Important Mechanics of Orthogonal Cutting Formulas PDF

Formulas
Examples
with Units

List of 10
Important Mechanics of Orthogonal Cutting Formulas

1) Area of Cut from Tool Temperature Formula

Evaluate Formula

Formula

$$A = \left(\frac{\theta \cdot k^{0.44} \cdot c^{0.56}}{C_0 \cdot U_s \cdot V^{0.44}} \right)^{\frac{100}{22}}$$

Example with Units

$$0.0073\,\text{m}^2 = \left(\frac{273\,\text{°C} \cdot 10.18\,\text{W/(m*K)}^{0.44} \cdot 4.184\,\text{kJ/kg*K}^{0.56}}{0.29 \cdot 200\,\text{kJ/kg} \cdot 120\,\text{m/s}^{0.44}} \right)^{\frac{100}{22}}$$

2) Cutting Speed from Tool Temperature Formula

Evaluate Formula

Formula

$$V = \left(\frac{\theta \cdot k^{0.44} \cdot c^{0.56}}{C_0 \cdot U_s \cdot A^{0.22}} \right)^{\frac{100}{44}}$$

Example with Units

$$2\,\text{m/s} = \left(\frac{273\,\text{°C} \cdot 10.18\,\text{W/(m*K)}^{0.44} \cdot 4.184\,\text{kJ/kg*K}^{0.56}}{0.29 \cdot 200\,\text{kJ/kg} \cdot 26.4493\,\text{m}^2{}^{0.22}} \right)^{\frac{100}{44}}$$

3) Cutting Speed given Spindle Speed Formula

Evaluate Formula

Formula

$$V = \pi \cdot D \cdot N$$

Example with Units

$$2.0016\,\text{m/s} = 3.1416 \cdot 0.01014\,\text{m} \cdot 600\,\text{rev/min}$$

4) Machining Time given Cutting Speed Formula

Evaluate Formula

Formula

$$t = \frac{\pi \cdot D \cdot L}{f \cdot V}$$

Example with Units

$$1.1377\,\text{s} = \frac{3.1416 \cdot 0.01014\,\text{m} \cdot 3\,\text{m}}{0.70\,\text{mm/rev} \cdot 120\,\text{m/s}}$$

5) Machining Time given Spindle Speed Formula

Evaluate Formula

Formula

$$t = \frac{L}{f \cdot N}$$

Example with Units

$$68.2093\,\text{s} = \frac{3\,\text{m}}{0.70\,\text{mm/rev} \cdot 600\,\text{rev/min}}$$

6) Nose Radius of Tool from Surface Finish Constraint Formula

Evaluate Formula

Formula

$$r_{nose} = \frac{0.0321}{C}$$

Example with Units

$$0.107\,\text{m} = \frac{0.0321}{0.3\,\text{m}^{-1}}$$

7) Specific Cutting Energy Per Unit Cutting Force from Tool Temperature Formula

Evaluate Formula

Formula

$$U_s = \frac{\theta \cdot c^{0.56} \cdot k^{0.44}}{C_0 \cdot V^{0.44} \cdot A^{0.22}}$$

Example with Units

$$33.0098\,\text{kJ/kg} = \frac{273\,\text{°C} \cdot 4.184\,\text{kJ/kg*K}^{0.56} \cdot 10.18\,\text{W/(m*K)}^{0.44}}{0.29 \cdot 120\,\text{m/s}^{0.44} \cdot 26.4493\,\text{m}^{2}{}^{0.22}}$$

8) Specific Heat of Work from Tool Temperature Formula

Evaluate Formula

Formula

$$c = \left(\frac{C_0 \cdot U_s \cdot V^{0.44} \cdot A^{0.22}}{\theta \cdot k^{0.44}} \right)^{\frac{100}{56}}$$

Example with Units

$$104.4024\,\text{kJ/kg*K} = \left(\frac{0.29 \cdot 200\,\text{kJ/kg} \cdot 120\,\text{m/s}^{0.44} \cdot 26.4493\,\text{m}^{2}{}^{0.22}}{273\,\text{°C} \cdot 10.18\,\text{W/(m*K)}^{0.44}} \right)^{\frac{100}{56}}$$

9) Surface Finish Constraint Formula

Evaluate Formula

Formula

$$C = \frac{0.0321}{r_{nose}}$$

Example with Units

$$0.3\,\text{m}^{-1} = \frac{0.0321}{0.107\,\text{m}}$$

10) Thermal Conductivity of Work from Tool Temperature Formula

Evaluate Formula

Formula

$$k = \left(\frac{C_0 \cdot U_s \cdot V^{0.44} \cdot A^{0.22}}{\theta \cdot c^{0.56}} \right)^{\frac{100}{44}}$$

Example with Units

$$610.8\,\text{W/(m*K)} = \left(\frac{0.29 \cdot 200\,\text{kJ/kg} \cdot 120\,\text{m/s}^{0.44} \cdot 26.4493\,\text{m}^{2}{}^{0.22}}{273\,\text{°C} \cdot 4.184\,\text{kJ/kg*K}^{0.56}} \right)^{\frac{100}{44}}$$

Variables used in list of Mechanics of Orthogonal Cutting Formulas above

- **A** Cutting Area *(Square Meter)*
- **c** Specific Heat Capacity *(Kilojoule per Kilogram per K)*
- **C** Feed Constraint *(1 per Meter)*
- C_0 Tool Temperature Constant
- **D** Workpiece Diameter *(Meter)*
- **f** Feed Rate *(Millimeter Per Revolution)*
- **k** Thermal Conductivity *(Watt per Meter per K)*
- **L** Length of Bar *(Meter)*
- **N** Spindle Speed *(Revolution per Minute)*
- r_{nose} Nose Radius *(Meter)*
- **t** Machining Time *(Second)*
- U_s Specific Cutting Energy *(Kilojoule per Kilogram)*
- **V** Cutting Velocity *(Meter per Second)*
- **θ** Tool Temperature *(Celsius)*

Constants, Functions, Measurements used in list of Mechanics of Orthogonal Cutting Formulas above

- constant(s): **pi**, 3.14159265358979323846264338327950288 *Archimedes' constant*
- Measurement: **Length** in Meter (m) *Length Unit Conversion*
- Measurement: **Time** in Second (s) *Time Unit Conversion*
- Measurement: **Temperature** in Celsius (°C) *Temperature Unit Conversion*
- Measurement: **Area** in Square Meter (m²) *Area Unit Conversion*
- Measurement: **Speed** in Meter per Second (m/s) *Speed Unit Conversion*
- Measurement: **Thermal Conductivity** in Watt per Meter per K (W/(m*K)) *Thermal Conductivity Unit Conversion*
- Measurement: **Specific Heat Capacity** in Kilojoule per Kilogram per K (kJ/kg*K) *Specific Heat Capacity Unit Conversion*
- Measurement: **Angular Velocity** in Revolution per Minute (rev/min) *Angular Velocity Unit Conversion*
- Measurement: **Specific Energy** in Kilojoule per Kilogram (kJ/kg) *Specific Energy Unit Conversion*
- Measurement: **Feed** in Millimeter Per Revolution (mm/rev) *Feed Unit Conversion*
- Measurement: **Reciprocal Length** in 1 per Meter (m^{-1}) *Reciprocal Length Unit Conversion*

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