Drilling Equations

**Rotational Speed (RPM’s)**

\[ N = \frac{v}{\pi D} \]

\( N \) = Rotational Speed (RPM’s)
\( v \) = Cutting Speed (SFPM)
\( D \) = Drill Diameter

**Feed Rate \((\text{Dist}/\text{Min})\)**

\[ f_r = N f \]

\( f_r \) = Feed \((\text{Dist.}/\text{Rev.})\)
Drilling Equations

**Approach Distance**

\[ A = 0.5 \, D \, \tan(90 - \frac{\Theta}{2}) \]

- \( A \) = Approach Distance
- \( D \) = Drill Diameter
- \( \Theta \) = Drill Point Angle

**Machining Time**

\[ T_m = \frac{d \text{ or } t + A}{f_r} \]

- \( T_m \) = Machining Time (Min.)
- \( d \) or \( t \) = Part Thickness/Depth
- \( A \) = Approach Distance
- \( f_r \) = Feed Rate (Dist./Min.)
Drilling Equations

**Material Removal Rate** \((\text{cu.in.}/\text{Min})\)

\[
MRR = \frac{\pi D^2 f_r}{4}
\]

- \(MRR = \text{Material Removal Rate (\text{cu.in.}/\text{Min})}\)
- \(D = \text{Drill Dia.}\)
- \(f_r = \text{Feed Rate (In./Min.)}\)
Drilling Example

Data: \( D = 0.375'' \); \( v = 130.50 \text{ SFPM} \); \( f = 0.002 \frac{\text{in}}{\text{rev}} \);
\( \theta = 112^\circ \); Through Hole
Drilling Example

**Approach Distance**

\[ A = 0.5 \, D \, \tan \left( 90 - \theta/2 \right) \]

\[ A = (0.5) \, (0.375) \, \tan \left( 90 - \frac{112}{2} \right) \]

\[ A = 0.1265'' \]

**Rotational Speed**

\[ N = \frac{v}{\pi \, D} \]

\[ N = \frac{(130.50) \, (12)}{\pi \, 0.375} \]

\[ N = 1,329.3718 \text{ RPM's} \]
Drilling Example

**Feed Rate**

\[ f_r = N f \]

\[ f_r = (1329.3718)(0.002) \]

\[ f_r = 2.6587 \text{ in/Min} \]

**Machining Time**

\[ T_m = \frac{t + A}{f_r} \]

\[ T_m = \frac{0.750 + 0.1265}{2.6587} \]

\[ T_m = 0.3297 \text{ Min} \]
Drilling Example

**Material Removal Rate**

\[ MRR = \frac{\pi D^2 f_r}{4} \]

\[ MRR = \frac{\pi (0.375^2)(2.6587)}{4} \]

\[ MRR = 0.2936 \text{ in}^3/\text{Min} \]