}$$

Milling

$$tc = \frac{2 f_r}{N \times z}\sqrt{d/D} \qquad tc_m = 1/2tc$$

$f = f_r/(N*z)$ $\qquad P_s = K_s \times w \times t$

$$P_{s(total)mean} = \frac{f_r \times d \times w}{\pi \times D \times N} \times K_s \qquad Power_{mean} = P_{s(total)mean} \times V$$

$$A = \sqrt{d(D-d)}$$

$$T_m = \frac{L + A}{f_r}$$

$$MRR = \frac{L \times d \times w}{T_m}$$