Radial Chip Thinning

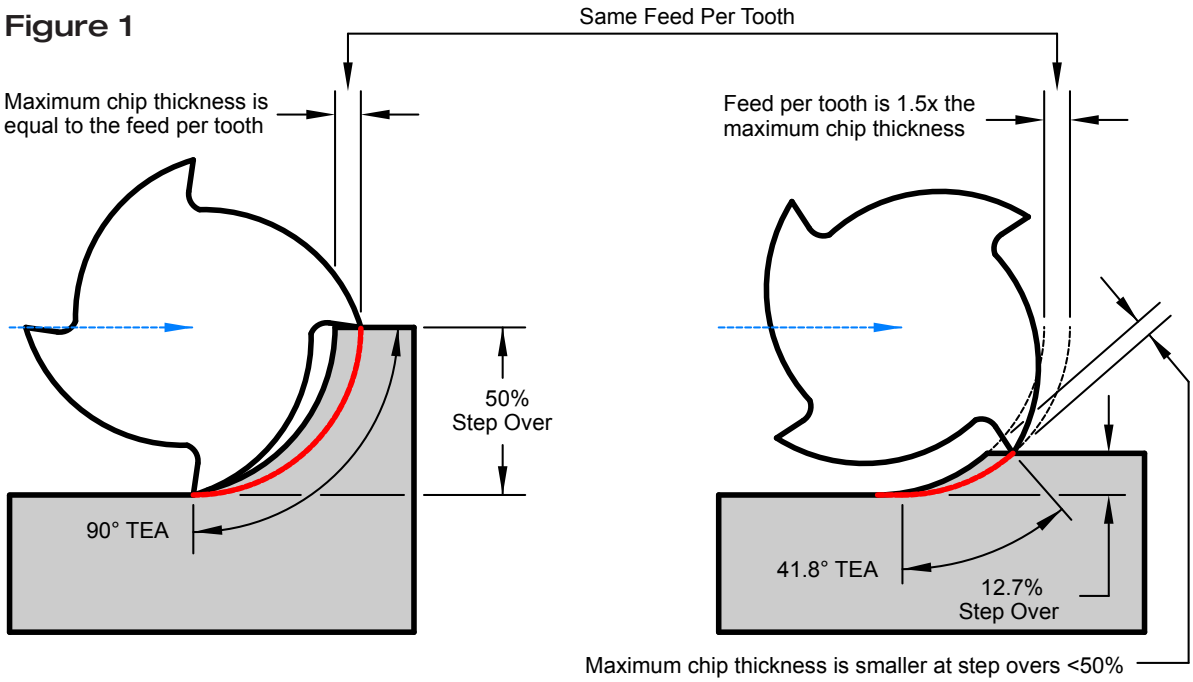
Defining Chip Thinning

Radial chip thinning is a phenomenon that occurs with varying radial depths of cut, and relates to chip thickness and feed per tooth. While these two values are often mistaken as the same, they are separate variables that have a direct impact on each other. Feed per tooth translates directly to your tool feed rate, and is commonly referred to as IPT or chipload.

Chip Thickness

Chip thickness is not as often thought of directly. It is the actual thickness of each chip cut by a tool, measured at its largest cross-section. Users should be careful not to confuse chip thickness and feed per tooth, as these are each directly related to the ideal cutting conditions.

Figure 1



Why It Happens

When using a 50% step over (left side of **Figure 1**), the chip thickness and feed per tooth are equal to each other. Each tooth will engage the workpiece at a right angle, allowing for the most effective cutting action, avoiding rubbing as much as possible. Once the radial depth of cut falls below 50% of the cutter diameter (right side of **Figure 1**), the maximum chip thickness decreases, in turn changing the ideal cutting conditions of the application. This can lead to poor part finish, inefficient cycle times, and premature tool wear. Adjusting the running parameters can greatly help reduce these issues, giving you great results in all situations.

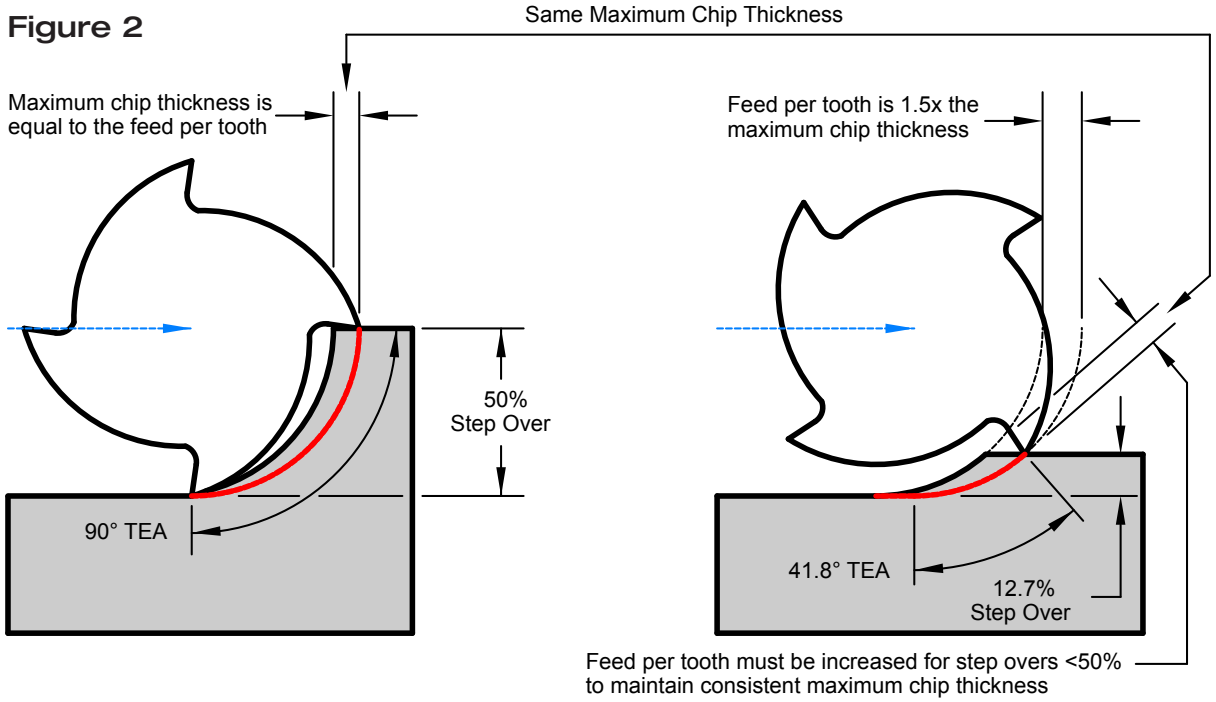
Radial Chip Thinning (cont.)

Optimize Your Feed Rates

The aim is to achieve a constant chip thickness by adjusting the feed rate when cutting at different radial depths of cut (step over). This can be done with the following equation using the tool diameter (D), radial depth of cut (RDOC), chip thickness (CT), and feed rate (IPT). For chip thickness, use the recommended value of IPT at 50% step over. Finding an adjusted feed rate is as simple as plugging in the desired values and solving for IPT. This keeps the chip thickness constant at different depths of cut, rather than keeping the feed rate constant at different depths of cut. The adjustment is illustrated in **Figure 2**.

Inches Per Tooth (Chip Thinning Adjustment) $IPT_{adj} = \frac{CT \times D}{2 \times \sqrt{(D \times RDOC) - RDOC^2}}$

Figure 2



Lasting Benefits

In the end, the purpose of these chip thinning adjustments is to get the most out of your tool. Keeping the chip thickness constant ensures that a tool is doing as much work as it can within any given cut. Other benefits include: reduced rubbing, increased metal removal rates, and improved tool life.

The Helical Milling Advisor™ will complete these types of calculations for you by providing recommended speeds and feeds in a wide variety of materials and applications. This program takes your machining requirements into account and helps calculate your optimal milling parameters.