ZW3D Advanced Tutorial

VoluMill

ZW3D™ V2023 CAM VoluMill

Printed in the P. R. China.

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Foreword

In this tutorial, we provide various case studies, which are from easy to difficult and combine theory with practice. We hope to improve users' 3D CAD/CAM skills and techniques with ZW3D.

The tutorial bases on our technical engineers' years of experience in the industry and ZW3D, which is the fruit of a lot of efforts and wisdom. We sincerely hope that the tutorial will do help to you, and your precious advice on it is highly welcomed.

There are three series for this tutorial: ***Primary Tutorial***, ***From Entry to Master Tutorial***, and ***Advanced Tutorial***. From easy to difficult, they offer a step-by-step learning process that can meet different user needs.

Primary Tutorial series is for users who have little or no prior 3D CAD/CAM experience. If you are green hands of 3D CAD/CAM software, or if you are a new user of ZW3D, we recommend that you get started with this tutorial. Here you can learn the basic knowledge and concepts of ZW3D, rapidly master the simple operations and workflows of ZW3D, and practice simple cases.

From Entry to Master Tutorial series is for users with basic know-how of 3D CAD/CAM software. If you have experience in 3D CAD/CAM software and want to master common functions of ZW3D, we suggest that you start with this series. Here you can dig deeper into the functions and master more operations of ZW3D.

Advanced Tutorial series is for users with practical experience in 3D CAD/CAM software. If you hope to have a comprehensive command of ZW3D and get the complicated operations done independently, you can choose to learn this series. Here you can learn to use the software more flexibly and get rich experience to increase your efficiency.

What you are learning is ***ZW3D CAM VoluMill***, an advanced tutorial.

Thanks for being our user!

The ZW3D Team

Contents

1 Introduction

Key Points:

✧ The benefits of VoluMill Technology
✧ The General Workflow while Using VoluMill in ZW3D

1.1 VoluMill Benefits

VoluMill for ZW3D is an add-on for ZW3D CAM. By avoiding sharp directional changes and controlling the rate of material removal, it can significantly extend tool life. VoluMilll for ZW3D works with you to get your job done quickly and budget friendly.

The benefits are obvious.

- **Reduce 70%+ cycle time.** With VoluMill, rough milling performance is significantly increased in all materials.
- **Extend 800%+ Cutting Tool Life.** VoluMill toolpaths use smooth, flowing motion, eliminating sharp directional changes. This enables cutting tools to operate under ideal milling conditions throughout, regardless of a part's shape or complexity.

1.2 Start with VoluMill

ZW3D can generate 2X and 3X toolpaths with VoluMill technology. You can find the icons from the ribbon tab as below.

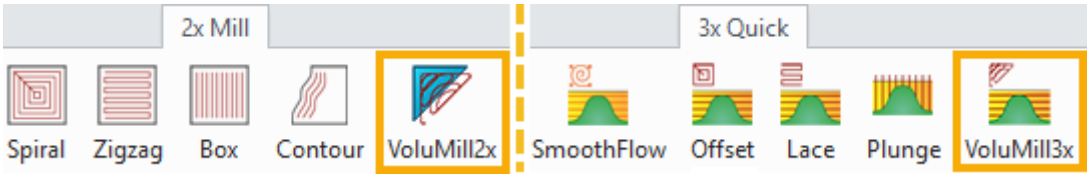


Figure 1 VoluMill Operations

Notes:

1) VoluMill operations are available only after you activate the matched license.
2) This tutorial is based on ZW3D 2021 version, some functions or icons may not match the current version.

1.3 General Workflow

The general workflow of creating VoluMill toolpaths is shown as below.

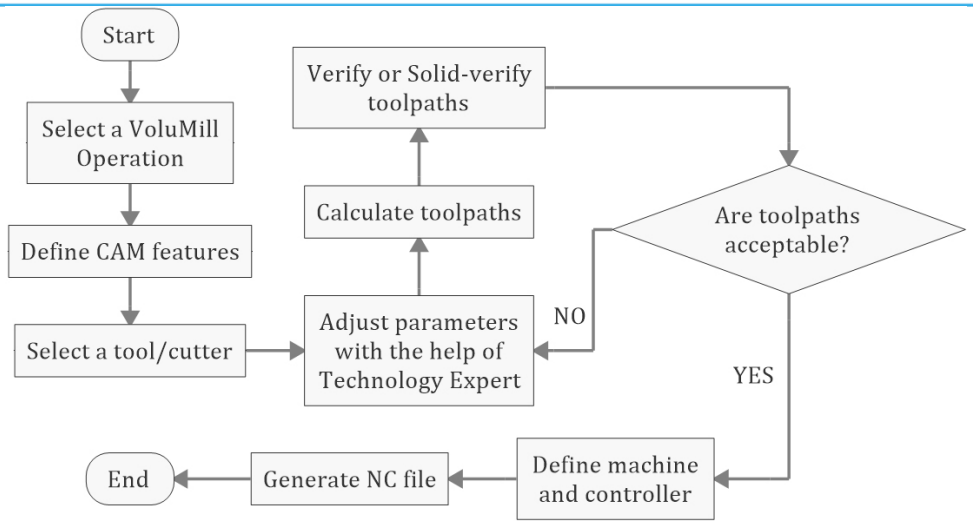


Figure 2 General Workflow to Create VoluMill Toolpaths

STEP 01 Select a VoluMill operation (2X/3X).

STEP 02 Define CAM features.

STEP 03 Select a tool.

STEP 04 Adjust the parameters with the help of VoluMill Technology Expert.

STEP 05 Calculate toolpaths.

STEP 06 Verify the toolpaths until they are acceptable.

STEP 07 Define machine and controller parameters.

STEP 08 Post process NC code to file.

About this tutorial

Before you start with this tutorial, ensure that you have an understanding of all the basic 2X and 3X machining concepts of ZW3D. And it is highly recommended to go through the PDF resource ***ZW3D_FromEntryToMaster_2X Machining*** and ***ZW3D_FromEntryToMaster_3X Machining***.

2 2X VoluMill

Key Points:

- ✧ Define the Profile Features
- ✧ Technology Expert
- ✧ Key Parameters
- ✧ Case Study

2.1 Getting Started

The model file for this chapter is located in ZW3D installation folder. The default path should be ***C:\Program Files\ZWSOFT\ZW3D 201X Eng (x64)\training\VoluMill Model***

2.1.1 Create a VoluMill 2X Operation

Click the icon ***VoluMill 2x*** from the 2X Mill ribbon tab, then you can create a 2X operation on the CAM tree.

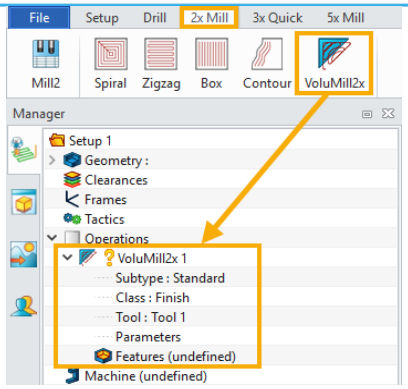
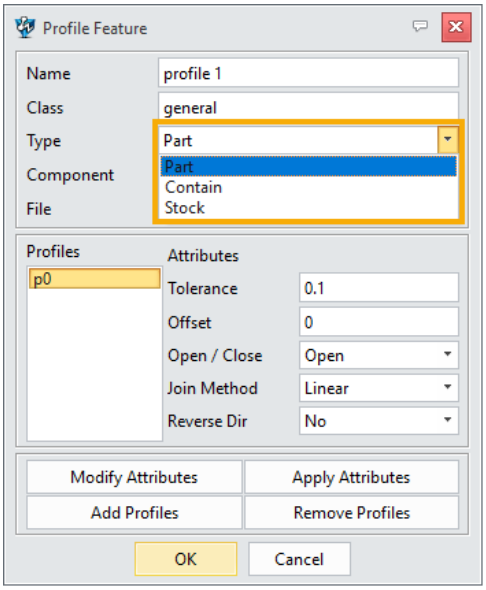


Figure 3 Create a VoluMill2x Operation

2.1.2 Define the Profile Features

2X VoluMill operations can only generate toolpaths based on Profile features. In ZW3D, there are three types of profiles in total, as shown in the figure below. Remember that the ***Part*** and ***Stock*** types can be used in VoluMill2x operation, but the ***Contain*** type is only valid in 3X VoluMill operation.



Part: This type of profile is used to define the boundary of the work part to avoid the tool cutting.

Contain: This type of profile is used to constrain the cutting area, which is only valid in 3X VoluMill operation.

Stock: This type of profile is used to define the open edges of an open pocket in 2X VoluMill operation, which allows the toolpaths to cut across.

Figure 4 Valid Profile Types for VoluMill2x

Create 3 profiles as below figures and calculate the VoluMill2x operation based on Profile 2 and Profile 3. The toolpaths are shown in Figure 8, illustrating the difference between Part and Stock type profiles.

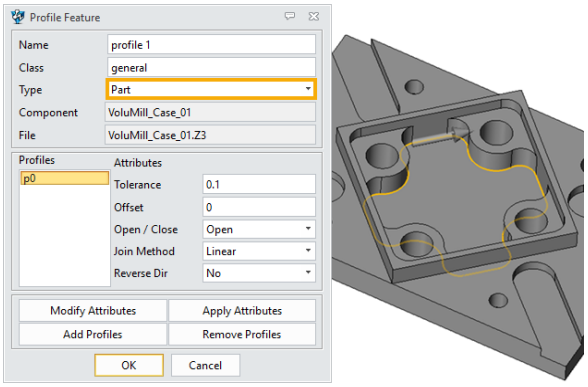


Figure 5 Profile 1 (Inner Pocket Bounday)

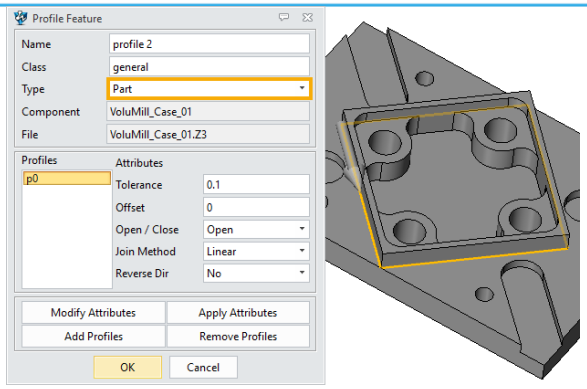


Figure 6 Profile 2 (Outlines of the Central Part)

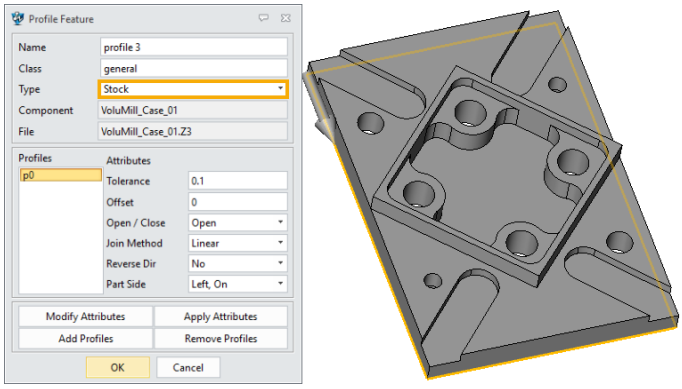


Figure 7 Profile 3 (Boundary of the Bottom)

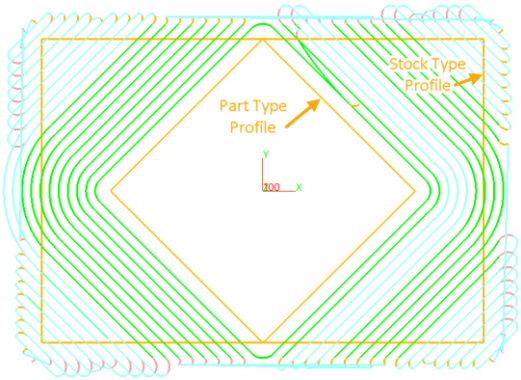


Figure 8 Difference Between Part and Stock Type Profile

2.1.3 Define the Tool

Define the tool ***D10R0***, the parameters are shown as below.

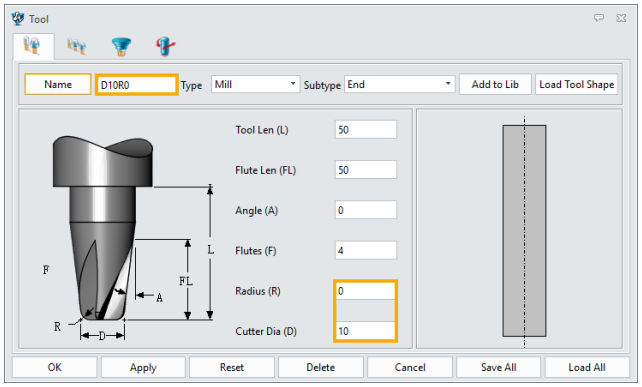


Figure 9 Tool Paramaters

2.2 Operation Parameters

This chapter will explain the unique parameters of the VoluMill 2x operation. Regarding the same parameters in other 2x operations, please refer to the 2X milling tutorials.

2.2.1 Technology Expert

Technology Expert is a powerful tool which can provides recommended feed & speed parameters to maximize the performance of VoluMill high-speed machining. You can find the access to Technology Expert in ***Primary*** parameter tab.

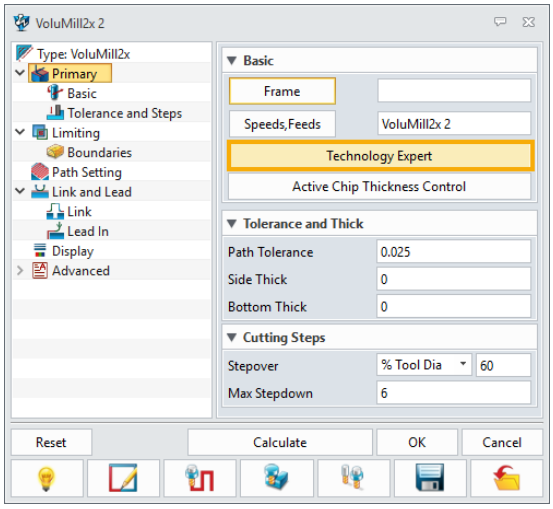
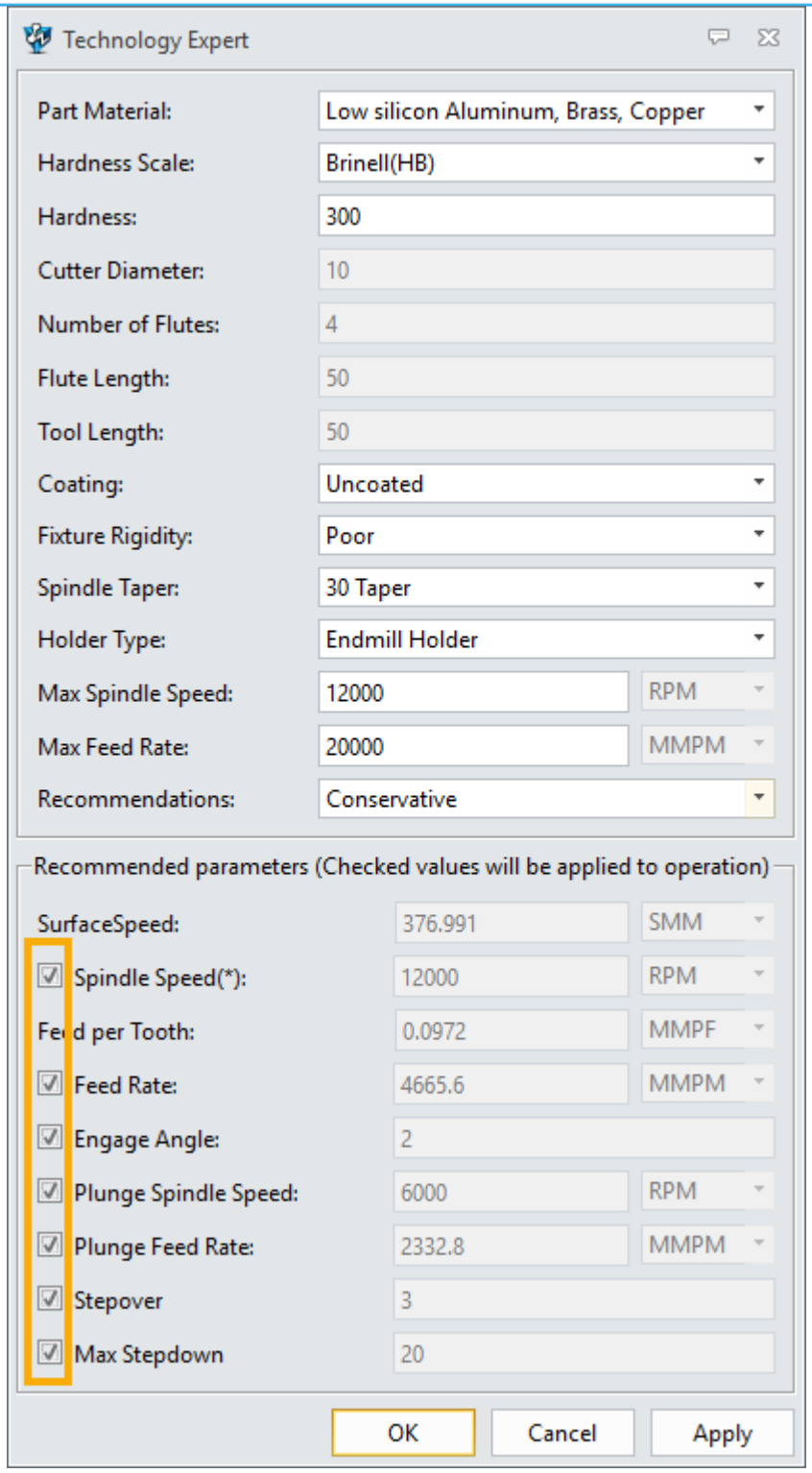


Figure 10 VoluMill2x Operation Parameters (Primary)

Technology Expert: Access to Technology Expert tool.

Active Chip Thickness Control: Redefine the parameters after using the recommended values from Technology Expert, so they are more suitable for the real machine.

The Technology Expert window is shown as below. The upper part of the window is used to define the attributes of the part and machine. And the lower part are the recommended values for operation parameters. Remember to check the boxes before applying them to the operation.



Material Attributes

Tool parameters inherited from the tool, which are not editable here

Status of coating, fixture rigidity, spindle taper and holder type.

The maximum speed and feed of the machine

The method (conservative or aggressive) to generate recommended values.

Recommended parameters. Remember to check the boxes on the left if you want to apply them in the operation.

Figure 11 Technology Expert

The recommended parameters can be redefined by ***Active Chip Thickness Control*** window. You can set object to recalculate (Chip Thickness by default). Change any parameters that are not greyed out and click ***Calculate***, then other ones will get updated.

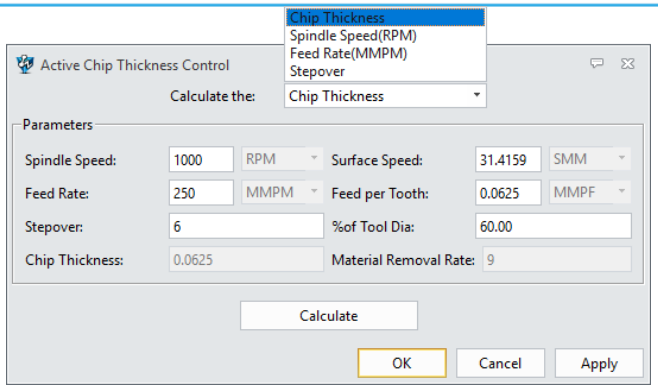


Figure 12 Active Chip Thickness Control Window

2.2.2 Key Parameters

Most parameters of VoluMill2x are the same as other 2X operations. The key parameters are listed as below.

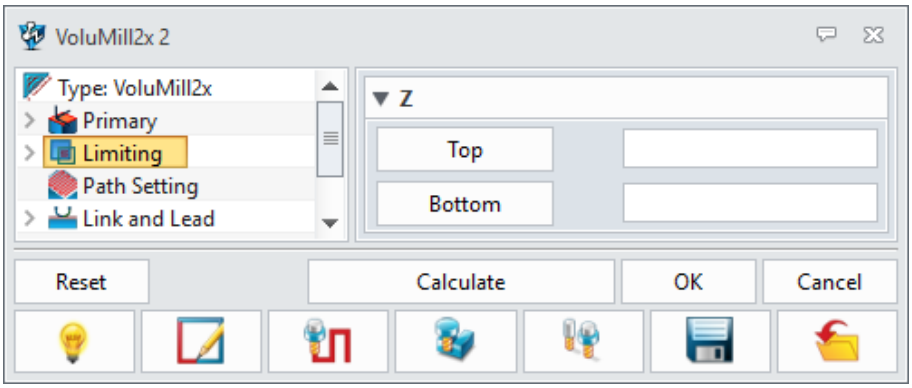


Figure 13 VoluMill2x Operation Parameters (Limiting)

***Notes**:*

The VoluMill2x operation calculates the toolpaths based on profiles, so it is recommended to set the top or bottom position manually.

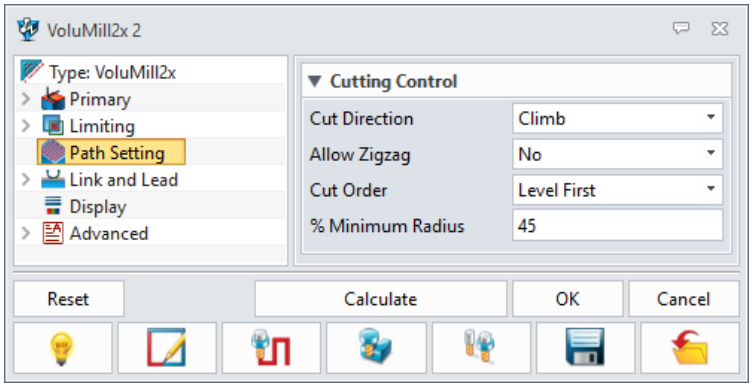


Figure 14 VoluMill2x Operation Parameters (Path Setting)

% Minimum Radius: Define the minimum radius (5-45% of the tool radius) of the toolpaths when milling a sharp corner or a narrow area.

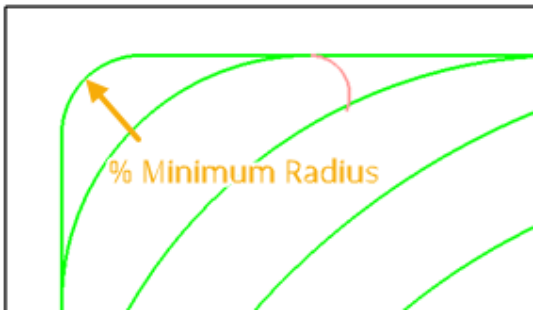


Figure 15 % Minimum Radius

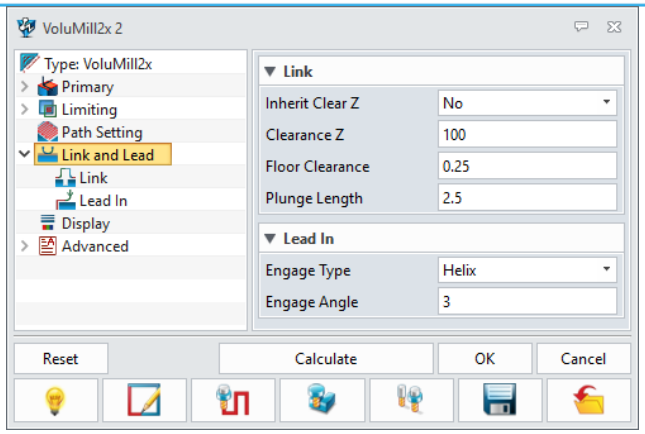


Figure 16 VoluMill2x Operation Parameters (Link and Lead)

Inherit Clear Z: Define whether to use the same clearance height as the general one or not. If set to ***No***, the following ***Clearance Z*** option is available.

Clearance Z: Define the clearance height only applied in this operation.

Floor Clearance: Define the height of the helical move that is used when entering or exiting a cut. Only non-negative values are allowed. If a positive value is entered, repositioning moves between cuts will take place above the already- machined floor. If zero is entered, the tool will drag across the already-machined floor during these moves. In this case, set the Traversal Feed Rate parameter (see the following figure) to be no greater than the cutting feed rate to help ensure more consistent tool marks on the floor.

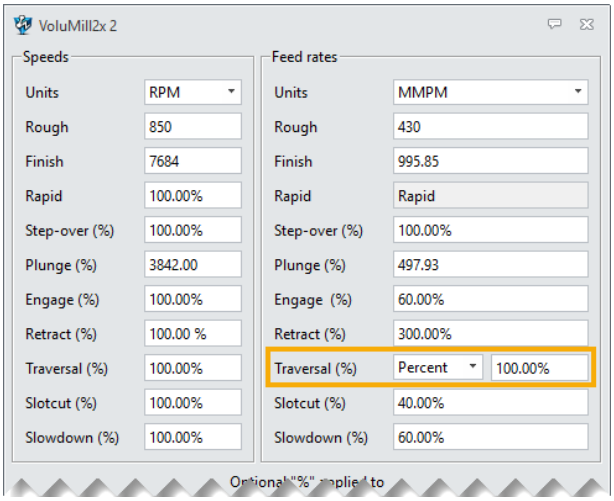


Figure 17 Traversal Feed Rate Parameter

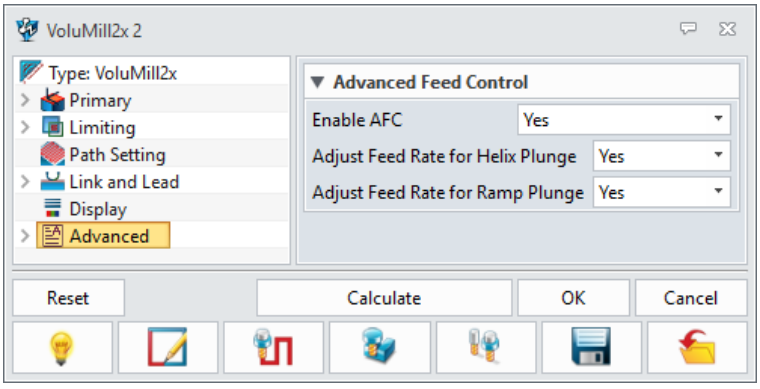


Figure 18 VoluMill2x Operation Parameters (Advanced)

Enable AFC: Define whether to apply Automatic Feed Control (AFC) or not. AFC function enables ZW3D to auto-adjust the feeds along the toolpaths according to cutting areas and path shapes.

Adjust Feed Rate for Helix/Ramp Plunge: Define whether to apply AFC on Helix or Ramp plunge or not. These options are available when ***Enable AFC*** is ***Yes***.

2.3 Case Study

This chapter will show a simple example on how to create a VoluMill2x operation.

STEP 01 Open the part file ***VoluMill_Case_01.Z3*** and go to CAM level.

STEP 02 Click the Ribbon ***VoluMill2x*** to create a 2X VoluMill operation.

STEP 03 Add Profile 1 created in previous chapter into the CAM features.

STEP 04 Select the tool ***D10R0*** created in previous chapter.

STEP 05 Open Technology Expert and apply all the recommended values.

STEP 06 Set the top and bottom points as Figure 20. Keep other parameters as default.

STEP 07 Calculate the toolpaths. The result will be shown as Figure 21

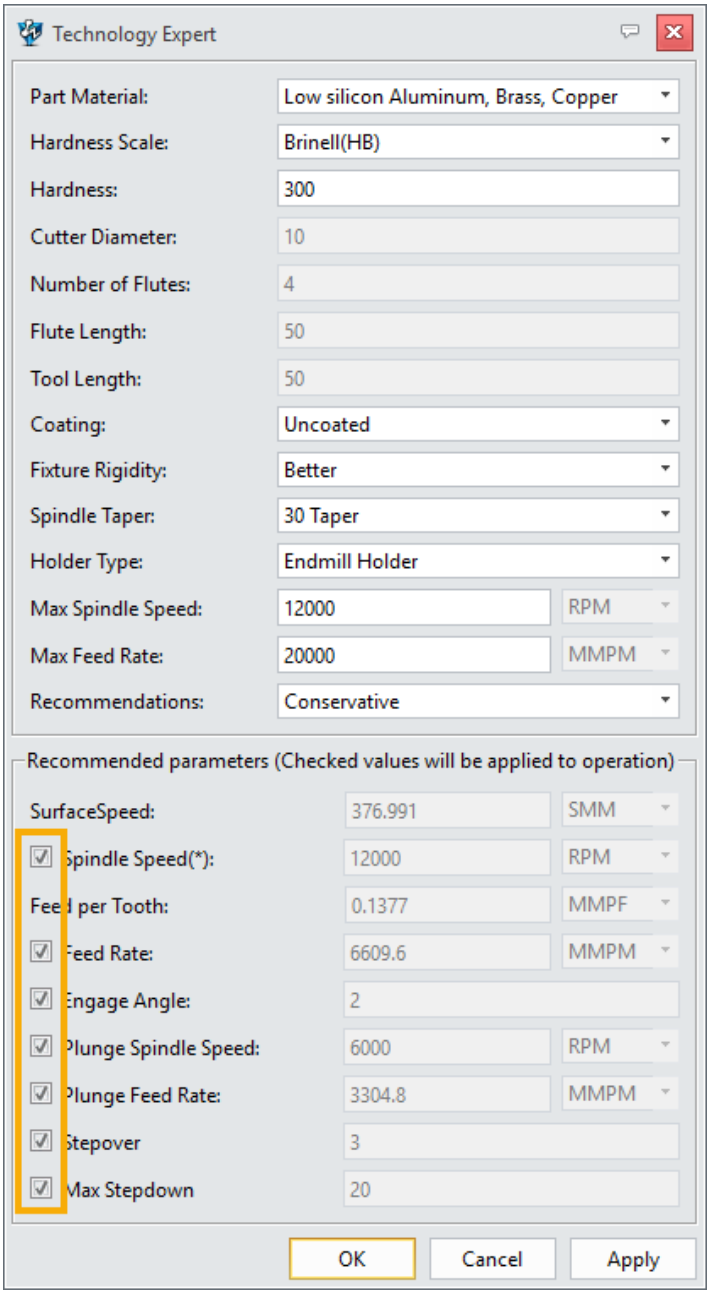


Figure 19 Apply Recommended Values by Technology Expert

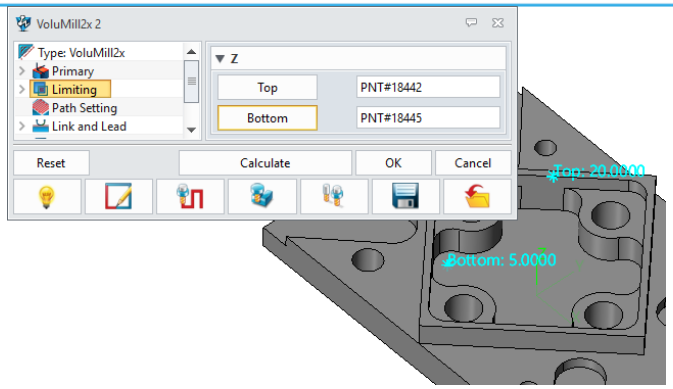


Figure 20 Top and Bottom Points

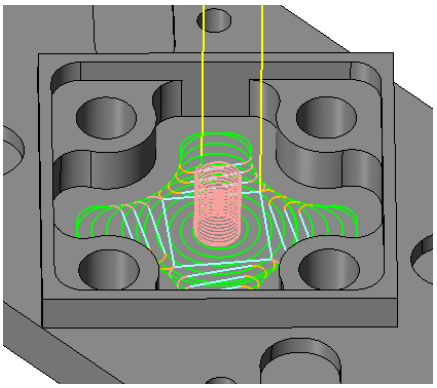


Figure 21 Toolpaths

3 3X VoluMill

Key Points:

- ✧ Available Features and Key Parameters
- ✧ Case Study

3.1 Available Features

Normally, both Part and Stock are necessary for 3X VoluMill operations to generate toolpaths. Besides, users can also add Solid, Surface and Profile features in to limit the cutting area for a better result.

The way to apply these features works as the same as other 3X operations, so this chapter won't explain these features in detail.

The model file for this chapter is located in ZW3D installation folder. The default path should be ***C:\Program Files\ZWSOFT\ZW3D 201X Eng (x64)\training\Volumill model***

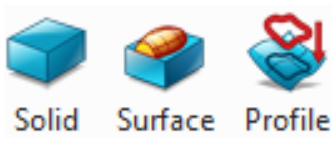


Figure 22 Availabe Features for 3X VoluMill

3.2 Operation Parameters

The Technology Expert tool is also available in VoluMill3x operation. It has the same functionality as in VoluMill2x operation. Other unique parameters of VoluMill3x operation are explained in detail as below figures show.

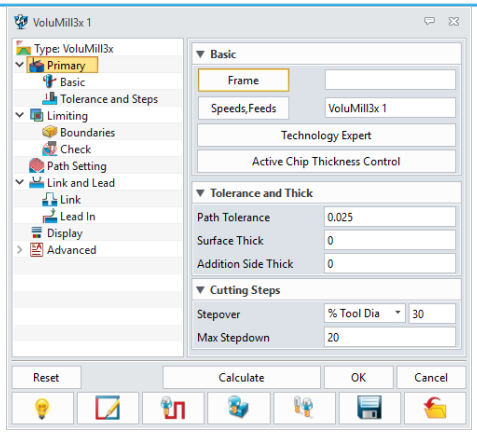


Figure 23 VoluMill3x Operation Paramters (Primary)

Additional Side Thick: Additional thickness will be left on the side walls after the operation is done, besides the value set in ***Surface Thick*** option.

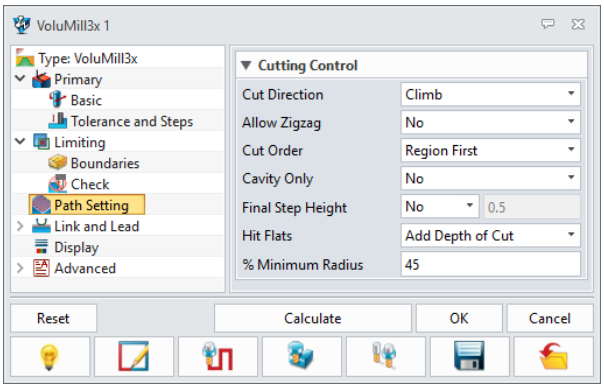
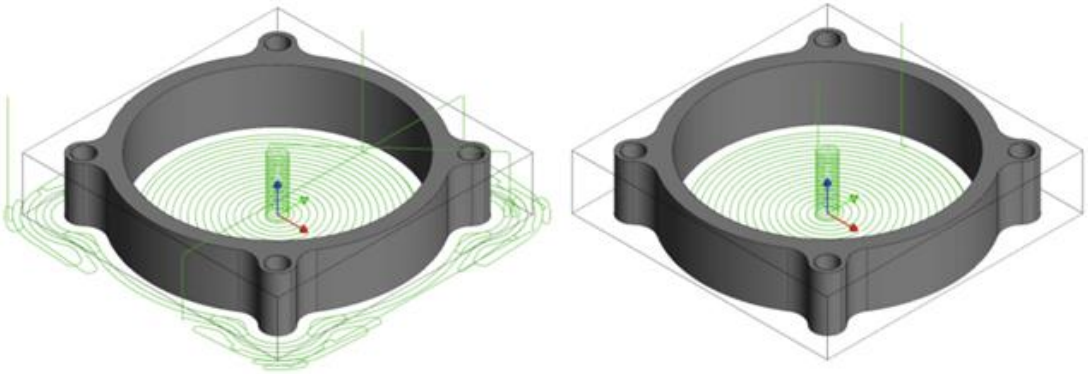


Figure 24 VoluMill3x Operation Paramters (Path Setting)

Cavity Only: This option should be used when machining a cavity from material with a flat top surface. The benefit is that stock need not be defined separately. See Figure 25for details.

Final Step Height: This option is used to control the height of the steps that will remain. Instead of making a shallow depth of cut across the entire part to leave smaller steps, VoluMill first machine larger steps and then automatically re-machine them to leave smaller steps. Thus the tool can remove the bulk of material most efficiently and still leave smaller steps for a semi-finish or finish toolpath. See Figure 26 for details.

Hit Flats: This option is used to control how flat surfaces, that are not coincident with any depth of cuts or final step heights, are machined. See Figure 27 for details.



Cavity Only: No VS Cavity Only: Yes

Figure 25 Cativy Only Option

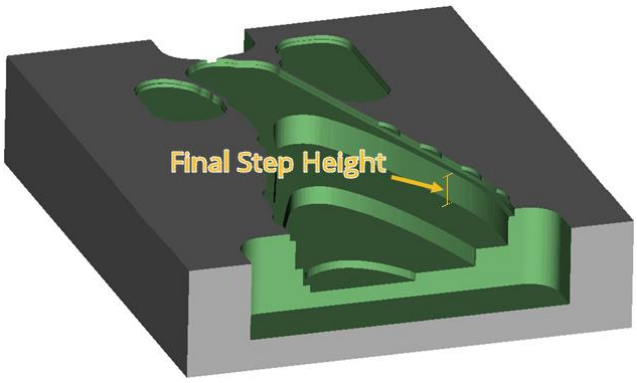


Figure 26 Final Step Height Option

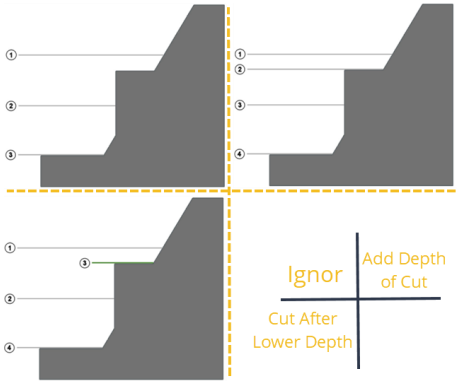


Figure 27 Hit Flats Option

3.3 Case Study

STEP 01 Open the model file *VoluMill_Case_02.Z3* and go to CAM level.

STEP 02 Click the Ribbon ***VoluMill3x*** to create a 3X VoluMill operation.

STEP 03 Add the part and a stock into the CAM features.

STEP 04 Select the tool ***D10R0*** created in previous chapter.

STEP 05 Open Technology Expert and apply all the recommended values.

STEP 06 Set the Final Step Height and Hit Flat options as Figure 29. Keep other parameters as default.

STEP 07 Calculate the toolpaths. The result is shown as Figure 30.

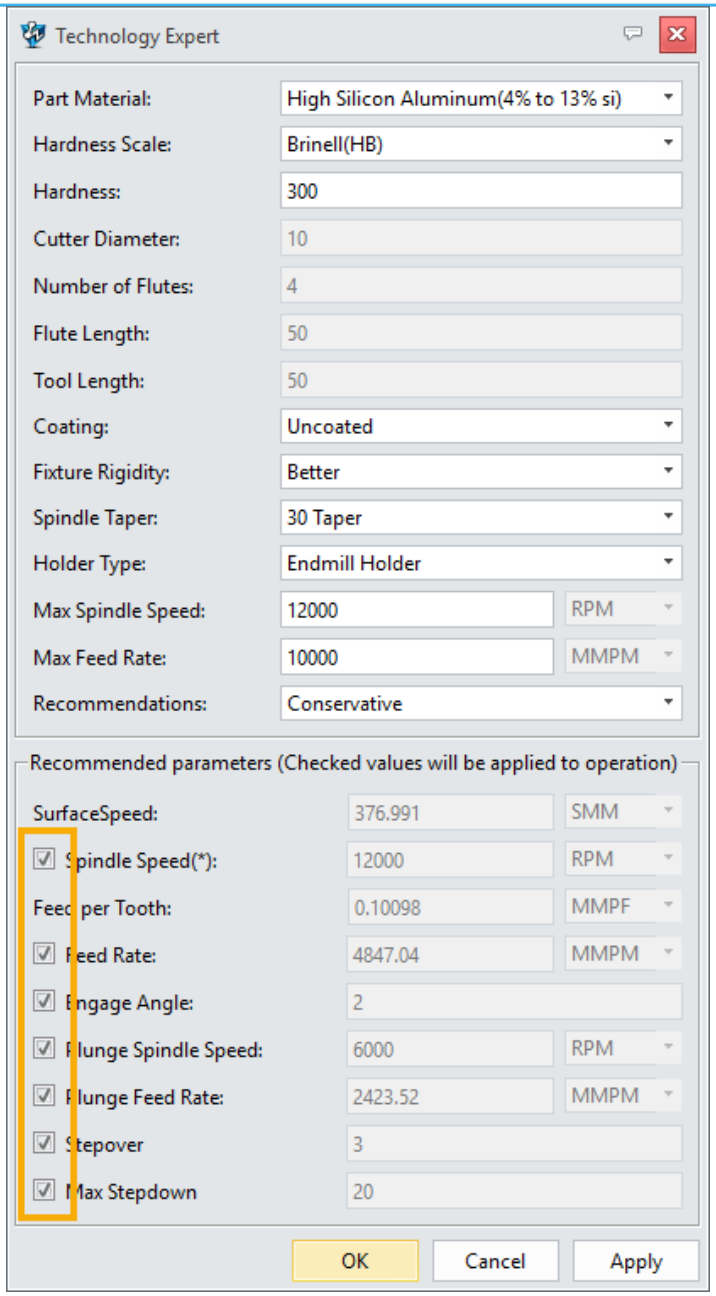


Figure 28 Apply Recommended Values by Technology Expert

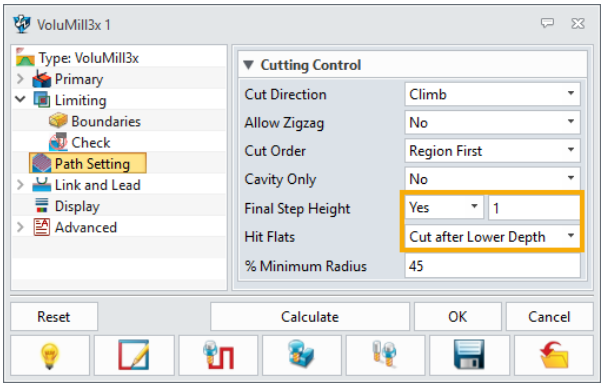


Figure 29 Final Step Height and Hit Flats Options

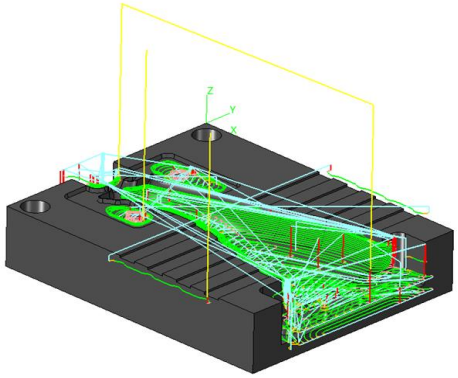


Figure 30 VoluMill3x Toolpaths

4 Epilogue

Thank you for your valuable time.

In this tutorial, we've shown you how to create 2X and 3X VoluMill toolpaths with the key parameters explained in detail. We hope this tutorial can help you understand the way to apply VoluMill in ZW3D.

This tutorial is based on ZW3D 2021 version, some functions or icons may not match the current version. If you have any suggestions or questions about this tutorial, please contact us at

ZW3D Global Website: https://www.zwsoft.com

ZW3D Support Team: sales@zwsoft.com