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Software: Mastercam 2020

Date: June 18, 2019

ISBN: 978-1-77146-861-9

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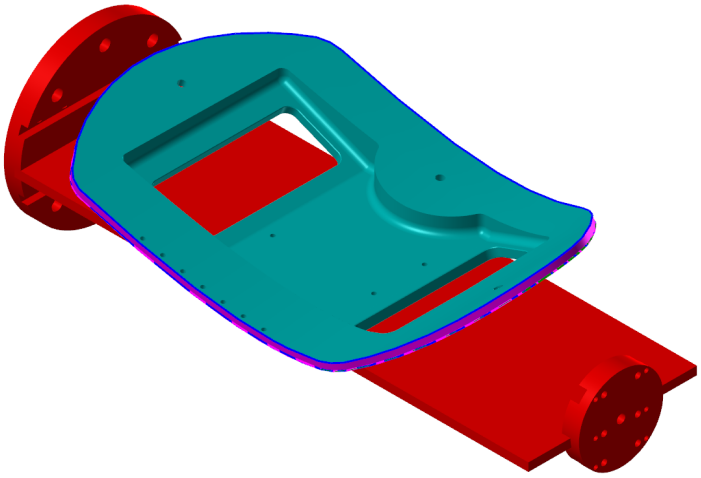
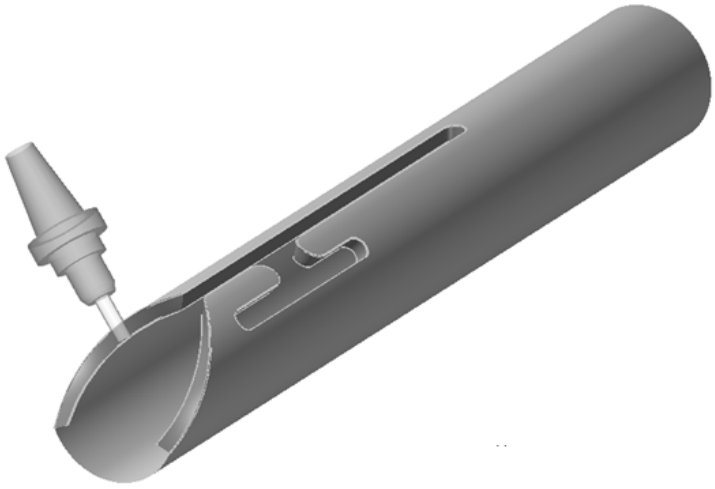
Swarf 5-Axis



INTRODUCTION

The purpose of this section is to introduce you to Swarf Milling machining; machining walls along curves with the side of the cutter.

Swarf (Side Wall Axial Relief Feed) toolpaths allows you to machine the wall surfaces with the side of the tool. This type of milling is common in the aerospace industry where part walls are tapered for increased strength and low weight as shown.



Some parts that can be machined using three axes mill and surface toolpaths can be machined much more efficiently using Swarf toolpaths since the Swarf toolpath can reduce the number of machining setups and cut passes.

OVERVIEW OF EXERCISE:

In this lesson you will machine the part shown by first using the Contour Toolpath with multiple passes to machine the two steps. You will compare this toolpath with the Peel Mill Toolpath.

You will machine the slots using Contour - Ramp Toolpath.

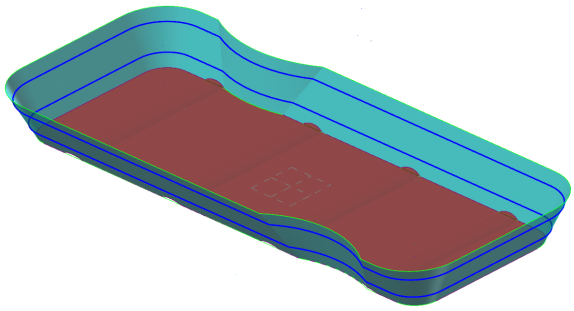
NEW CONCEPTS COVERED IN THIS TUTORIAL:

- Swarf 5 axis - Walls defined by surfaces; floor defined by surfaces; output format 4 axis.
- Swarf 5 axis - Walls defined by surfaces; floor defined by surfaces; output format 5 axis.
- Swarf - Walls defined by chains; Tip control to lower rail; output format 4 axis.

INSTRUCTOR DEMONSTRATION

Topics:

- **Swarf 5 axis - Walls set to surfaces; floor defined by surfaces; output format 4 axis.**
- **Swarf 5 axis - Walls set to surfaces; floor defined by surfaces; output format 5 axis.**
- **Swarf - Walls set to chains; floor defined by surfaces; output format 5 axis.**
- **Swarf - Walls set to chains; floor defined by lower rail; output format 4 axis.**



NOTES:

EXERCISE 1: SWARF 5 AXIS - WALLS DEFINED BY SURFACES; OUTPUT FORMAT 4 AXIS

Swarf 5-axis can create a 4-axis or 5-axis toolpaths along a wall defined by surfaces or two chains.

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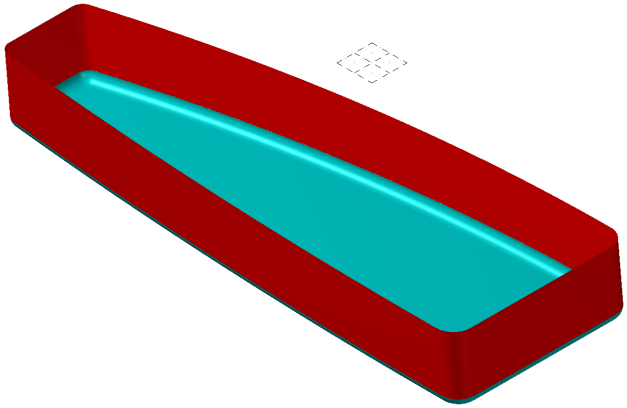


1. Open File

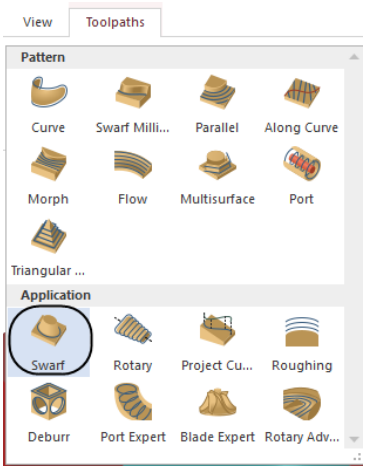
- From the **QAT**, select the **Open** icon.
- Select **SWARF OUTPUT FORMAT 4 AXIS.MCAM.**

STEP 1: SWARF 5 AXIS WITH THE OUTPUT FORMAT SET TO 4 AXIS

1.1 Select The Toolpath

Toolpaths

- From the **Multiaxis** group, select the **Expand gallery** arrow and from the **Application** family select **Swarf**.



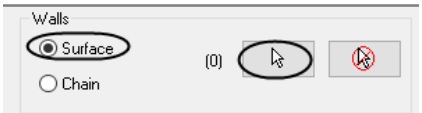
1.2 Tool

- Select the **1.0" Bull Endmill** with a **Corner radius** of **0.25"**.

1.3 Cut Pattern

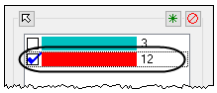
The **Cut Pattern** page allows you to select the wall geometry using Surface or Chains. It also allows you to set the compensation type and direction, maximum step, cut tolerance and starting location for closed walls.

- **Walls** set to **Surface**.
- Click on the **Select** button.

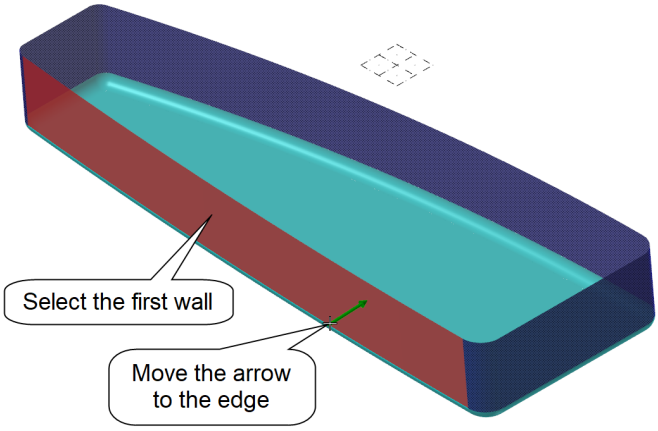


- From the **QM** buttons, click on the left half of the **Select all entities by color** button.

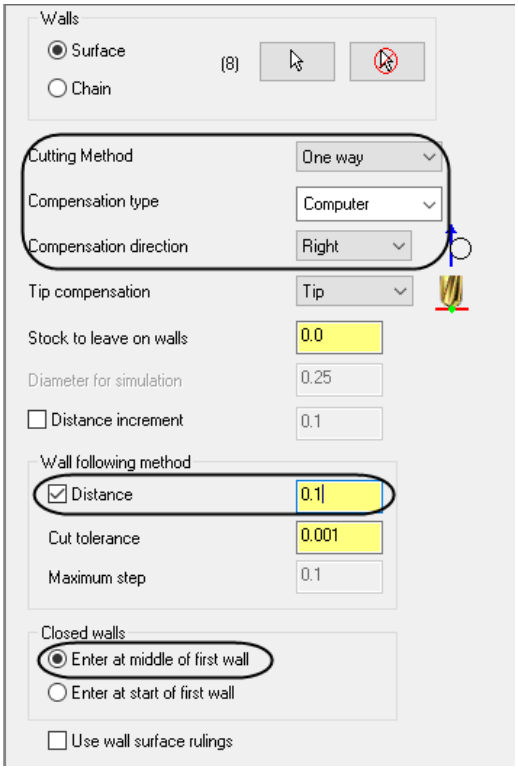
- Select the red color.



- Select the **first wall** and move the arrow to the lower edge of the wall.
- The **chain direction** should be **CW**, otherwise **Reverse Direction**.



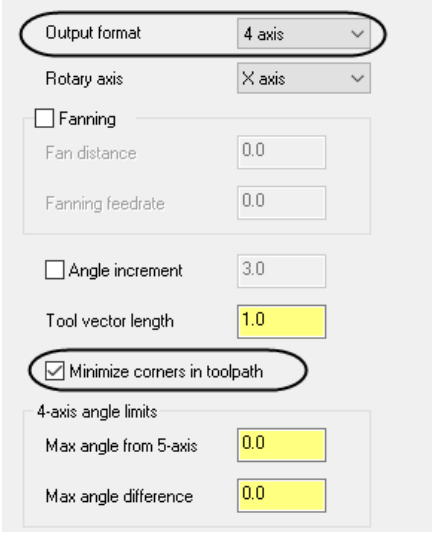
- **Cutting method** set to **One Way**.
- **Compensation type** set to **Computer**.
- **Compensation direction** set to **Right**.
- **Stock to leave on walls = 0.0.**
- **Distance = 0.1.**
- **Cut tolerance = 0.001.**
- Enable **Enter at middle of first wall**.



1.4 Tool Axis Control

Tool Axis Control settings determine the tool's orientation in relation to the geometry being cut.
They allow you to set the output format, fanning, angle increment, and minimize the tool movement when cutting corners.

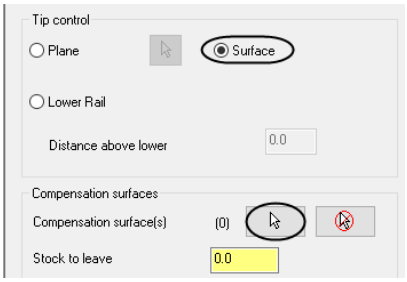
- **Output format** set to **4 axis**.
- **Rotary axis** set to **X axis**.
- Enable **Minimize corners in toolpath** to remove vectors immediately before and after any corner in the toolpath.



1.5 Collision Control

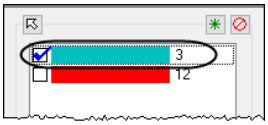
The **Collision Control** page allows you to set the collision control parameters for the **Swarf** toolpath. Collision control settings determine the tip compensation, establish the check and compensation surface behavior, and set the gouge process settings. The tip compensation can be set to a plane, to surfaces or to the lower rail.

- **Tip control** set to **Surface**.
- From the **Compensation surfaces** area, click on the **Select** button.

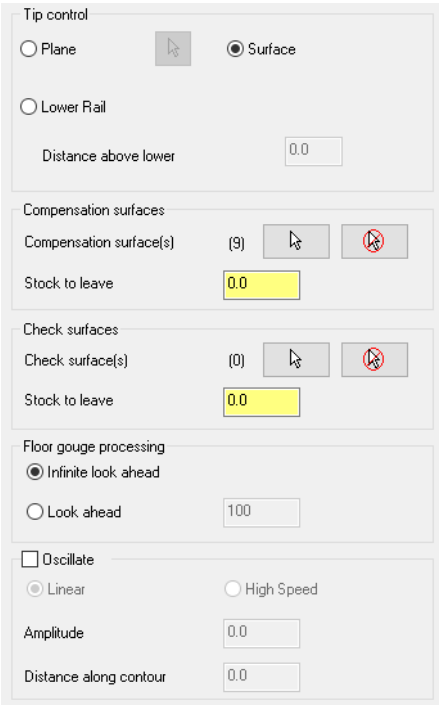


- From the **QM** buttons click on the **Select all entities by color** left half button.

- Select all blue colored surfaces.



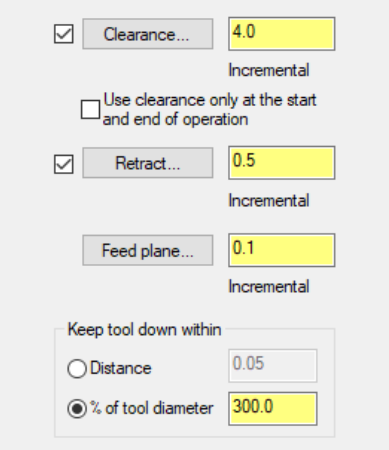
- No check surfaces are required.
- Enable **Look ahead 100** to evaluate ahead of the tool position.



1.6 Linking

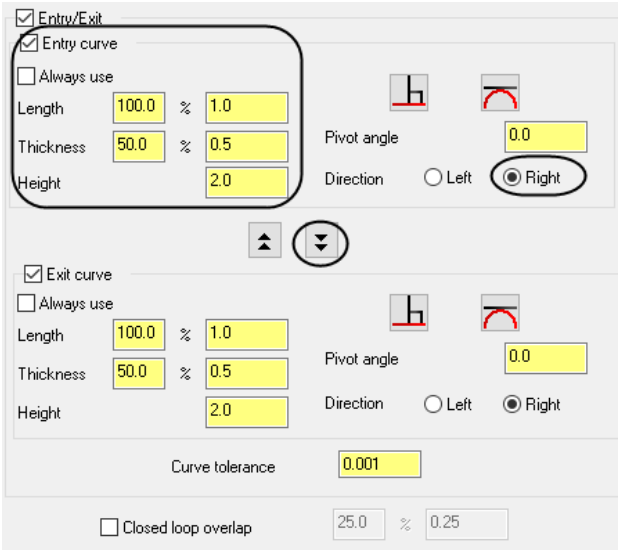
Linking sets the links between the cutting passes. In general, you can think of linking moves as air moves when the tool is not in contact with the part.
Clearance sets the height at which the tool moves to and from the part.
Retract sets the height that the tool moves up to before the next tool pass.
Feed plane sets the height that the tool rapids to before changing to the plunge rate to enter the part. The tool also moves to this height between operations if you do not enter both the clearance height and the retract height.
Keep tool down instructs Mastercam not to create a retract move if the distance from the end of one pass to the start of the next pass is less than this value. The tool will move directly between the passes at the feed rate.

- **Clearance = 4.0.**
- **Retract = 0.5.**
- **Feed plane = 0.1.**
- **Keep tool down within = 300.**



1.7 Entry/Exit

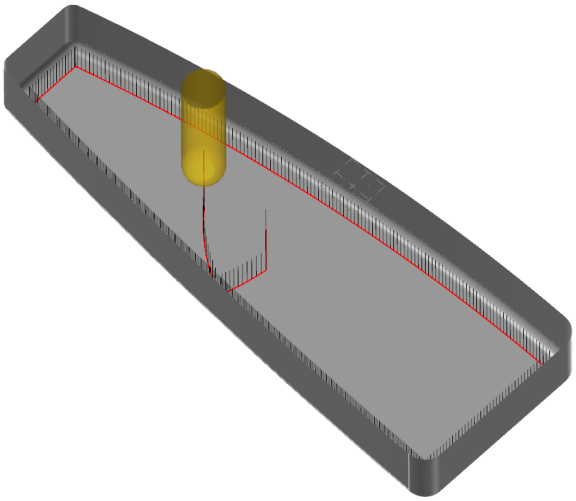
- Enable **Entry/Exit curve** and set the **Length** to **1.0**, **Thickness** to **0.5**, and **Height** to **2.0**.
- Set the **Direction** to **Right**.



1.8 Roughing Disabled

- Select the **OK** button to generate the toolpath.

1.9 Backplot The Toolpath



EXERCISE 2: SWARF 5 AXIS - WALLS DEFINED BY CHAINS

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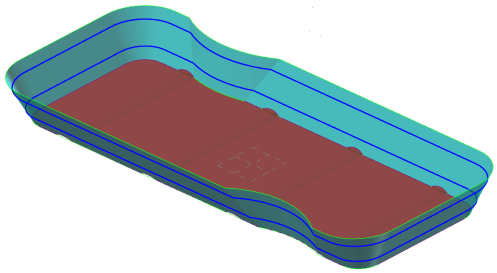


1. Open File

- From the **QAT**, select the **Open** icon.
- Select **SWARF1.MCAM.**

STEP 1: SWARF 5 AXIS WITH THE OUTPUT FORMAT SET TO 5 AXIS

1.1 Select The Toolpath

Toolpaths

- From the **Multiaxis** group, select the **Expand gallery** arrow and from the **Application** family select **Swarf**.

1.2 Tool

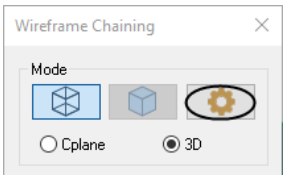
- Select the **0.25" Bull Endmill** with a **Corner radius** of **0.03125".**

1.3 Cut Pattern

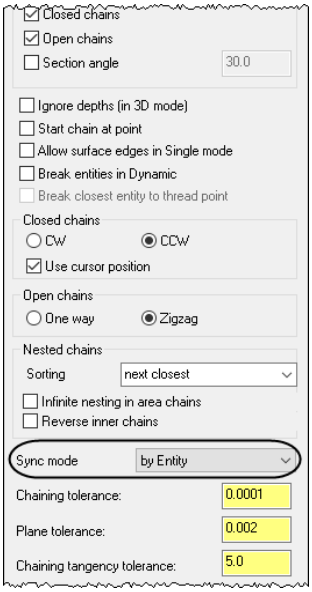
The **Cut Pattern** page allows you to select the wall geometry using Surface or Chains. It also allows you to set the compensation type and direction, maximum step, cut tolerance and starting location for closed walls.

- **Walls** set to **Chain**.
- Click on the **Select** button.

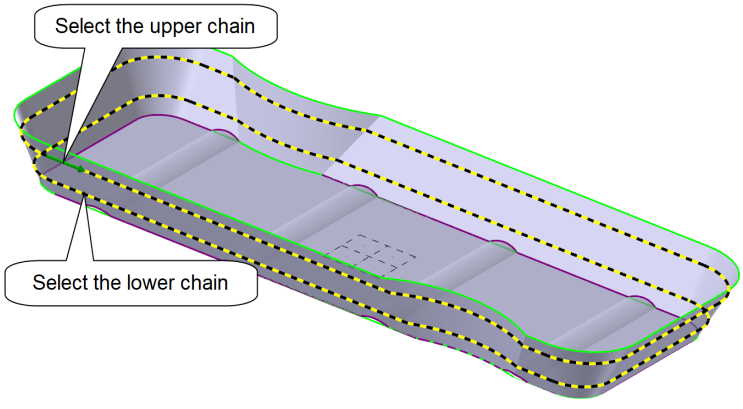
- In the **Wireframe Chaining** dialog box, click on the **Option** button.

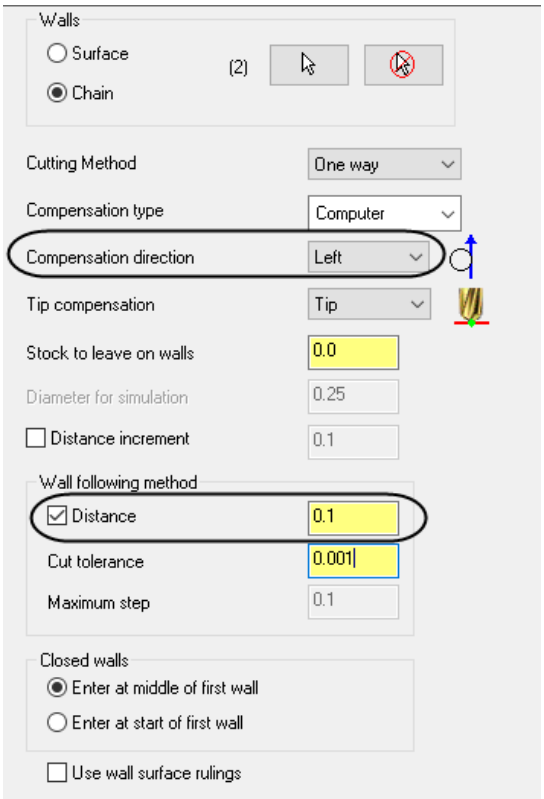


- Set the **Sync mode** to **by Entity**.



- Select the lower contour in the **CCW** direction, otherwise **Reverse Direction**.
- Select the upper contour in the **CCW** direction. Make sure that the start point is aligned with the lower contour.





- **Cutting method** set to **One Way**.
- **Compensation type** set to **Computer**.
- **Compensation direction** set to **Left**.
- **Stock to leave on walls = 0.0.**
- **Distance = 0.1.**
- **Cut tolerance = 0.001.**
- Enable **Enter at middle of first wall**.

1.4 Tool Axis Control

Tool Axis Control settings determine the tool's orientation in relation to the geometry being cut.
They allow you to set the output format, fanning, angle increment, and minimize the tool movement when cutting corners.

- **Output format** set to **5 axis**.
- Enable **Minimize corners in toolpath** to remove vectors immediately before and after any corner in the toolpath.

1.5 Collision Control

The **Collision Control** page allows you to set the collision control parameters for the multiaxis swarf toolpath. Collision control settings determine the tip compensation, establish the check and compensation surface behavior, and set the gouge process settings. The tip compensation can be set to a plane, to surfaces or to the lower rail.

- **Tip control** set to **Surface**.
- From the **Compensation surfaces** area, click on the **Select** button.
- From the **QM** buttons click on the **Select all entities by color** left half button.
- Select the brown color.
- No check surfaces are required.
- Enable **Look ahead 100** to evaluate ahead of the tool position.

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This 3-part series is designed to help you prepare for your Professional Level Mastercam Certification™ Test. The skills exam must be administered by a Mastercam Certified Instructor or a Mastercam Certified Reseller.

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Part 1 – Mill 2D begins at the absolute basics by introducing the Mastercam user interface. It will have you creating geometry, drilling and creating contour toolpaths before you know it. Its gradual progression leads to more advanced concepts such as multiple setup scenarios and 2D High Speed Toolpaths. All of the parts within the book are designed with machinability in mind.

A multitude of topics are covered including 2D geometry, tool settings, stock setup, drilling, tapping, contouring, pocketing, circle milling. You will learn the 2D High Speed Toolpaths such as dynamic mill, area mill, dynamic rest mill, how to import a solid and machine it and how to use the WCS in multiple fixture applications.

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Part 1, 2 & 3 Bundle

This part 1, 2 & 3 bundle provides you all three Mastercam Professional Certification Curriculum at a better price.

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The Mastercam 2020 Handbooks provide an academic approach to teaching the theory and application of Mastercam. The Handbook series is designed to teach the fundamentals of Mastercam, gradually working up to more complex material with each volume. Each Handbook comes with a Student DVD that contains files referenced within the book, and the Mastercam 2020 HLE Demo Software.

Handbook Volume 1
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The Mastercam 2020 Handbook Volume 1 is an excellent resource that teaches the theory of Mastercam Mill and Solids. The material intertwines conceptual subject matter with practical applications suitable for beginners and intermediates alike. You not only learn how to use Mastercam but why things work as they do.

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Mill Essentials eCourse

The Mill Essentials eCourse introduces students to 2D CAD and milling toolpaths. It covers wireframe and solids creation as well as 2D mill toolpaths such as contour, drilling, blend, peel, dynamic area, transform, Feature Based Drilling, and more. This course serves as an excellent introduction to Mastercam.

Mill Advanced eCourse

The Mill Advanced eCourse builds on what students have learned in the Mill Essentials eCourse. It moves into more advanced CAD and demonstrated 3D wireframe, solid, and surface creation commands. 3 axis toolpaths such as Area Roughing, Dynamic OptiRough, Scallop, Pencil, Waterline, Radial, Hybrid, and more are covered.

Lathe eCourse

The Mastercam Lathe eCourse covers wireframe creation, working with imported part files, stock setup, facing, roughing, finishing, grooving, drilling, and cutoff toolpaths. Stock operations such as advance, flip, and tailstock are also covered. You will also learn how to program parts in a VTL.

Multiaxis Essentials eCourse

The Multiaxis Essentials eCourse covers 4 & 5 axis toolpaths. Toolpaths include contour with axis substitution, drilling with axis substitution, drilling with rotary axis positioning, rotary 4-axis, curve 5-axis, swarf 5-axis, drill 5-axis, circle mill 5-axis, flow 5-axis, and multisurface 5-axis. This course skips most CAD in favor of focusing on toolpaths.

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PROFESSIONAL COURSEWARE

The Mastercam Professional Courseware titles are intended for industrial training settings. Instead of step-by-step instructions, these books introduce concepts through sequences of specialized training exercises followed by parts the users are expected to produce with minimal guidelines.

Professional Courseware Mill Essentials

The Mastercam 2020 Mill Essentials Professional Courseware provides in-depth coverage of 2D wireframes and solids geometry, as well as contour, pocket, drilling, circle milling and slot milling toolpaths. More advanced exercises explain the use of the Work Coordinate System (WCS), 2D high speed toolpaths, Feature Based Machining (FBM) and more.

Price $60 (eBook)
ISBN: 978-1-77146-896-1
Price $70 (Print)
ISBN: 978-1-77146-858-9

Professional Courseware Mill Advanced

The Mastercam 2020 Mill Advanced Professional Courseware covers a multitude of features that teach a user to create 3D wireframes, surfaces and solids for 3D modeling and toolpaths. Interactive training exercises introduce 3D geometry functionality, while newer surface high speed toolpaths are thoroughly investigated along with their various parameter settings.

Price $50 (eBook)
ISBN: 978-1-77146-897-8
Price $60 (Print)
ISBN: 978-1-77146-859-6

Professional Courseware Lathe

The Mastercam 2020 Lathe Professional Courseware offers an in-depth look at Mastercam Lathe geometry and toolpath creation. Advanced toolpaths such as Misc Ops and C-Axis toolpaths are also described. Additional Mastercam files are provided along with guidelines for creating the toolpaths to machine each part.

Price $55 (eBook)
ISBN: 978-1-77146-898-5
Price $65 (Print)
ISBN: 978-1-77146-860-2

Professional Courseware Multiaxis

The Mastercam 2020 Multiaxis Professional Courseware details numerous toolpaths that allow a user to successfully machine 4-axis and 5-axis parts. Multiaxis Advanced toolpaths have been included with more complex parts along with instructions on how to machine them. Machine Simulation is used to check for any collisions between the part, the tool and any of the machine's components.

Price $65 (eBook)
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240 Holiday Inn Drive, Unit A
Cambridge, Ontario, Canada N3C 3X4
T: 800.529.5517 F: 519.658.1335
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