Delcam Advanced Manufacturing Solutions

PowerMILL 2013

What's New

Powering your productivity

Delcam Advanced Manufacturing Solutions

www.delcam-ams.com

Whether you are a new or long-term user of Delcam products, you may not be aware of the complementary technologies available from Delcam that could improve your company's productivity.

Delcam Advanced Manufacturing Solutions offers a complete and diverse range of CADCAM software solutions to integrate every aspect of your production life-cycle – from designing a complex concept, to manufacturing it and inspecting the final output – providing you with unrivalled speed, flexibility, and ease-of-use throughout your product development process.

Adding to your suite of Delcam solutions minimises the impact on your daily production operations while also enabling you to enter new markets or automate your processes with our advanced functionality.

All products work independently or together as one complete manufacturing solution tailored to your specific needs.

PowerSHAPE

www.powershape.com

PowerSHAPE provides a complete environment to manipulate surface form, build from wireframe, and add solid features for prismatic parts.

- Import/export Parasolid-based systems with no translation.
- Create complex molds from solid models, complete with split surfaces.
- Powerful surface and face-editing tools quickly repair imported data.
- Tools to perform non-feature-based edits quickly and efficiently.

PowerMILL

www.powermill.com

PowerMILL is the world's leading specialist NC CAM software for the manufacture of complex shapes, providing advanced-machining strategies to minimise machining time and maximise finish quality.

- World-leading high-speed machining strategies.
- Advanced 5-axis machining techniques.
- Support for 64-bit platforms and multi-threading.
- Innovative collision-avoidance methods.
- Powerful toolpath editing and tool-axis stabilisation.

FeatureCAM

www.featurecam.com

FeatureCAM is a unique CAM system that uses feature-based and knowledge-based technologies for automated machining, minimising programming times for mills, lathes, turn/mill, and wire machines.

- Easy to use.
- Single interface for multiple machine platforms.
- Powerful turning and milling operations from 2.5D to 5-axis.
- Multi-threading capabilities.

Delcam for SolidWorks

www.delcamforsolidworks.com

Delcam for SolidWorks is a SolidWorks Certified Gold Product that revolutionises CAM programming inside SolidWorks.

- Integrates the feature-based technology from FeatureCAM.
- Multi-threaded toolpath algorithms from PowerMILL.
- 2-axis, 3-axis, and 5-axis positional milling and drilling.
- Turning, turn/mill, and wire EDM capabilities.
- Automatic selection of cutting tools, machining strategies, and feeds and speeds.
- Exceptional toolpath-calculation speeds.
- Set-up wizards.
- Full-machine simulation.

PartMaker

www.partmaker.com

PartMaker applies a patented Visual Programming approach to automate the programming of multi-axis Swiss-type lathes and Turn-Mill Centres.

- Easier programming of turning with live tooling via the Divide-and-Conquer programming approach.
- Automatic process synchronisation.
- Vivid 3D simulation and crash detection.
- Wide array of proven post processors for Turn-Mill Centres and Swiss-type lathes.

PowerINSPECT

www.powerinspect.com

PowerINSPECT leads the way in today's inspection market. It delivers a complete CAD-based inspection solution that can accept data from all types of hardware, including manual and CNC coordinate measuring machines, portable arms, optical measuring devices, and CNC machine tools.

- Part comparison against all mainstream CAD formats.
- Support for all types of measuring devices.
- Market-leading inspection reports that are quick to create and easy to understand.
- IGES export of measured features, including digitized curves.
- Additional modules for part alignment, laser line inspection, and tube inspection.

www.artcam.com

ArtCAM is a unique application that combines the benefits of computerised design and CNC machining in a simple-to-use format to create decorative products from artwork.

- Import 3D models, clipart, and other CAD system formats.
- Add geometric shapes, weaves, and textures.
- Choose from extensive visualisation and rendering materials.
- Use the comprehensive and customisable tool database for fast toolpath-calculation.
- Powerful toolpath simulation verifies machining times and materials.
- Design in the 3D view.

Delcam also provides a range of healthcare CADCAM solutions for the dental, custom orthotic insoles, medical implants, and orthopaedic footwear industries, as well as CADCAM solutions for footwear design and manufacturing.

You can connect with Delcam in a variety of ways:

visit: www.delcam.com | watch: www.delcam.tv | learn: www.delcam.tv/lz

PowerMILL 2013

What's New

Release Issue 1

PowerMILL

Acknowledgements

Patents

The Raceline smoothing functionality is subject to patent applications.

Patent granted: GB 2374562 Improvements Relating to Machine Tools

Patent granted: US 6,832,876 Machine Tools

Some of the functionality of the ViewMill and Simulation modules of PowerMILL is subject to patent applications.

Patent granted: GB 2 423 592 Surface Finish Prediction

The Vortex machining functionality is subject to patent applications.

Patent application: 1121277.6 Adaptive Clearance

The MachineDNA functionality is subject to patent applications.

Patent application: 1204908.6 Machine Testing

Licenses

Intelligent cursor licensed under U.S. patent numbers 5,123,087 and 5,371,845 (Ashlar Inc.)

PowerMILL 2013. Published on 08 November 2012

Contents

Summary of new features

PowerMILL is the leading NC CAM software specialising in the manufacture of complex shapes typically found in the toolmaking, automotive, and aerospace industries. PowerMILL 2013 offers all of the original features of PowerMILL 2012 R2, but with numerous improvements. This document describes the most significant improvements.

Toolpath preparation

There is a new **Reorder Segments**  button which lists all the curve segments and enables you to change the order of the segments in a boundary or pattern (see page 4).

There is a new type of boundary called a private boundary. A private boundary is linked to a specific toolpath and cannot be used by any other entities (see page 10).

The tool axis definitions are now consistent across all toolpath strategies. The options available to measure the tool axis vary with the strategy but always include the option used in previous versions (see page 16).

There is a new undercut option which selects surfaces that are entirely or partially undercut (see page 24).

There is a new **Transform**  button on the **Boundary** toolbar and **Pattern** toolbar (see page 26).

Transformations all require an origin. Now each transformation type has its own default origin (see page 31).

You can now import and export pockets, slots, and bosses from an XML file from/to PowerSHAPE (see page 31). Previously this functionality was available only for holes.

Toolpath generation

When creating an area clearance toolpath, you now always have the choice of using either a precise stepdown or a constant stepdown (see page 32).

There is a new offsetting option available when creating a blisk area clearance strategy with a trochoidal toolpath (see page 34). The offsets are of constant height and radius between blades, but with the edges rounded off. Each pass loops before joining the next one to create a trochoidal path.

All spiral toolpaths, area clearance or finishing toolpaths, are now much smoother (see page 38).

There is improved tool axis movement in contact-point based strategies (such as flowline toolpaths). This smooths the tool axis while maintaining the same contact point (see page 39).

You can now see a history of your toolpath edits (see page 40).

Toolpath verification

When a component of a machine tool collides with another component of the machine tool or the workpiece, the colliding component(s) of the machine tool change colour (see page 43).

Viewmill simulation is up to three times faster.

There are new simulation defaults (see page 45).

When simulating toolpaths, new keyboard shortcuts provide an option for smaller toolpath steps (see page 45).

Toolpath output

There is a new **Reorder** option on the individual NC program context menu. This enables you to automatically reorder the toolpaths in an NC program (see page 47).

User interface

There is a new concept of a mode toolbar which makes it more obvious when you enter a graphics mode (see page 49).

PowerMILL now saves any custom colours in the colour palette, so they are available the next time you use PowerMILL (see page 52).

Automation

There is a new horizontal plugin window which enables plugins to be designed with a horizontal layout (see page 54).

The macro programming language now includes the ability to:

- Create entity variables.
- Execute a macro string as a command using DOCOMMAND.

For more information, see the Macro Programming Guide.

General enhancements

PowerMILL now makes more effective use of memory. This improves machining times on large parts (see page 56).

Improved calculation times of area clearance toolpaths on large parts.

There is less fragmentation of toolpaths when rest roughing a stock model.

Arc fitting is much improved and more reliable (see page 56).

When using stock engagement, ordering Constant Z toolpaths is now safer and more efficient.

You can now export models as .stl files even when no machine operations have taken place (see page 56).

New parameters are available for tool holder and tool shank components (see page 56).

Toolpath strategy dialogs open twice as fast (see page 56).

You can now convert a model to a reference model (see page 56).

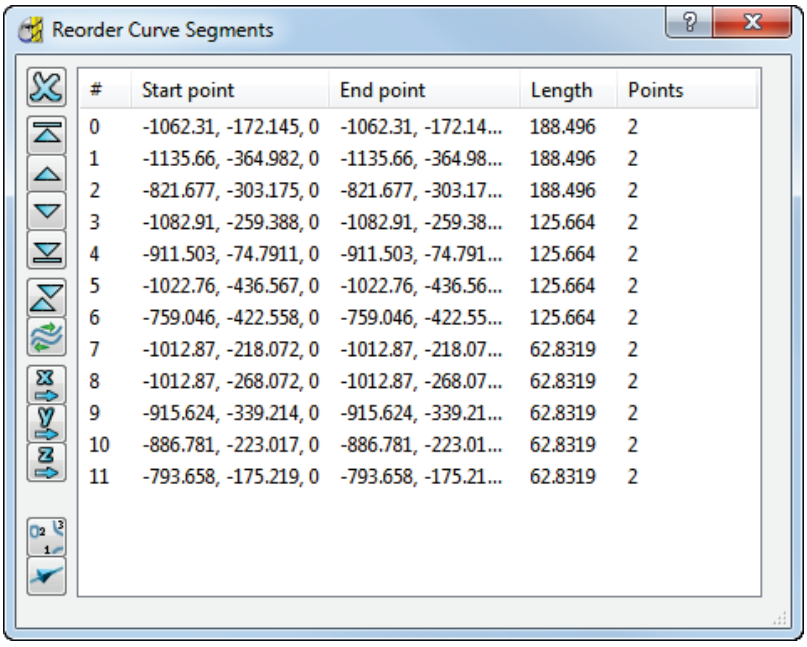
The **Delete Selected** menu option has moved from the **File** menu to the **View** menu (see page 56).

The **Measure** dialog now includes the ability to easily measure the apparent angles of a defined line (see page 57).

Toolpath preparation

Reordering curve segments

There is a new **Reorder Segments** button on the **Curve Editor** mode toolbar which lists all the curve segments and enables you to change the order of the segments in a boundary or pattern. This is very similar to the **Reorder Toolpath** option.



The curve segment order is important when a toolpath uses a pattern to define its path. For example, pattern engraving of text where you need to reorder segments so the order reflects the correct letter order.

Selecting components within the list also selects them graphically, turning them yellow. Similarly, selecting a segment from the graphics window moves to that segment in the list. The columns in the list are:

— The segment number.

Any movement or removal of segments renumbers the affected segments. So the segment number is a temporary, not a permanent, number and you cannot use it to identify a specific segment.

Start point — The coordinates of the segment start point.

End point — The coordinates of the segment end point.

Length — The segment length.

Points — The number of points in the segment.

The **Reorder** toolbar on the left side of the dialog enables you to reorder the selected segments.

 **Delete Selected** — Click to delete the selected segments.

 **Move to Start** — Click to move the selected segments to the start of the toolpath.

 **Move Up** — Click to move the selected segments up one position.

 **Move Down** — Click to move the selected segments down one position.

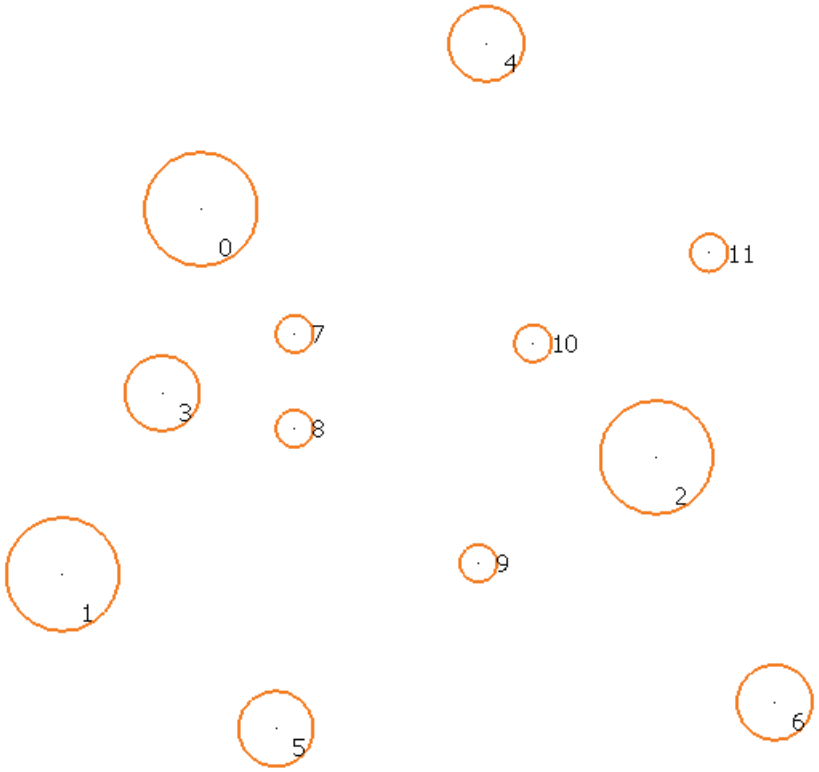
 **Move to End** — Click to move the selected segments to the end.

 **Reverse Order** — Click to move the order of the selected segments. If no segments are selected then this reverses all segments.

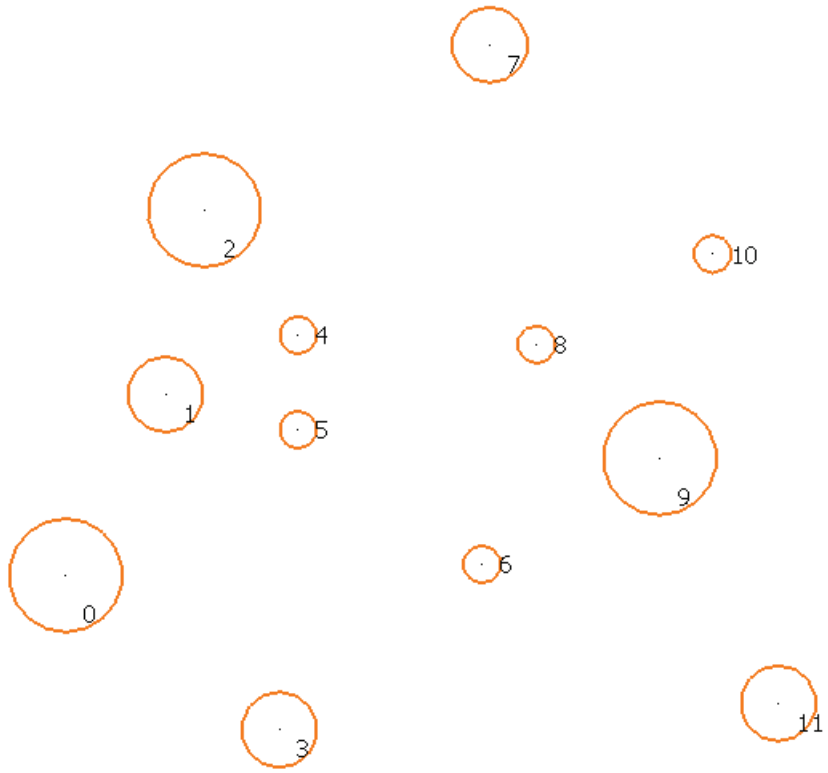
 **Reverse Direction** — Click to reverse the direction of each selected segment, so the start and end points are switched round. If no segments are selected then this reverses the direction of the whole curve.

Sort in X — Click to sort the curves along the X direction.

It converts this:

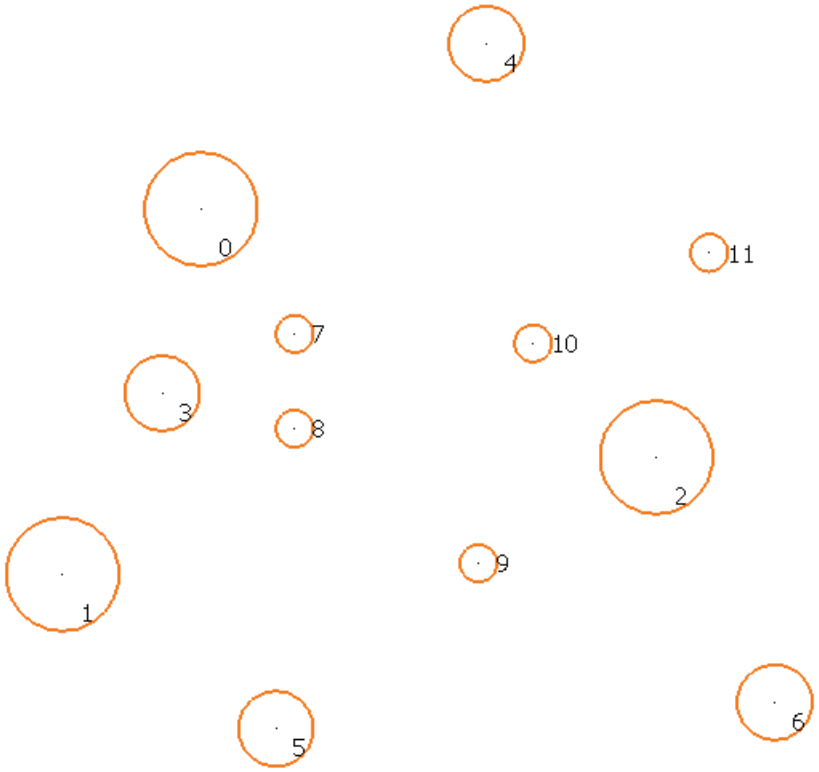


to this:

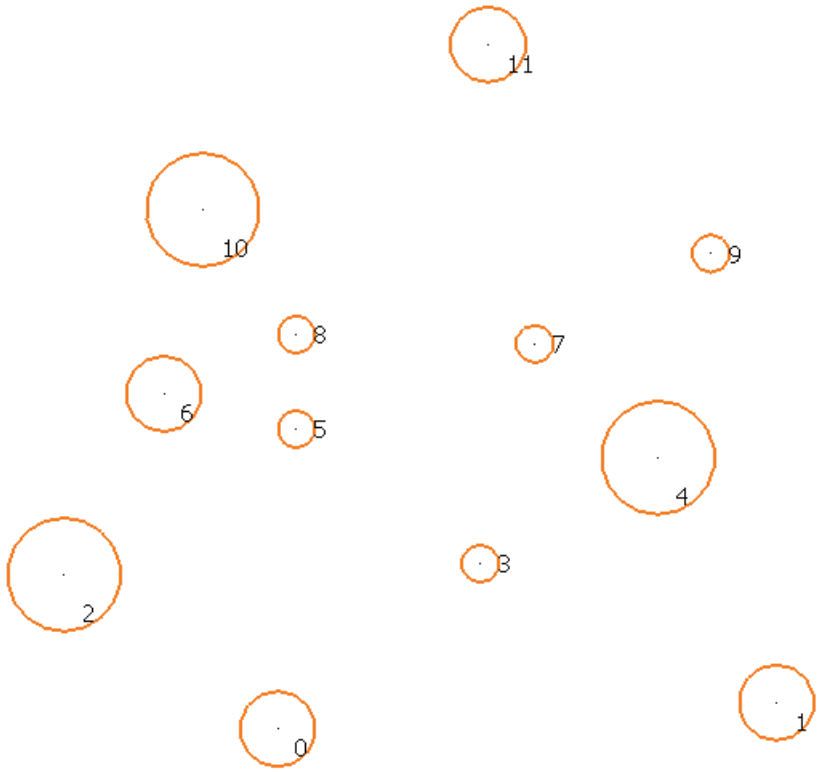


*Click **Number Segments** to see the order.*

Sort in Y — Click to sort the curves along the Y direction. It converts this:



to this:

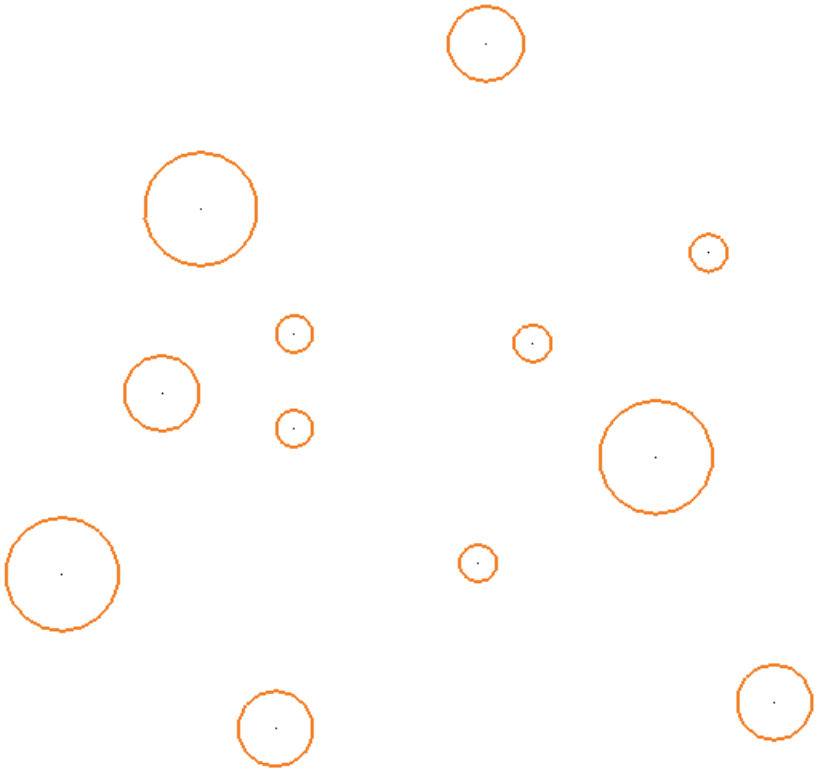


*Click **Number Segments** to see the order.*

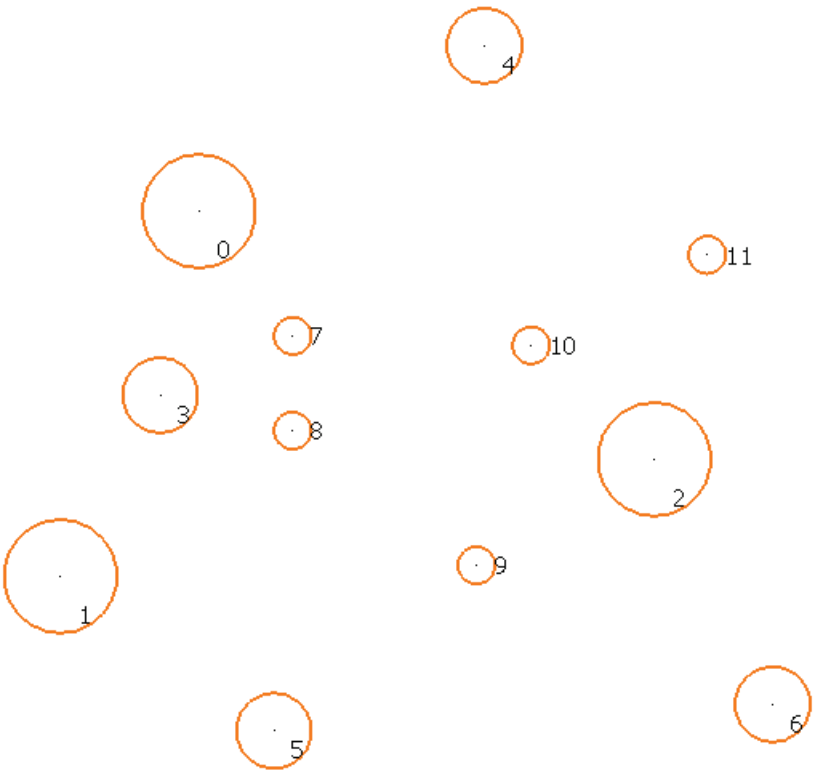
Sort in Z — Click to sort the curves along the Z direction.

Number segments — Click to number the segments in the selected curve.

It converts this:

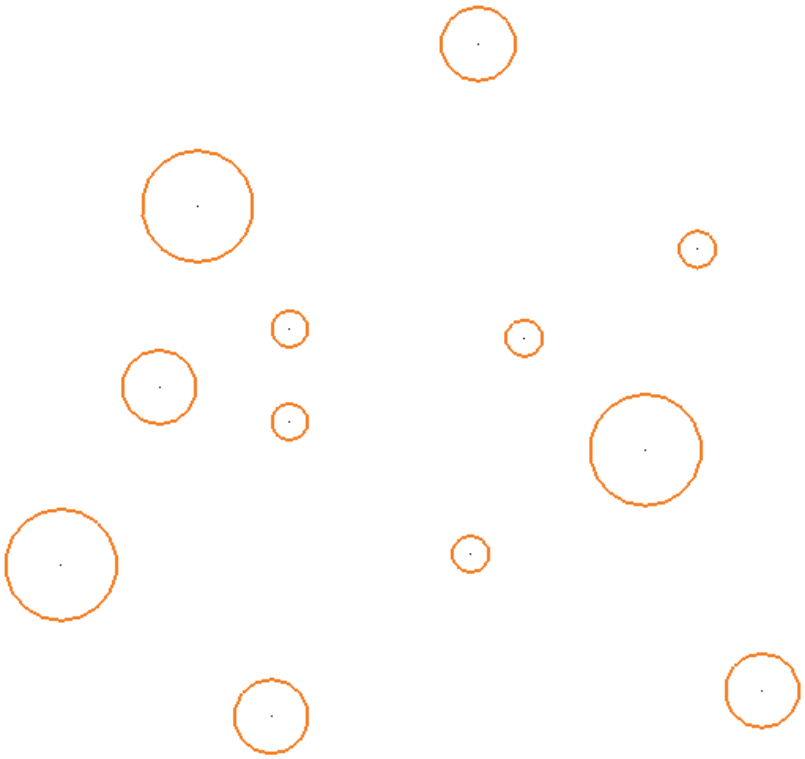


to this:

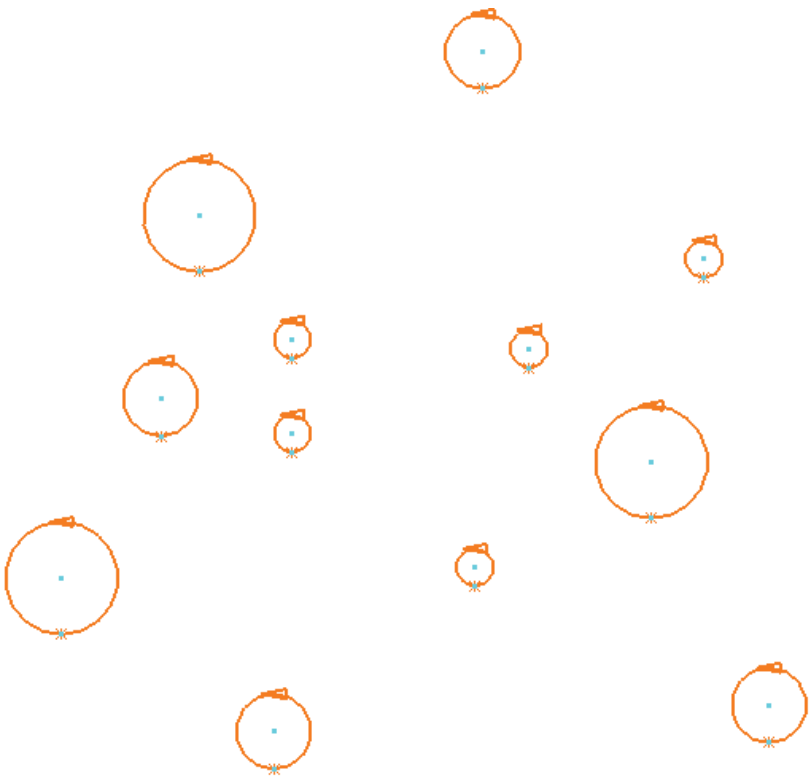


Instrumentation — All curves have a direction. Click to instrument a curve, which places an arrow on each segment (pointing towards the end of the segment) and an '*X*' at the end of each segment.

It converts this:



to this:



*If you want to undo an operation on the **Reorder Segments** dialog, use the **Undo** button on the **Curve Editor** mode toolbar.*

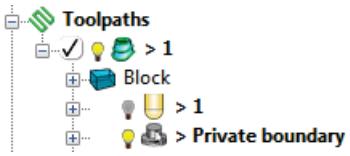
You cannot reorder a locked boundary or pattern.

Private boundaries

There is a new type of boundary called a private boundary. A private boundary is linked to a specific toolpath and cannot be used by any other entities. To use the same boundary elsewhere, you must duplicate it.

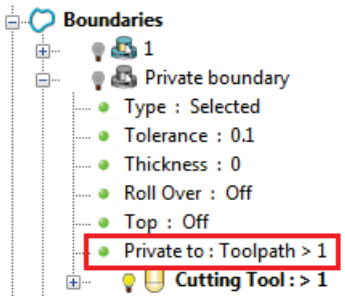
By default, all boundaries are created as private boundaries.

- A private boundary uses the tolerance, thickness, and tool of its associated toolpath. The private boundary controls all other properties (such as limits, collision checking, and block).
- When you create a boundary you can indicate if you want to allow it to become private. It isn't private at this stage but becomes private when it is used by either a toolpath or stock model.
- When creating a toolpath using a private boundary, the toolpath takes ownership of the boundary and the boundary is removed from the boundaries branch of the explorer. However, it is still accessible from the individual toolpath branch of the explorer and from the **Limits** page of the toolpath dialog.



- A private boundary icon is a different colour to an ordinary boundary. For a selected surface boundary, an ordinary boundary is represented by and a private boundary by .
- When you delete a toolpath using a private boundary, the boundary is deleted along with the toolpath.
- If you change the private boundary associated with a toolpath, the toolpath releases the boundary and it re-appears in the boundaries branch of the explorer.
- To display private boundaries in the **Boundaries** branch of the explorer, from the **Tools** menu select **Options > Boundaries > Private boundaries > Display private boundaries in the explorer**.

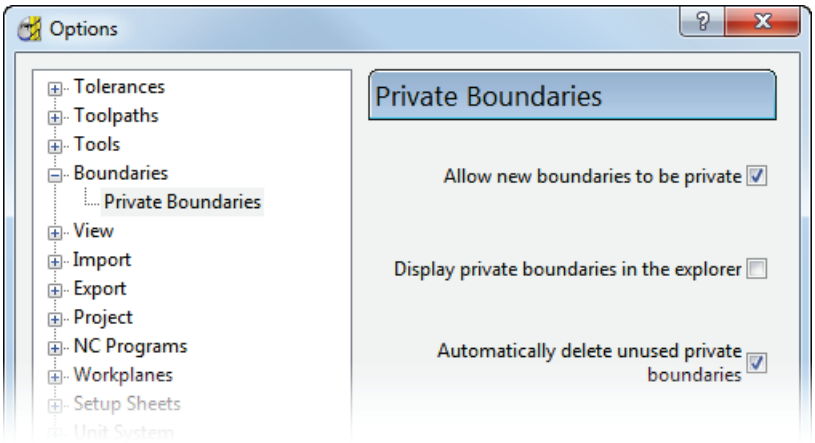
- If you display private boundaries in the **Boundaries** branch of the explorer, you can see the toolpath that uses it.



Options > Boundaries

The Boundaries items define the default boundary options.

Private Boundaries



Allow new boundaries to be private — When selected, PowerMILL creates boundaries that can be made private. They are not private on creation, but as soon as they are attached to a toolpath, or stock model, they become private. When deselected, creates ordinary boundaries that can be used by many toolpaths and stock models. This option determines the default behaviour, but you can override this on boundary creation.

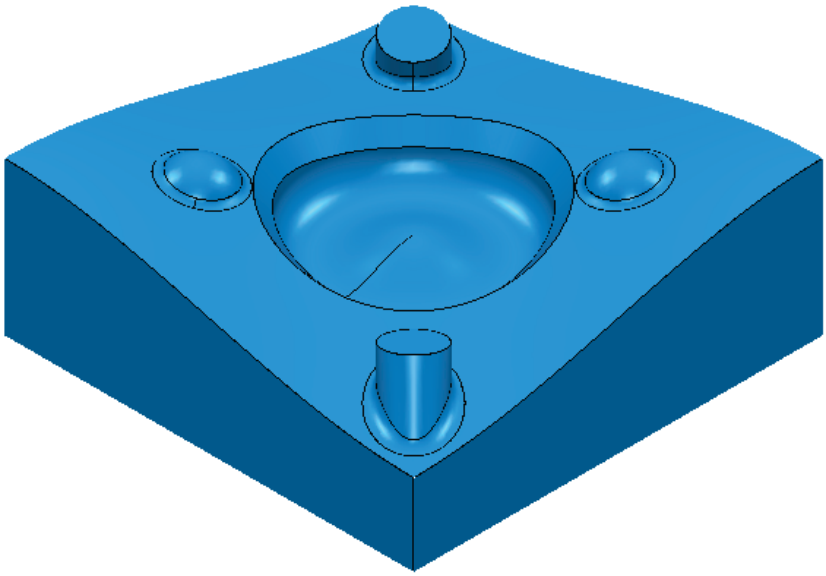
Display private boundaries in the explorer — When selected, PowerMILL displays private boundaries in the boundaries branch of the explorer as well as in the individual toolpath branch of the explorer. When deselected, displays private boundaries only in the individual toolpath branch of the explorer.

Groups always display any private boundaries placed in them.

Automatically delete unused private boundaries — When selected, PowerMILL automatically deletes unused private boundaries. For example, if you have a toolpath using a private boundary and then you edit the toolpath to use a different boundary, the original boundary is deleted.

Using private boundaries

This example uses the 5_axis_Test.dgk model in the Examples folder.

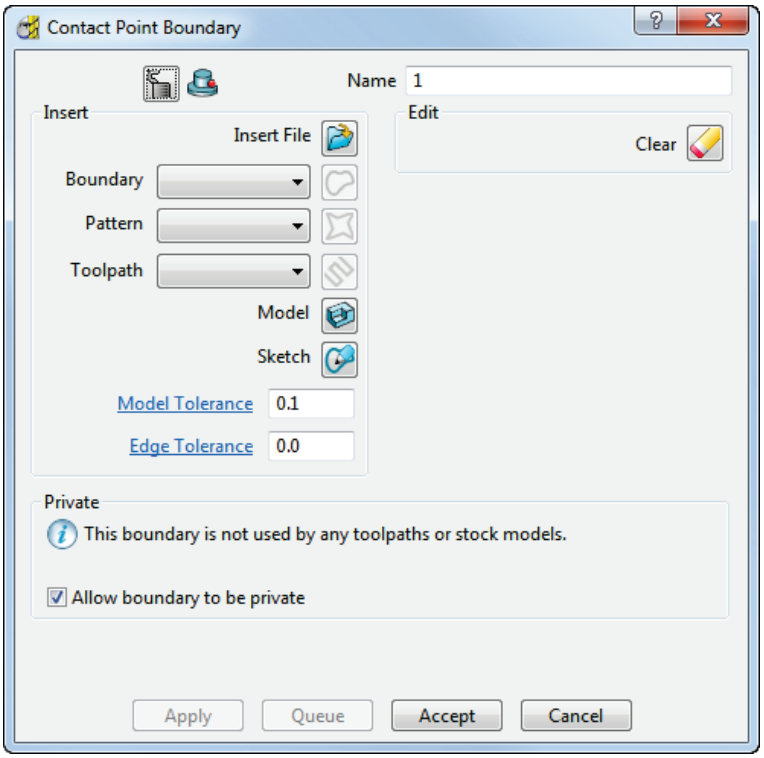


1 Create a **Block** and define a 10 mm ball nosed **Tool** .

Ensure the block extends above the top of the model.

2 Select the top surface.

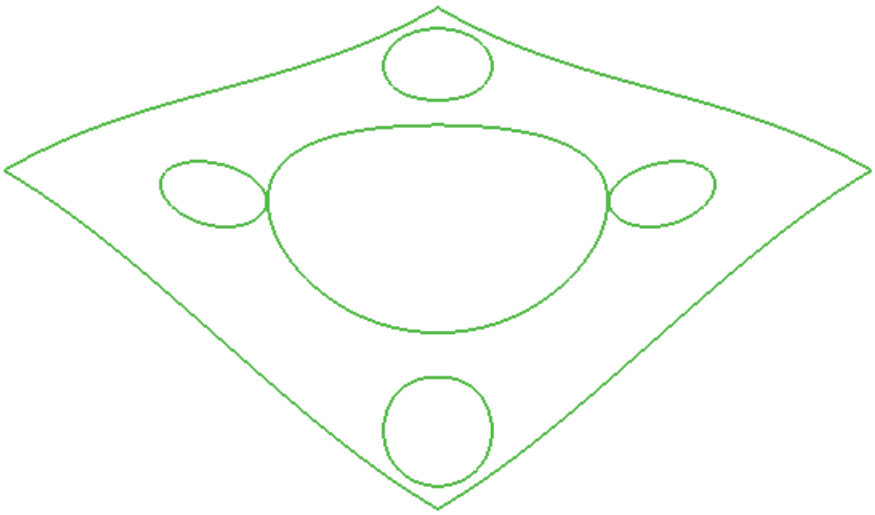
3 From the **Boundaries** context menu, select **Create Boundary > Contact Point**. This displays the **Contact Point** dialog.



a Click the **Model** button.

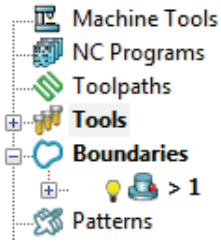
b Select the **Allow boundary to be private** option.

c Click **Accept**.

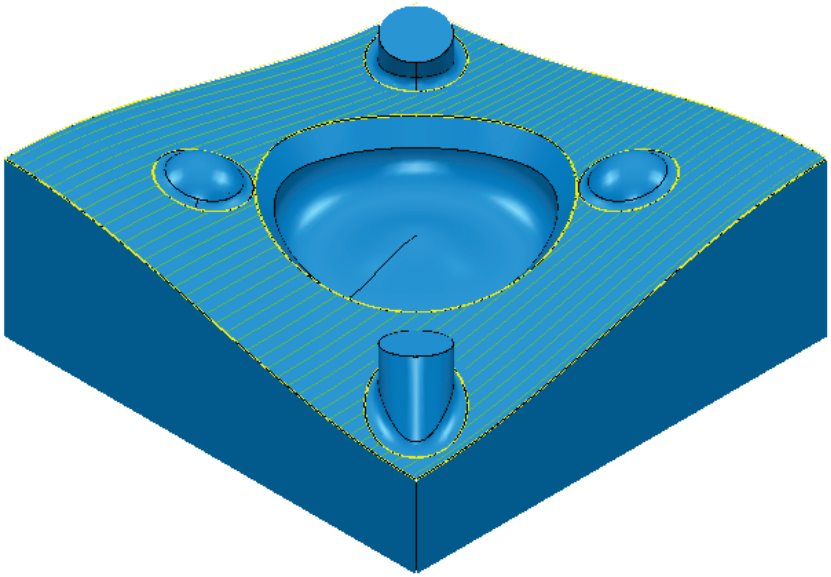


For more information, see Example of Contact Point Boundary.

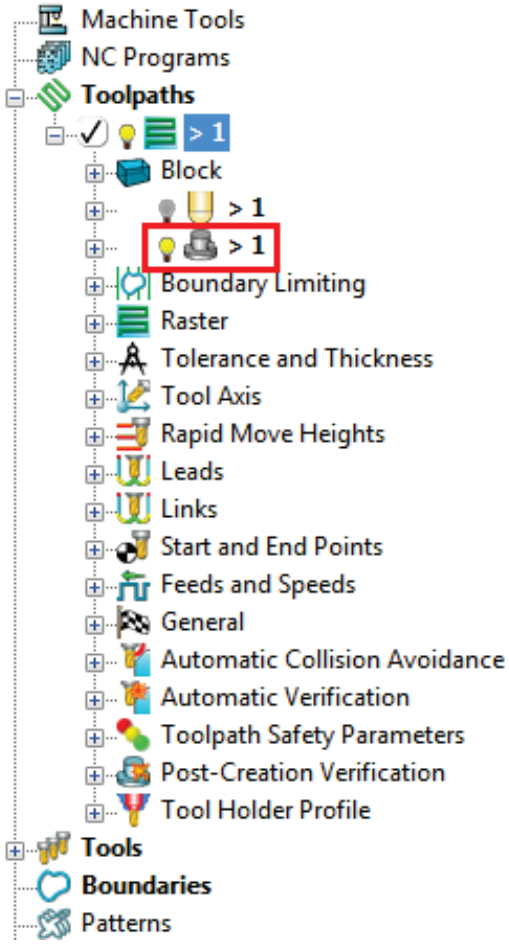
The boundary appears in the **Boundaries** branch of the explorer.



4 Create a **Raster Finishing** toolpath using the **Contact Point Boundary**.

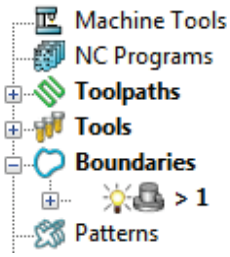


The boundary is no longer displayed in the **Boundaries** branch of the explorer. Instead, it is displayed in the individual toolpath branch of the explorer.

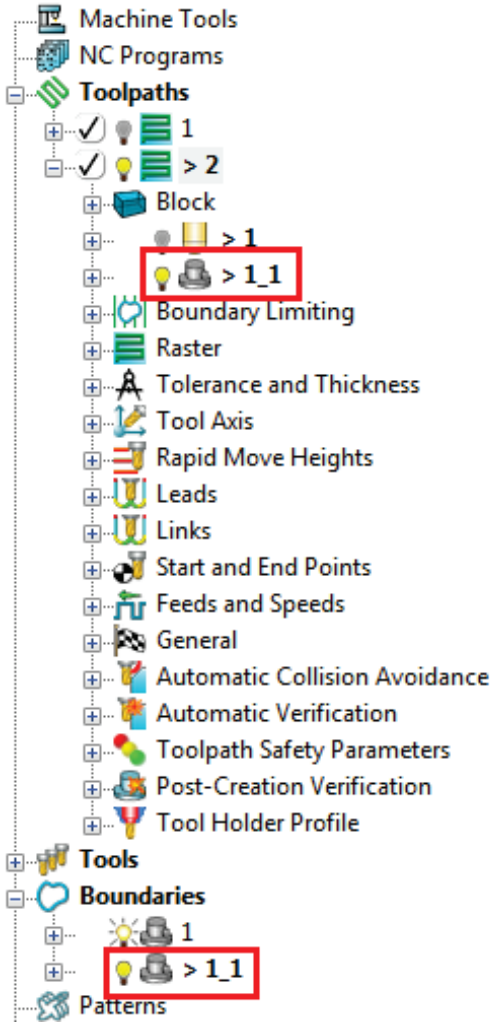


The icon changes from  to  .

5 In the **Options** dialog (accessed from **Tools > Options > Boundaries > Private boundaries**), select **Display private boundaries in the explorer** to display this boundary in the **Boundaries** branch of the explorer.



6 If you try to create another toolpath which uses this private boundary, the new toolpath creates a copy of the private boundary.

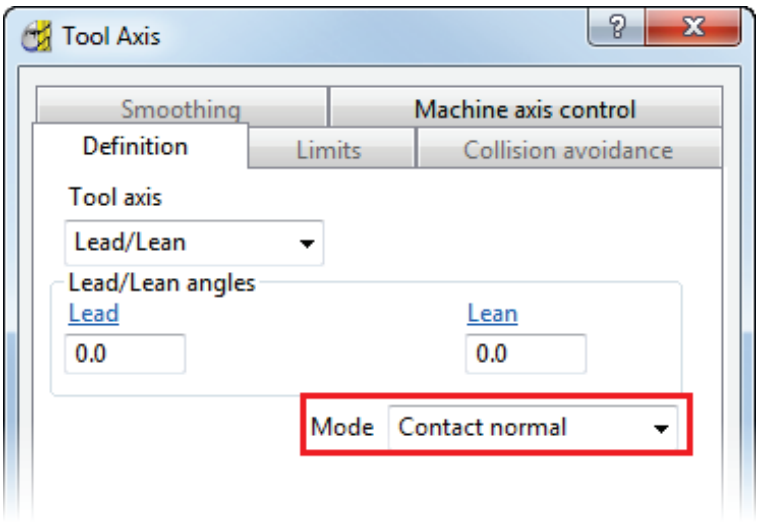


7 If you delete a toolpath which uses a private boundary, the private boundary is deleted along with the toolpath.

Tool axis definitions

The tool axis definitions are now consistent across all toolpath strategies. To achieve this, there is an additional **Mode** option on the **Definitions** tab of the **Tool Axis** dialog. The options available in the **Mode** list vary with the strategy. These options always include the measuring method used in previous versions, but this may not be the default value. The default value gives the best results in most instances.

These new options provide more flexibility but still enable you to maintain existing behaviour.



The **Mode** options define how to measure the tool axis.

With a **Tool Axis** of **Lead/Lean**, the **Lead angle** is measured with respect to the reference direction in the direction of travel. The **Lean angle** is measured with respect to the plane containing the reference direction and the tool movement direction. So, with a **Lead** of **0** and a **Lean** of **0**, the tool is aligned with the reference direction.

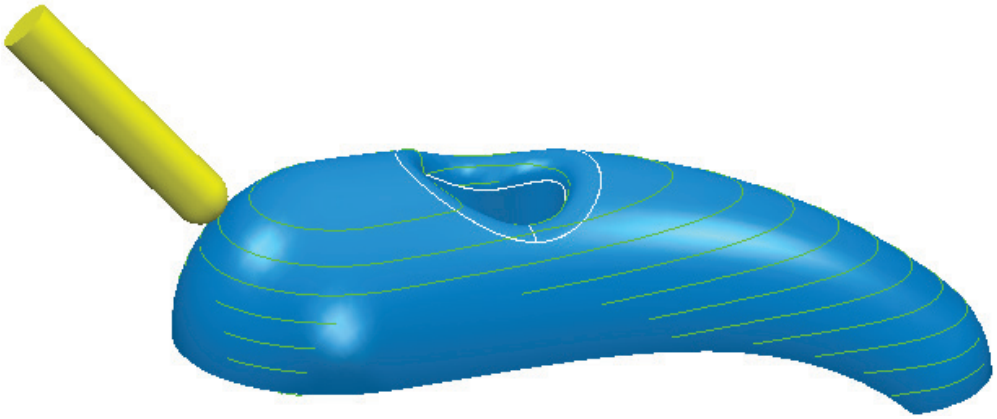
Contact normal — This measures the lead angle from the toolpath contact normal. This is the default option.

This example uses a constant Z toolpath with a **Tool axis** of:

Lead angle of **0°**

Lean angle of **0°**

Mode of **Contact normal**.



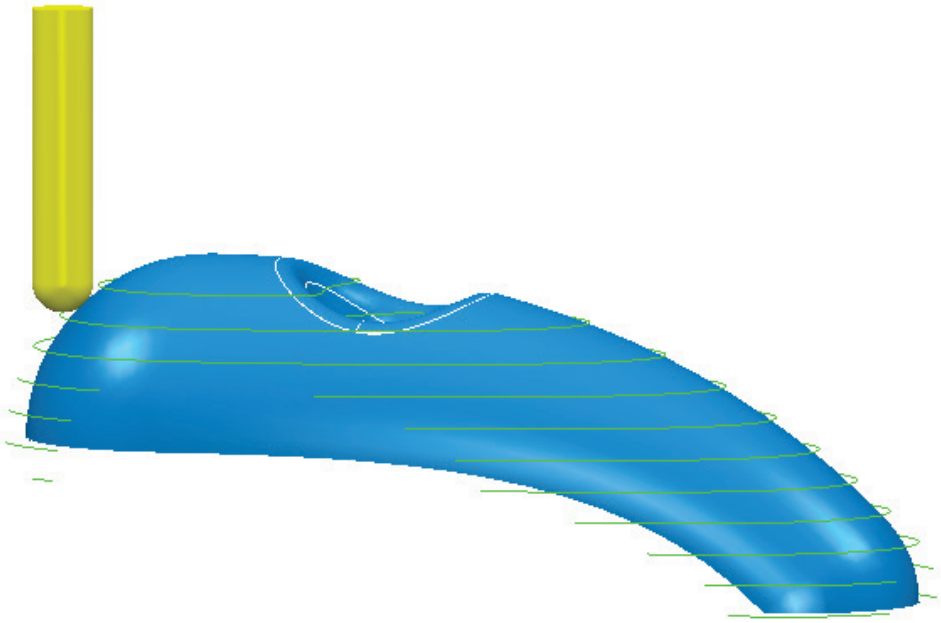
Vertical — This measures the lead angle from the Z axis.

This example uses a constant Z toolpath with a **Tool axis** of:

Lead angle of **0°**

Lean angle of **0°**

Mode of **Vertical**.

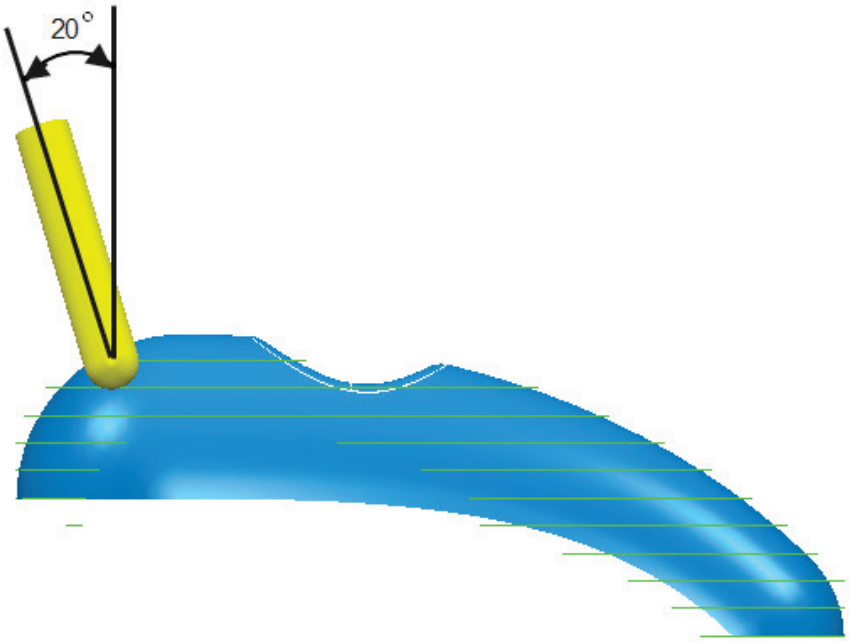


This example uses a constant Z toolpath with a **Tool axis** of:

Lead angle of **20°**

Lean angle of **0°**

Mode of **Vertical**.



PowerMILL 2012 R2 — The behaviour available in PowerMILL 2012R2 which, in most cases, used a **Mode** of **Vertical**.

The strategies which used a **Mode** other than **Vertical** are:

Strategy	PowerMILL 2012 R2 mode
Embedded pattern	Contact normal
Flowline	Contact normal
Parametric spiral	Undercut angle
Pattern, using toolpath	Reference tool axis
Profile	Contact normal
Projection (curve, line, plane, point, surface)	Preview frame normal
Surface machining	Contact normal

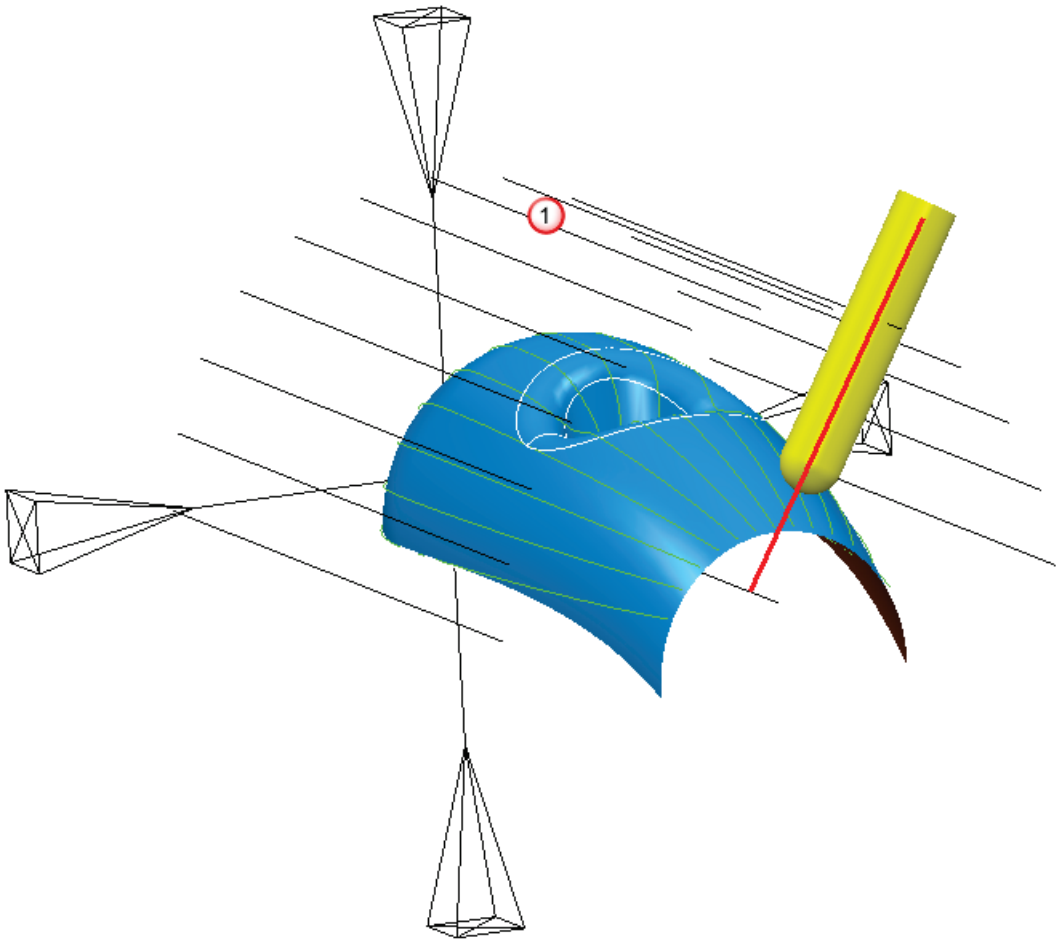
Preview frame normal — This measures the lead angle from the normal to the pattern that forms the preview frame.

This example uses a line projection toolpath with a **Tool axis** of:

Lead angle of **0°**

Lean angle of **0°**

Mode of **Preview frame normal**.



1 Preview frame

The tool is normal to the pattern (or preview frame).

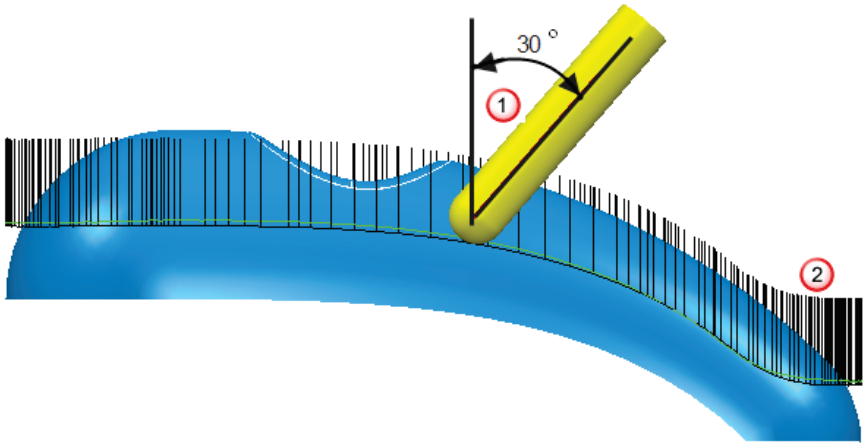
Reference tool axis — This measures the lead angle from the tool axis used by the reference toolpath. This option is available only for pattern finishing toolpaths which use a toolpath as the drive curve.

This example uses a pattern toolpath which uses a reference toolpath as the drive curve, and a **Tool axis** of:

Lead angle of **30°**

Lean angle of **0°**

Mode of **Reference tool axis**.



1 Lead angle

2 Tool axis of reference toolpath

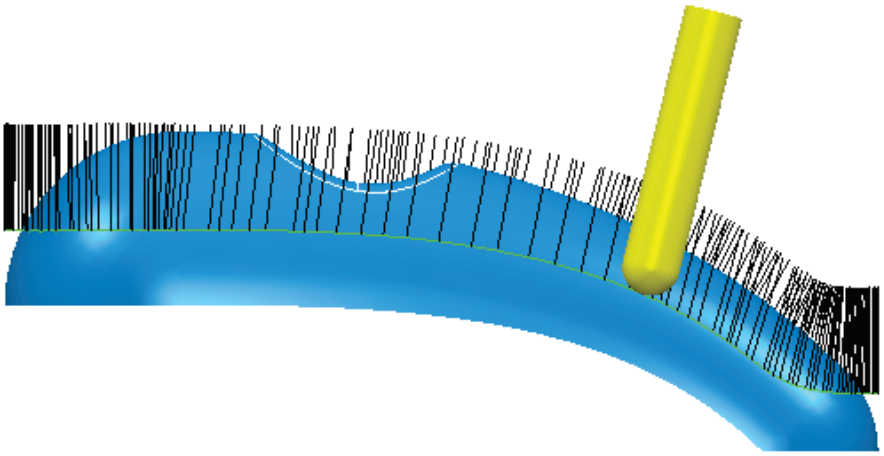
Tangent normal — This measures the lead angle from the perpendicular to the tangent direction of the reference curve. This option is available only for pattern finishing toolpaths which use a pattern as the drive curve.

This example uses a pattern toolpath with a **Tool axis** of:

Lead angle of **0°**

Lean angle of **0°**

Mode of **Tangent normal**.



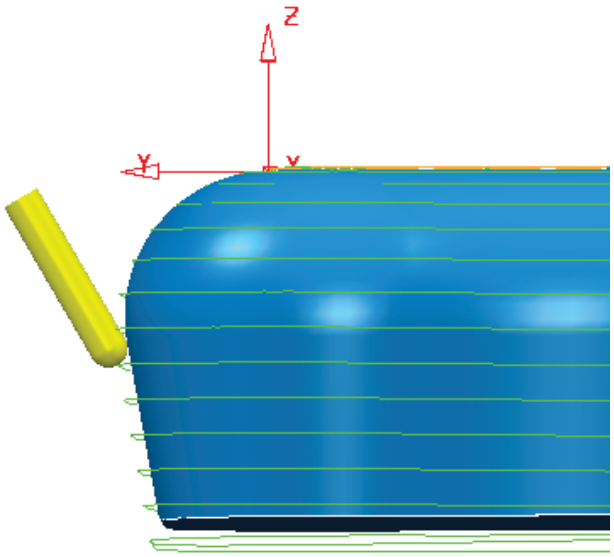
Undercut angle — This measures the lead angle from the projection direction corresponding to the specified degree of undercut. This option is available only for parametric spiral toolpaths.

This example uses a line parametric spiral toolpath with an Undercut Angle of **10°** and a **Tool axis** of:

Lead angle of **0°**

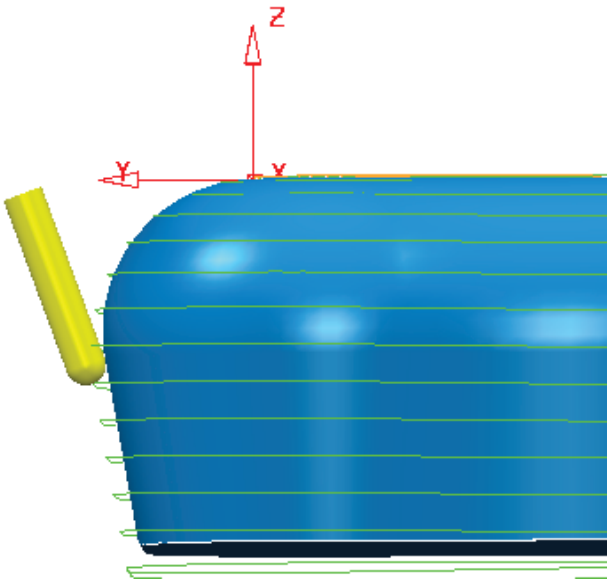
Lean angle of **-20°**

Mode of **Undercut Angle**.



With the same options except:

Mode of **Vertical**.



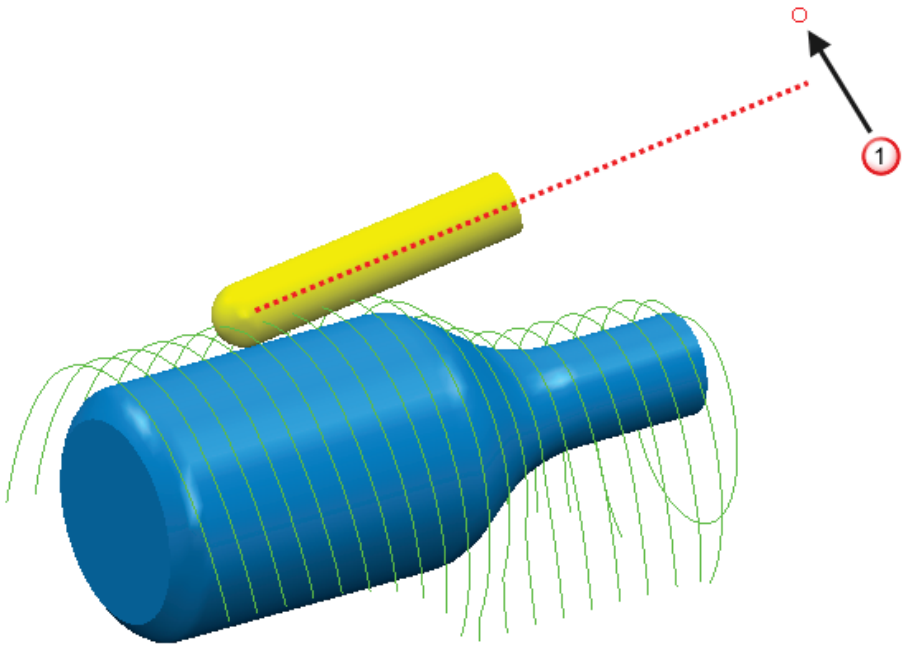
Tool Axis of Towards... or From...

With a **Tool Axis** of **Towards...** or **From...** the **Mode** options are:

Preview frame — The tool axis is defined on the preview frame and then the toolpath is projected onto the model.

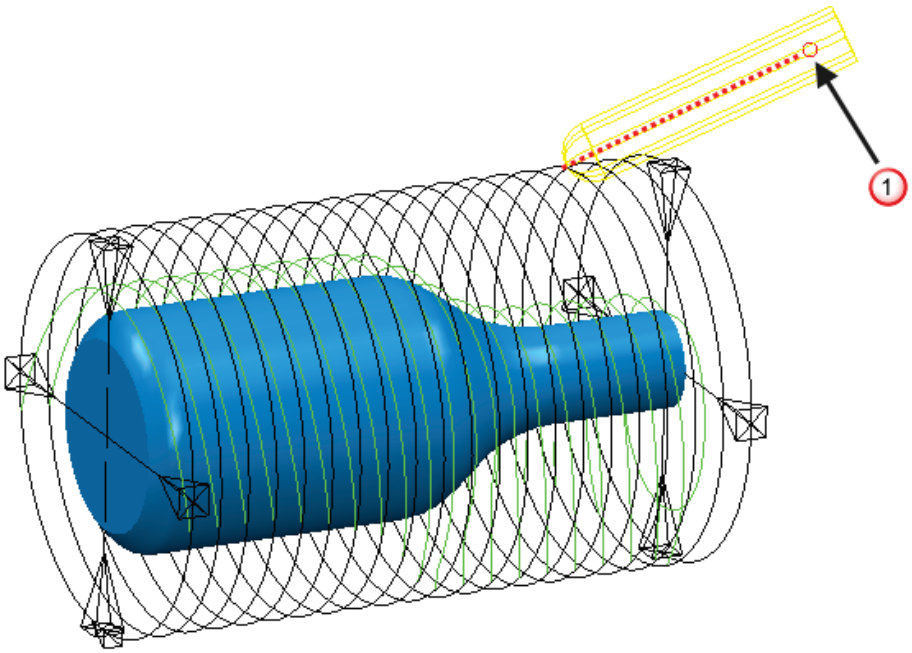
A **Tool axis** of **From point**

A **Mode** of **Preview Frame**



1 the **From point**

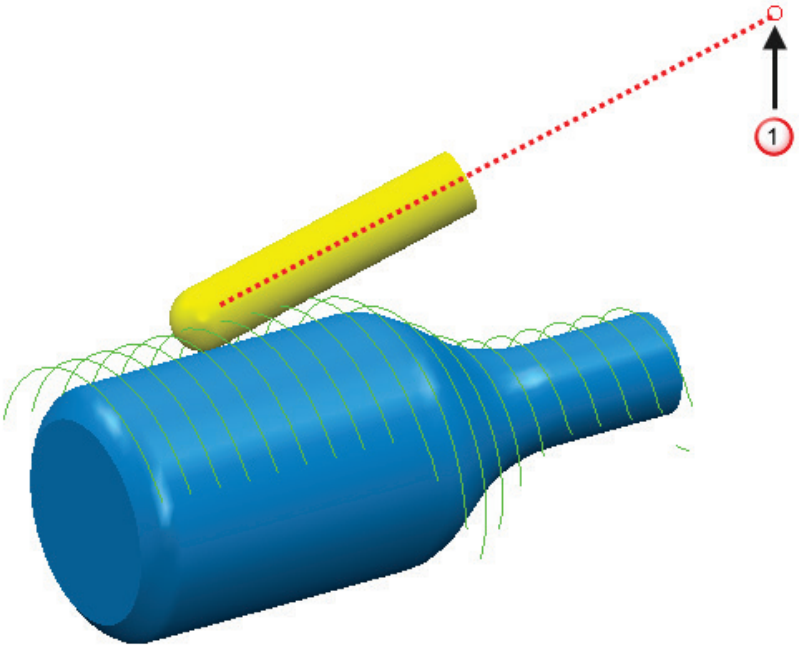
The tool axis doesn't pass through the **From point**. However, if you offset the tool to the preview frame it would pass through the **From point**.



Toolpath — The toolpath is projected onto the model and then the tool axis is defined on the model.

A **Tool axis** of **From point**

A **Mode** of **Toolpath**

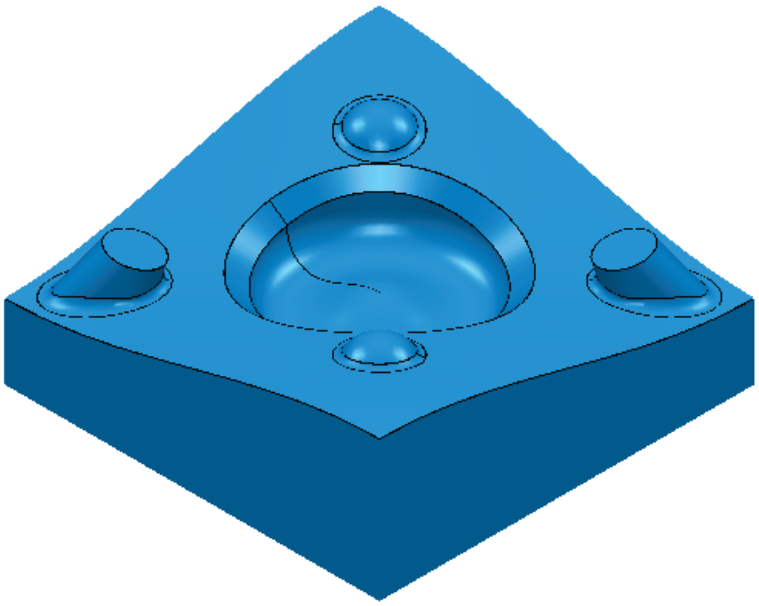


1 The tool axis passes through the **From point**.

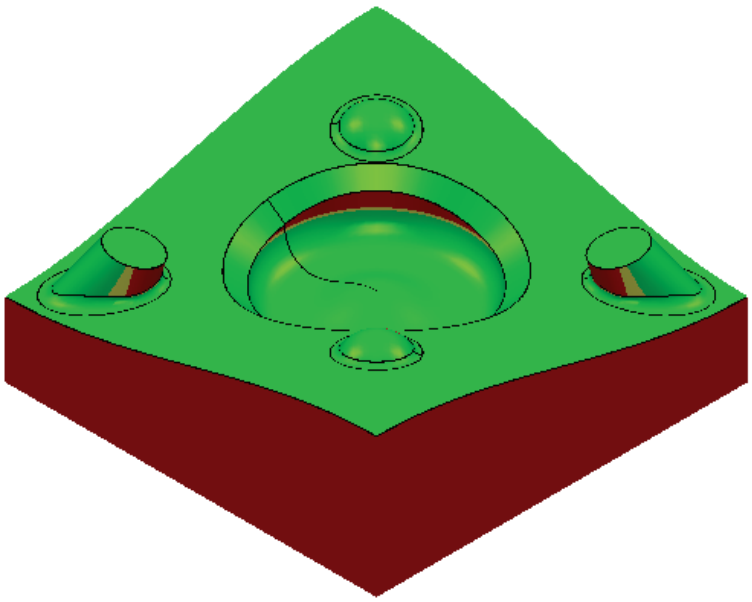
Selecting undercut surfaces

There is a new undercut option on the **Model** context menu of **Selection tools > Select undercut components**. This option selects surfaces that are entirely or partially undercut.

This example uses the 5_axis_test.dgk model in the Examples file to show the effects of this option.

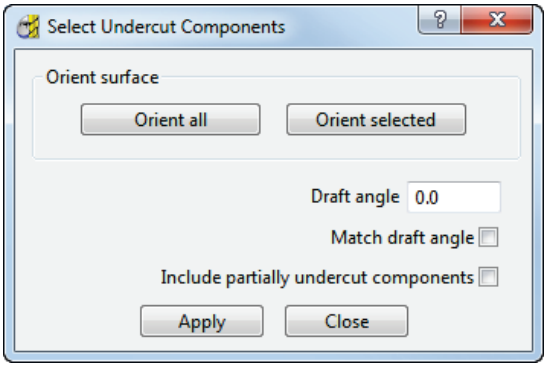


Selecting **Draft Angle Shade**  on the shade toolbar displays:



Selecting **Selection tools > Select undercut components** displays the **Select Undercut Surfaces dialog.**

The **Select Undercut Components** dialog selects surfaces that are entirely or partially undercut.



Undercut shading requires the correct surface orientation of the model.

The **Orient surface** options enable you to correctly orient your model.

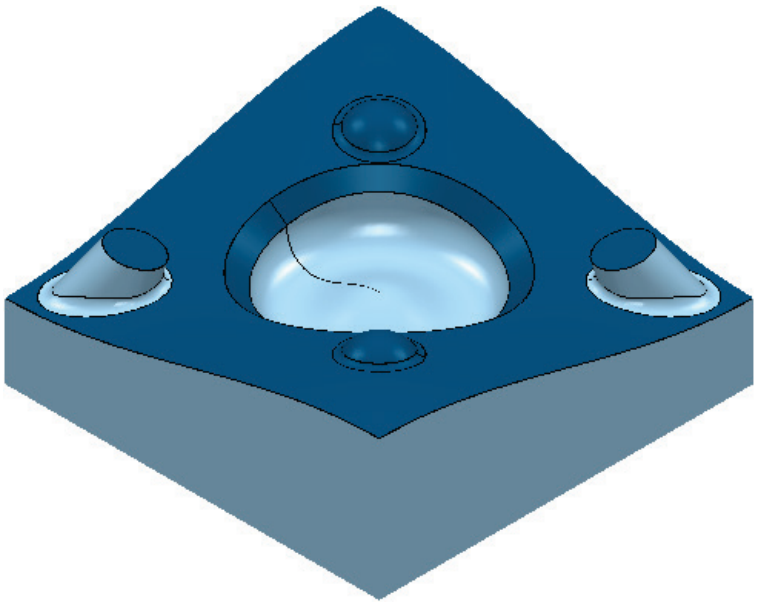
Orient all — Click to automatically reverse the orientation of all the surfaces which are incorrectly oriented in the current view.

Orient selected — Click to automatically reverse the orientation of all the selected surfaces which are incorrectly oriented in the current view.

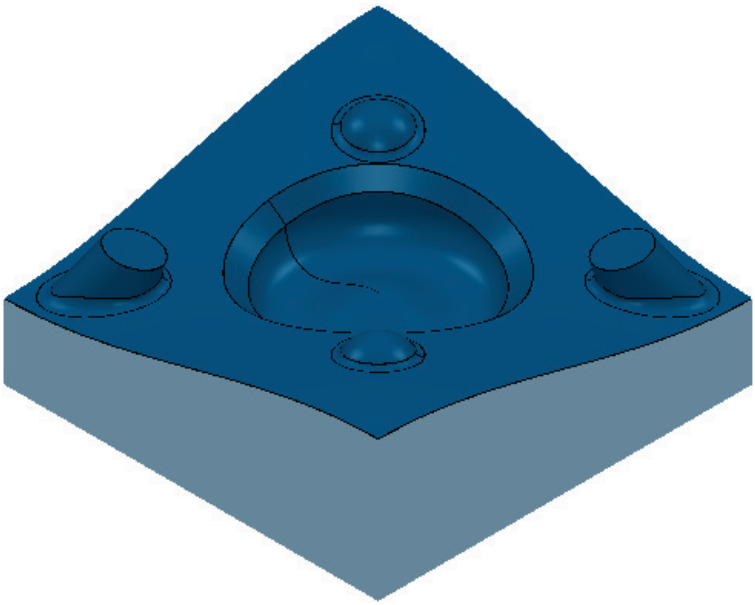
Draft Angle — Enter the draft angle. This is an angle incorporated into a wall of a mold, so the opening of the cavity is wider than the base, which allows for easier ejection of the part. This option selects undercut surfaces less than, or equal to this value.

Match draft angle — When selected, undercut surfaces equal to the draft angle are selected (undercut surfaces less than the draft angle are not selected).

Include partially undercut surfaces — When selected, any surface which has an undercut region is selected.



When deselected, any surface which is wholly undercut is selected.



*Selecting **Include partially undercut surfaces** selects at least as many surfaces as when deselected.*

Selecting either of these options adds to your current selection, so, the undercut surfaces are selected, as well as any previously selected components.

Transforming boundaries and patterns

There is a new **Transform** button on the **Boundary** toolbar and **Pattern** toolbar. This works in a very similar way to the **Transform** button on the **Toolpath** toolbar.

Selecting **Transform** from the individual boundary menu, or clicking on the **Boundary** toolbar, displays the **Boundary Transform** mode toolbar.

Selecting **Transform** from the individual pattern menu, or clicking on the **Pattern** toolbar, displays the **Pattern Transform** mode toolbar.

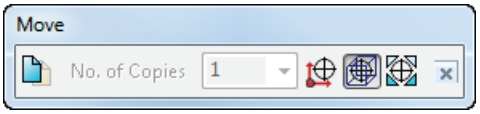
The transformations allow you to move, rotate, or mirror curves.

This is very similar to the **Toolpath Transform** mode toolbar and **Workplane Transform** toolbar.

Activating a mode disables most of PowerMILL's functionality until you exit from the mode. For more information, see Mode toolbars.

These options are very similar to those on the **Transformations** toolbar on the **Curve editor** mode toolbar.

Move — Click to transform the curves by the specified coordinates.



Keep original — This determines whether the entities are copied or replaced when transformed.

Replace original — When selected, the original entities are replaced with the transformed ones.

Keep original — When selected, keeps both the original and transformed entities.

No. of copies — Enter the number of copies.

Workplane origin — When selected, the active workplane is the origin. If no workplane is active then the global coordinate system is the origin.

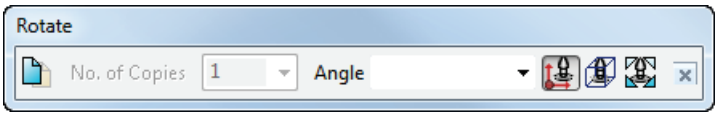
Bounding box origin — When selected, the origin is the centre of the bounding box containing all the entities.

Move origin — When selected, you can move the origin graphically by dragging or by entering coordinates using , , or and in the **Status** bar.

Finish — Click to accept the changes and close the toolbar.

For more information, see the moving curves example, the moving toolpaths example, or the moving workplanes example.

Rotate — Click to rotate the curves around the specified axis by the selected angle.



Keep original — This determines whether the entities are copied or replaced when transformed.

Replace original — When selected, the original entities are replaced with the transformed ones.

Keep original — When selected, keeps both the original and transformed entities.

No. of copies — Enter the number of copies.

Angle — Enter the rotation angle in degrees.

Workplane origin — When selected, the active workplane is the origin. If no workplane is active, then the global coordinate system is the origin.

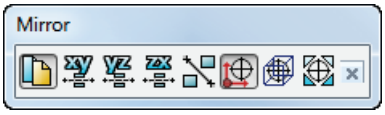
Bounding box origin — When selected, the origin is the centre of the bounding box containing all the entities.

Move origin — When selected, enables you to move the origin graphically by dragging or by entering coordinates using , , or and in the **Status** bar.

Finish — Click to accept the changes and closes the toolbar.

For more information, see the rotating curves example, the rotating toolpaths example, or the rotating workplanes example.

Mirror — Click to mirror the curves along one of the principal planes of the active workplane or along an arbitrary mirror line. If no workplane is active, the mirroring is about the relevant plane of the global coordinate system.



Keep original — This determines whether the entities are copied or replaced when transformed.

Replace original — When selected, the original entities are replaced with the transformed ones.

Keep original — When selected, keeps both the original and transformed entities.

Mirror in XY — Click to mirror the entity in the XY plane.

Mirror in YZ — Click to mirror the entity in the YZ plane.

Mirror in ZX — Click to mirror the entity in the ZX plane.

Mirror in line — Click to mirror the entity in a plane defined by selecting either an existing line or two points.

Workplane origin — When selected, the active workplane is the origin. If no workplane is active, then the global coordinate system is the origin.

Bounding box origin — When selected, the origin is the centre of the bounding box containing all the entities.

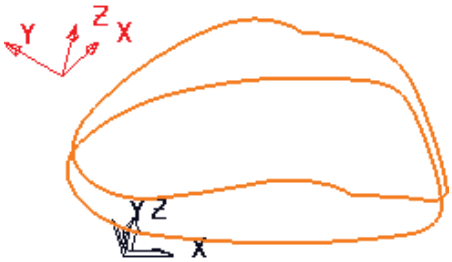
Move origin — When selected, enables you to move the origin graphically by dragging or by entering coordinates using , , or and in the **Status** bar.

Finish — Click to accept the changes and closes the toolbar.

Multiple transform — Click to perform multiple **Moves** or **Rotations** .

Transform to workplane — Click to move the curves so they are in the same place relative to the active workplane as they were to the global transform.

Converts this:

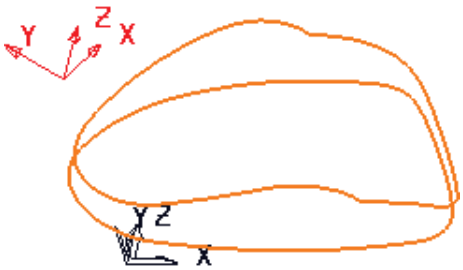


to this:

Transform to world — Click to move the curves so they are in the same place relative to the global transform as they were to the active workplane.

Converts this:

to this:



Undo — Click to revert to what it was before the last change.

Redo — Click to reinstate the edit you have just undone.

Accept changes — Click to accept and keep all the created curves.

Cancel changes — Click to delete all the created curves.

Transformation origin

All transformations require an origin. This can be either a **Workplane origin** or a **Bounding box origin**. In PowerMILL 2012 R2 there was one default for all transformation types. In PowerMILL 2013, each transformation type has its own default.

Transformation	Default origin
Move	Bounding box
Rotate	Workplane
Mirror	Workplane
Scale	Bounding box
Multiple transform - Rectangular	Bounding box
Multiple transform - Circular	Bounding box

Importing features from PowerSHAPE

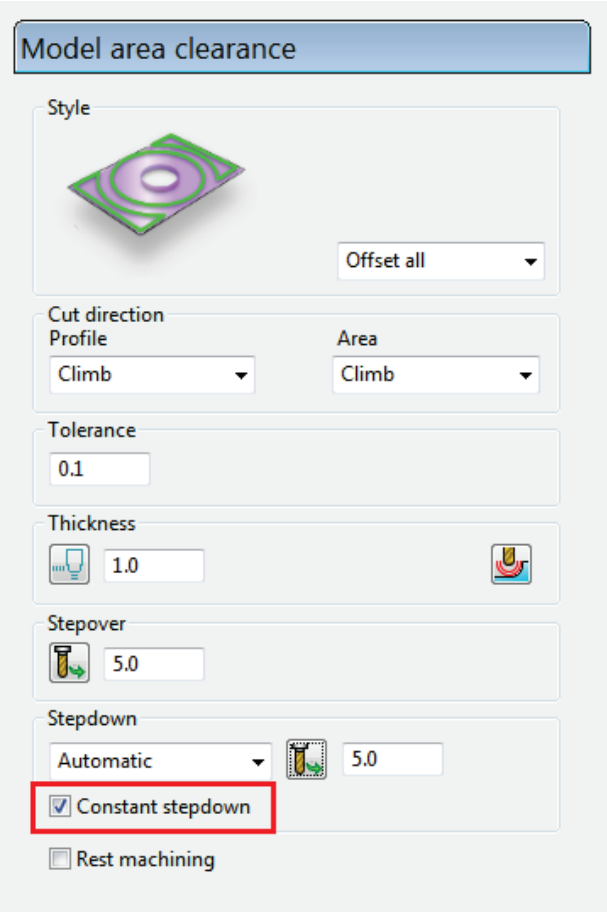
In previous versions, you could read a hole from an .xml file into a feature set and export a hole in a feature set to an .xml file.

In PowerMILL 2013, you can now import pockets, slots, and bosses from an .xml file from PowerSHAPE. Previously, this functionality was available only for holes. You can also export them to a .xml file and import them in PowerSHAPE.

Toolpath generation

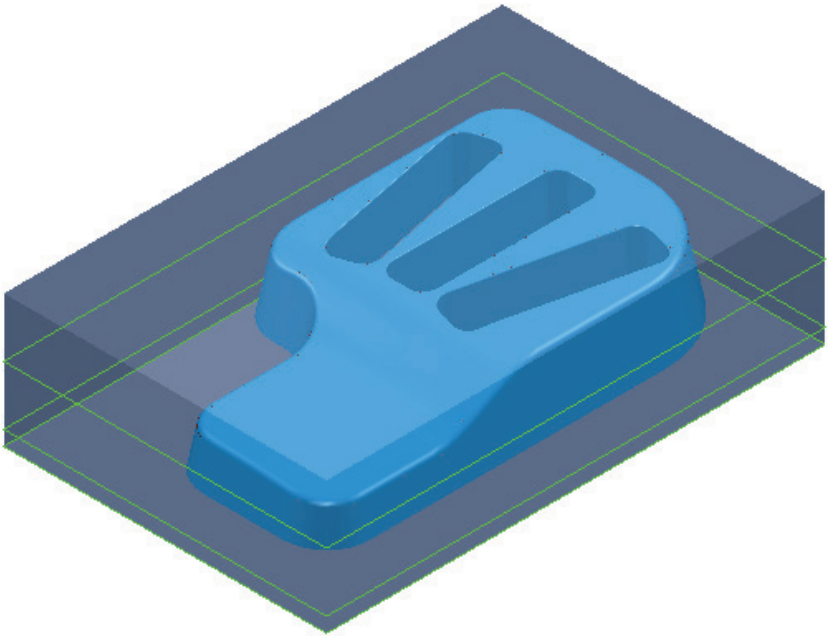
Area clearance stepdown

When creating an area clearance toolpath, you can now always choose whether to use the precise stepdown or a constant stepdown. In previous versions, this choice was only available if you selected a **Stepdown** of **Manual**.



Constant Stepdown — When selected, all the machining levels are equispaced, and the **Stepdown** value is a maximum stepdown. When deselected, the difference between consecutive machining levels is the **Stepdown** value for all levels except the last one which is at the bottom of the block.

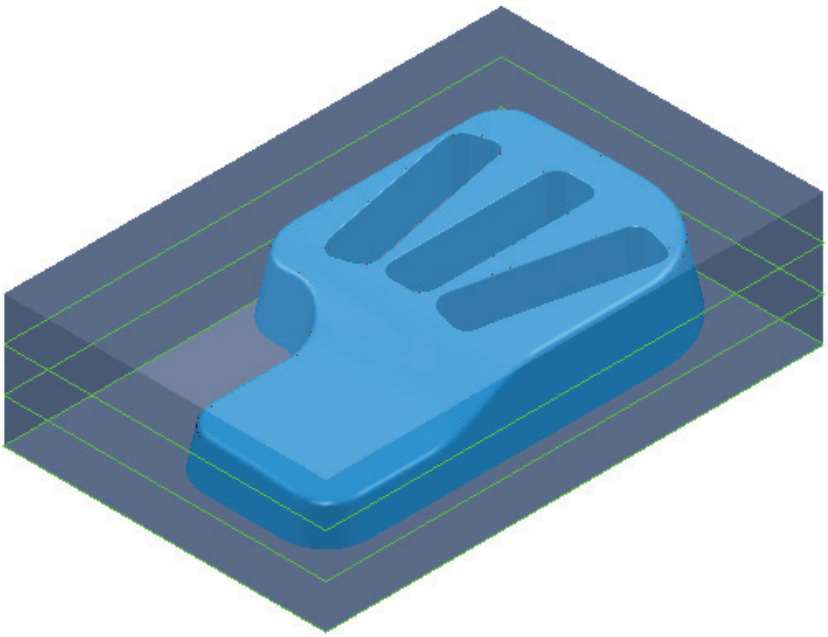
Constant Stepdown deselected:



With a **Stepdown** of **20**, the Z heights are at 15, -5, and -10.

The stepdown is the amount specified for all levels (in this case **20**) except for the last one, which is at the bottom of the block (in this case a **Stepdown** of **5**).

Constant Stepdown selected:



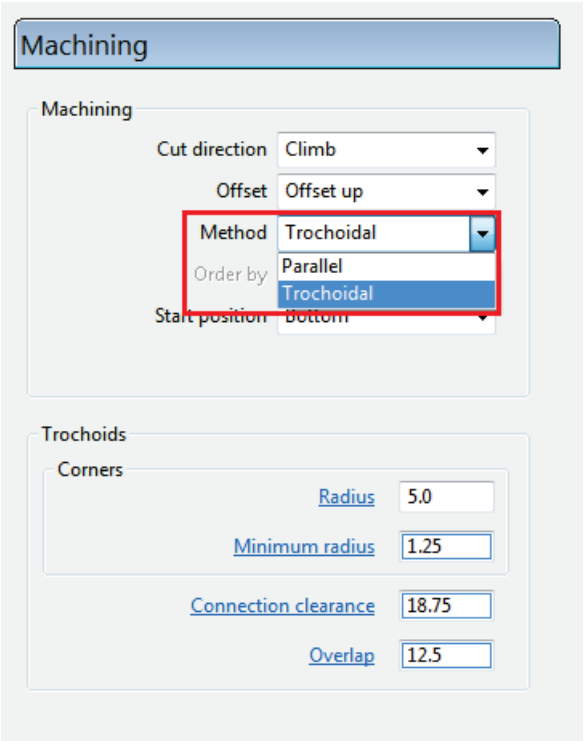
With a **Stepdown** of **20**, the Z heights are at 20, 5, and-10. This gives an effective stepdown of 15.

The stepdown is the same between all levels but isn't necessarily the amount specified. In this case, PowerMILL uses a **Stepdown** of **15** rather than **20**.

Blisk area clearance offsets

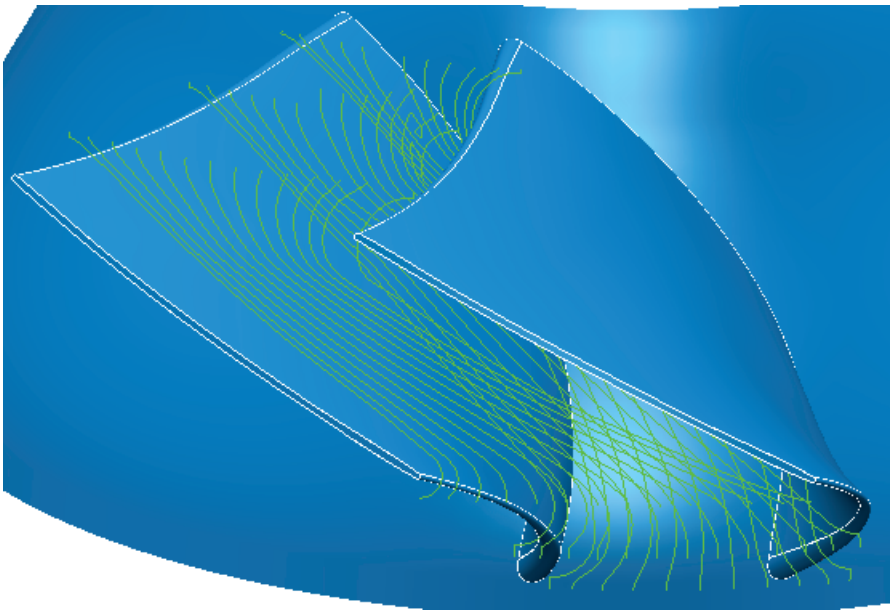
You can now specify the type of offsetting when creating a blisk area clearance strategy.

The **Machining** page has an additional option of **Method**.

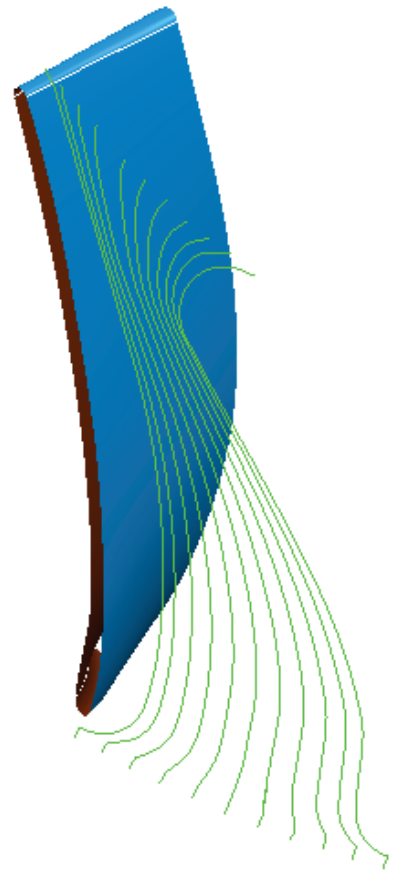


Method — These options determine the offsetting method between the two blades.

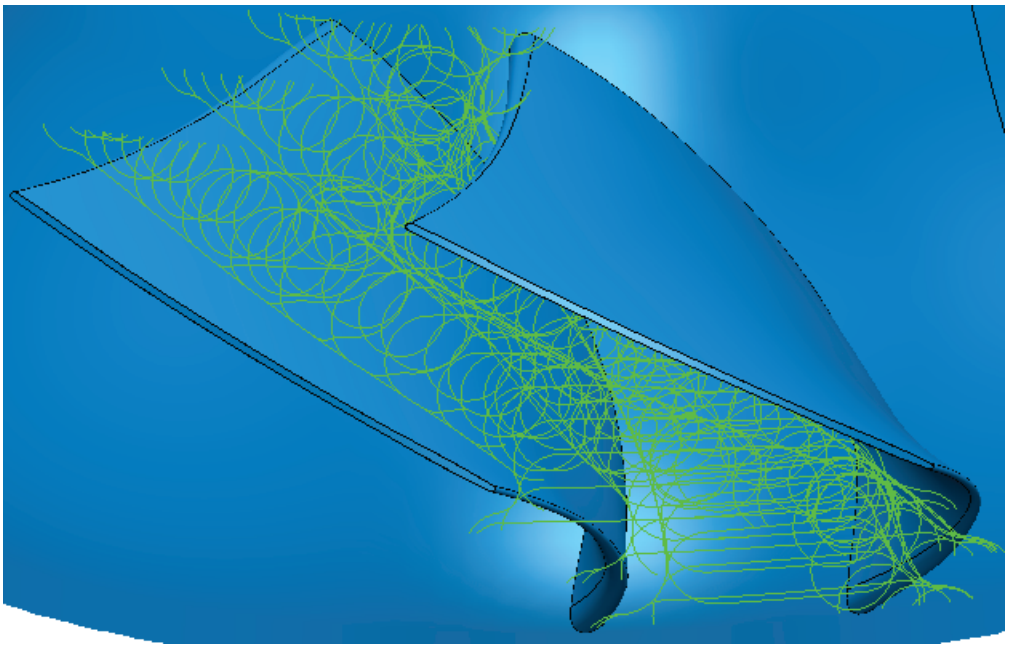
Parallel — The offsets are approximately parallel to the blades. This was the only option in previous versions.



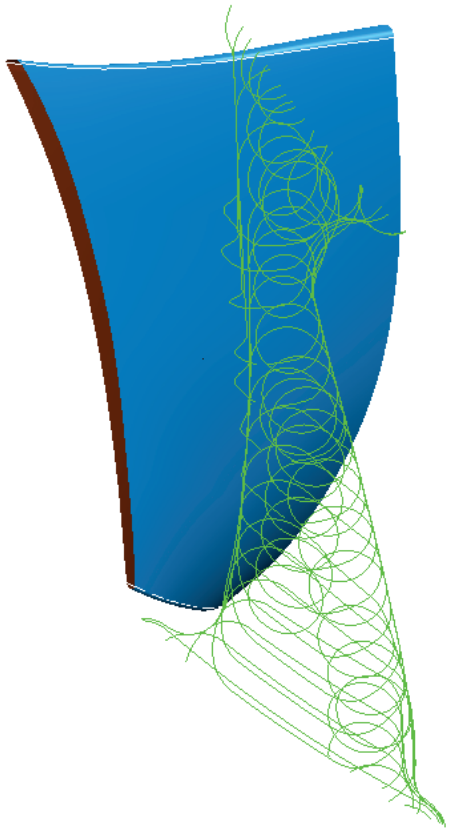
Looking in detail:



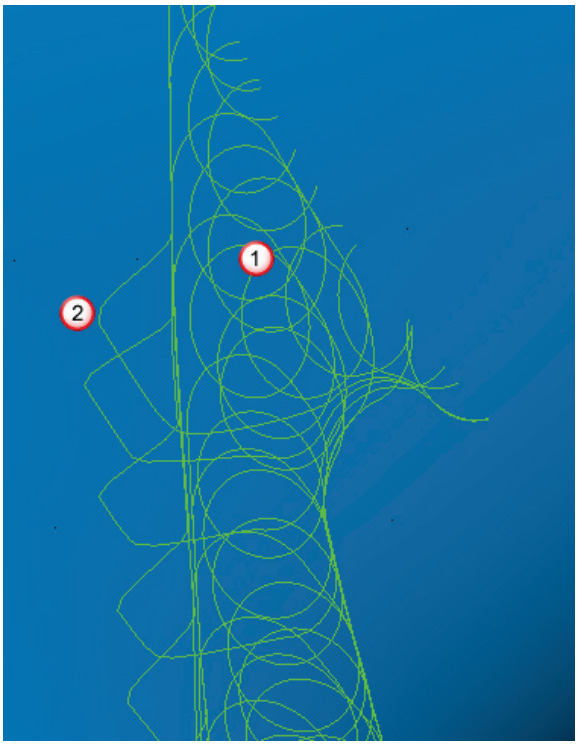
Trochoidal — The offsets are of constant height and radius moving between blades, but with the edges rounded off. Each pass loops before joining the next one to create something resembling a trochoidal path. Selecting this option enables the **Trochoids** area of the dialog.



Looking in detail:



Looking in even more detail:



1 shows the trochoidal cutting moves.

2 shows the loop to connect to the next cutting path. This portion of the toolpath is air cutting.

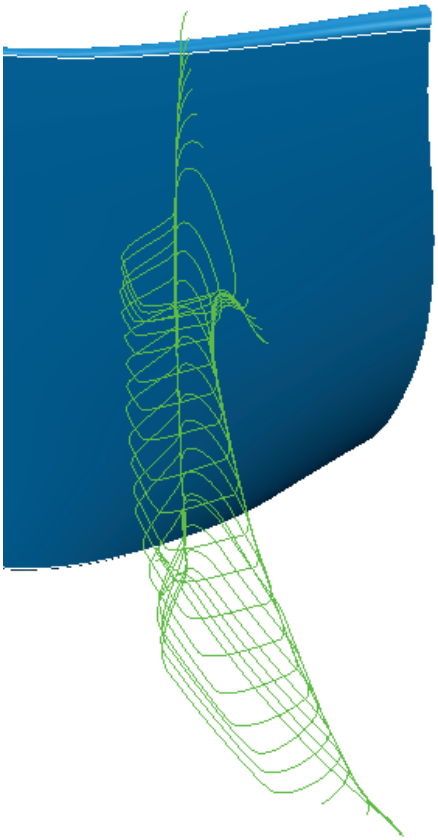
Trochoids

Radius — Enter the preferred radius for the rounding at corners.

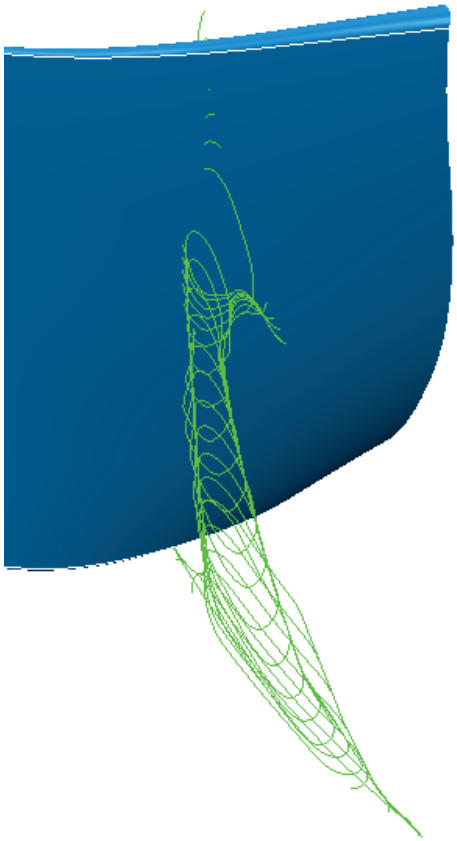
Minimum radius — Enter the minimum radius for the rounding at corners.

Connection clearance — Enter the tool retract distance for the back of the trochoids (the portion of the toolpath which is air cutting).

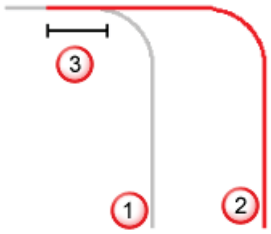
Connection clearance of **20**



Connection clearance of **5**



Overlap — Enter the overlap distance between consecutive passes. This enables each pass to start before the previous pass curves away from the edge.

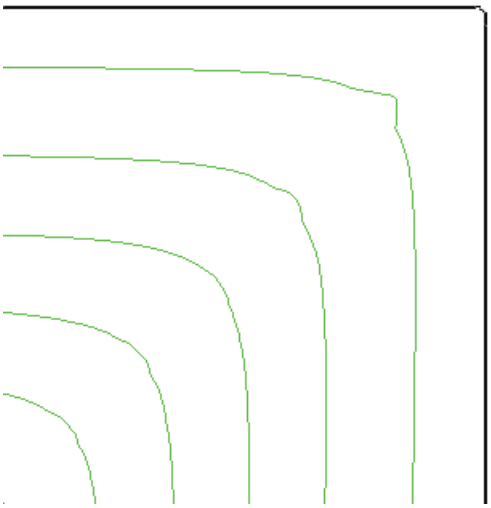


1. First pass
2. Second pass
3. Overlap

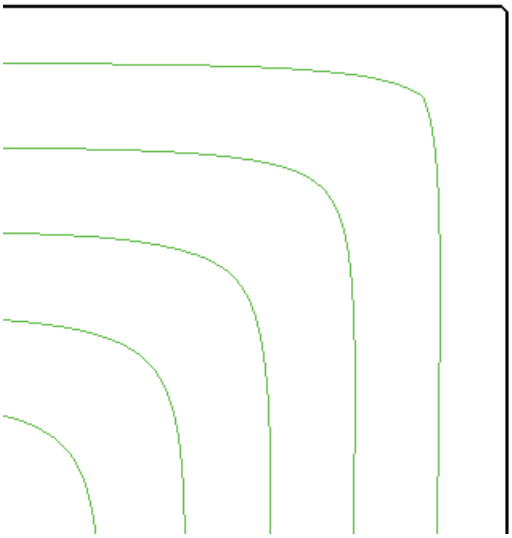
Spiral toolpath improvements

All spiral toolpaths (whether area clearance or finishing toolpaths) are now much smoother. This improvement has no speed implications, so spiral toolpaths are calculated just as quickly in PowerMILL 2013 as in PowerMILL 2012 R2.

Looking in detail at a spiral toolpath created in PowerMILL 2012 R2 where the toolpath isn't smooth:



The improved toolpath created in PowerMILL 2013 still follows the outer contour but smooths the inner contours:

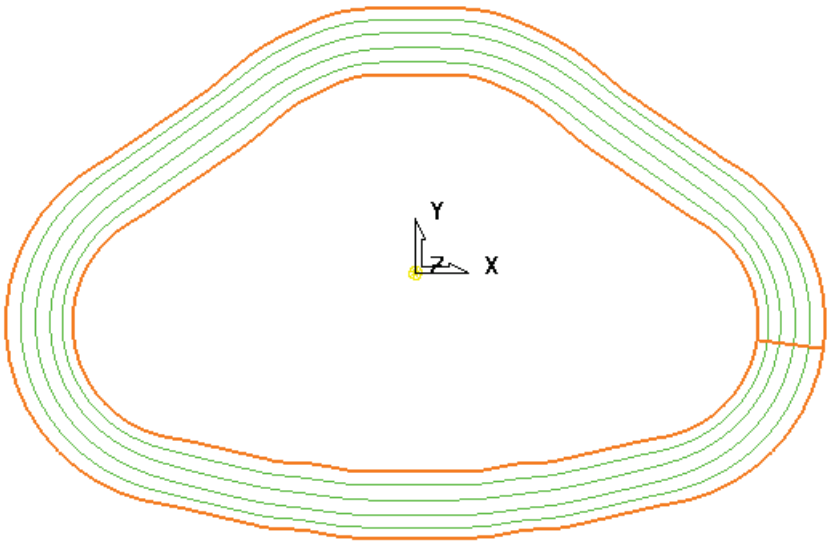


The smoothing takes place automatically on toolpath creation.

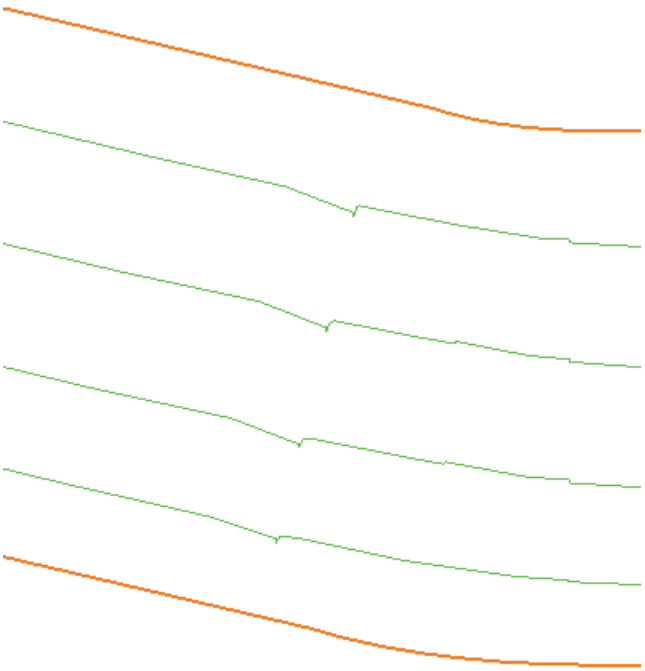
Flowline toolpath improvements

PowerMILL 2013 provides improved tool axis movement in contact-point based strategies. This smooths the tool axis while maintaining the same contact point. This includes flowline toolpaths and any other strategies that use an embedded pattern.

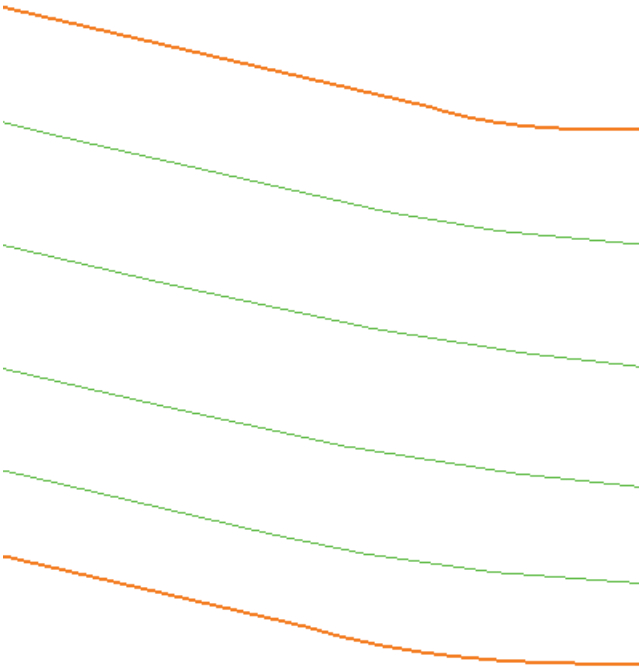
You can see the improvements in a flowline toolpath on the Die.dgk model in the Examples folder.



Looking in detail at the toolpath created in PowerMILL 2012 R2:



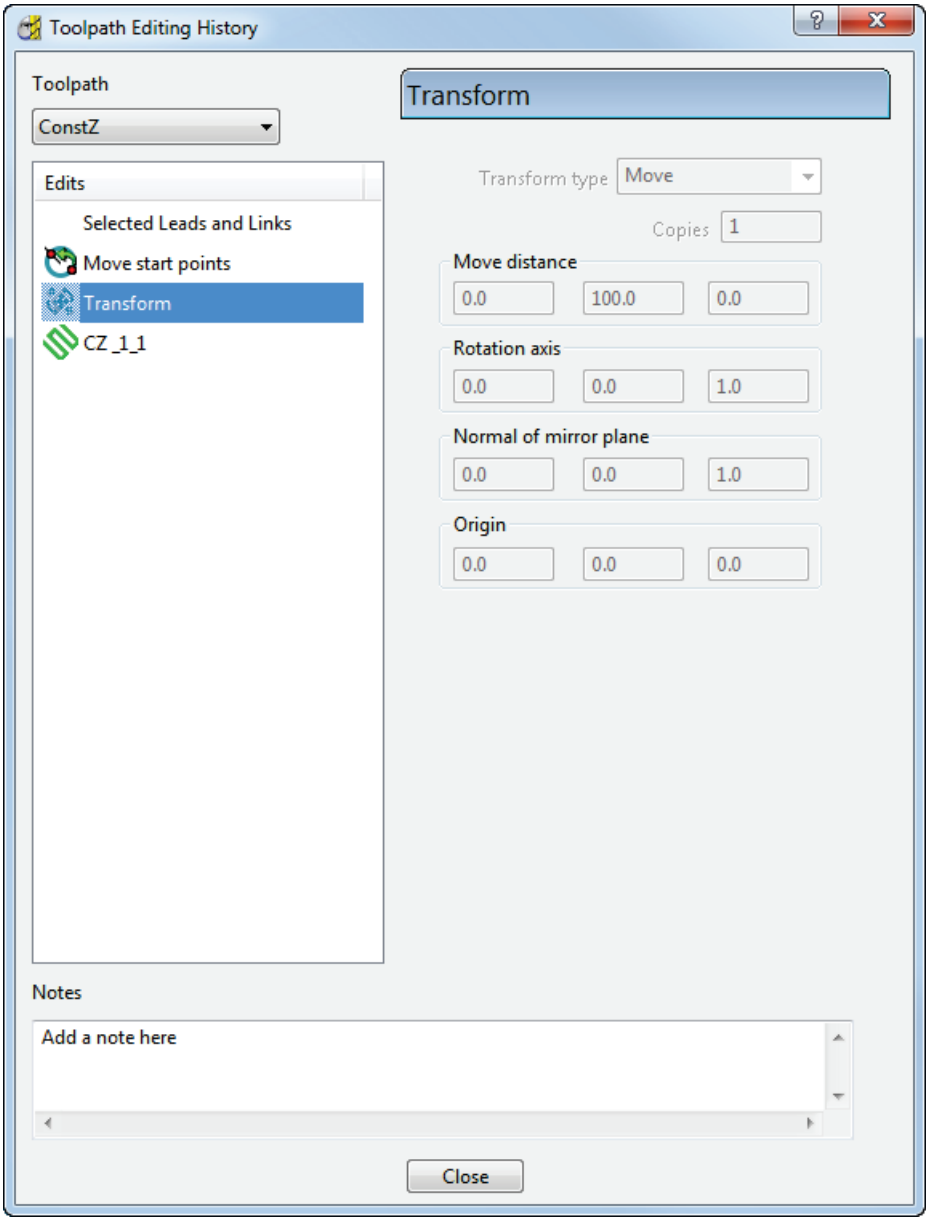
and the improved toolpath created in PowerMILL 2013:



The smoothing takes place automatically on toolpath creation.

Toolpath editing history

You can now see a history of your toolpath edits. The **Toolpath Editing History** dialog is available from the individual toolpath **Edit > Toolpath Editing History** menu or from  on the **Toolpath** toolbar.



Toolpath — Select the toolpath to review its edits.

Edits — The pane displays a list of all the edits performed on the toolpath. The most recent edit is at the top of the list and the original toolpath is at the bottom of the list.

The right side of the dialog displays information on the selected edit. In this case, you can see the edit moved the toolpath by 100 mm in Y.

If you select the toolpath, rather than an edit the right hand side of the dialog displays the toolpath **Notes**.

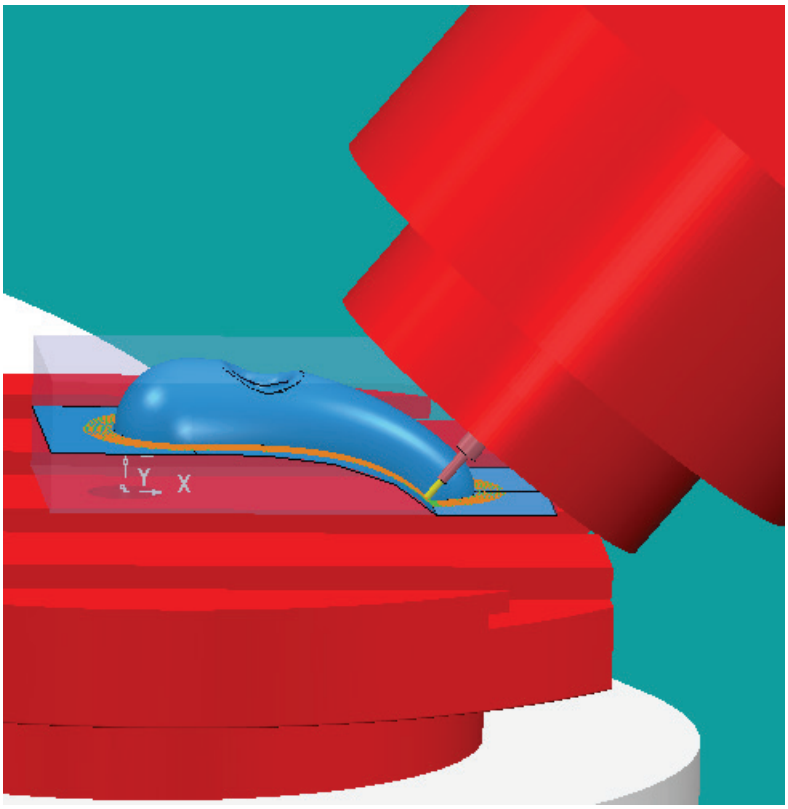
Notes — Type any specific notes to help you understand the edit.

This functionality records the edits on a toolpath but doesn't allow you to change or edit them.

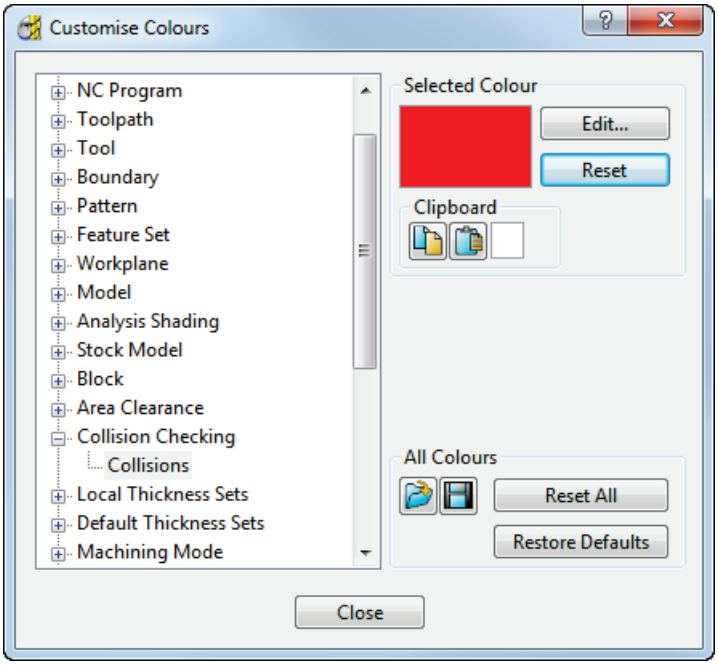
Toolpath verification

Machine tool collisions

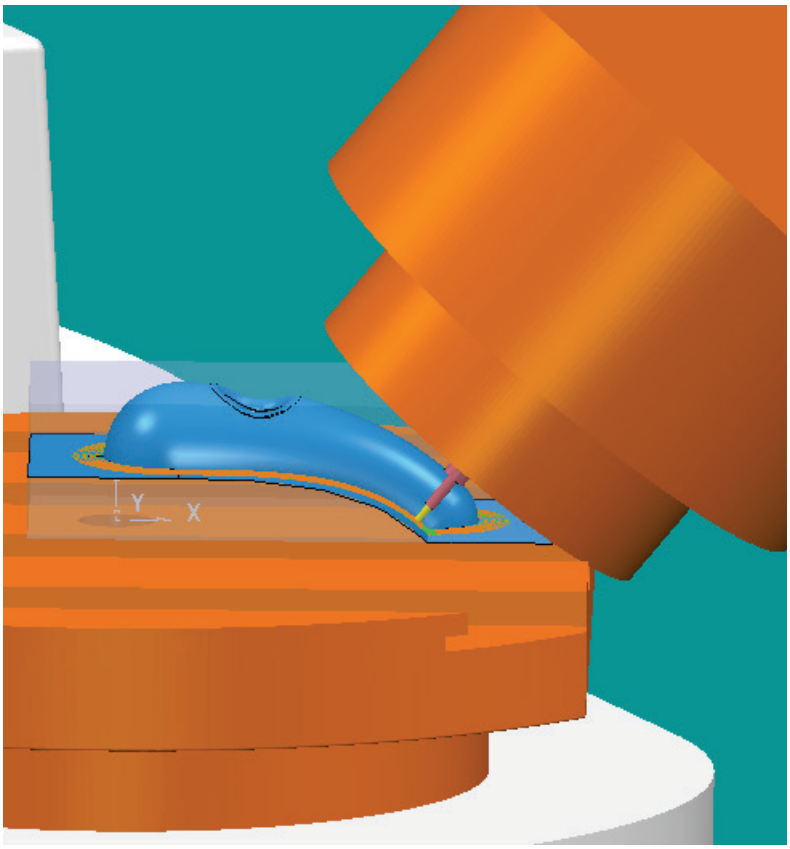
When machine tool components collide with each other, or with the workpiece, all the colliding components are highlighted red. Previously, only two components could be highlighted, even if there were more involved in the collision.



You can change the default collision colour on the **Customised Colour** dialog (accessed from **Tools > Customise Colours**).



In this case, the collision colour has been changed to orange:



Simulation enhancements

Viewmill simulation is up to three times faster.

There are new simulation defaults of **Point-to-point simulation** with the **Speed control** set to the maximum speed. If the simulation is too fast (especially without ViewMill), reduce the speed using the controller.

When simulating toolpaths you can use:

- the buttons on the **Simulation** toolbar; or,

- the keyboard shortcuts.

The keyboard shortcuts now give an option for smaller toolpath steps.

If you select **Point-to-point simulation**, the step sizes are dependent on the point spacing. If you select **Feed rate simulation**, the step sizes are based on the feed rate. The keyboard shortcuts are:

Key	Description
→	Steps forwards through the simulation.
→ + **CTRL**	Makes a long step through the simulation.
→ + **CTRL** + **Shift**	Makes an extra long step through the simulation
→ + **Shift**	Makes a short step through the simulation.
←	Steps backwards through the simulation.
← + **CTRL**	Makes a long step back through the simulation.
← + **CTRL** + **Shift**	Makes an extra long step back through the simulation.
← + **Shift**	Makes a short step back through the simulation.

Key	Description
Page Down	Moves the tool to the start of the next toolpath segment.
Page Up	Moves the tool to the start of the current toolpath segment, or to the beginning of the previous one if the tool is already at the start.
End	Moves the tool to the end of the toolpath.
Home	Moves the tool to the start of the toolpath.

Since feed rate stepping doesn't stop on every point, it may appear as if it skips the odd point. Since arcs are smashed for simulation, the tool doesn't follow arcs exactly.

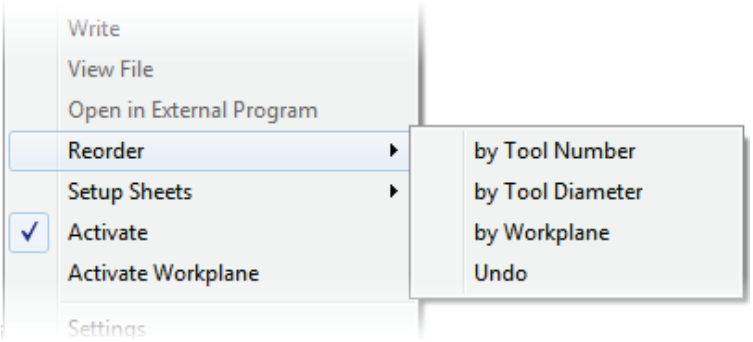
Toolpath output

Reordering toolpaths in an NC program

There is a new **Reorder** option on the individual NC program context menu. This enables you to automatically reorder the toolpaths in an NC program. Previously you could only reorder toolpaths manually.

This is particularly useful when you want to minimise tool changes, as changing tools on a machine can be slow and often involves a long move back to the tool change position.

There are three **Reorder** options:



by Tool Number — Select to sort the toolpaths by their tool number and place the toolpath with the smallest tool number first.

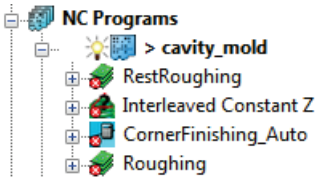
You must define all your tool numbers to use this option.

by Tool Diameter — Select to sort the toolpaths by their tool diameter and place the toolpath with the largest tool diameter first.

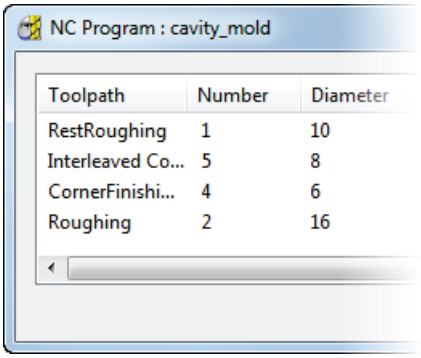
by Workplane — Select to sort the toolpaths by their workplane Z axis and place the toolpaths with the Z axis most closely aligned to the global coordinate system first.

Undo — Select to revert to what it was before the last change.

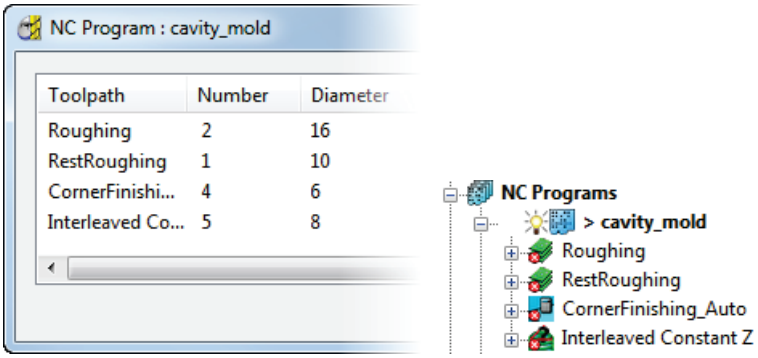
For example, starting with these toolpaths:



If you look at the **Toolpath List** dialog (available from  on the **NC Program** dialog) you can see the tool number and diameter of each toolpath.

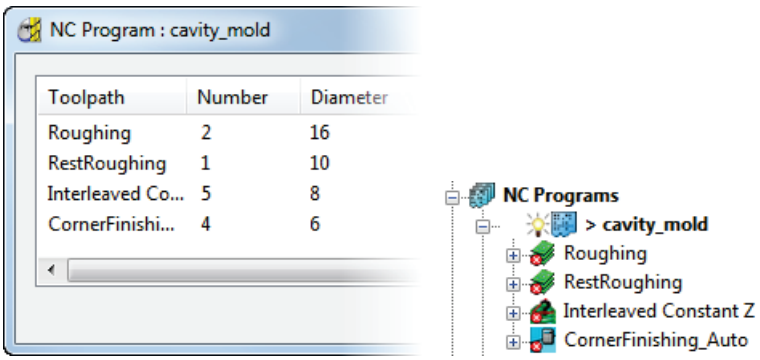


Selecting **Reorder > by Tool Number** changes the toolpath order to:



*Although the **RestRoughing** toolpath has a tool number of 2, it appears last in the list as it cannot be calculated until the **Roughing** toolpath is calculated because it uses the **Roughing** toolpath as a reference toolpath.*

Selecting **Reorder > by Tool Diameter** changes the toolpath order to:



User interface

Mode toolbars

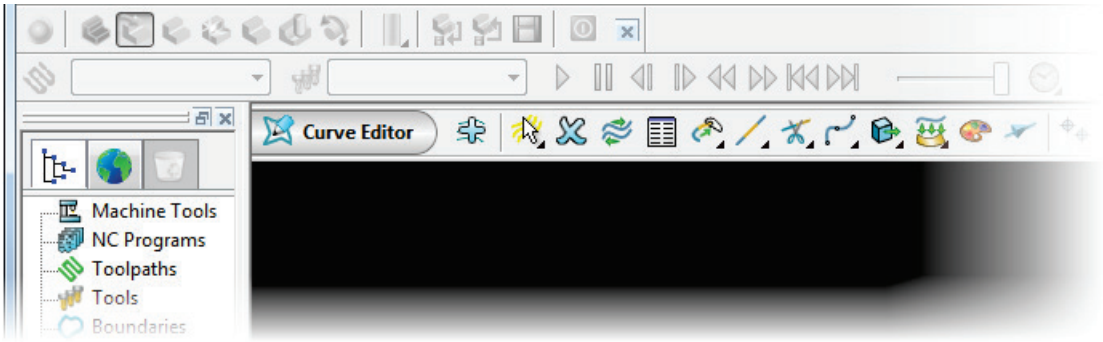
There is a new concept of a **mode toolbar** which makes it more obvious when you enter a graphics mode. A **mode toolbar** makes it easier to use the graphics modes within PowerMILL. There is a separate mode toolbar for each mode. This is similar to a normal toolbar except:

- It is in a fixed location at the top of the graphics window.
- It displays the title and icon of the mode.
- It disables most other PowerMILL functionality.

Activating a mode disables most of PowerMILL's functionality until you exit from the mode. This includes disabling:

- the menu bar
- most toolbars
- the explorer's context menus
- the graphics area's context menus
- most commands

A mode toolbar is displayed just above the graphics window.



The mode toolbars display the toolbar name and icon on the left 

.

If the mode toolbar is too wide for the graphics window:

- Initially, the toolbar icon isn't displayed, 

; or,
- If reduced further, the icon is displayed, but the name isn't 
; or,
- If reduced still further, neither the name nor the icon are displayed 
.

The mode toolbar always displays the **Accept** and **Cancel** buttons. If possible, PowerMILL displays the whole mode toolbar:

But, if the graphics window is too narrow, PowerMILL removes the buttons immediately to the left of the **Accept** and **Cancel** buttons.

Accept changes — Click to accept and keep all the changes. This mode toolbar closes, which enables the main PowerMILL functionality.

Cancel changes — Click to delete all the changes. This mode toolbar closes, which enables the main PowerMILL functionality.

The mode toolbars are:

Block Editor

Boundary Transform

Create Workplane

The icon on the left side depends on the create workplane option selected on the **Workplane** toolbar.

Curve Editor

Feature Set Editor

Measure Mode

Measure Difference Mode

Move Start Points

Pattern Collect

Pattern Decoration

Pattern Transform

Pick Entity

Pick Tool Pattern

Activate Picked Entity

Snapshot Mode

Toolpath Transform

Workplane Editor

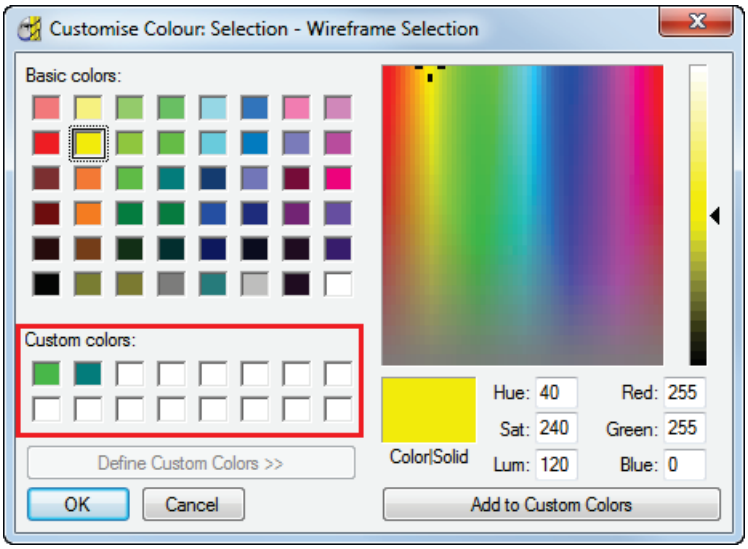
Workplane Transform

The functionality and options on the toolbars remain unchanged.

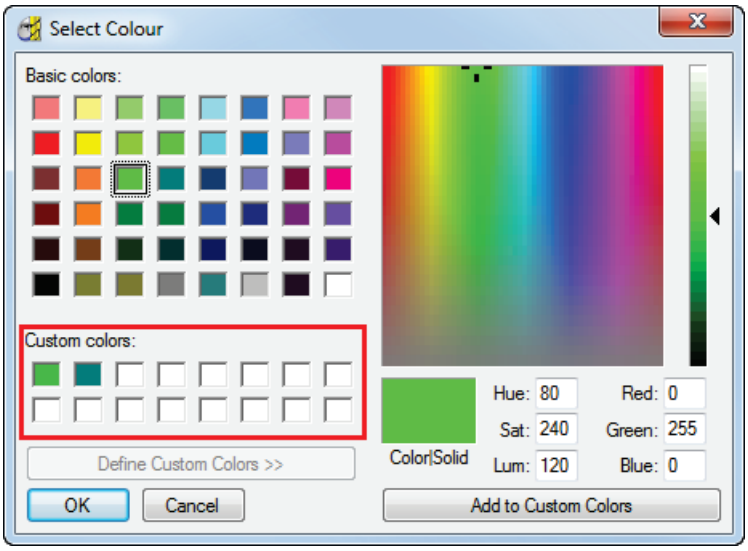
Saving custom colours

PowerMILL now saves any custom colours in the colour palette between sessions. You can define custom colours by going to either:

- The **Tools > Customise Colours** menu, and selecting one of the options in the tree, say **Selection > Wireframe Selection**, and then selecting **Edit** to display the **Customise Colour** dialog.



- The **Draw > Model** menu, and selecting either **Colour** or **Shade Colour** to display the **Select Colour** dialog.

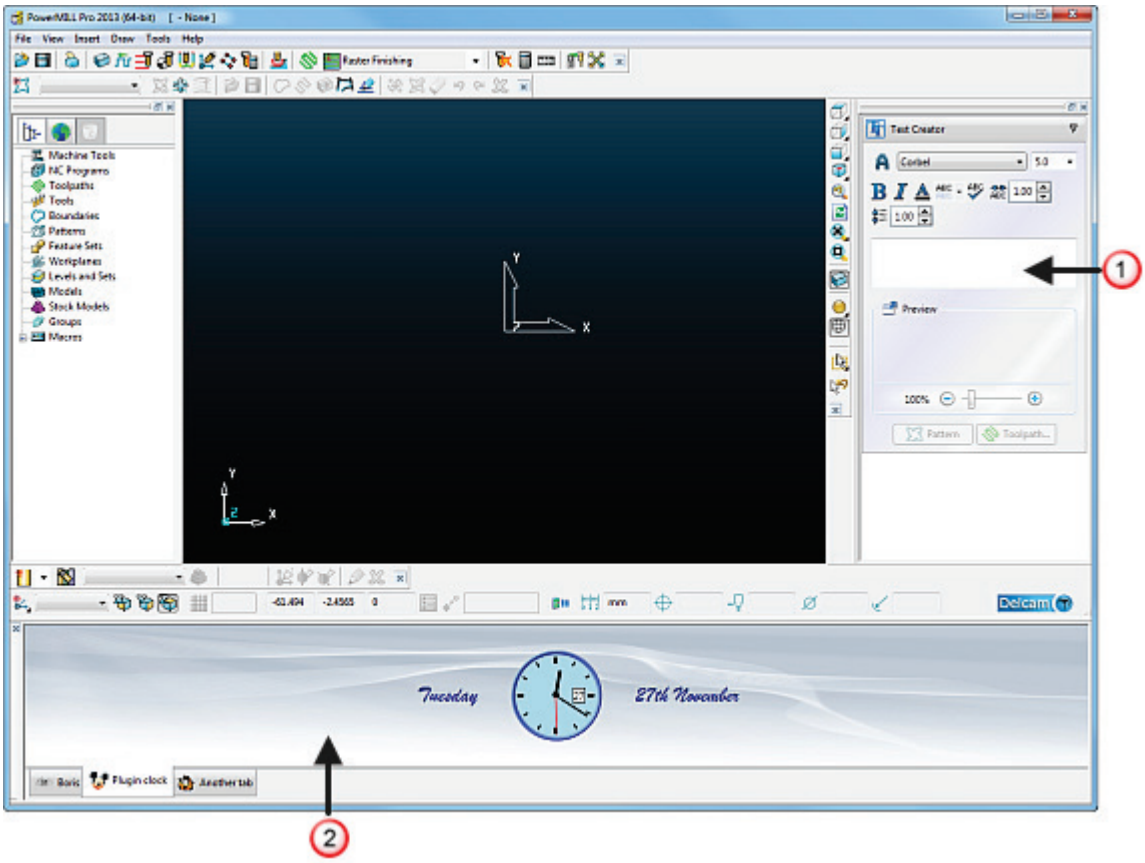


The custom colours are the same in both instances.

Automation

Plugin enhancements

A new horizontal plugin window has been added to PowerMILL. Now PowerMILL features both a horizontal and a vertical plugin window.



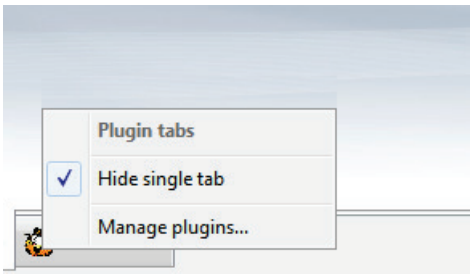
1. **Vertical plugin window**
2. **Horizontal plugin window**

The horizontal layout of the new plugin window provides developers with a greater amount of flexibility when designing plugins.

Plugins are either displayed in the horizontal plugin window or the vertical plugin window.

You cannot change where a plugin is displayed; this is determined by the developer.

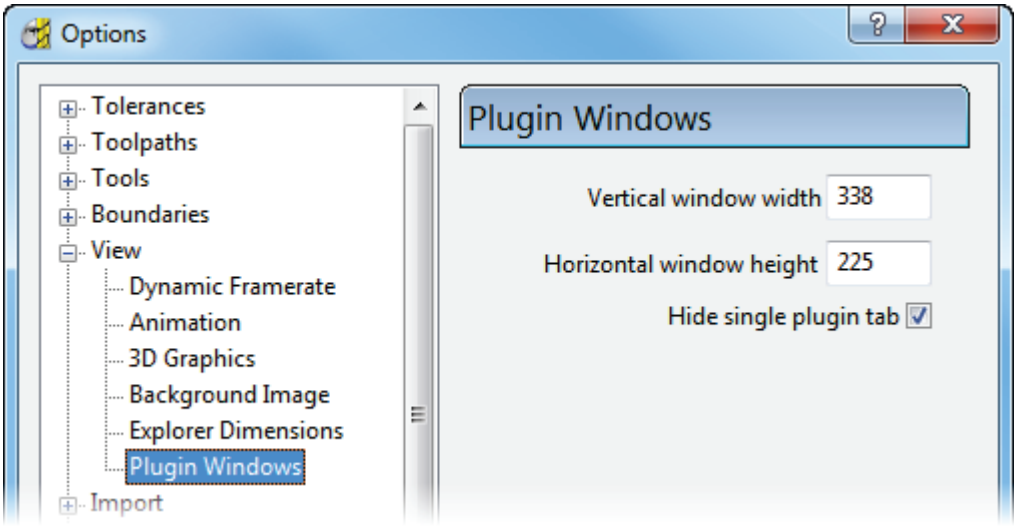
To display the plugin window's 'context menu', right-click on a plugin tab.



Hide single tab — Select to only display plugin tabs when there are two or more plugins enabled.

Manage plugins — Select to display the **Plugin Manager**. The **Plugin Manager** enables you to manage the plugins that are currently installed on your PC.

To specify the plugin windows' default settings, use the new **Plugin Windows** page.



Macro programming enhancements

The macro programming language now includes the ability to:

- Create entity variables.
- Execute a macro string as a command using DOCOMMAND.
- Allow users to select multiple entities from a list.
- Pause a running macro to allow user selection and picking. The command to do this is:

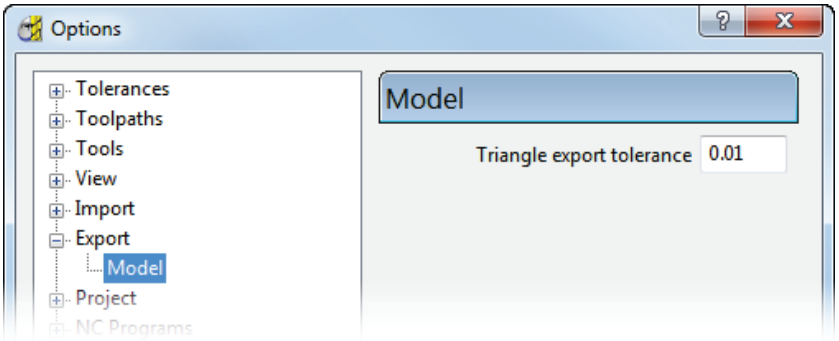
  ```
  MACRO PAUSE "User help instructions"
  ```

For more information, see the Macro Programming Guide.

General enhancements

There are a few general enhancements:

- PowerMILL now makes more effective use of memory. This improves calculation times of area clearance toolpaths on large parts.
- There is less fragmentation of toolpaths when stock model rest roughing.
- Arc fitting is much improved and more reliable. Arc fitting is available from the high speed pages of area clearance, constant Z and raster strategies.
- When using stock engagement, much improved safety and efficiency of ordering of constant Z toolpaths .
- You can now export models as .stl files even when no machine operations have taken place. You can determine the **Triangle export tolerance** on the **Options** dialog (available from **Tools > Options > Export > Model** menu).



Triangle export tolerance determines the accuracy used to translate from the dgk format to an stl format.

- New parameters are available for tool holder and tool shank components. You can use these parameters in macros and setup sheets.

  For example:

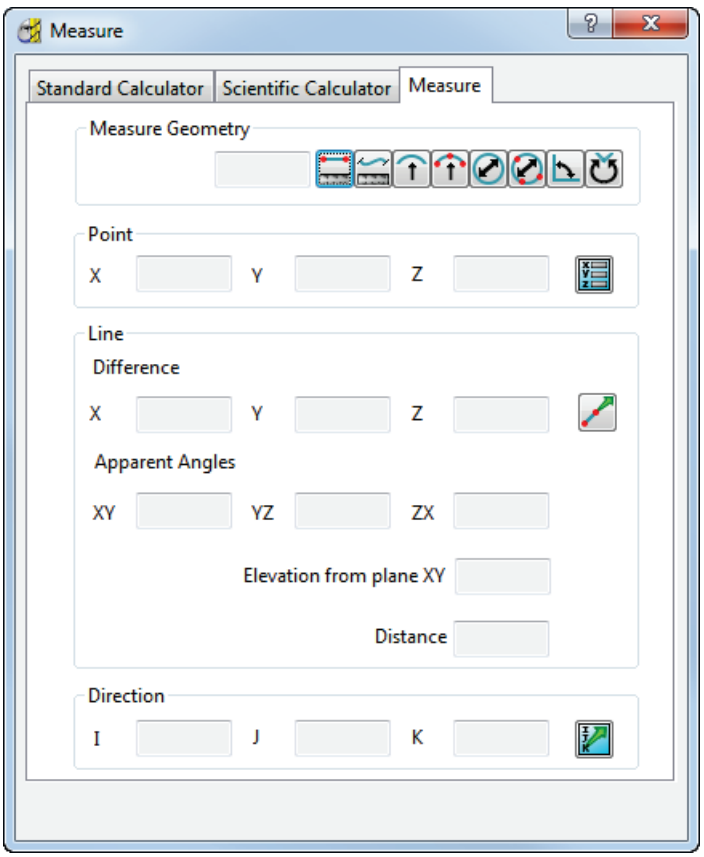
  `tool.ShankSetValues[0].UpperDiameter` for the upper diameter of the first shank component.

`tool.HolderSetValues[2].Length` for the length of the third holder component.

- Toolpath strategy dialogs open twice as fast in PowerMILL 2013 as in 2012 R2.
- There is a new option on the individual Model > Edit menu of **Convert to Reference Model**. This converts the model to a reference model. A reference model contains geometry which isn't considered for machining, but may be used for construction purposes or clamp arrangements. This option allows you to create geometry ion PowerSHAPE and import it into PowerMILL and then convert it to a reference model.
- The **Delete Selected** menu option has moved from the **File** menu to the **View** menu. This option deletes selected items in the graphics view, excluding model components and toolpath segments.

Measurer enhancements

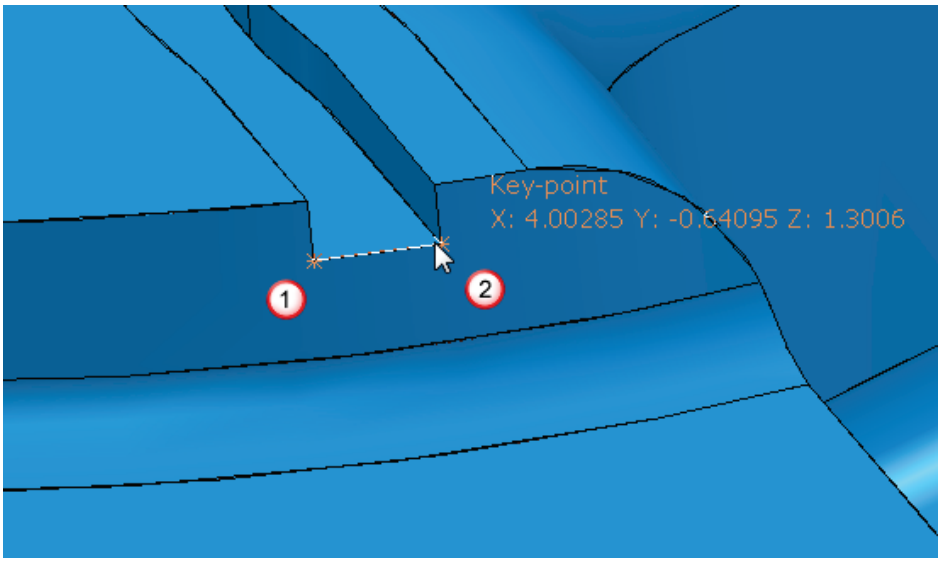
The **Measure** dialog now includes the ability to easily measure the apparent angles of the defined line (or two points). Although it was possible to find the apparent angle in version 2012 R2, it wasn't as easy to use as the old **Measurer** dialog (version 2011).



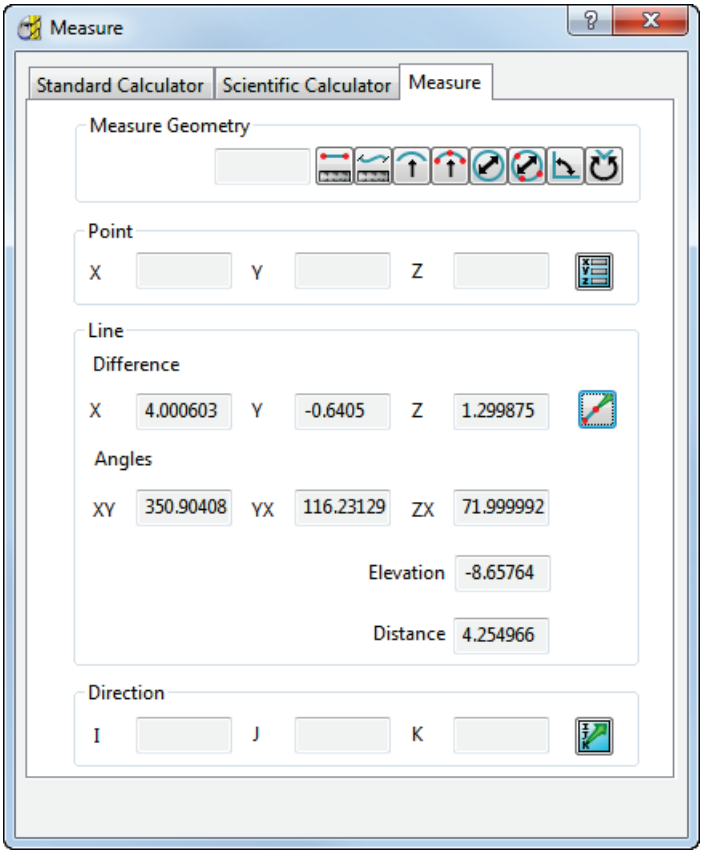
Clicking  displays the **Measure Difference** mode toolbar.

Click two points on the model to measure the distance and see the apparent angles.

For example:



The **Measure Difference** mode toolbar closes and updates the **Measure** dialog with the distance between the two points and the apparent angles.



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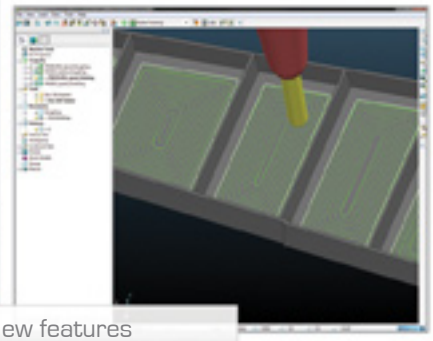

new features

Delcam TV

www.delcam.tv

PowerMILL 2013 Learning Zone

www.delcam.tv/lz

PowerMILL Website

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