P8.3 Consider temperature in the chip, neglecting heat conducted through the tool. Refer to Section 8.2.2 and Fig. P8.3.

(a) Chip width $b = 8\,mm$, $h_1 = 0.12\,mm$, $v = 3000\ mm/sec$, $K_s = 2000\ N/mm^2$, $L_c = 1.0\,mm$, $\phi = 30^\circ$, $\beta = 20^\circ$, $T_{room} = 20°C$, $\Delta x = 0.002\,mm$, $\Delta y = 0.01\,mm$, $k = 40\ N/(sec.°C)$, $(\rho c) = 3.6\ N/(mm^2.°C)$. Determine:

Shear-plane temperature: $v_s(mm/sec)$, $F_s(N)$, $P_s(mW)$, $T_s(°C)$,

Friction power distribution: $F_f(N)$, $v_c(mm/sec)$, $P_f(mW)$, $P_{max}(mW)$:

Start of the potential computation:

Determine $T_{1,1}, T_{2,1}, T_{3,1}, T_{1,2}, T_{2,2}, T_{3,2}$

(b) Chip width $b = 10\,mm$, $h_1 = 0.15\,mm, v = 2500\ mm/sec\,, K_s = 2000\ N/mm^2$, $L_c = 1.0\,mm$, $\phi = 30^\circ, \beta = 20^\circ$, $T_{room} = 20°C, \Delta x = 0.002\,mm, \Delta y = 0.01\,mm$, $k = 40\ N/(sec.°C)$, $(\rho c) = 3.6\ N/(mm^2.°C)$.

(c) $b = 10\,mm$, $h_1 = 0.1\,mm$, $h_2 = 0.2\,mm$, $\Delta x = 0.002\,mm$, $\Delta y = 0.01\,mm$, $K_s = 1800\ N/mm^2$, $v = 2500\ mm/sec$, $k = 24.5\ N/(sec.°C)$, $(\rho c) = 3.5\ N/(mm^2.°C)$, $\phi = 26.57^\circ, \beta = 20^\circ, T_{room} = 20°C$.

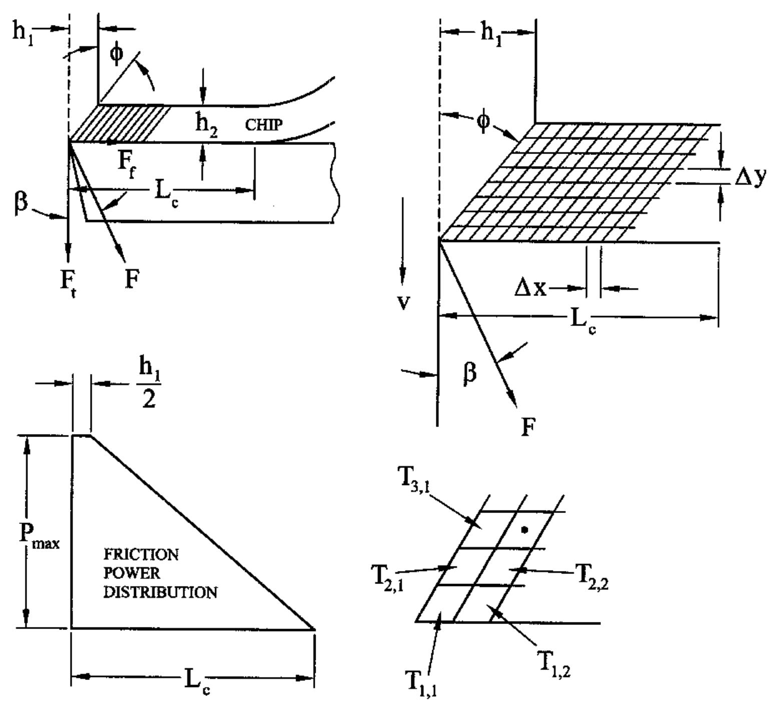
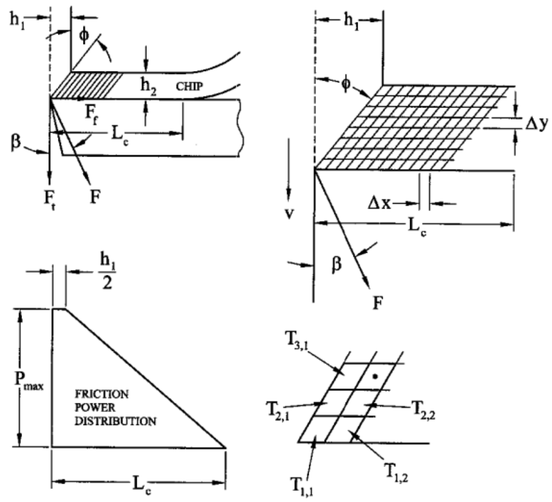


Figure P8.3

P8.4 Consider temperature in the chip; neglect heat conducted through the tool. Refer to Section 8.2.2 and Fig. P8.3. Machining steel 1035, $k = 43\ N/(sec.°C)$, $\alpha = 12\ mm^2/sec$, $(\rho c) = 3.7\ N/(mm^2.°C)$, $h_1 = 0.2\, mm$, $b = 10\, mm$, $L_c = 0.8\, mm$, $v_c = 1.5(m/sec)$, $\Delta x = 0.0025\, mm$, $\Delta y = 0.02\, mm$, $\beta = 20^{\circ}$, $\phi = 25^{\circ}$.



The following values have been precomputed: Shear-plane temperature $T_s = 510°C$, friction power $P_f = 2.07 \times 10^6\ N.mm/s\ (mW)$.

(a) Determine P_{max}.

(b) Determine the initial tempratures in the thermal field: $T_{1,1}, T_{2,1}, T_{3,1}, T_{1,2}, T_{2,2}$.

P8.5 Consider temperatures in the chip; neglect heat through the tool. Refer to Section 8.2.2 and Fig. P8.5 and P8.10. Cutting steel $K_s = 2000\ N/mm^2$, $(\rho c) = 3.7\ N/(mm^2.°C)$, $h_1 = 0.25\, mm$, $b = 8\, mm$, $\beta = 25^{\circ}$, $\phi = 30^{\circ}$, $\alpha = 0^{\circ}$, $v = 3\ m/sec$. Determine cutting force $F(N)$, shearing force $F_s(N)$, shearing velocity $v_s(mm/sec)$, shearing power $P_s(N\, mm/s)$, and shear-plane temperature $T_s(°C)$, assuming $T_{room} = 20°C$. Thermal diffusivity $\alpha = 12\ mm^2/sec$. Determine chip velocity v_c, friction force F_f, and friction power $P_f(N\, mm/s)$. Element dimentions: $\Delta x = 0.0025\, mm$, $\Delta y = 0.022\, mm$. Determine time step Δt. In the course of computation, we find: $T_{1,165} = 779.2°C$, $T_{2,165} = 706.0°C$, $T_{3,165} = 670.1°C$, and $T_{1,166} = 781.0°C$. Determine $T_{2,166}$.

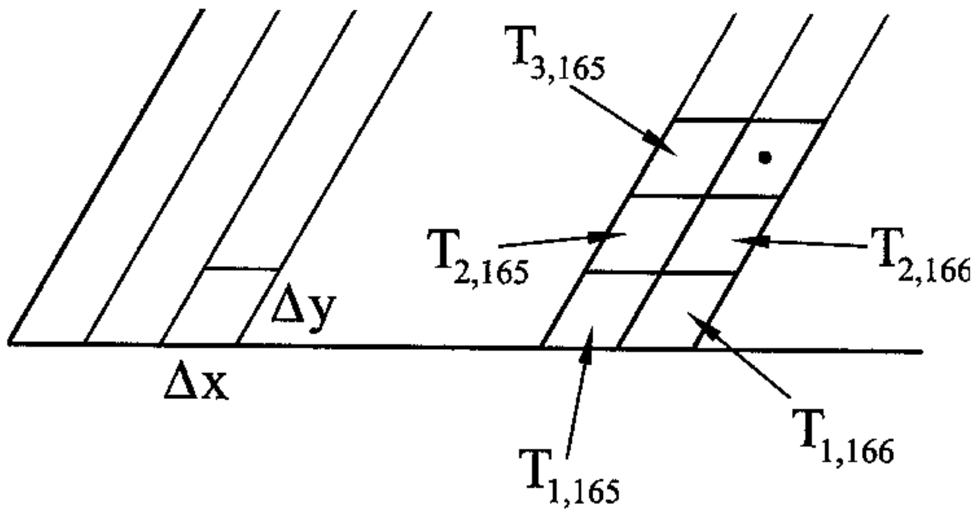


Figure P8.5