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Mechanics of Orthogonal Cutting Formulas

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List of 10 Mechanics of Orthogonal Cutting Formulas

Mechanics of Orthogonal Cutting

1) Area of Cut from Tool Temperature

Open Calculator

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

ex $$26.4493\text{m}^2 = \left(\frac{273^\circ\text{C} \cdot (10.18\text{W/(m*K)})^{0.44} \cdot (4.184\text{kJ/kg*K})^{0.56}}{0.29 \cdot 200\text{kJ/kg} \cdot (120\text{m/min})^{0.44}} \right)^{\frac{100}{22}}$$

2) Cutting Speed from Tool Temperature

Open Calculator

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

ex $$120\text{m/min} = \left(\frac{273^\circ\text{C} \cdot (10.18\text{W/(m*K)})^{0.44} \cdot (4.184\text{kJ/kg*K})^{0.56}}{0.29 \cdot 200\text{kJ/kg} \cdot (26.4493\text{m}^2)^{0.22}} \right)^{\frac{100}{44}}$$

3) Cutting Speed given Spindle Speed

Open Calculator

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

ex $$120.0933\text{m/min} = \pi \cdot 0.01014\text{m} \cdot 600\text{rev/min}$$

4) Machining Time given Cutting Speed

Open Calculator

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

$$68.26232\text{s} = \frac{\pi \cdot 0.01014\text{m} \cdot 3\text{m}}{0.70\text{mm/rev} \cdot 120\text{m/min}}$$

5) Machining Time given Spindle Speed

Open Calculator

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

$$68.20926\text{s} = \frac{3\text{m}}{0.70\text{mm/rev} \cdot 600\text{rev/min}}$$

6) Nose Radius of Tool from Surface Finish Constraint

Open Calculator

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

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

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

Open Calculator

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

$$200\text{kJ/kg} = \frac{273^\circ\text{C} \cdot (4.184\text{kJ/kg*K})^{0.56} \cdot (10.18\text{W/(m*K)})^{0.44}}{0.29 \cdot (120\text{m/min})^{0.44} \cdot (26.4493\text{m}^2)^{0.22}}$$

8) Specific Heat of Work from Tool Temperature

Open Calculator

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

ex $$4.184\text{kJ/kg*K} = \left(\frac{0.29 \cdot 200\text{kJ/kg} \cdot (120\text{m/min})^{0.44} \cdot (26.4493\text{m}^2)^{0.22}}{273^\circ\text{C} \cdot (10.18\text{W/(m*K)})^{0.44}} \right)^{\frac{100}{56}}$$

9) Surface Finish Constraint

Open Calculator

fx $$C_s = \frac{0.0321}{r_{nose}}$$

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

10) Thermal Conductivity of Work from Tool Temperature

Open Calculator

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

ex $$10.18\text{W/(m*K)} = \left(\frac{0.29 \cdot 200\text{kJ/kg} \cdot (120\text{m/min})^{0.44} \cdot (26.4493\text{m}^2)^{0.22}}{273^\circ\text{C} \cdot (4.184\text{kJ/kg*K})^{0.56}} \right)^{\frac{100}{44}}$$

Variables Used

- **A** Cutting Area *(Square Meter)*
- **c** Specific Heat Capacity *(Kilojoule per Kilogram per K)*
- C_0 Tool Temperature Constant
- C_s Constraint on Feed *(1 per Meter)*
- **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_m Machining Time *(Second)*
- U_s Specific Cutting Energy *(Kilojoule per Kilogram)*
- **V** Cutting Velocity *(Meter per Minute)*
- **θ** Tool Temperature *(Celsius)*

Constants, Functions, Measurements used

- Constant: **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 Minute (m/min)
  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

Check other formula lists

- **Mechanics of Orthogonal Cutting Formulas**

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