# *Adaptive Clearing*: *The missing strategy for roughing*

## Use the other 70% of your tool's cutting capability

### Traditional Area Clearing Strategy, using offset contours.

While you can specify the step-over, cuts which use the full width of the tool are sometimes unavoidable. Each Z-step must be shallow enough to limit the maximum tool load. Tool wear occurs only at the tip, and cutting forces are applied far from the tool holder.

*Tip cutting*

*Flank cutting*

### New Adaptive Clearing Strategy, using stock simulation

You can cut with the full depth of the tool and safely run your machine at the optimum speed without exceeding its limits at an isolated point. Tool wear is spread evenly across the cutting surfaces. The centre of force is half-way up the tool, reducing deflection and the potential for vibration.

x 2

x 10
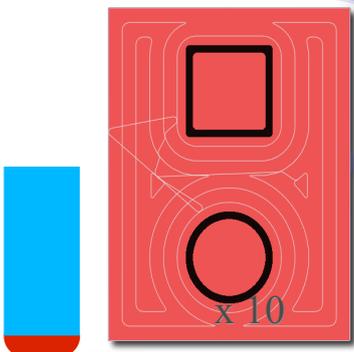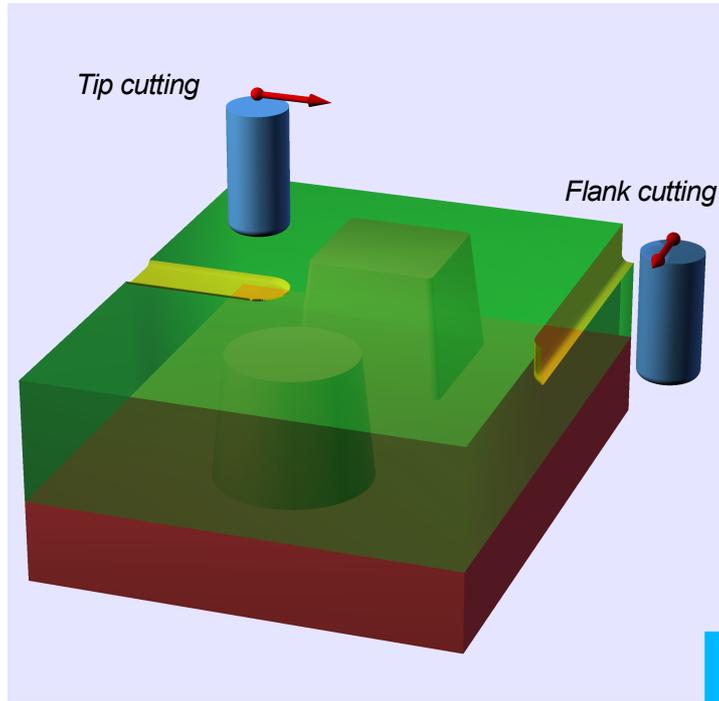
Tool contact at tip (red)
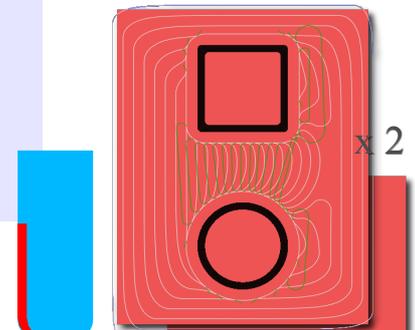
Tool contact at flank (red)

x 8

| Strategy | *Offset* | *Adaptive* |
|----------|----------|------------|
| **Z steps** | 10 complete | 2 complete, 8 rest |
| **Cutting length** | 21024 mm | 8177 mm |
| **Total length** | 22369 mm | 13736 mm |
| **Feedrate** | 8000mm/min | 8000mm/min |

*Adaptive Clearing is shorter because most levels are not completely cleared. For most levels only the remaining material left by the previous large step-down needs to be removed.*
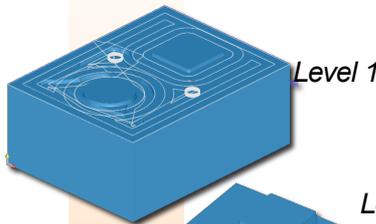
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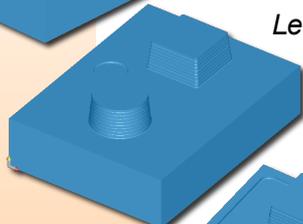
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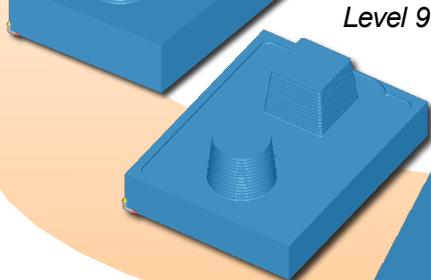
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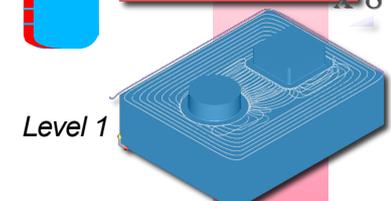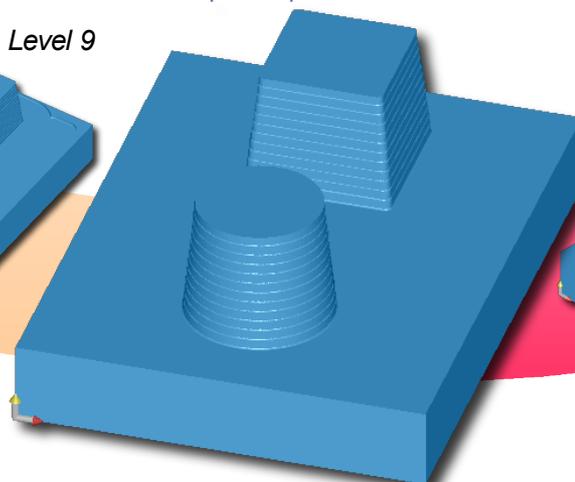
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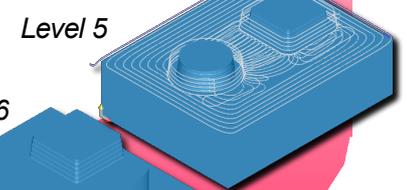
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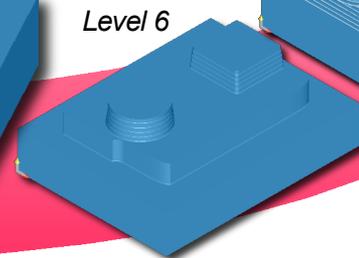
Level 6

*The Adaptive Clearing algorithm is available for integration into any CAM system under license, and is currently sold as an optional extra to Mastercam from CIMCO Integration (www.cimco-hsm.com). More information, including an online interface to generate toolpaths for your own models can be found on:*

## www.freesteel.co.uk
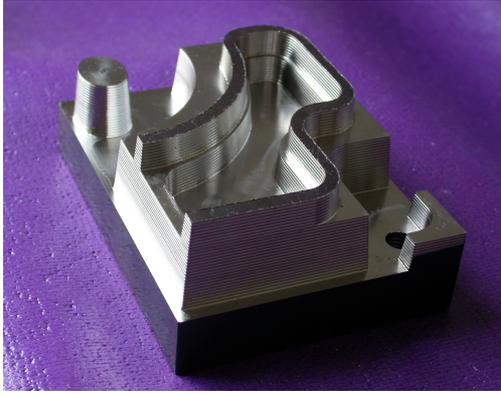
## Case Studies

| | | | | |
|---|---|---|---|---|
| Material: | 1.276 7HRC54 Steel | | Material: | Aluminium |
| Tool: | 10mm diam, 0.5 corner radius | | Tool: | 10mm diam, 0 corner radius |
| Steps: | 10mm step down, 1mm step up, 0.6mm step side | | Steps: | 10mm step down, 1mm step up, 3mm step side |
| Spindle: | 8000mm$^{-1}$ | | Spindle: | 30000mm$^{-1}$ |
| Feedrate: | 8000mm/min | | Feedrate: | 30000mm/min |

*"Adaptive Clearing allows us to rough machine the parts the way we want to, and it has saved us thousands of hours of machining and programming molds. With the HSM Performance Pack we were able to start cutting chips in 15 minutes."* - Scott Sizemore, B&J Specialty Inc.

Adaptive Clearing is the only general purpose algorithm that can generate side-milling tool paths for any CAD model and any set of tooling parameters. Without it, the advantages of side-milling are limited to production parts where the geometry is simple and the tool paths can be generated or verified manually.

Adaptive Clearing works by simulating the stock at every point during the tool path generation. While some algorithms run a stock simulation after the tool path has been generated to trim away air-cuts and optimize the feed rate, no other algorithm uses the dynamic simulation to actually steer the cutter. It is robust, easy to use, and subject to continuous improvement. There are no patents covering this technology, and anyone is free to develop their own version, although the costs are likely to be higher than buying the software ready-made.

Adaptive Clearing has been written independently by Julian Todd and Martin Dunschen, who have 25 years of software development for High Speed Machining between them, with special thanks to our collaborators, Cimco Integration. It is available for license to all CAM vendors who market software for 3-axis machines. We are looking for partners to sell this strategy for the benefit of all users.

If you would like this algorithm to be part of the CAM system you sell, contact Julian or Martin at team@freesteel.co.uk, or telephone (UK) +44 (0)151 726 1366. Alternatively, contact Peter Jensen at peter@cimco-software.com or telephone (Denmark) +45 45 85 60 50.

See this at www.freesteel.co.uk



Adaptive Clearing can be demonstrated on-line using the world's only experimental CAM system in a web-page. Alternatively, ask for a windows exe file to be sent to you by email. Or see it in action with the HSM Performance Pack for Mastercam, available from CIMCO at www.cimco-hsm.com.

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