CAM-TOOL

CAD/CAM System for Molds & Dies

“V 15.1 Explanations of Functions No.1” Chapter 1 and First Half of Chapter 2

2018/2/26

C&G SYSTEMS INC.
Product Planning Supervision Department, Sales Technology Division

List of V-UP Functions

CAM-TOOL

Chapter 1 and First Half of Chapter 2
"V15.1 Explanations of Functions No.1"
This Document

1. Development of Functions for Shortening CAM Operation Time

- □ Improvement of calculation process lists (improvements for creating new list, addition of common settings, addition of display columns, etc.)
- □ Automation of reset color for Solid Display
- Improvement of Multi support
- □ Show tool shape
- Information (Entity): Display of profiles used
- Effective length standards implemented for safety distance heights of tools
- Improvement of Tooling DB functions (addition of display columns for neck angles, improvement of input for Multi-taper, etc.)

2. Enhancements and Improvements of Cutting Paths

- Enhancement of fine and precision functions (Z-Level High Efficiency Rough Cutting, Z-Level Finishing)
- Enhancement of Z-level Finishing functions (Support for spherical lenses)
- Low Lying Processing (Variable pitch path)
- Low Lying Processing (Enhancement of corner processing)
- □ Z-level low angle finishing: Spiral cutting
- □ Scale calculation: Enhancement of supported cutting modes
- Scanning-line cutting: Support for fillet
- CL-5x Editor - Component point rearrangement
- □ Enhancement: Curve Cutting
- Improvement of 5Axis Conversion (Auto)
- Enhancement of cutting modes when using Barrel Cutter Tool
- Other function enhancement/specification changes
- □ 2.5D Side Cutting: Support for spirals
- 2.5S approach: Avoid interference with surfaces
- □ 2.5D Rough Cutting: Last Step Over
- □ 2.5D Side Cutting: Last Step Over, Last Step Down
- □ 2.5D Re-machining: Combine processing
- Hole: Support for Cross Hole Drilling using a gun drill
- □ Hole: Circular Hole-wall Cutting: Helical cutting
- Hole: Helical tapping: Support for original contour
- Hole: Entity (Create All): Create work plane

List of V-UP Functions

CAM-TOOL

3. Enhancement of Cutting for Large/3D Objects
   - Addition of Re-machining area commands
   - Merge solid from CAM-TOOL main unit
   - Re-machining: Output pencil path
   - Improvement of connecting move
4. Other Function Enhancements
   - Animation (Multi type)
   - CL Editor: Load polygon entity
   - Machining process list: Enhancement of NC output destination
   - Initial settings for “Save as type”
   - Enhancement of support for mpf output variables
   - Binary support for mpf files and machine files
   - Vericut I/F: Output of work/jig shape
   - OM Inspect: Projecting direction of point to inspect
5. Linkage with Host CAD
   - Support for RGB colors
6. Surface Plus
   - Enhancement of Fill Surface
7. Addition of New Option Functions
   - Addition of Edit Polygon functions
8. Enhancement of Translator Functions
   - IGES Import: Conversion of Entity106 elements to points
   - IGES Import: Conversion of Entity406 strings to layer comments
   - Parasolid Import: Support for x_b extension in file “Open” and “Add”
   - RBG support for DXF Export

1. Development of Functions for Shortening CAM Operation Times

- □ Improvement of calculation process lists (improvements for creating new list, addition of common settings, addition of display columns, etc.)
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Calculation Process List

Overview

Functions were added and improvements were made to calculation process lists. These functions simplify the work for configuring multiple settings and also improve operability.

Function Items

1. Improvement of Create New Calculation Process List
2. Addition of Common Settings Function for Tool Initial Position, Clearance Z
3. Addition of Relative Value Function for Tool Initial Position
4. Switching Between Common Settings and Individual Setting
5. CAM Environment, Common Settings for Input of Calculation Process List
6. Collective Change of Multiple Profile Names
7. Addition of "Open All" and "Close All" in Calculation Process List
8. "Select Specified Shape" of Active Profile
9. Addition of Items in Control Calc. Mode: "Effective length", "Minimum Z", "Start Z", "End Z", "Machine compensation"
10. Change of Specifications for Optimization Status in Setting Tool Diameter Compensation, Addition of "Machine compensation" Item
11. Miscellaneous

Calculation Process List

1. Improvement of Create New Calculation Process List

Until V14.2, initial work shapes and product shapes were registered after creating a calculation process list. However, in V15.1, it is now possible to register shapes when creating a calculation process list, which reduces the number of operations performed until execution of optimization calculation.

Until V14.2

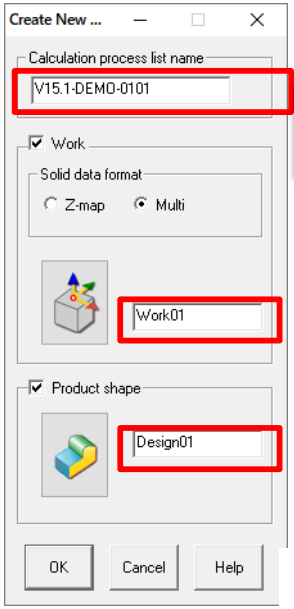
1. Calculation Process List "New"
2. Create Work
3. Register Work in Calculation Process List
4. Create Product Shape
5. Register Product Shape in Calculation Process List

*

Setting-related works for five items required

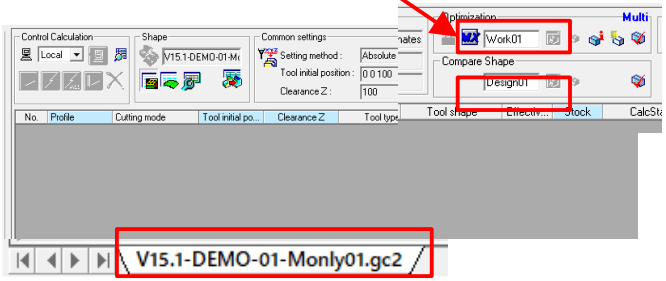
*Loads names defined in CAM environment

V15.1

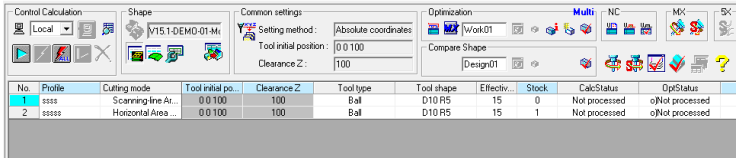


Setting-related works consolidated

Work and product shape name reflected



Results of Create New Calculation Process List



By merely registering a profile,
it is now possible to execute until optimization calculation
(*After setting shapes to the profile)

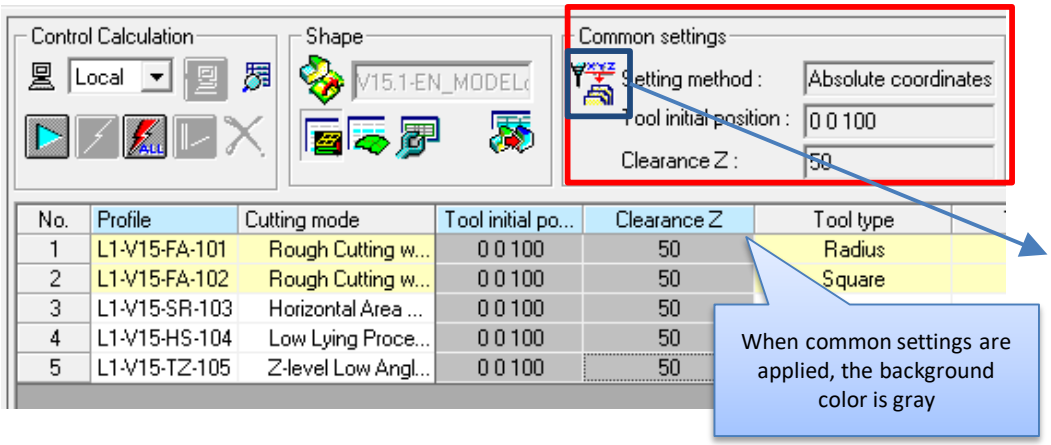
Operations required to enable optimization calculation

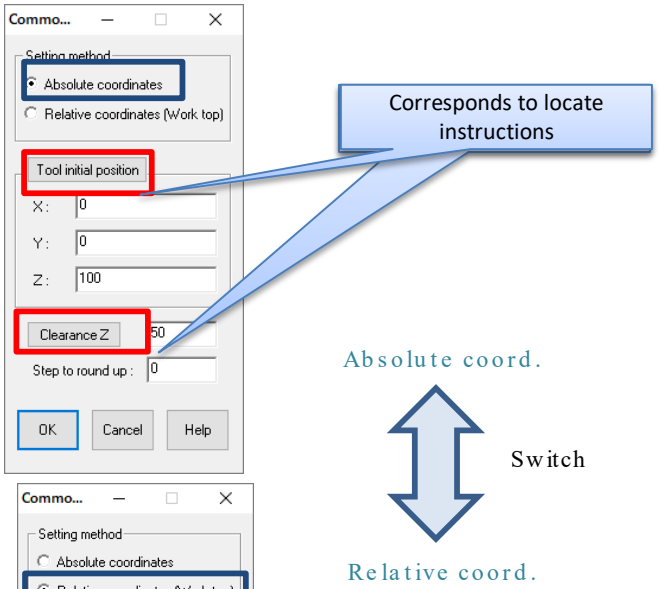
Folder: V15.1\V15.1-DEMO-01
Demo model file: V15.1-DEMO-01.gmd
LAY shapes: 1, 2; tool path boundary: 3; work: 5
Template file: V15.1-ENZAN_001.gmt

Calculation Process List

2. Addition of Common Settings Function for Tool Initial Position, Clearance Z

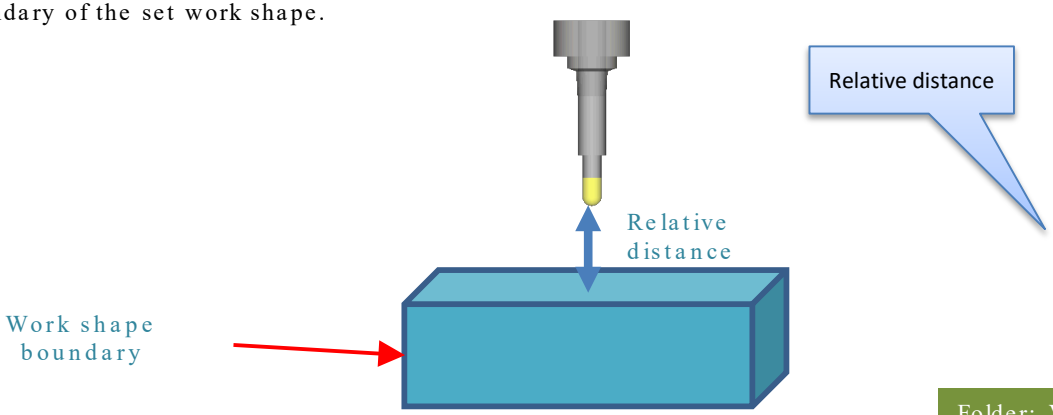
A common settings function has been added. This function sets the "Tool initial position" and "Clearance Z" to an entire calculation process list in the V14.2 format in which each profile has an individual "Tool initial position" and "Clearance Z".

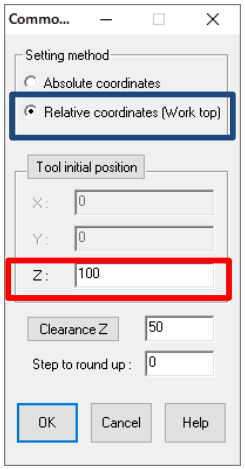




3. Addition of Relative Value Function for Tool Initial Position

The tool initial position is determined by referencing the relative position from the boundary of the set work shape.

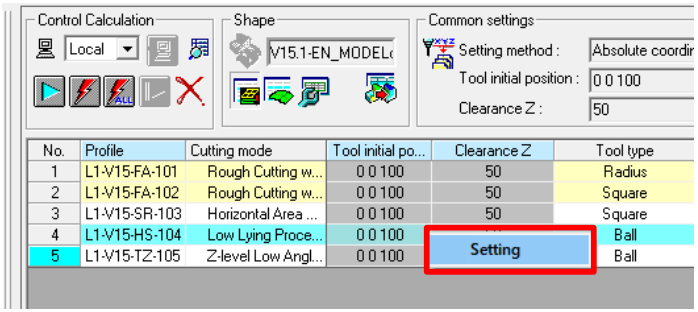




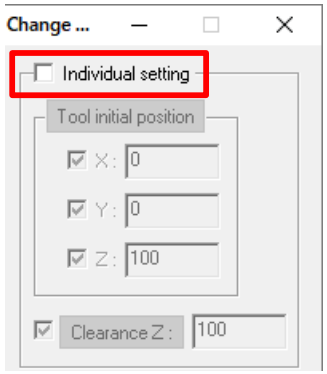
Folder: V15.1\V15.1-DEMO-01
Calculated model file: V15.1-DEMO-01.gmd
Calculation process list: V15.1-01-ENZAN_RESET.gc2

4. Switching Between Common Settings and Individual Setting: "Change CAM Settings"

Switching between common settings and individual setting is now possible with "Change CAM Settings".

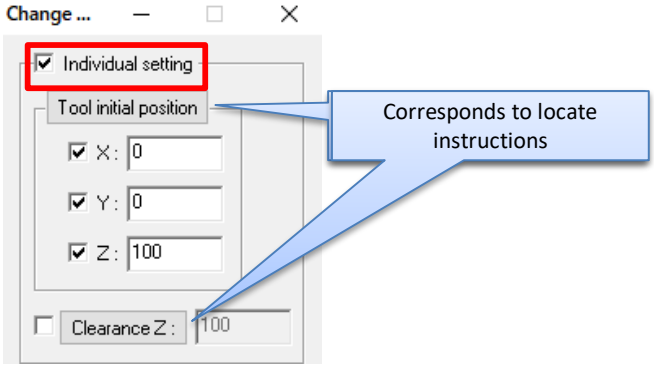


Select target process -> launch settings



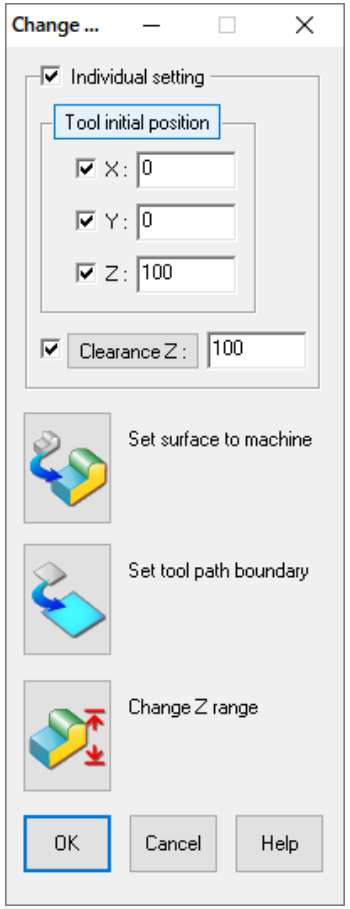
"Individual setting" OFF

Selection process
-> Common settings



"Individual setting" ON

Selection process
-> Individual setting



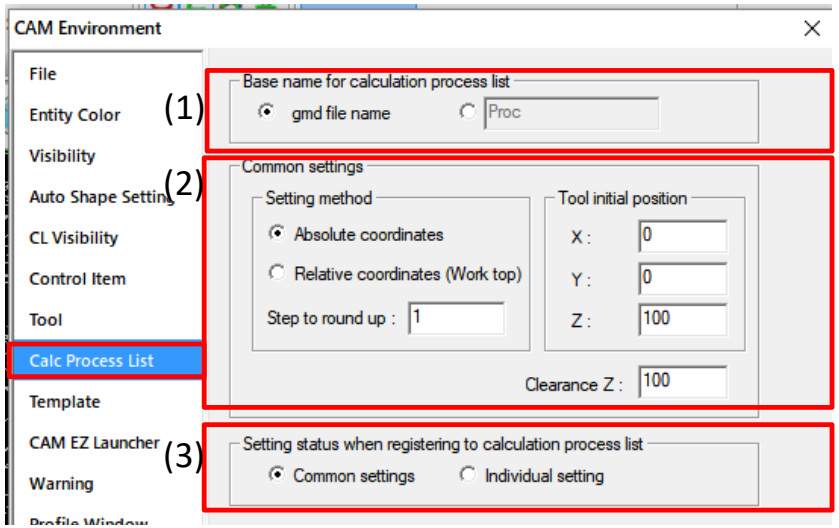
Change CAM Settings

Folder: V15.1\ V15.1-DEMO-01
Calculated model file: V15.1-DEMO-01.gmd
Calculation process list: V15.1-01-ENZAN_RESET.gc2

Calculation Process List

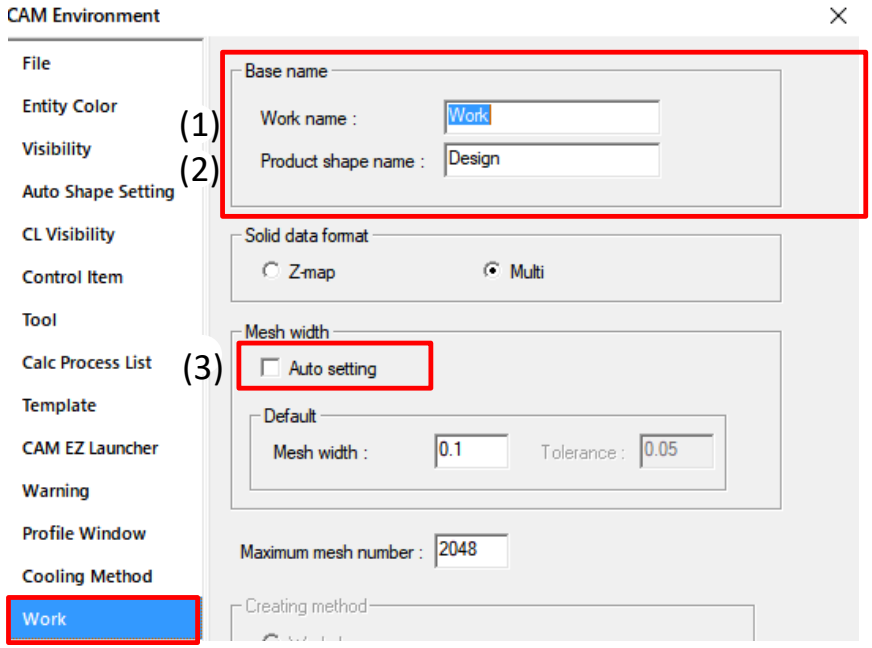
5. CAM Environment Detailed Settings

Registering the filename and initial values in the environment settings reduces the items to input when creating a new calculation process list.



Settable items

(1) Base name for calculation process list (When multiple lists are created, numbers are added sequentially.)
(2) Absolute/relative coordinate settings and initial tool position for common settings
(3) Switching between common settings/individual setting when registering calculation process list

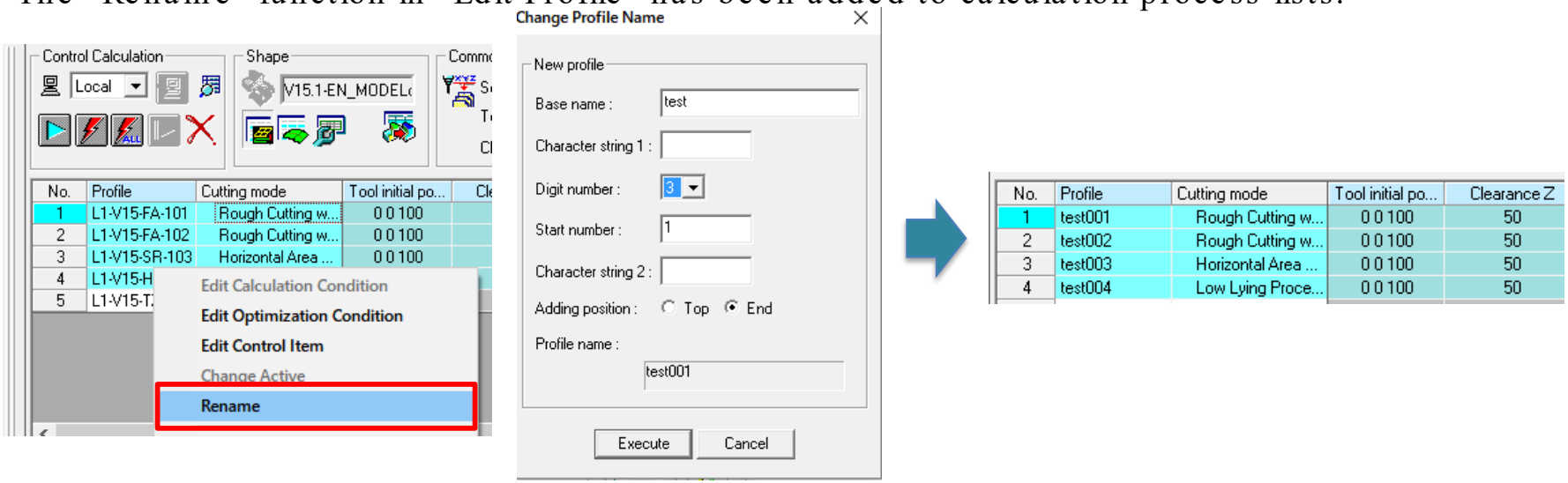


1. Work name registered to calculation process list
(2) Product shape name registered to calculation process list
(3) Auto setting of work mesh width

Folder: V15.1\V15.1-DEMO-01
Calculated model file: V15.1-DEMO-01.gmd

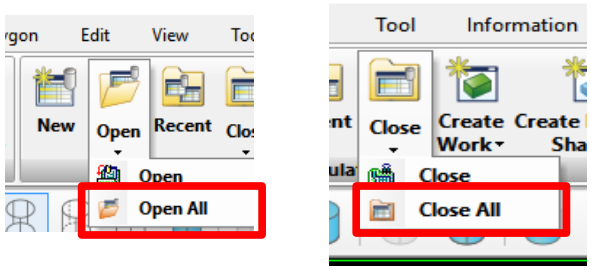
6. Collective Change of Multiple Profile Names

The "Rename" function in "Edit Profile" has been added to calculation process lists.



7. Addition of "Open All" and "Close All" in Calculation Process List

It is now possible to open and close multiple calculation process list files at once.



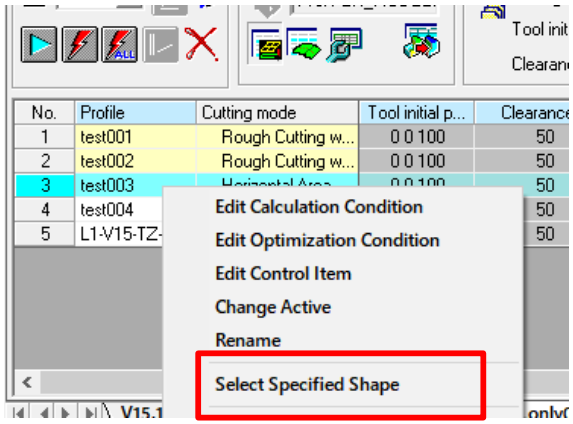
Operations for handling multiple profiles

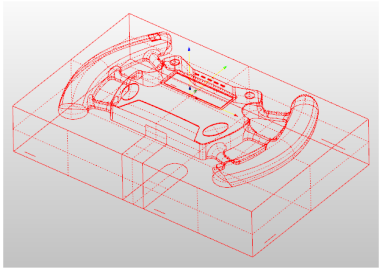
Folder: V15.1\V15.1-DEMO-01
Calculated model file: V15.1-DEMO-01.gmd
Calculation process list: V15.1-01-

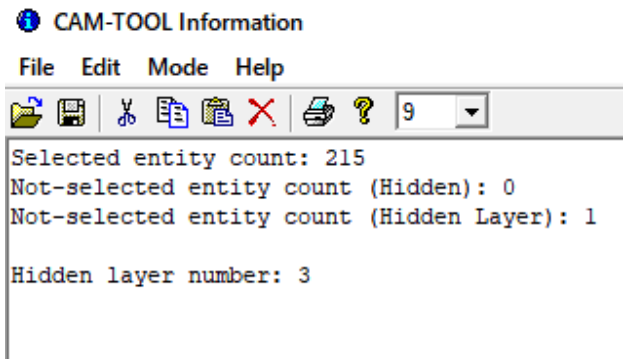
Calculation Process List

8. Select Specified Shape of Active Profile

This command selects entities for which the shape is specified in the active profile.







9. Items Added to Control Calc. Mode

"Effective length", "Minimum Z", "Start Z", and "End Z" added

Tool type	Tool shape	Effective length	Stock	CalcStatus
Radius	D20 R2	45	0.1	Normal
Square	D10 R0	15	0.1	Normal
Square	D10 R0	20	0	Normal
Ball	D8 R4	40	0.05	Normal

Start Z	End Z	Minimum Z
-	-	-27.63447

Added to the end

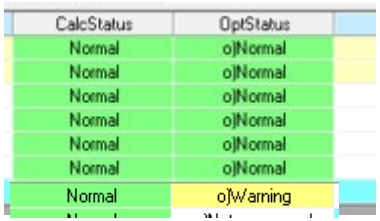
The Minimum Z information is displayed when CL has been created.

Folder: V15.1\V15.1-DEMO-01
Calculated model file: V15.1-DEMO-01.gmd
Calculation process list: V15.1-01-ENZAN_RESET.gc2

Calculation Process List

10. Change of Specifications for Optimization Status in Setting Tool Diameter Compensation, Addition of "Machine compensation" Item

For profiles in which tool diameter compensation (offset) has been set, the specifications are unified to be the same as tool diameter compensation (original contour), and the status for items not subject to optimization and the optimization status finish normally.



CalcStatus	OptStatus
Normal	o]Normal
Normal	o]Normal
Normal	o]Normal
Normal	o]Normal
Normal	o]Normal
Normal	o]Normal
Normal	o]Warning

V14.2

Revised 2/14

No.	Profile	Cutting mode	Tool sl			CalcStatus	OptStatus	Create NC	Calculation origin	Machine compensation
1	L1-FA-101	Rough Cutting w...	D20 R2	45	0.1	Normal	o]Normal	-	TOP	-
2	L1-FA-102	Rough Cutting w...	D10 R0	15	0.1	Normal	o]Normal	-	TOP	-
3	L1-SR-103	Horizontal Area ...	D10 R0	15	0	Normal	o]Normal	-	TOP	-
4	L1-HS-104	Low Lying Proce...	D8 R4	14	0.05	Normal	o]Normal	-	TOP	-
5	L1-TZ-105	Z-level Low Angl...	D8 R4	14	0.05	Normal	o]Normal	-	TOP	-
6	L1-TZ-106	Z-level Low Angl...	D8 R4	14	0	Normal	o]Normal	-	TOP	-
7	L1-RIN-107	Contour Cutting	D10 R0	15	0	Normal	o]Normal	-	TOP	Mark

V15.1

Warning message

```
[Process 1] <Optimization> Warning
WARNING : Tool diameter compensation
```

V14.2

Folder: V15.1\V15.1-DEMO-01
Calculated model file: V15.1-DEMO-01.gmd
Calculation process list: V15.1-01-ENZAN_RESET.gc2

Calculation Process List

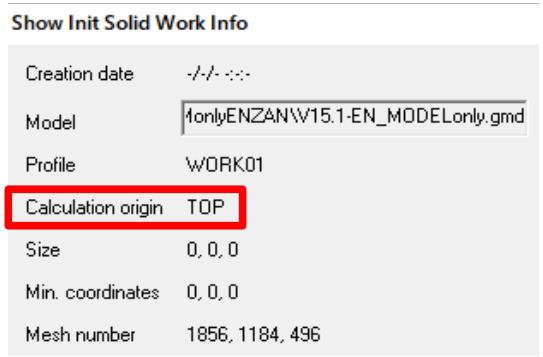
11. Miscellaneous

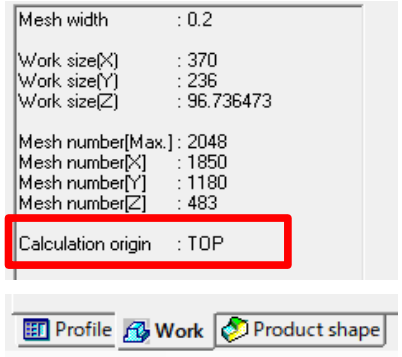
Enhancement of -V calculation

- When Control Item parameters have been updated, such as by specifying machining data, the specifications have been changed to omit check overcut when there are no change to cutter paths, even when "Check overcut" is set to "On".
- *Until V14.2, check overcut was performed even if there were changes to Control Item parameters without any changes to cutter paths.

Initial Solid Work Info

- It is now possible to check work calculation origin information with "Show Init Solid Work Info" and "Control Window".





Calculation Monitor

- The display of calculation time has been changed. 000:00:00 -> 00:00:00

Folder: V15.1\V15.1-DEMO-01
Calculated model file: V15.1-DEMO-01.gmd
Calculation process list: V15.1-01-ENZAN_RESET.gc2

Automation of Reset Color for Solid Display

Overview

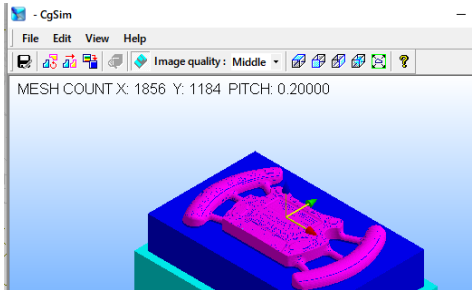
The color reset function has been added to “Solid display (CgSim)”. This function displays the cutting part of the next process in a single color, which makes the screen easier to read. Also, a mechanism which automatically resets the color whenever a work solid is passed to the next process is provided, in order to reduce the operations for resetting the color each time.

V14.2

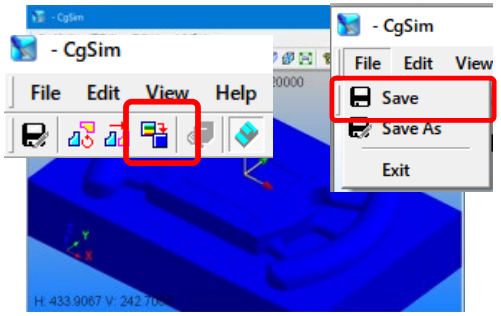
- In Multi, different colors are added to each part that has been cut by process. It makes hard to find just cutting parts for the process in question due to the absence of a color reset function.
- The operations for performing color reset are time consuming when it is not necessary to use different colors for each process.

V15.1

- Color reset function added to “Solid display (CgSim)”

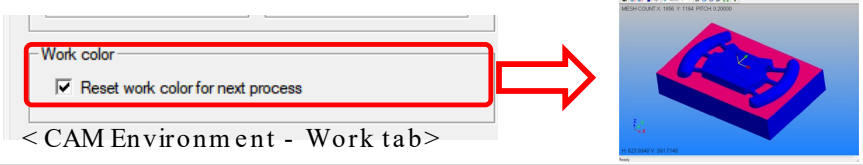


Cutting parts displayed in multiple colors

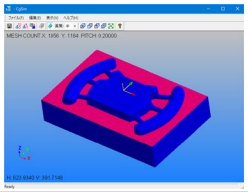


The color reset state is reflected in the process when it is over-written and saved.

- Added function for switching between using different colors for cutting parts for each process or automatically resetting colors at the next process



<CAM Environment - Work tab>



Automatic color reset is performed when checked ON, and the cutting areas of each process are displayed in a single color.

Folder: V15.1\ V15.1-DEMO-01
Calculated model file: V15.1-DEMO-01.gmd
Calculation process list: V15.1-01-ENZAN_RESET.gc2
V15.1-01.ENZAN_NONRESET.gc2

Improvement of Multi Solid Support

Overview

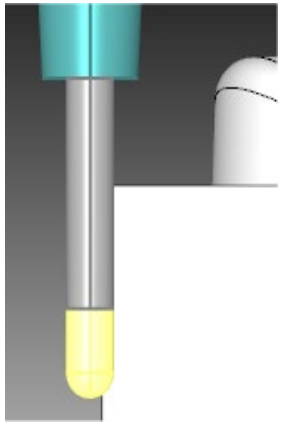
Functions for supporting Multi solid were added, and improvements were made to problems when creating a Multi solid. Opportunities to use Multi solids with higher stock precision will increase.

V14.2 problems

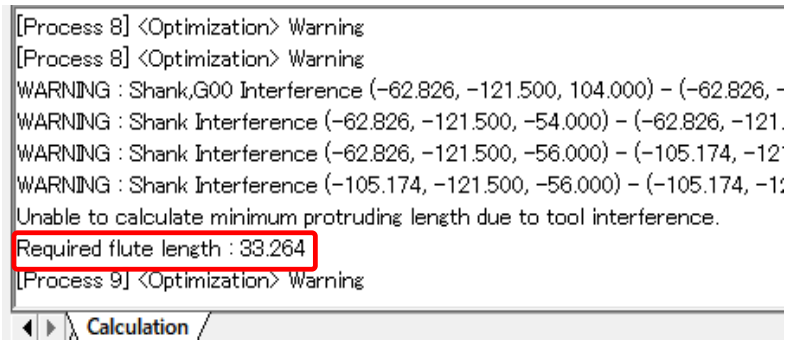
- "Required flute length (Max. cutting depth)" during tool interference is unclear
- When creating Multi solid
  - Front and rear surfaces must be aligned
  - Locations to be corrected when a Multi solid could not be created are unclear

V15.1

- Addition of "Required flute length (Max. cutting depth)" calculation function



"Max cutting depth" output with Zmap is newly included as "Required flute length" for Multi solid. It is now possible to use these as information in the event of an interference.



Revised 2/14

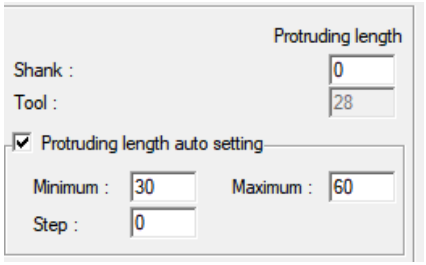
Folder: V15.1\ V15.1-DEMO-01
Calculated model file: V15.1-DEMO-01.gmd
LAY = 1
Calculation process list: V15.1-01-ENZAN_NONRESET.gc2

Improvement of Multi Solid Support

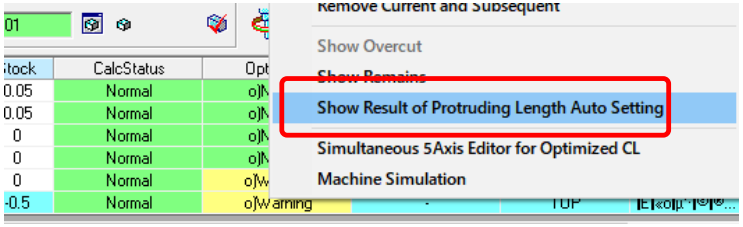
Required under neck length

In Multi, calculation of the required under neck length requires usage of protruding length auto setting.

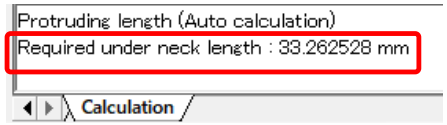
Optimization Condition



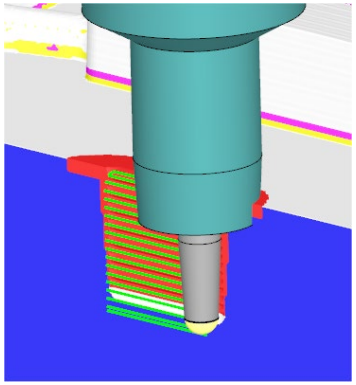
Protruding length auto setting



Show Result of Protruding Length Auto Setting



Required under neck length



Holder interference

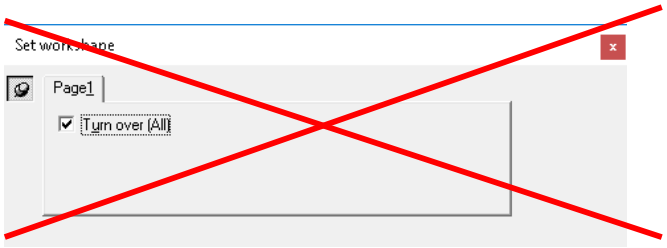
Revised 2/14

Revised 2/14

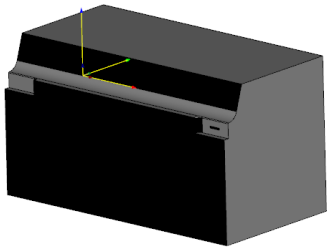
Folder: V15.1\V15.1-DEMO-01
Calculated model file: V15.1-DEMO-01.gmd
LAY = 1
Calculation process list: V15.1-01-ENZAN_NONRESET.gc2

Improvement of Multi Solid Support

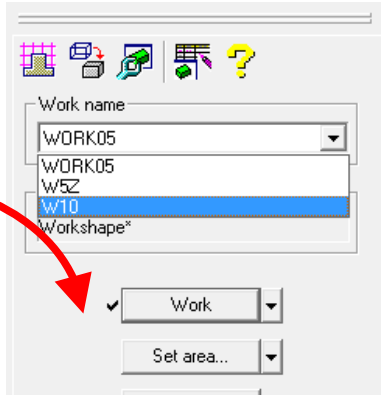
- It is no longer necessary to align the front and rear surfaces when creating a Multi solid.



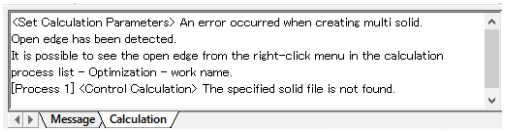
A command sheet is not displayed during work shape setting.



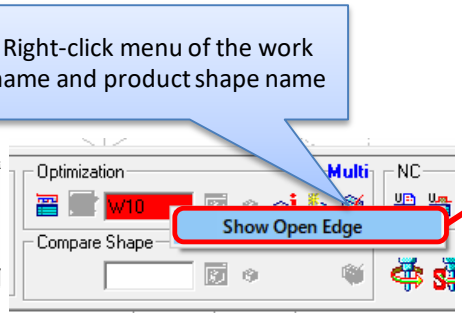
Multi solids can be created even with shapes which have both the front and rear surfaces



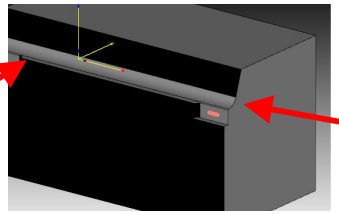
- Added a function which displays the open edge that is the source of a Multi solid creation error



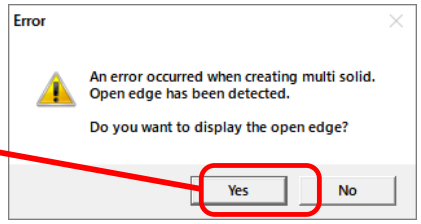
Multi solid creation error



Execute “Show Open Edge”



Open edge is changed into an entity and displayed (undo/redo possible)



When converting a work into solid, open edges can be displayed from the error dialog

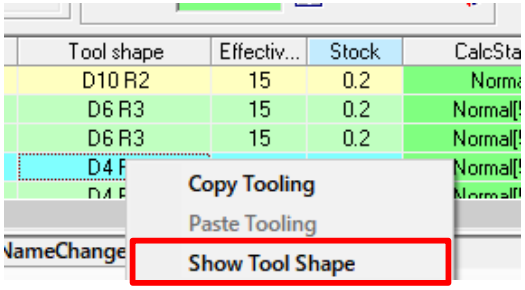
Folder: V15.1\V15.1-DEMO-01
Calculated model file: V15.1-DEMO-01.gmd
LAY = 10
Calculation process list: V15.1-01-ProNameChange.gc2

Improvement of Show Tool Shape

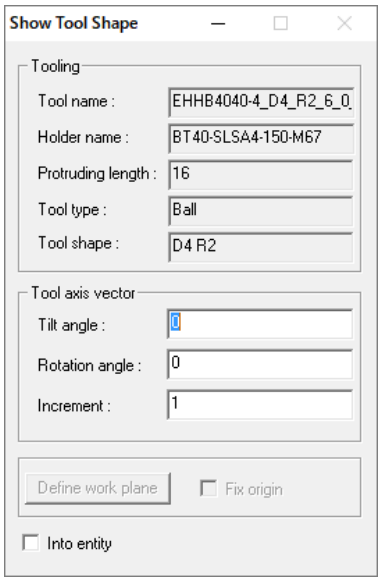
Overview

Show Tool Shape of active profile has been improved, and usability of 5-axis machining consideration has been improved with tracking of the mouse pointer and adjustment of the tool tilt angle, etc.
Also, it has been enhanced to make it possible to define work planes with the tool axis direction as Z-axis in order to make it easier to consider the tool direction for positional machining.

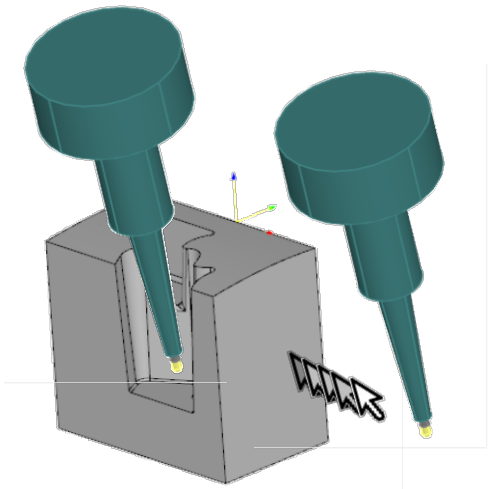
➢ Show Tool Shape



Command startup from calculation process list (Can be started from the ribbon menu or toolbar)



Show Tool Shape

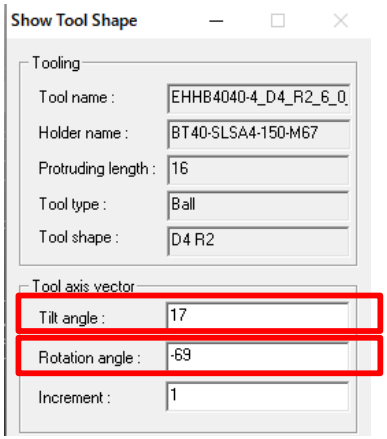


Tool shape tracking the mouse pointer

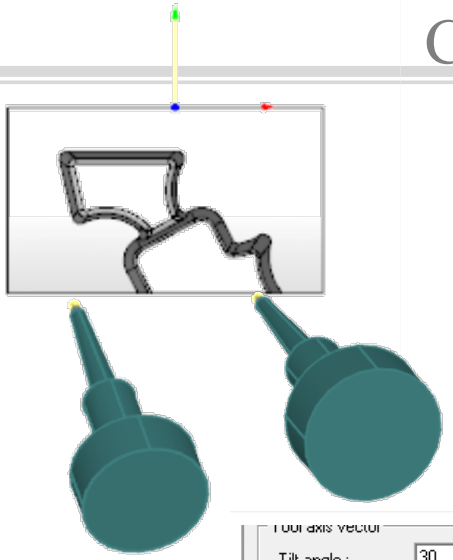
Folder: V15.1\V15.1-DEMO-04-5AXIS
Model file: V15.1-DEMO-04-5AXIS.gmd
LAY = 30
Calculation process list: V15.1-04-5AXIS-03.gc2

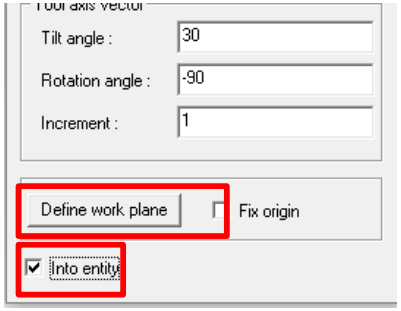
Improvement of Show Tool Shape

- Adjustment of rotation angle and tilt angle



Rotation angle and tilt angle can be adjusted
- Tilt angle is adjusted by pressing [Alt] and up and down arrow keys together
- Rotation angle is adjusted by pressing [Alt] and left and right arrow keys together





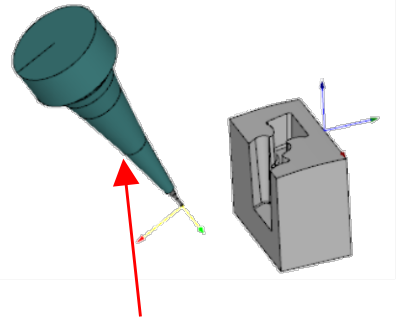
Define work plane

- Define work plane

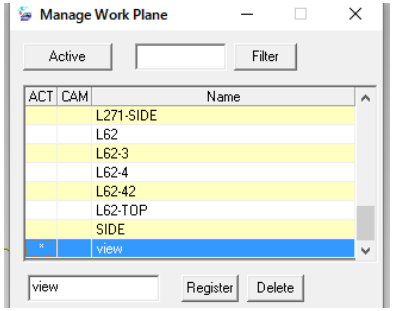
"Unregistered" work planes are defined with the tool axis vector as Z-axis, and the work plane name is set in Manage Work Plane.

- Into entity

Arranged tooling is changed into an entity as a surface.



Into entity



Manage Work Plane

Folder: V15.1\V15.1-DEMO-04-5AXIS
Model file: V15.1-DEMO-04-5AXIS.gmd
LAY = 30

Overview

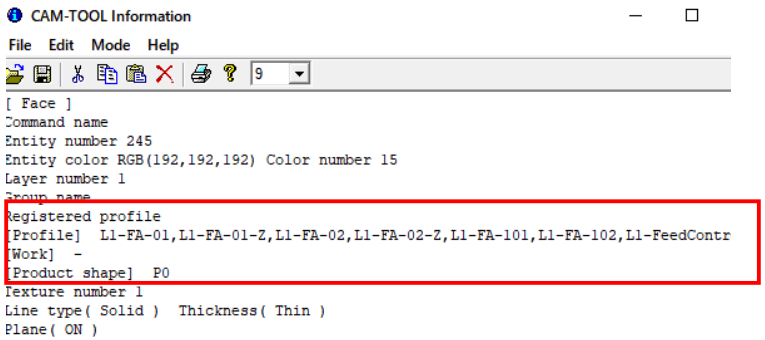
When executing Information (Entity) command, the profile name registered for the entity has been added as a display item.

V14.2

- A warning is displayed whenever an entity with a registered profile is deleted. However, there is no way to check which profile the entity is registered to.

V15.1

-  the following items are registered during Information (Entity) execution, the profile name is yed.
  - Process profile
  - Work
  - Product shape
- Objective entity
  - Wireframe, surface, cube, hole entity, 2.5D structure
  - Compcurve, 3D compcurve, polygon entity
  - Point entity



*"-" is displayed when not registered

Provides support for confirmation work!!

Folder: V15.1\V15.1-DEMO-01
Calculated model file: V15.1-DEMO-01.gmd
LAY = 1
Calculation process list: V15.1-01-ENZAN_RESET.gc2

Overview

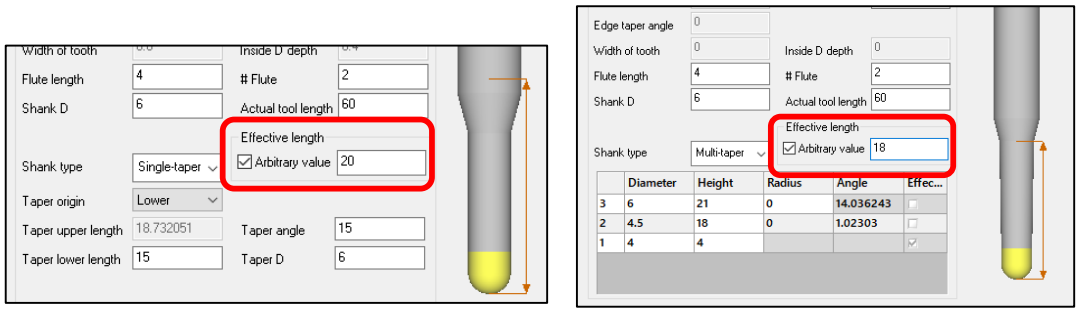
"Arbitrary value" has been added in "Effective length" for Tooling DB and tooling settings for Optimization. This has made it possible to adjust the height of parts where the shank is to be expanded when checking for shank interference.

V14.2 problems

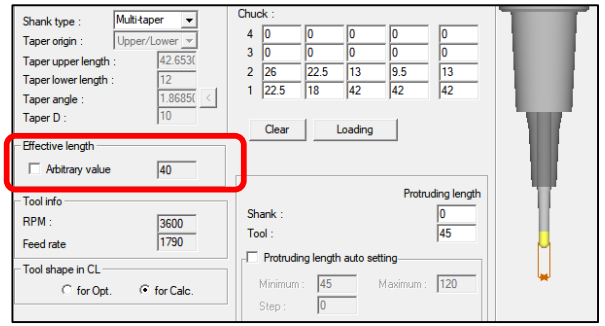
- The height of parts where the shank is to be expanded was determined according to the tool shape and type, and it could not be adjusted.

V15.1 improvements

- "Arbitrary value" added to "Effective length" for Tooling DB and tooling settings for Optimization



Tooling DB



Optimization Tooling tab

When arbitrary value is on, the area above the height specified for the effective length is subject to expand with safe distance.

Operability for tool settings is improved!!

Enhancement of Tooling DB Functions

Overview

In Tooling DB, Multi-taper shanks have been improved, and function enhancements and improvements on operability have been applied (e.g. restrictions on the hardness of the materials have been mitigated).

V15.1 improvements

1. It is now possible to “cancel with ESC key” the dialogs other than main screen of the Tooling DB.
2. Previous setting values.status of “With cutting conditions” and “Filter by clamp D” are stored.
3. When the height has been changed with multi-taper, shapes above that height will not be changed.
4. “Shank taper angle1” and “Shank taper angle2” display columns have been added to allow users to check the neck angle (multi-taper angle information).
5. It is now possible to filter cutting conditions by selecting the list, without inputing characters.
6. “HRA” was added to unit for hardness of material.
   (The current input value limit has been changed to “0 □ value □ 1000000”)

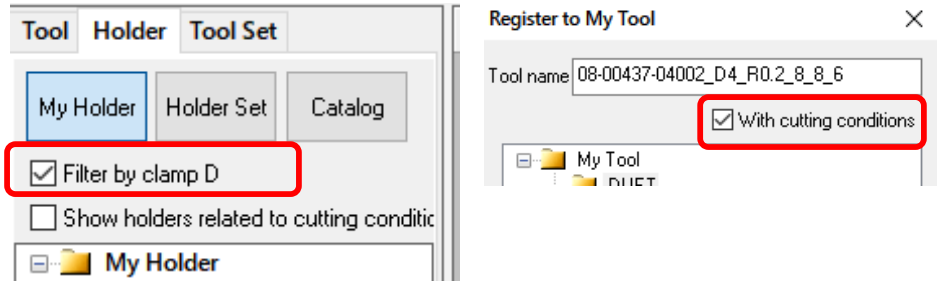
Operability for tool settings is improved!!

Enhancement of Tooling DB Functions

1. It is now possible to “cancel with ESC key” the dialogs other than main screen of the Tooling DB.

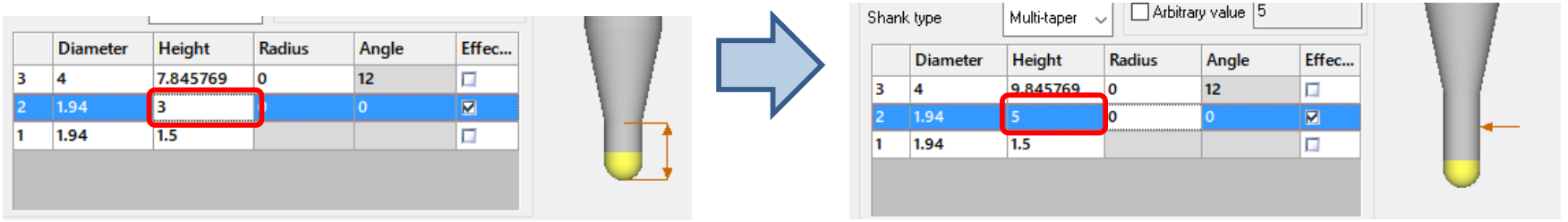
With the ESC key, it is now possible to cancel “Edit Tool” or “Special tool creator” dialog boxes, etc.

2. Previous setting values/ status of “With cutting conditions” and “Filter by clamp D” are stored.



ON/ OFF status of check box is inherited from the previous setting.

3. When the height has been changed with multi-taper, shapes above that height will not be changed.



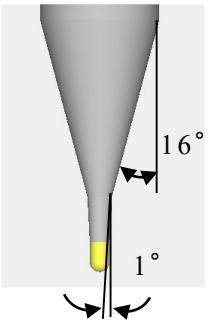
Shape above the changed part is retained by applying the increment value.

Enhancement of Tooling DB Functions

4. “Shank taper angle1” and “Shank taper angle2” display columns have been added to allow users to check the neck angle (multi-taper angle information).

Effective length	Shank type	Shank taper angle1	Shank taper angle2
0.9	Multi-taper	0.5	16
0.9	Multi-taper	1	16
0.9	Multi-taper	1.5	16
0.9	Multi-taper	0.5	16
0.9	Multi-taper	1	16
0.9	Multi-taper	1.5	16

Neck angles can be checked without opening the tool settings screen



Tool settings screen

5. Filtering of cutting conditions can be selected from the list, and all filters can be deactivated from the right-click menu.

Keyword1	Keyword2	Keyword3	Protruding le...	RPM.	Fe
*	*		*	*	*
STAND...	SHAPE MILLING		10	44000	23
STAND...	*		10	44000	23
STAND...	SHAPE MILLI...		10	25500	85
STAND...	SHAPE MILLI...		10	25500	71
STAND...	SHAPE MILLI...		10	32500	15

Filter and select conditions from the list

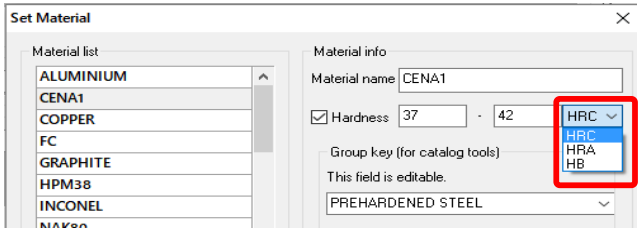
i1	Keyword2	Keyword3	Protruding le...	RPM.	Feed r...	Step o...
	*					
..	SHAPE MILL					.06
..	SHAPE MILLI...		10	44000	2340	0.06
..	SHAPE MILLI...		10	25500	850	0.048
..	SHAPE MILLI...		10	25500	713	0.036
..	SHAPE MILLI...		10	32500	1500	0.06

Clear All Filters of Cutting Condition

Filters can be deactivated from the right-click menu

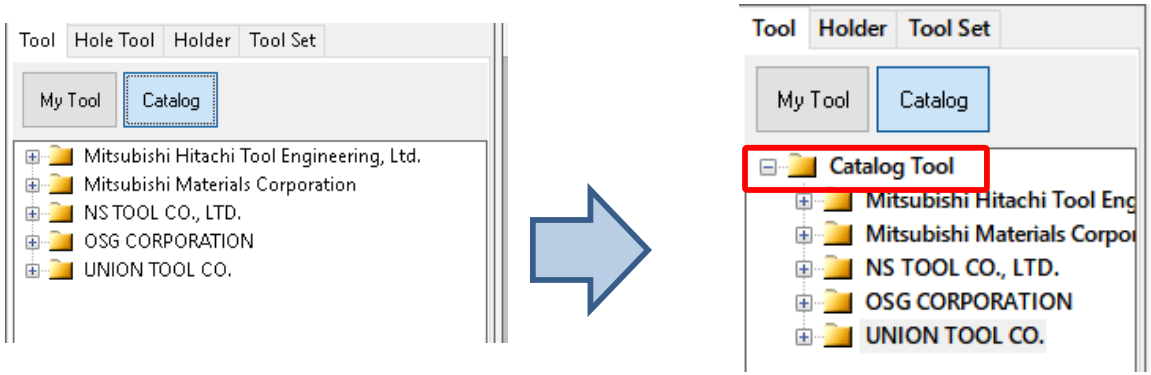
6. “HRA” was added to unit for hardness of material.
(The current input value limit has been changed to “0 ≤ value ≤ 1000000”)

An arbitrary value for the material hardness can be input.

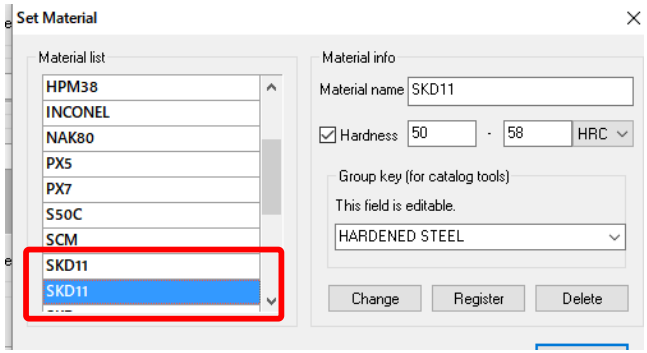


7. Other Specification Changes

- The top folder is displayed in the Catalog tree view.



- Materials with the same name can be registered when the thickness is different.



- DB structure has been changed from V15 in order to extend the tool types that can be registered in the catalog.
- V15 DB catalog separate from the conventional catalog is being prepared, and scheduled to be updated further.
- Changed CSV format for output from My Tool

2. Enhancements and Improvements of Cutting Paths

- Enhancement of fine and precision functions (Z-Level High Efficiency Rough Cutting, Z-Level Finishing)
- Enhancement of Z-level Finishing functions (Support for spherical lenses)
- Low Lying Processing (Variable pitch path)
- Low Lying Processing (Enhancement of corner processing)
- Z-level low angle finishing: Spiral cutting
- High precision mode: Enhancement of supported cutting modes
- Scanning-line cutting: Support for fillet
- CL-5x Editor - Component point rearrangement
- Enhancement of Curve Cutting functions
- Improvement of 5Axis Conversion (Auto)
- Enhancement of cutting modes when using Barrel Cutter Tool
- Other function enhancement/specification changes
- 2.5D Side Cutting: Support for spirals
- 2.5S approach: Avoid interference with surfaces
- 2.5D Rough Cutting: Last Step Over
- 2.5D Side Cutting: Last Step Over, Last Step Down
- 2.5D Re-machining: Combine processing
- Hole: Support for cross hole drilling using a gun drill
- Hole: Circular Hole-wall Cutting: Helical cutting
- Hole: Helical tapping: Support for original contour
- Hole: Entity (Create All): Create work plane

Overview

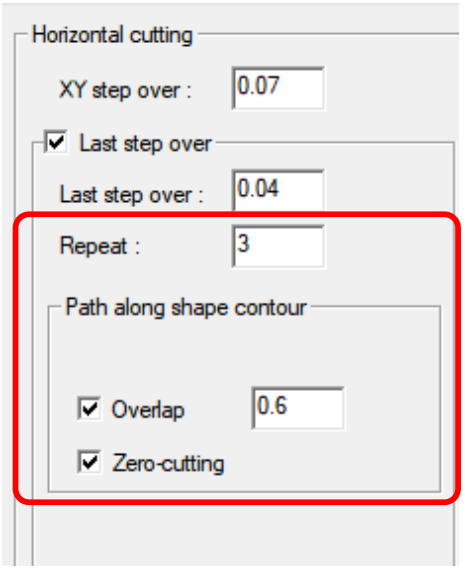
In fine and precision cutting using small-diameter tools, the cutting precision of a rough cutting process greatly affects the finishing process. Therefore, the functions of high-precision and fine/ precision cutting in Z-Level High Efficiency Rough Cutting have been enhanced.

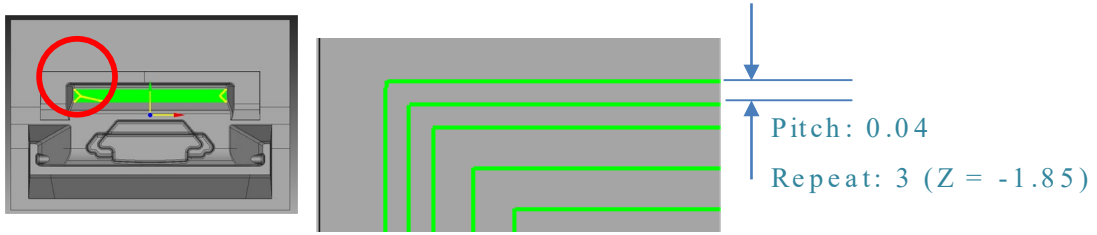
➢ Last step over function added

1. Limited: Driving in multiple times with a shallow cutting pitch reduces the load of cutting and suppresses tool collapse.

2. Overlap: Overlapping the cutting start/end points in each round path aims to suppress cut marks.

3. Zero-cutting: Cutting mistakes (remains) when a tool collapses due to the load of cutting are further suppressed.





1. Last step over limited

2. Overlap

3. Zero-cutting* (Z = -1.85)

*On the same Z, round segments and zero-cutting segments are segmented

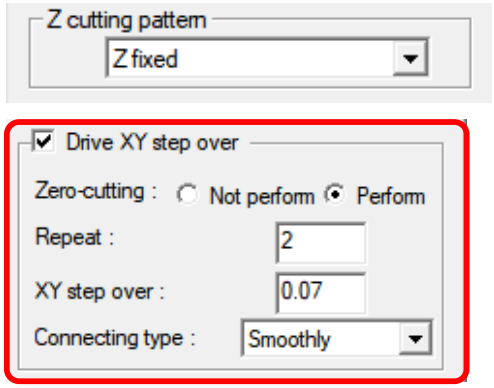
Folder: V15.1\ V15.1-DEMO-02-ScaleEnzan
Model file: V15.1-DEMO-02-ScaleEnzan.gmd
LAY = 1
Calculation process list: V15.1-02-ScaleEnzan.gc2
Process: L1-TKA-001

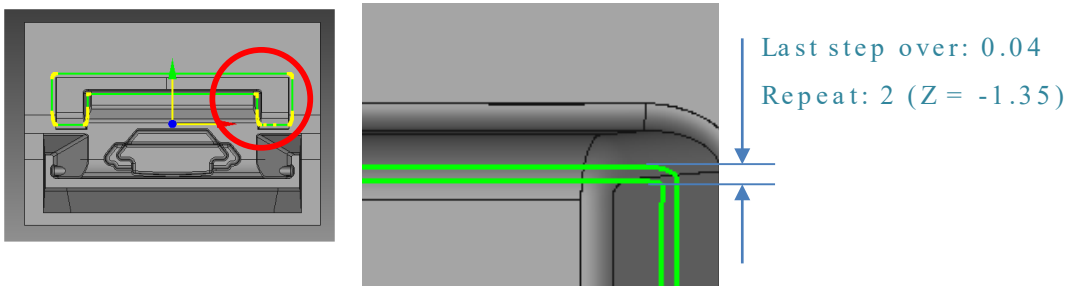
Overview

The functions of high-precision and fine/precision cutting in Z-Level Finishing, which requires a final finishing process of fine/precision cutting using small-diameter tools, have been enhanced.

➢ Support for Drive XY step over, Z fixed

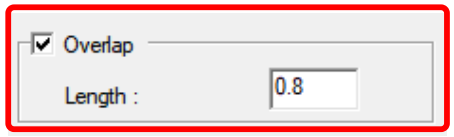
In addition to “Concave-convex area Fixed”, it is now possible to use “Z fixed”. This option is available in situations such as when it is thought that thin wall surfaces might fall over
when executing at area fixed in a cavity which has thin wall surfaces.

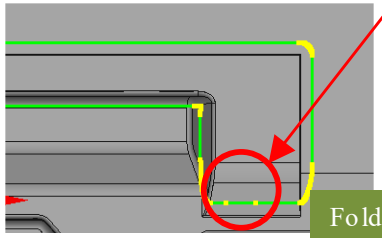




➢ Overlap

Overlapping the cutting start/end points in each round path aims to suppress cut marks.





*Overlapping part of zero-cutting segment

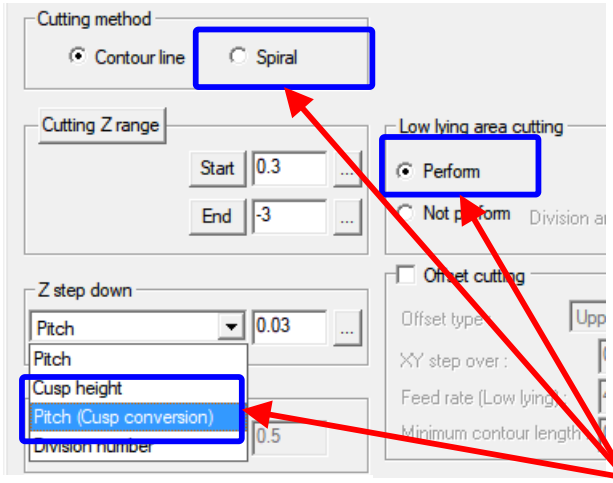
Folder: V15.1\ V15.1-DEMO-02-ScaleEnzan
Model file: V15.1-DEMO-02-ScaleEnzan.gmd
LAY = 1
Calculation process list: V15.1-02-ScaleEnzan.gc2
Process: L1-TS-003

Overview

The cutter path of Z-Level Finishing has been improved, and it is now possible to output Z-levels to the tops (highest height) or bottoms (lowest height) of spherical lens shapes.

Improvement of center spiral paths

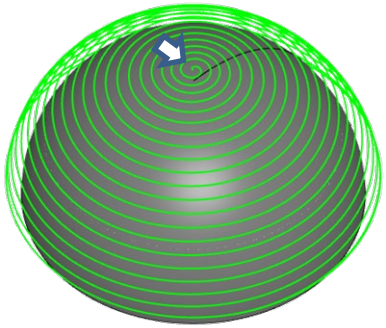
- In convex shapes, spiral paths are created in the center with the start point being near the center of the first contour line path. In concave shapes, spiral paths are created in the center with the end point being near the center of the last contour line path.



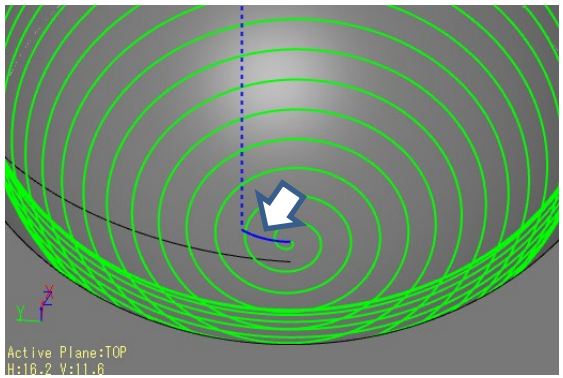
(1) "Z step down" => Cusp height or Pitch (Cusp conversion)

(2) Select all three parameters

Output conditions (1) + (2)



Top (highest height)

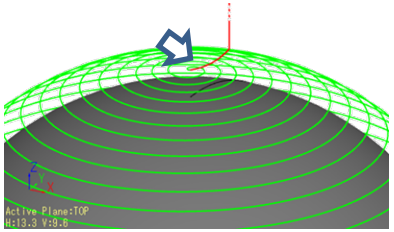


Bottom (lowest height)

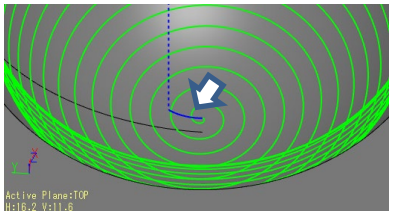
Suppresses remains at top and bottom of spherical lenses to realize high-precision finishing surfaces!!

Folder: V15.1\ V15.1-DEMO-03
Model file: V15.1-DEMO-03.gmd
LAY = 10, 12
Calculation process list: V15.1-03-gc2
Process: L10-TS-001, L12-TS-003

Details of specifications



Convex shape



Concave shape

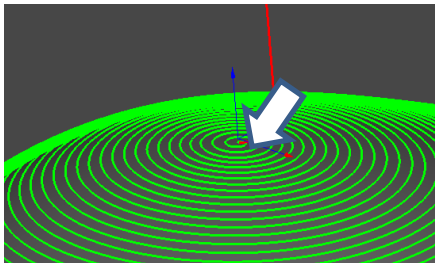
- Approach/escape

  Convex: Plane direction approach of 3D arc

  Concave: Plane direction escape of 3D arc

- Path output to non-spherical shapes

  Path near the center is created when the first or last Z-level is approximately circular



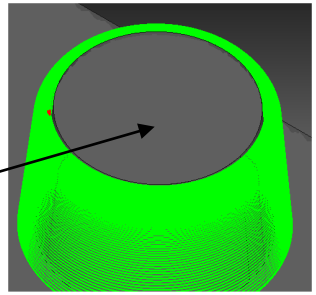
Path output to non-spherical shapes

- Center spiral paths on a horizontal surface

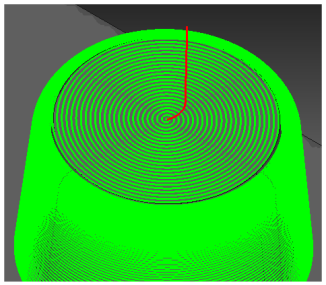
  Offset cutting OFF -> Even in horizontal surfaces in which the Z-level is approximately circular, this path is not created.

  Offset cutting ON -> Spiral path created on horizontal surface.

Horizontal plane
(Z-level circular)



Offset path OFF



Offset path ON

Reduction in work for CAM operators realizes high-precision finishing surfaces!!

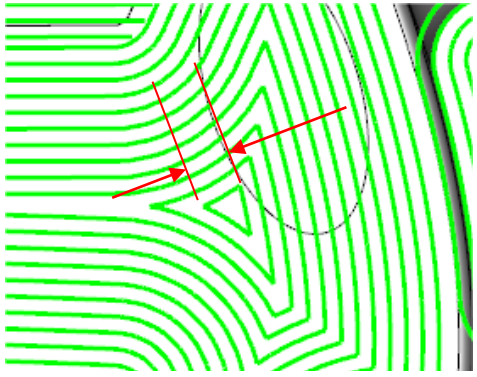
Folder: V15.1\ V15.1-DEMO-03
Model file: V15.1-DEMO-03.gmd
LAY = 10.12.15
Calculation process list: V15.1-03-gc2
Process: L10-TS-001 ,L10-TS-002 ,L12-TS-003
L15-TS-004

Low Lying Processing (Variable Pitch Path)

Overview

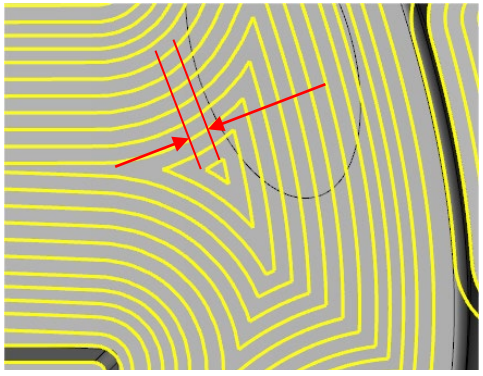
- In Low Lying Processing, the specifications have been changed so that the cutter path pitch which had been constant is now offset at a variable. Also, it is now possible to suppress any remains as much as possible.
- The Insert R function has been added to corners of cutter paths to avoid remains on finishing surfaces.

Automatic change of offset pitch in areas where remains are generated



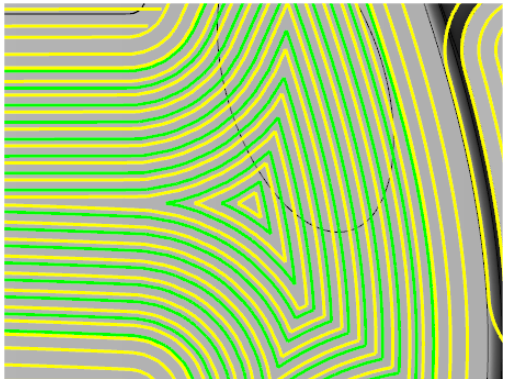
Width of innermost offset path is higher than the plane pitch

V14.2 (Constant pitch)



Pitch of innermost offset path is automatically changed

V15.1 (Variable pitch automatically processed)



Offset pitch other than the innermost one is automatically changed (V15.1)

Comparison between V14.2 and V15.1 paths

Reduces remains!!

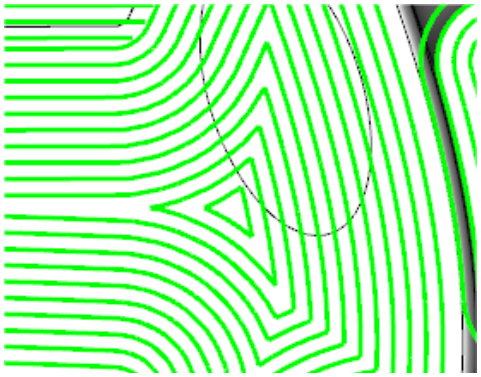
Folder: V15.1\ V15-DEMO-03
Model file: V15.1-DEMO-03.gmd
LAY = 60
Calculation process list: V15.1-03-gc2

Low Lying Processing (Enhancement of Corner Processing)

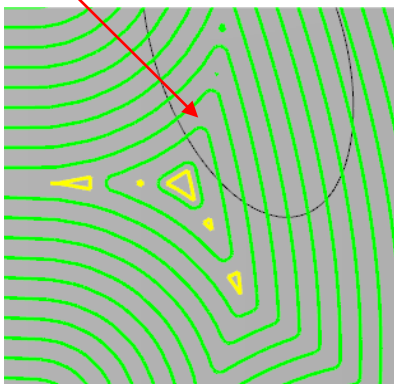
- Insert R function has been added to corners of cutter paths to avoid remains on finishing surfaces

When inserting R at a corner,
the arc radius can be specified

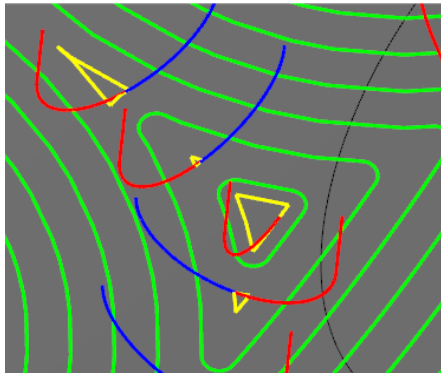
*Insert R is not on offset paths that have been added automatically



V14.2 Without path corner rounding



V15.1 Path corner rounding enabled



Offset path automatically added

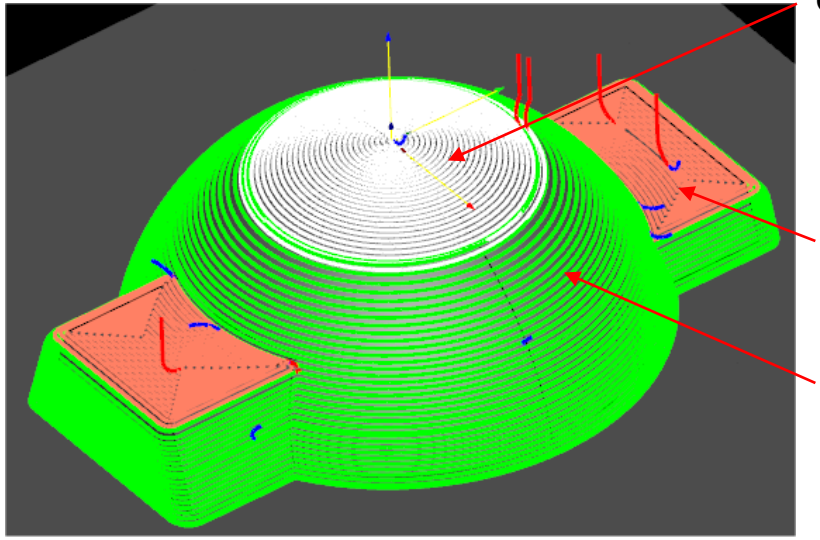
Improved cutting quality!

Folder: V15.1\ V15.1-DEMO-03
Model file: V15.1-DEMO-03.gmd
LAY = 60
Calculation process list: V15.1-03-gc2
Process: L60-HS-007, L60-HS-008

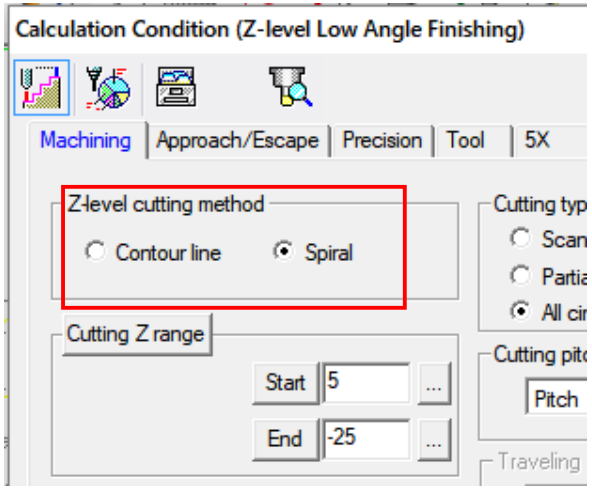
Z-Level Low Angle Finishing: Spiral

Overview

A spiral cutting function has been added to Z-Level Low Angle Finishing. It is now possible to select either “Contour line” or “Spiral”.



Spiral cutting
Division angle: 31°



1. The condition in which spiral interpolation is possible is the same as when selecting Spiral in “Z-Level Finishing”.
2. Spirals are not applied in low lying paths.

Improved cutting quality and

Folder: V15.1\ V15.1-DEMO-03
Model file: V15.1-DEMO-03.gmd
LAY = 20
Calculation process list: V15.1-03-gc2
Process: L20-TZ-006

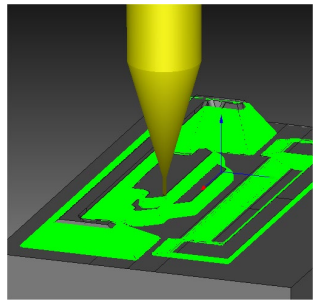
Overview

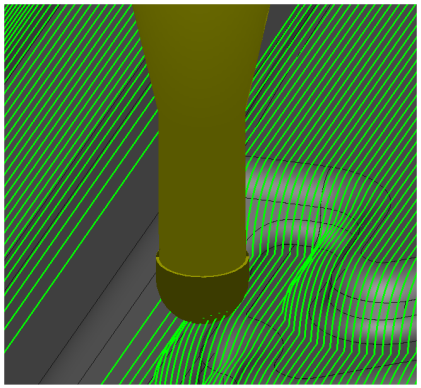
➢ Modes which support scale calculation of polygon type cutting modes have been enhanced. There is now support for cutting modes other than rough cutting mode, as “High precision mode”.

Applicable cutting modes

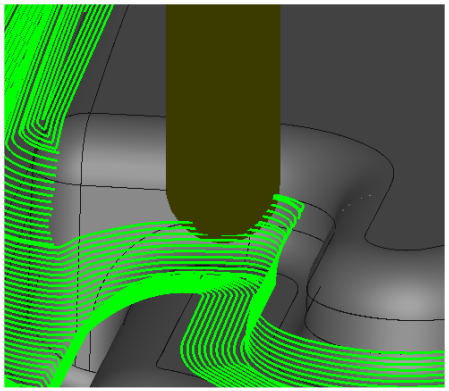
- Z-level Re-machining □ Renamed from “Fine Mode” to “High precision mode” □
- Corner Processing (Polygon)
- Z-level Fishing (Polygon)
- Scanning-line Cutting
- 3D Offset Cutting

□ “High precision mode” Tool lower limit: Φ 0.1

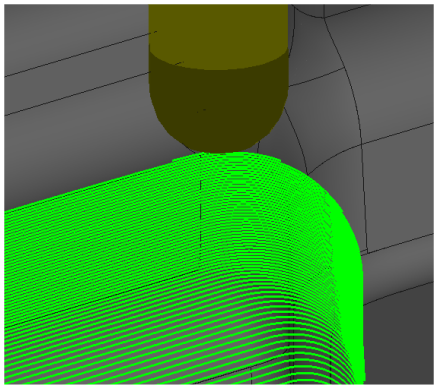




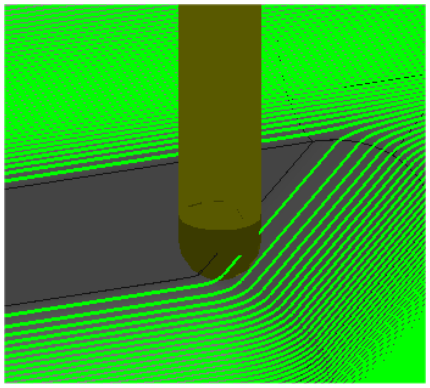
Scanning-line Cutting
L1-SOU-006



Corner Processing
L1-MTRN-007



3D Offset L1-MOS-008



- Z-level Fishing (Polygon)
L1-TOUSHI-009

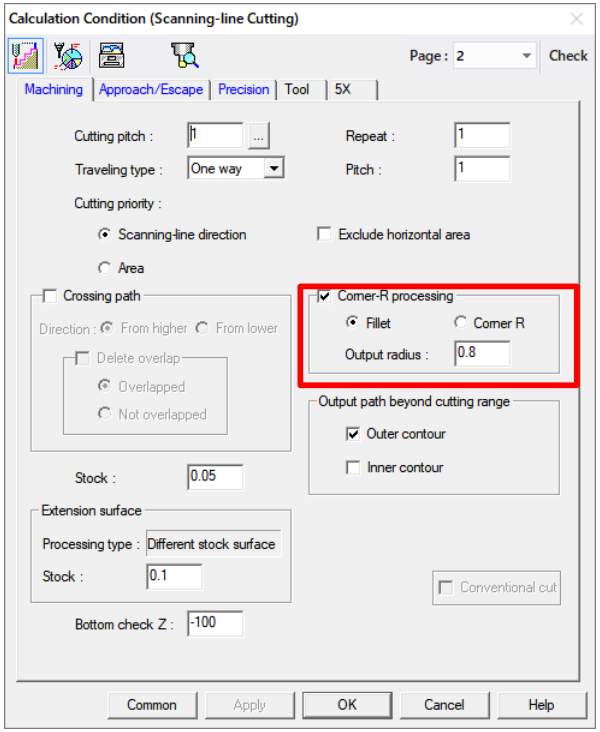
Reduces remains!!

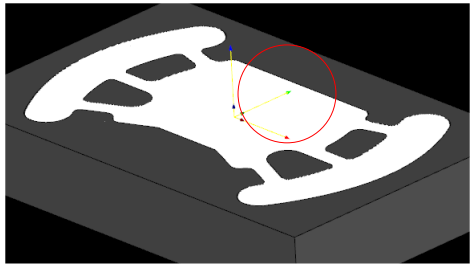
Folder: V15.1\ V15.1-DEMO-02-ScaleEnzan
Model file: V15.1-DEMO-02-ScaleEnzan.gmd
LAY = 1
Calculation process list: V15.1-02-ScaleEnzan.gc2

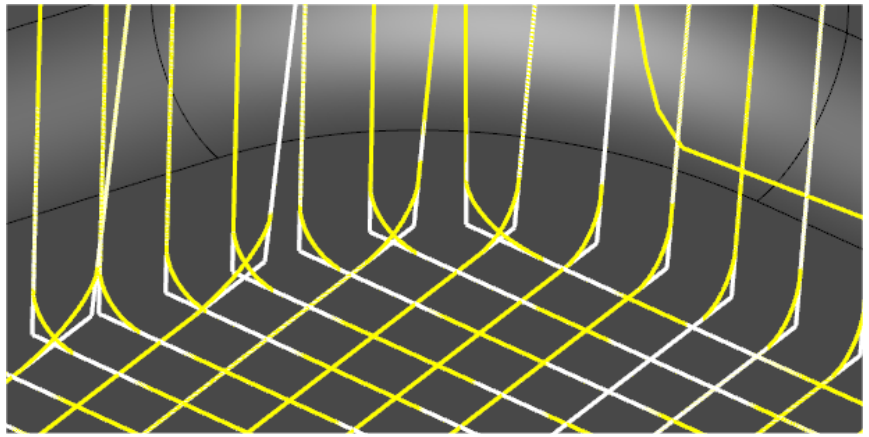
Scanning-line Cutting: Support for Fillet

Overview

- "Fillet (Auto-fillet)" function has been added to corner-R processing. It is now possible to reduce tool load during corner processing.







White: Without fillet
Yellow: With fillet

- Reduces modeling work and tool load!!

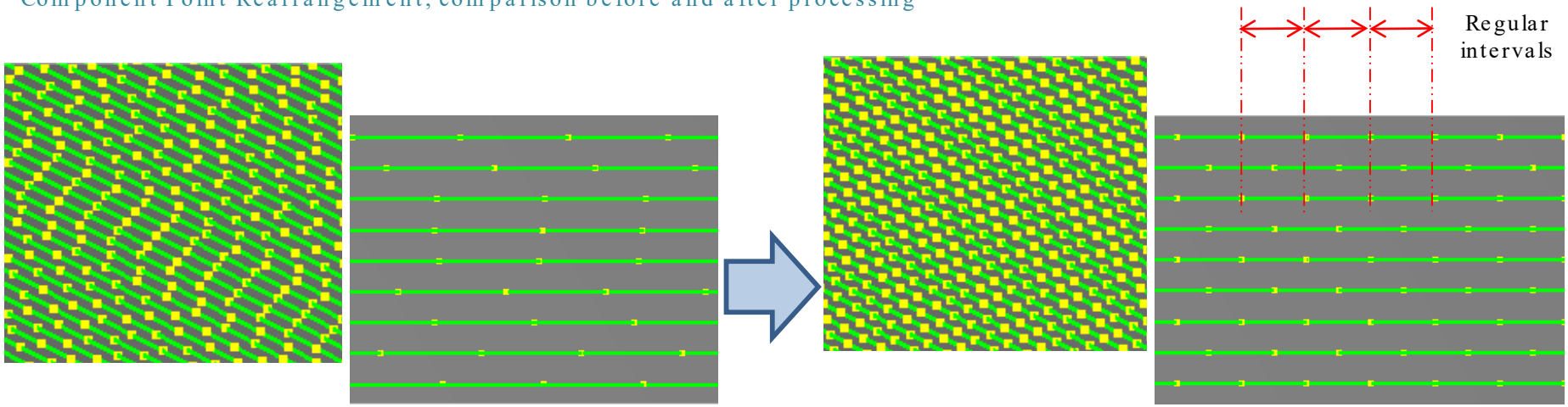
Folder: V15.1\V15.1-DEMO-03
Model file: V15.1-DEMO-03.gmd
LAY = 60
Calculation process list: V15.1-03-gc2
Process: L60-SOU-009, L60-SOU-010

Overview

The “Component Point Rearrangement” function, which arranges component points in the cutter path at regular intervals, has been newly added.

It is now possible to rearrange, at fixed intervals, component points after calculation that have been arranged in an irregular manner.

Component Point Rearrangement, comparison before and after processing



Before rearrangement processing

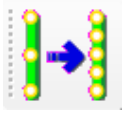
After rearrangement processing

Effects

This realizes smooth operation of machines (greatly reduces acceleration and deceleration), so users can expect improvements in the quality and precision of surface.

Folder: V15.1\ V15.1-DEMO-03
Model file: V15.1-DEMO-03.gmd
LAY = 70
Calculation process list: V15.1-03-gc2
Process: L70-SR-011-org, L70-SR-012-relayout

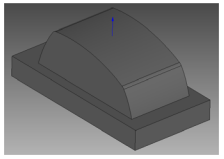
1. Command: CL/5Axis Editor “Component Point Rearrangement”



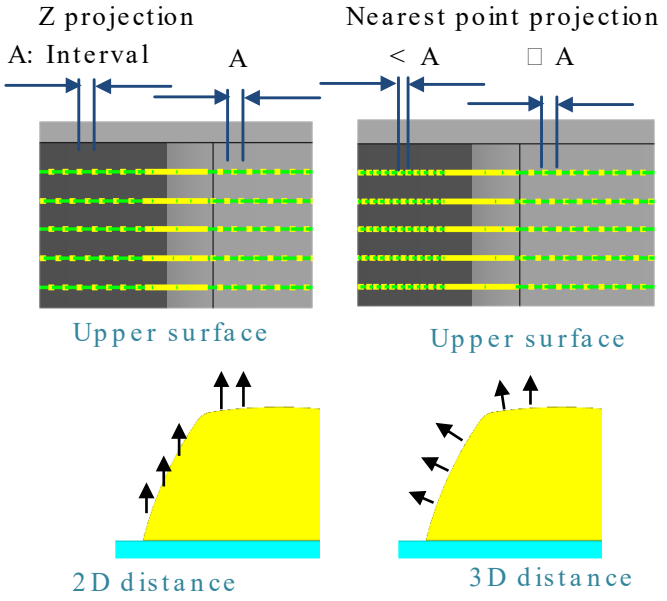
2. Explanation of GUI

Component Point Rearrangement

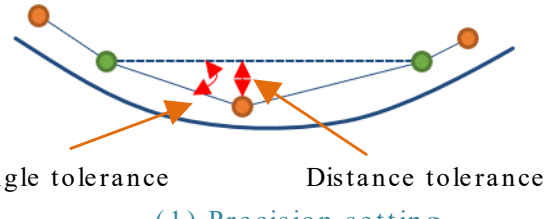
	Setting	
	Shape	MDL00002
	Component point	
	Interval	1
(1)	Distance tolerance	0.001
(1)	Angle tolerance	5
(1)	Minimum interval	0.01
(2)	Rearrangement type	Aligned
(3)	Distance type	2D
(4)	Datum	End point



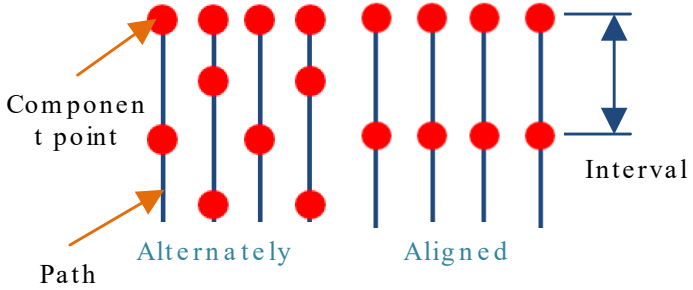
Shape selection



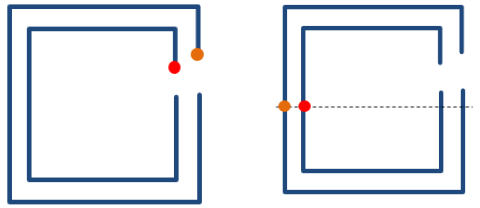
(3) Distance type



(1) Precision setting



(2) Rearrangement type



(4) Datum

Folder: V15.1\ V15.1-DEMO-03
Model file: V15.1-DEMO-03.gmd
LAY = 71
Calculation process list: V15.1-03-gc2
Process: L71-SR-013 (Calculated/CL Edited with 2D/3D settings)

Note

1. Cutting mode subject to processing	2. Usable tools
- Scanning-line Area - Curve Control Along Surface - Surface Finishing - Aiming Check - Re-machining - Base Surface Side Finishing - Base Surface Bottom Finishing - Scanning-line Cutting - Corner Processing (Polygon) - 3D Offset Cutting	- Ball - Radius

3. Restrictions

1. Common to all cutting modes
   (1) CL calculated using either “Conventional cut” or “Fine (High precision) mode” and “(Auto) Fillet” functions
      * In the case of “Conventional cut”, stl of auto-fillet is on the side opposite of the CL.
        In the case of “Fine (High precision) mode”, the stl of auto-fillet is scaled.
   (2) Cutting in which the following parameters have been set
      - “Corner-R processing” is ON and “Corner R” is selected
2. Scanning-line Area
   - The value specified in “Extending length” is less than 0
3. Curve Control Along Surface
   - “Driving in” is set to ON
4. Re-machining
   - The value specified in “Remain step” is less than 0
5. Scanning-line Cutting
   (1) The value specified in “Repeat” is equal to or greater than 2
   (2) “Outer contour” is ON in “Output path beyond cutting range”
6. Corner Processing (Polygon)
   (1) “Driving in” is set to ON
   (2) “Output pattern” is set to anything but “Only along plane”
7. Base Surface Side Finishing
   - “Lateral drive” is set to ON

Enhancement of Curve Cutting functions

Overview

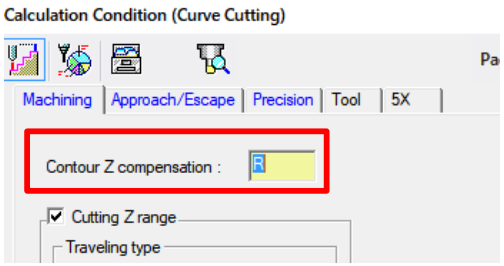
Contour Z compensation function has been newly added to Curve Cutting. It is now possible to easily change the Z direction compensation of a tool on a specified 3D compcurve.

V14.2 Curve Cutting problems

- Curve Cutting is specified for creating cutter paths at the tool center. To set by tool tip, user needs to either adjust the position of the compcurve or change using CL Editor afterwards.

V15.1 "Contour Z compensation" function newly added

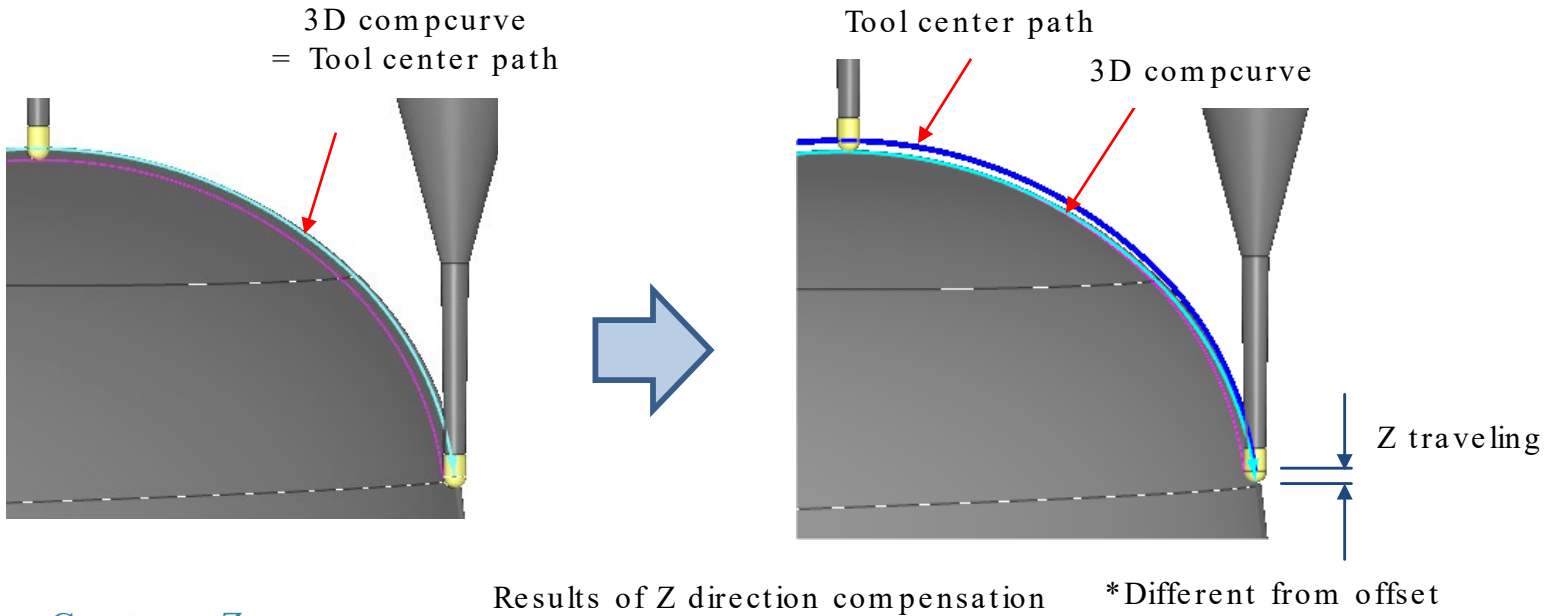
- A new function which compensates the Z direction of the tool position with a specified 3D compcurve is added. When a positive value is input, created cutter path goes up by that value.
- Variables are supported. In the case of a ball end mill, inputting "R" as the compensation value sets the cutter path at the tool tip.



Improves operability and safety when creating cutter paths,

Enhancement of Curve Cutting functions

V15.1 "Contour Z compensation" function newly added



Contour Z compensation: 0

Contour Z compensation: 0.5
(Tool: R 0.5 ball)

Improves operability and safety when creating cutter paths,

Folder: V15.1\ V15.1-DEMO-03
Model file: V15.1-DEMO-03.gmd
LAY = 50
Calculation process list: V15.1-03-Curv.gc2
Process: L50-Curve-05, L50-Curve-06

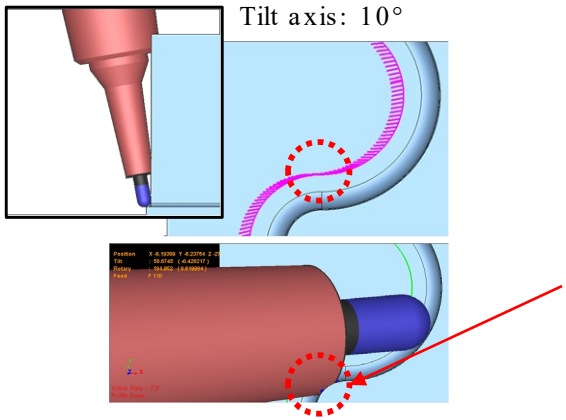
Improvement of 5Axis Conversion (Auto)

Overview

5Axis conversion (Auto) was improved, interference avoidance was reevaluated, and the quality of finishing surfaces after cutting was improved.

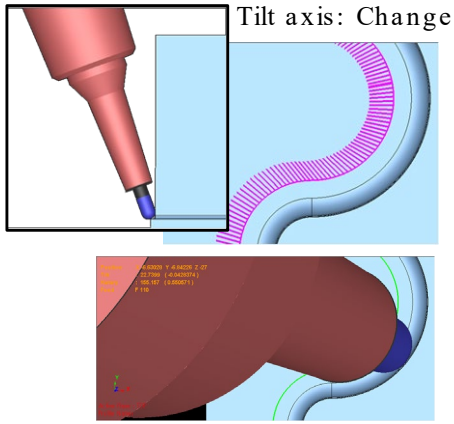
V14.2

1. When the rotation axis is in a direction close to the shape, the tilt axis is greatly slanted with Change tilt angle, and interference errors occur without avoidance being possible
   -> Requires looking at the shape and specifying a tilt angle which does not roughly interfere with the tooling
2. The location where avoid interference was conducted is the simultaneous 5Axis path. -> There are concerns regarding the quality of finishing surfaces after cutting



The rotation axis is in a direction close to the shape

Avoidance not possible
Interference error occurs



Tilt angle which does not roughly interfere with the tooling is specified after looking at the shape

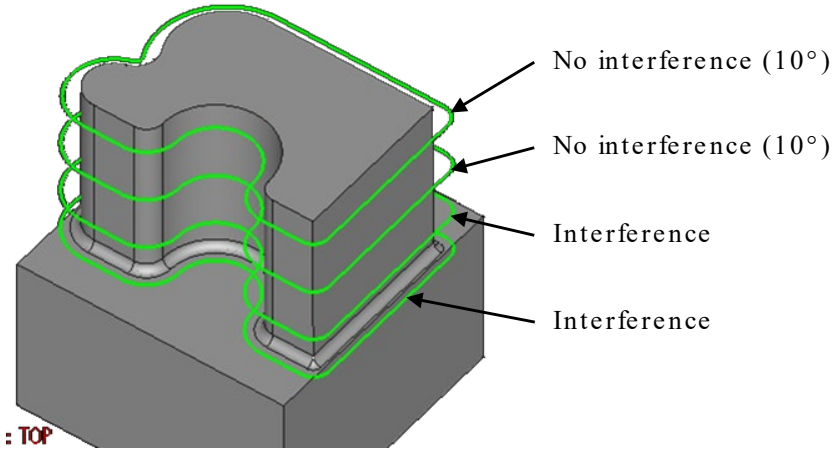
V15.1

1. The specified tilt axis angle is automatically changed internally (increased and decreased with a single engraving), and 5Axis conversion (Auto) is repeatedly conducted to reduce the locations where interference is to be avoided.
2. Using simultaneous 4Axis path on as many locations for interference avoidance as possible improves the quality of finishing surfaces after cutting.

Improvement of 5Axis Conversion (Auto)

V14.2

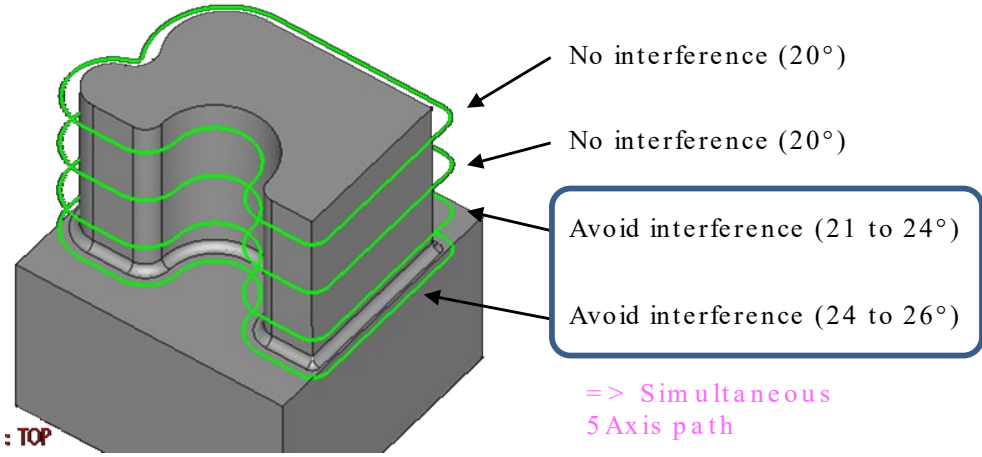
Tilt angle: 10°



Warning [5X interference]

Tilt angle which does not roughly interfere with the tooling needs to be specified after looking at the shape

Tilt angle: Changed to 20°



Normal [5X]

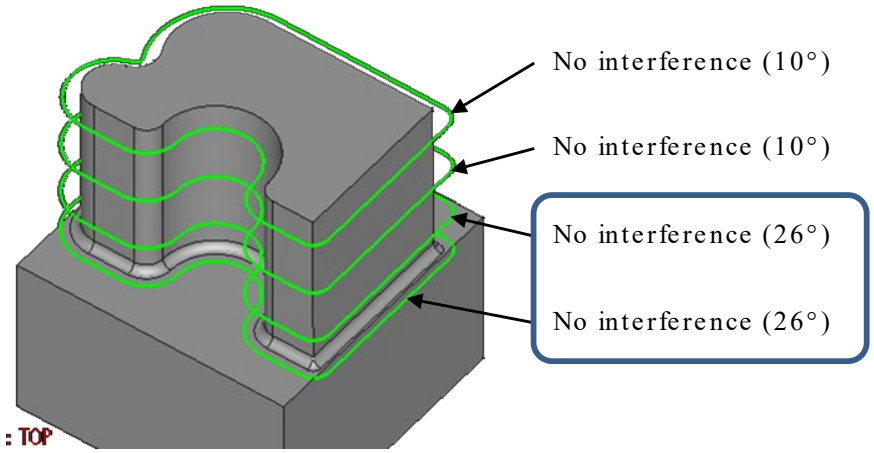
Avoid interference is conducted, but a simultaneous 5Axis path is created There are concerns regarding the quality of finishing surfaces.

Folder: V15.1\ V15.1-DEMO-04-5AXIS
Model file: V15.1-DEMO-04-5AXIS.gmd
Calculation process list: V15.1-04-5AXIS-01.gc2
Process: L10-TS-01-V14, L10-TS-02-V14

Improvement of 5Axis Conversion (Auto)

V15.1

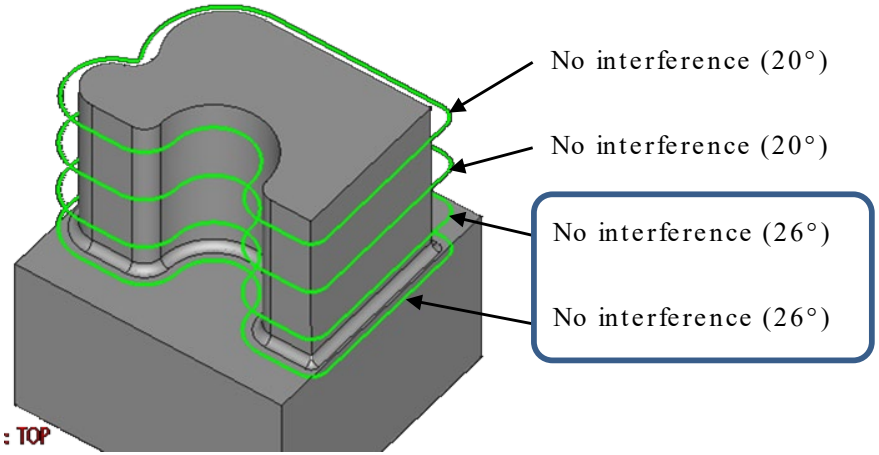
Tilt angle: 10°



=> Simultaneous 4Axis paths by segment

Normal [5X]

Tilt angle: 20°



=> Simultaneous 4Axis paths by segment

Normal [5X]

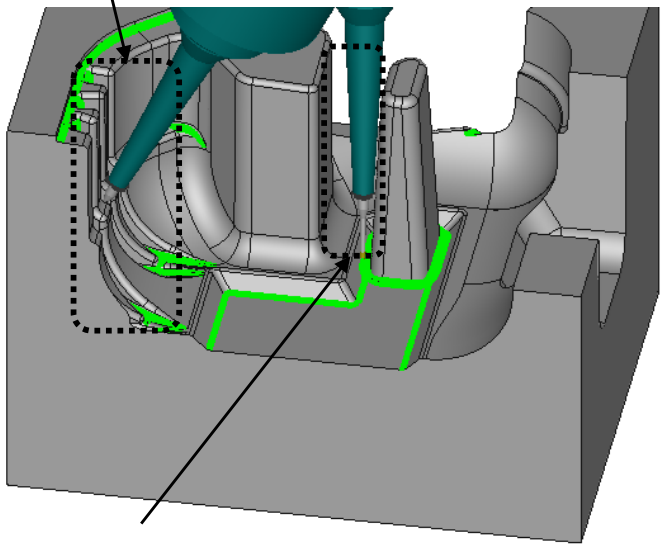
Reduces locations for interference avoidance, and using simultaneous 4Axis paths assures the quality of finishing surfaces after cutting!!

Folder: V15.1\ V15.1-DEMO-04-5AXIS
Model file: V15.1-DEMO-04-5AXIS.gmd
LAY = 10
Calculation process list: V15.1-04-5AXIS-01.gc2
Process: L10-TS-03-V15, L10-TS-04-V15

Improvement of 5 Axis Conversion (Auto)

Example of Results - 1

Locations with a tilt angle of 26° or higher, where avoid interference can be performed



V14.2
- Specified tilt angle of 9°
  - Warning [5X interference]
- Tilt angle = 30°
  - Warning [5X interference]

Interference occurs even when the tilt angle is adjusted to 9 or 30°
=> Interference avoidance was not possible in the direction of the rotation axis added with the specified tilt angle

V15.1
- Tilt angle: 9°
  => Normal [5X]: Fixed to 9 to 26° per segment (simultaneous 4Axis paths)
- Tilt angle = 30°
  => Normal [5X]: Fixed to 9 to 30° per segment (simultaneous 4Axis paths)

Locations with a tilt angle of 9°, where avoid interference can be performed

Folder: V15.1\V15.1-DEMO-04-5AXIS
Model file: V15.1-DEMO-04-5AXIS.gmd
LAY = 20
Calculation process list: V15.1-04-5AXIS-02.gc2
Process: L20-TN-01-V14, L20-TN-02-V14
L20-TN-03-V15, L20-TN-04-V15

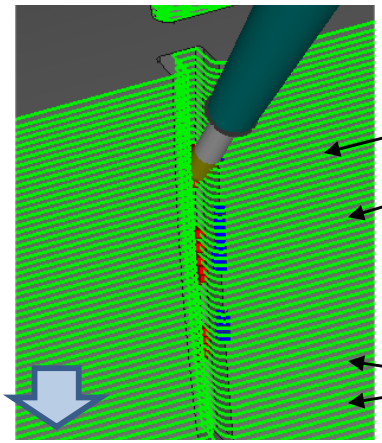
Improvement of 5Axis Conversion (Auto)

Example of Results - 2

V14.2

Tilt angle: 10°

*Maximum settable tilt angle: 40°



No interference (10°)

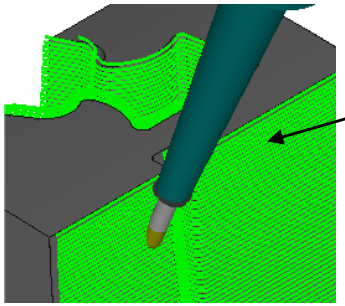
Interference (11 to 40°)

=> Simultaneous 5Axis path

No interference (40°)

Warning [5X interference]

Tilt angle: 20°



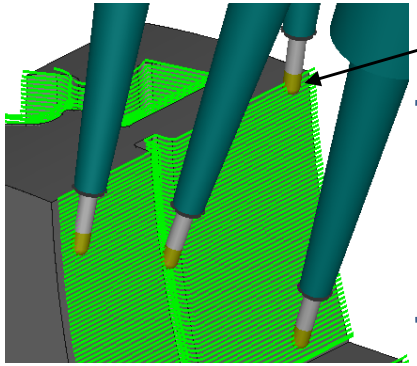
No interference (20°)

Simultaneous 4x path

Normal [5X]

V15.1

Tilt angle: 10°



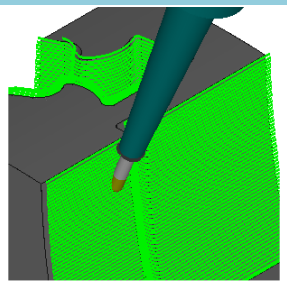
No interference (10°)

Simultaneous 4Axis path (19°)

19-degree tilt angle at which interference does not occur is calculated, and is output as simultaneous 4Axis path

Normal [5X]

Tilt angle: 20°



No interference (20°)

Simultaneous 4x

Set to 20-degree tilt angle at which interference does not occur, and output as simultaneous 4Axis path

Normal [5X]

Effects: Reduces 5Axis operations for avoiding interference!!

Folder: V15.1\ V15.1-DEMO-04-5AXIS
Model file: V15.1-DEMO-04-5AXIS.gmd
LAY = 30
Calculation process list: V15.1-04-5AXIS-03.gc2
Process: L30-TS-202-V14, L30-TS-205-V14
L30-TS-202-V15, L30-TS-205-V15

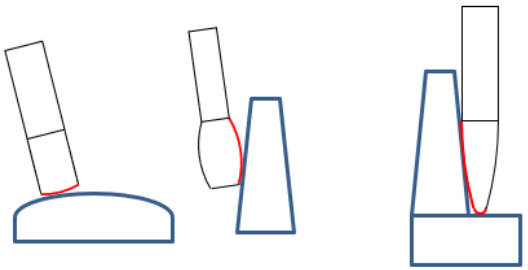
Enhancement of Cutting Modes with Barrel Cutter

Overview

The Barrel Cutter Tool now supports Curve Control Along Surface and 3D Offset Cutting. It is now possible to perform efficient 3D cutting with increased pitch in arbitrary cutting ranges on gently sloping surfaces.

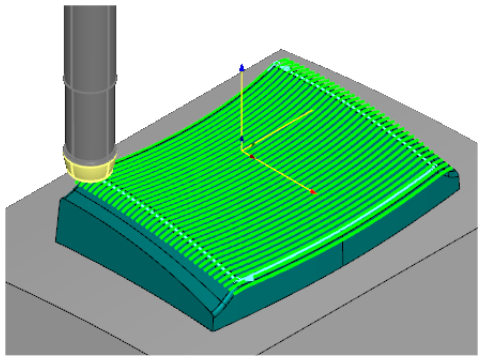
■ Supported cutting modes/tools

Cutting mode	Supported tools 3-axis machining, 5-axis conversion (Insert)
Curve Control Along Surface 3D Offset Cutting	Lens, barrel, oval

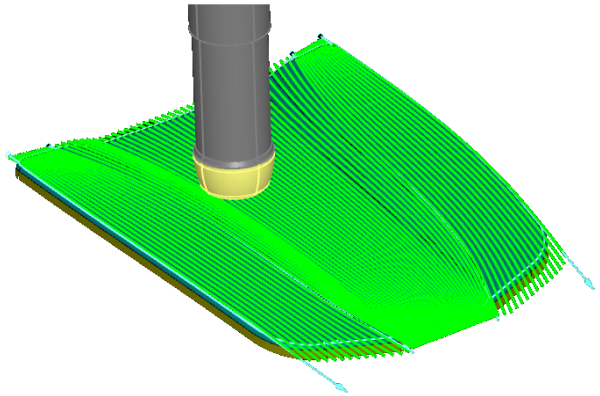


Lens Barrel Oval

*5Axis supported: Creates a path with the tool contacting the shape in the Z direction



Curve Control Along Surface



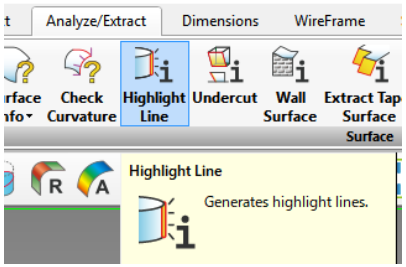
3D Offset Cutting

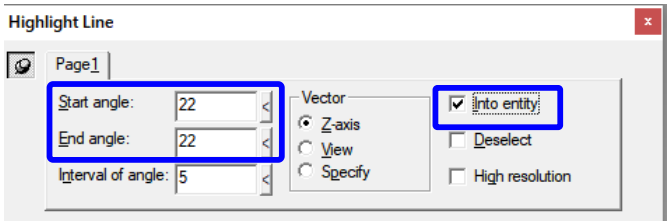
Realizes efficient 3D cutting!!

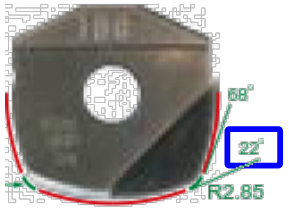
Curve Control Along Surface

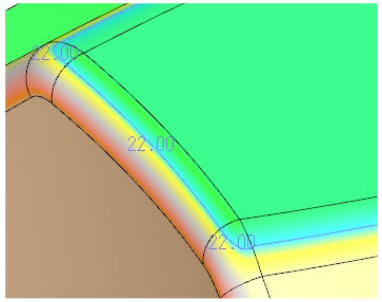
How to define cutting area with lens flute

(1) Create a curve with “Highlight Line”
(2) Connect to the curve with “Edit Connection”
(3) Create a 3D compcurve from the connected curve

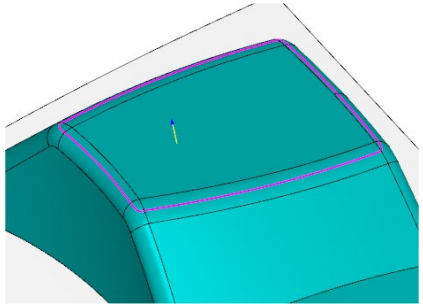




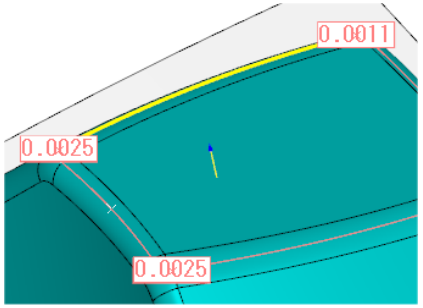




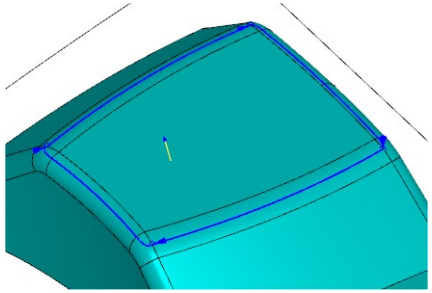
Highlight Line preview
Area with 22° tilt



(1) Highlight Line



(2) Edit Connection



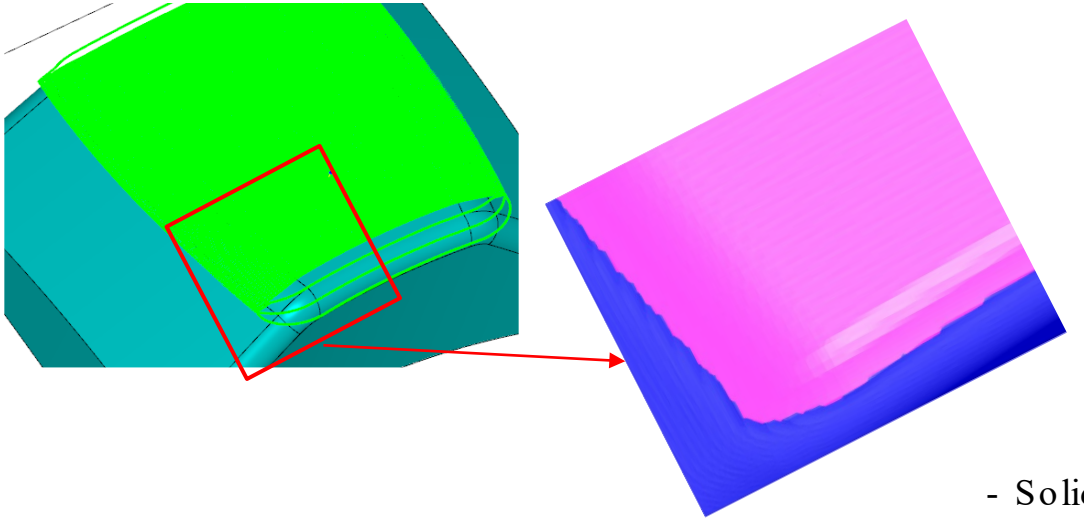
(3) Create 3D compcurve (4 lines)

Realizes efficient 3D cutting!!

Folder: V15.1\ V15.1-DEMO-03
Model file: V15.1-DEMO-03.gmd
LAY = 110.111
Calculation process list: V15.1-03-FREETOOL-01.gc2

- Curve Control Along Surface

  Pitch gap and cusp height



- Solid display
=> Cusp height fixed

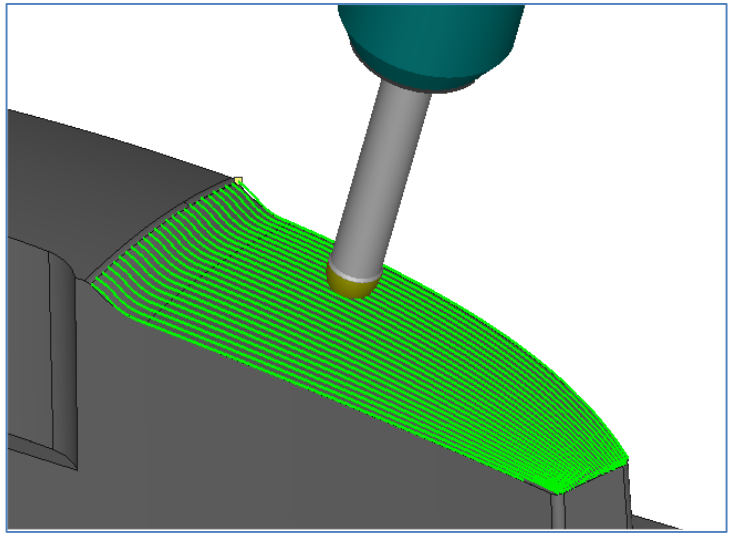
- Cutter path
  => The pitch at contact points are fixed,
  a pitch gap occurs in convex R locations.

Folder: V15.1\V15.1-DEMO-03
Model file: V15.1-DEMO-03.gmd
LAY = 110,110
Calculation process list: V15.1-03-FREETOOL-01.gc2

Enhancement of Cutting Modes with Barrel Cutter

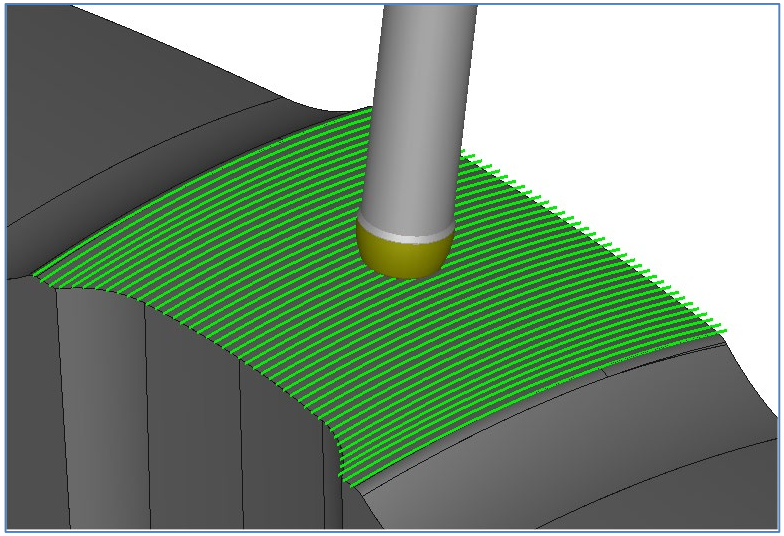
- 5Axis supported

- Tilt angle: 16°



3D Offset Cutting

- Tilt angle: 10°



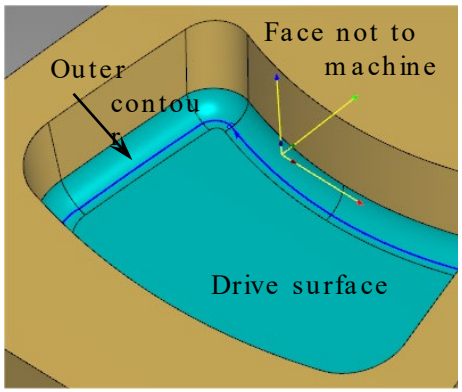
Curve Control
Along Surface

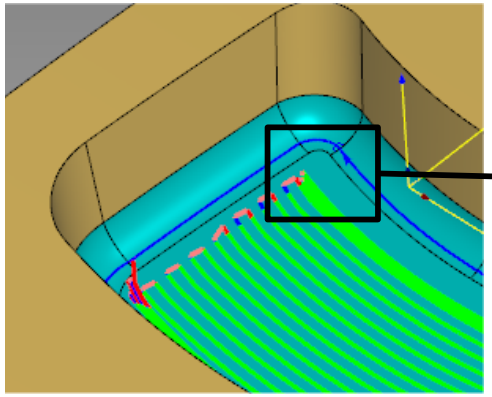
Folder: V15.1\ V15.1-DEMO-03
Model file: V15.1-DEMO-03.gmd
LAY = 130,132,133
Calculation process list: V15.1-03-FREETOOL-5X.gc2

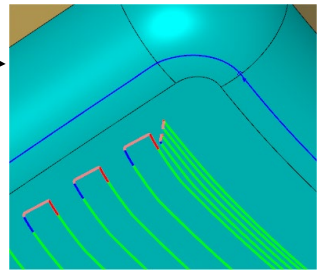
Operation when cutting bottom surface of a cavity shape

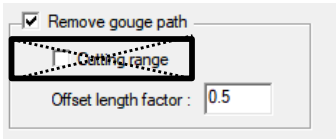
- For interference avoidance in side surfaces (gold surfaces below), “Remove gouge path”/”Cutting range” is normally used. However, it cannot be used when using a barrel tool.

  => Uses face not to machine. However, as shown in the following pictures, setting an outer contour on a shape in which the tool does not enter results in disruption of the path (crossing, etc.), even though avoid interference is performed.

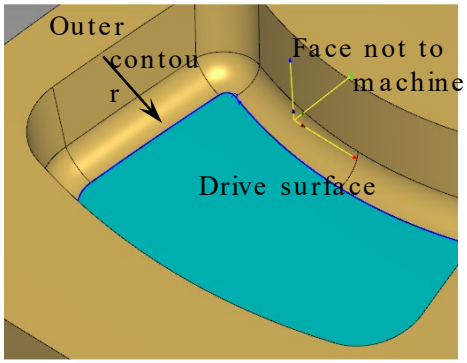


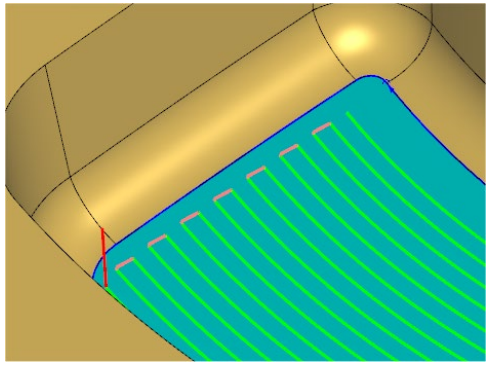






=> Set an outer contour on a shape in which the tool enters, and set shapes in which it does not enter as face not to machine.





=> Avoids interference and suppresses path disruption.

Folder: V15.1\ V15.1-DEMO-03
Model file: V15.1-DEMO-03.gmd
LAY = 124
Calculation process list: V15.1-03-FREETOOL-01.gc2
Process: L124-FM-07, L125-FM-08

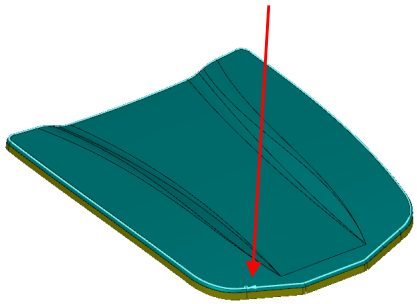
3D Offset Cutting

How to define cutting area with lens flute

(1) Create a curve with “Highlight Line”
(2) Connect to the curve with “Edit Connection”
(3) Create a 3D compcurve on the surface from the connected curve
(4) Create a 3D compcurve as an outer contour with “Create Guide Curve”
(5) Create a 3D compcurve for “Blend guide curves”

Operation is the same as for Curve Control Along Surface

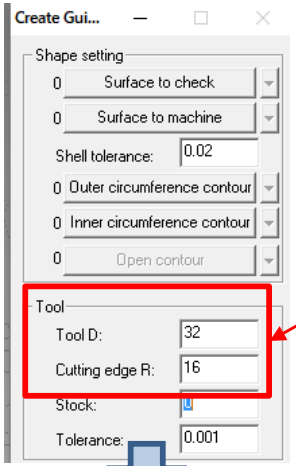
3D compcurve on surface



(1) Highlight Line

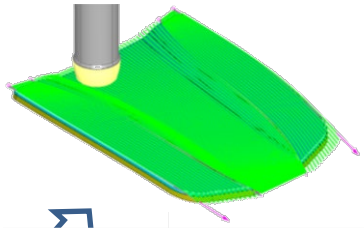
(2) Edit Connection

(3) Create 3D compcurve on the surface

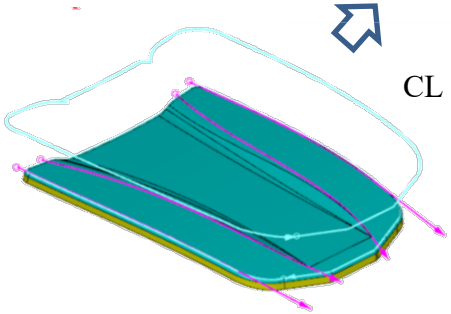


Lens R = 16

(4) Create a 3D compcurve with “Create Guide Curve”



CL calculation



(5) Create 3D compcurve for “Blend guide curves” (purple curves)

Realizes efficient 3D cutting!!

Folder: V15.1\ V15.1-DEMO-03
Model file: V15.1-DEMO-03.gmd
LAY = 120
Calculation process list: V15.1-03-FREETOOL-01.gc2

Functions not supported by each cutting modes

■ 3D-1

Cutting mode	3-axis CL	Simultaneous 5-axis CL (Insert)
Curve Control Along Surface	■ Cutting - Remove gouge path (Cutting range) - Corner-R processing	■ Cutting - Driving in ■ Approach/Escape - Z-axis direction 2, plane direction (tangent line, normal line, arc), connecting move (ramp on face) ■ 5X - 5Axis conversion (angle against shape), avoid interference, calculate required protruding length ■ Control Panel - Extension surface (face not to machine, different stock surface) - Control page (multiple pages)

■ 3D-2

Cutting mode	3-axis CL	Simultaneous 5-axis CL (Insert)
3D Offset Cutting	■ Cutting - Corner-R processing	■ Cutting Corner-R processing ■ Approach/Escape Z-axis direction 2, plane direction (tangent line), connecting move (3D curve, Insert R, max. connecting distance*1) ■ 5X 5Axis conversion (angle against shape), avoid interference, calculate required protruding length ■ Control Panel Extension surface (different stock surface), control page (multiple pages) *1: when value is higher than 0 (Please specify 0)

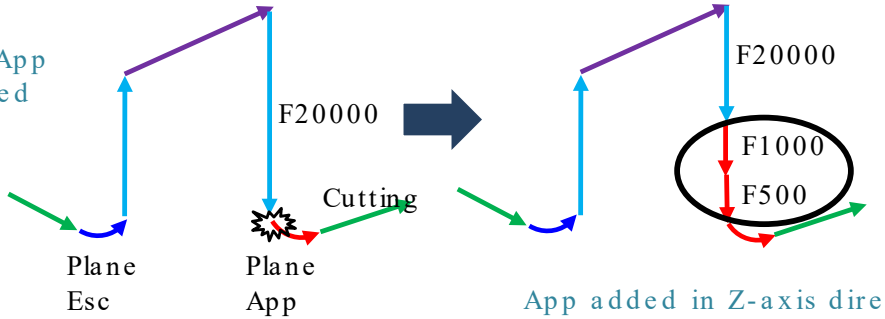
Other function enhancement/ specification changes

1. Connecting move - Direction of Z-axis between plane App
Cutting modes which can add App have been enhanced

- Z-level Scanning-line Rough Cutting

2. Support for barrel tool of the previous process

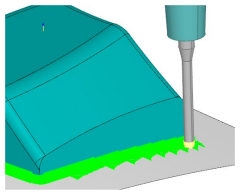
- Z-level Re-machining (previous process is 3Axis path)



App added in Z-axis direction

3. Change of "Acquire cutting Z range" in Z-level cutting modes

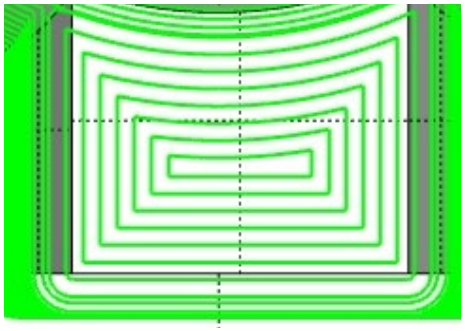
- Three decimal digits of the Z value up until V14.2 has been changed to six digits in V15.1 (7th digital is rounded down).



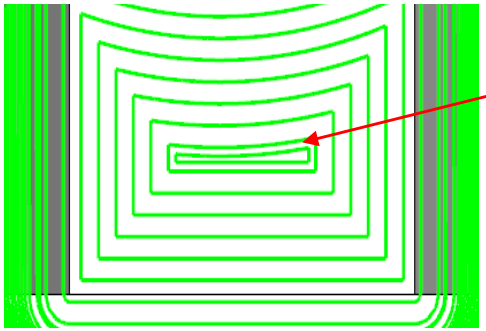
Support for barrel tool of the previous process

4. Z-Level Low Angle Finishing

- "Variable pitch" and "Enhancement of corner processing" where low lying > all circumference

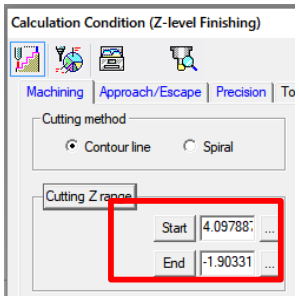


V14.2



V15.1

Z-Level Low Angle Finishing, variable pitch path



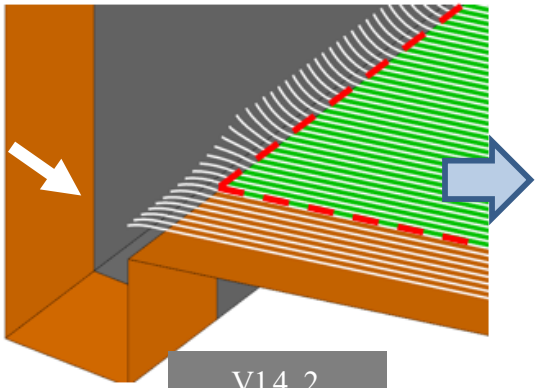
Changes in number of acquired digits

Folder: V15.1\ V15-DEMO-03
Model file: V15-DEMO-03.gmd
1. Calculation process list: V15-DEMO-03.gc2, Process: L140-TSR-016
2. Calculation process list: V15.1-03-FREETOOL-01.gc2, Process: L110-TTR-03
3. Calculation process list: V15-03.gc2, Process: L18-TS-005
4. Calculation process list: V15-03.gc2, Process: L20-TZ-006

■ The fillet creation range of the corner-R processing “Fillet” function has been updated, and now there is support for the offset of the range specified

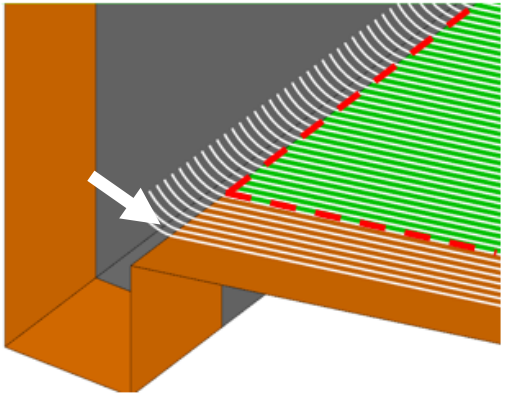
The fillet creation range in the Fillet function has been expanded, and there is now support for “Additional offset value” of the range specified.

Location where the path does not escape outside of the fillet creation range



V14.2

Path output range:
“Red broken lines“ +
“Offset outside”



V15.1

Cutting modes which support offset	
3D-1	Scanning-line Area Low Lying Processing Z-Level Low Angle Finishing Aiming Check
3D-2	Z-level Re-machining Corner Processing (Polygon) 3D Offset Cutting Scanning-line Cutting

Folder: V15.1\ V15.1-DEMO-03
Model file: V15.1-DEMO-03.gmd
LAY = 75
Calculation process list: V15.1-03-gc2
Process: L75-SR-014