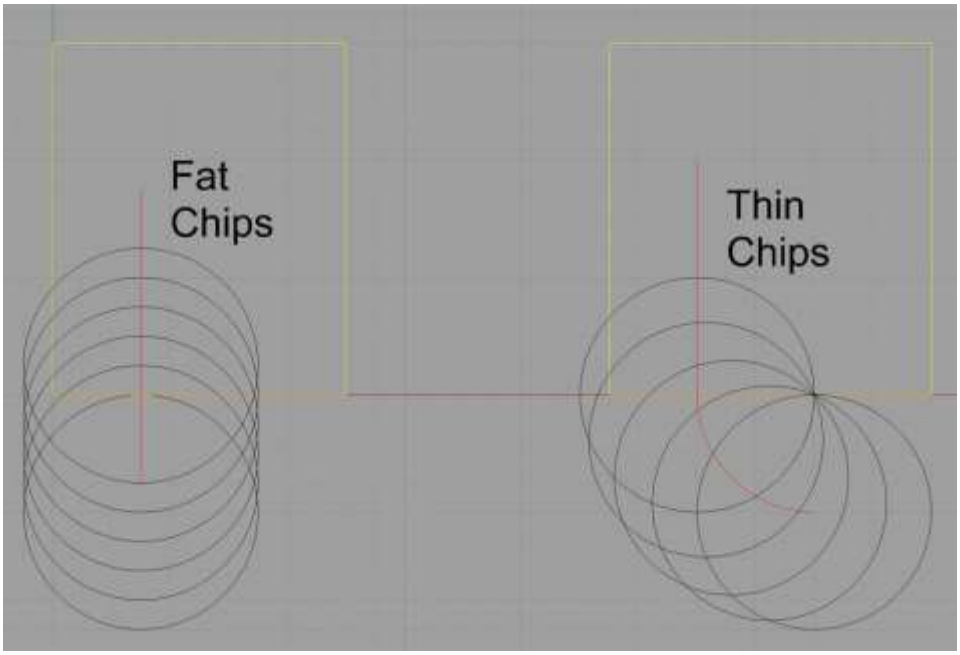
Face Milling Considerations:

Cut Entry and Exit

Entry into a cut is the worst case of interrupted cut, and causes the most wear and tear on the cutter. Ideally, you want to roll the cutter smoothly into the material with an arc motion rather than a straight line. If you must move in a straight line, avoid a head-on collision–try to enter almost tangentially. If you can't roll gently into a cut, try reducing the feedrate to half until the cutter is fully engaged in the cut.

Isn't it interesting how Mother Nature tends to like circles better than straight lines? Chip thinning, rolling into a cut, and the trochoidal paths of high speed maching are all about the behavior of circles as we try to use them (in the form of rotating cutters) to cut the straight lines that we humans are more comfortable with. Circles are more gentle and natural in these applications.

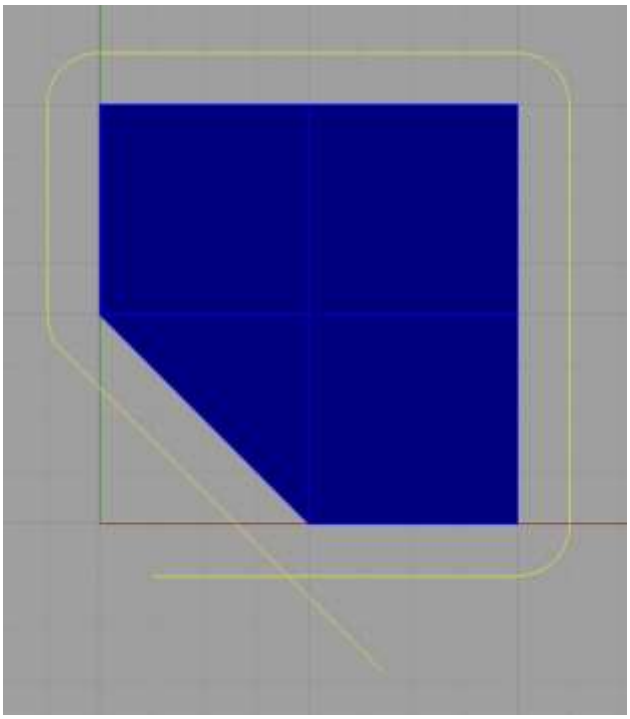


Not the chip shape to the right of the feed line (the red line is the path the cutter follows): thin chips on exit are better!

To execute an entry like this means starting the cutter out one radius to the right of the original starting location and then rolling it in along a path that is an arc with the same radius as the cutter. The folks on PM report that this works as well for endmills as it does for the face mills Sandvik shows in their video. In fact, they say it really helps improve cutter life on materials like Stainless Steel.

Entry for Profile Cuts Around the Edge

If you want to minimize tool marks resulting from lead-in and lead-out moves while profiling, align those moves with the part corner. For example, check out those moves on this part:



Follow this path to cut the outer part profile for best results…

Finished part is blue, toolpath is yellow. Note lead-in/lead-out on the lower corner, exaggerated for emphasis…
The technique works because the tool only touches on the corner during lead-in lead-out.

Stay off-center when Face Milling

If your cutter is wider than the cut, don't position the cutter right on the centerline–keep it on one side or the other. This loads one side of the cutter and makes for a more stable cut since the cutting forces will tend not to move around the way they do when the cutter is centered. Ideally, position on the side (based on spindle revolution) that results in climb milling where the chip starts large and gets smaller. This is left of center for a clockwise spindle rotation. A centered cutter has a large average chip thickness throughout, but an offset cutter can start chips large and have them get smaller, which is more favorable geometry as we discussed under Cut Entry and Exit.