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## **Mastercam 2020 Lathe Professional Courseware**

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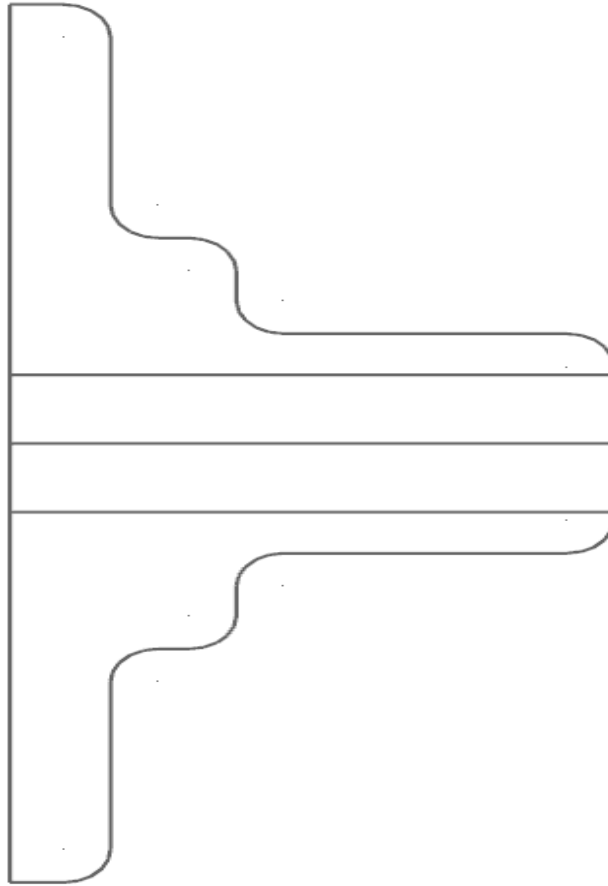
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## Geometry Tools - Part 1



## INTRODUCTION

This lesson will introduce the Mastercam user interface in detail and will also teach you the first geometry creation tools that you will need for creating your own geometry to define toolpaths or for creating supplemental geometry to graphically control the toolpath motions in Mastercam. The main goal of the geometry lessons is to give you the basic understanding of how to create geometry in Mastercam so that you can practice to become as proficient as your job requires.

## OVERVIEW OF EXERCISE:

In this lesson we will become familiar with the Mastercam screen components and learn tools and shortcuts to begin creating basic line geometry shapes.

## NEW CONCEPTS COVERED IN THIS LESSON:

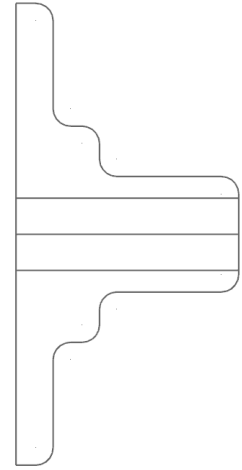
- ◆ The important components of the Mastercam Interface.
- ◆ Important Function Key shortcuts.
- ◆ How to create a Point knowing its Position.
- ◆ Line Creation - Several line creation methods with emphasis on Endpoints and Parallel.
- ◆ How to Delete Geometry.
- ◆ Fillet Creation.
- ◆ How to Trim and Extend Lines.
- ◆ How to Create Rectangles and Rectangular Shapes.

## INSTRUCTOR DEMONSTRATION PREVIEW

*Note: This entire lesson is a joint Instructor / Student exercise.*

### Topics:

- ◆ Mastercam Interface
- ◆ Point Position Command
- ◆ Line Endpoints Command
- ◆ Line Parallel Command
- ◆ Rectangle Commands
- ◆ Fillet Commands
- ◆ Trim Commands



### NOTES:



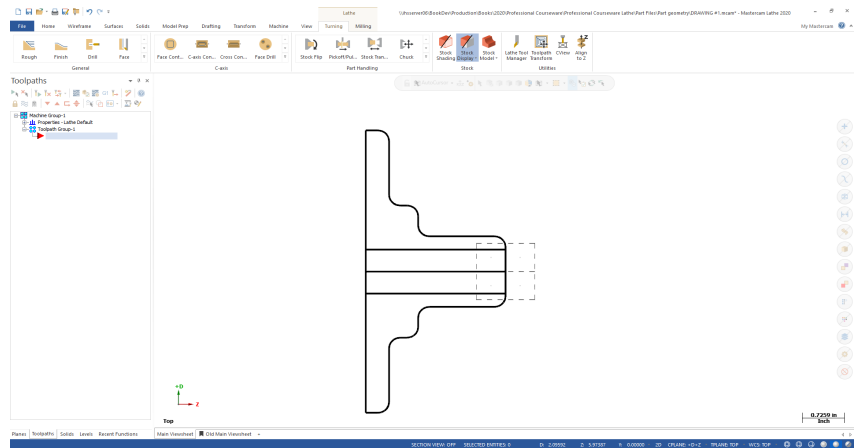
## GEOMETRY TOOLS PART 1: BASIC STEPS REFERENCE

In this first lesson the students and instructor will work through the topics as a group.

### EXPLORE MASTERCAM INTERFACE

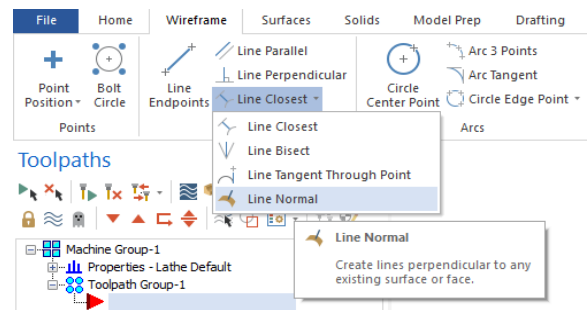
#### 1. Load the part: "DRAWING #1.MCAM"

We will do a "Preview" of some of the different components of the Mastercam screen. Goal is just to see where things are, not to master their usage yet.



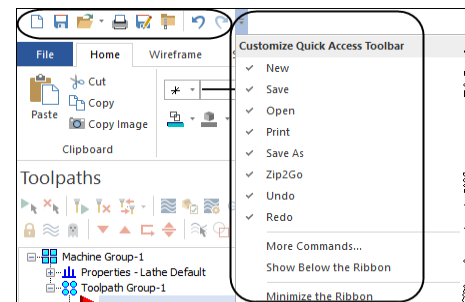
#### 2. Tabs - Buttons - Submenus - Tooltips

Like many Windows programs, many have submenus or options. We will not go through any specific at this point, just review how they work.



#### 3. Quick Access Toolbar

User can customize to add often used functions.

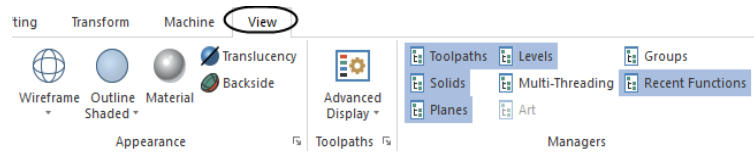


#### 4. The ESC (Escape) Key

(Master key for ending most functions)

### 5. The View Tab

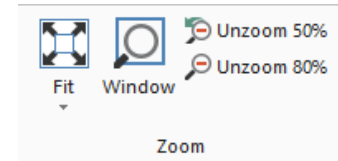
Provides access to many of the options to control the Mastercam layout.



### 6. Zoom Commands

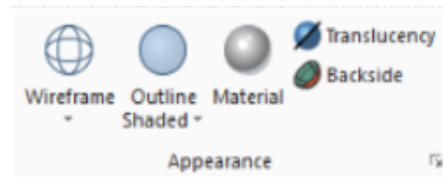
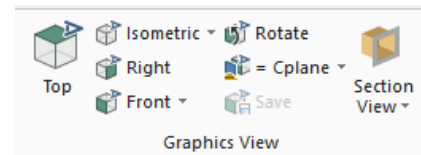
(Since these commands are used extensively, it may be useful to memorize the keyboard shortcut keys)

- ◆ **Fit (Alt+F1)**
- ◆ **Zoom Window(F1)**
- ◆ **Un-Zoom 80% (Alt+F2)**
- ◆ **Un-Zoom Previous / 50% (F2)**
- ◆ **Repaint (F3)**



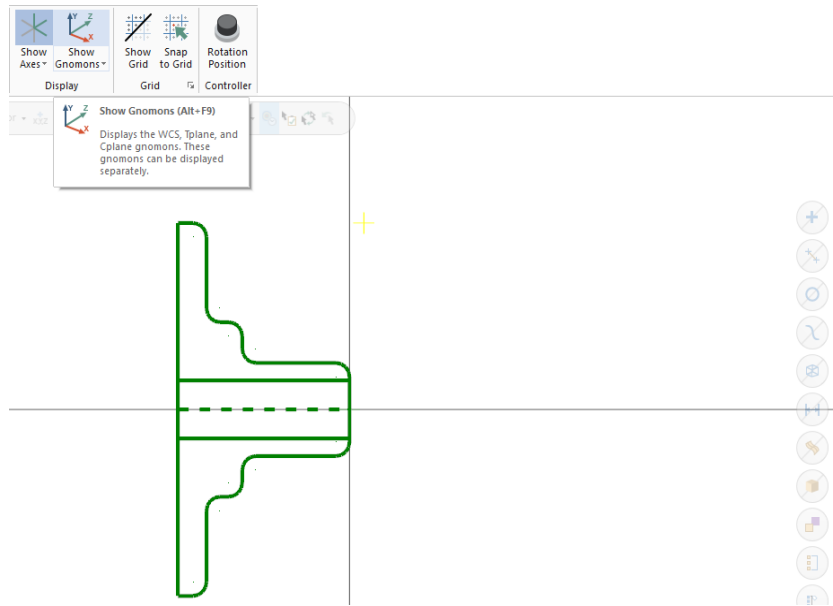
### 7. Graphic Views

- ◆ Standard View Choices RMB (Right Mouse Button options)
- ◆ Free Spin rotation with middle mouse button
- ◆ Zoom in and out with middle mouse wheel



### 8. Appearance

- ◆ Wireframe Choices
- ◆ Shaded Choices
- ◆ Appearance
- ◆ Stock Display options
- ◆ Shaded and Wireframe Display of Solid **Alt+S**

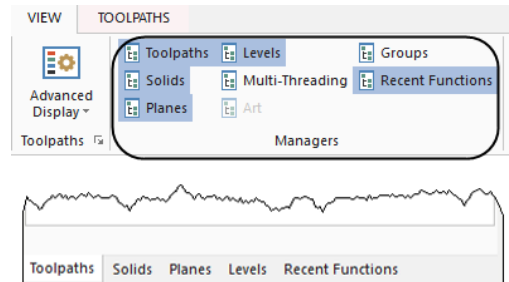


### 9. Axis and Gnomon Display

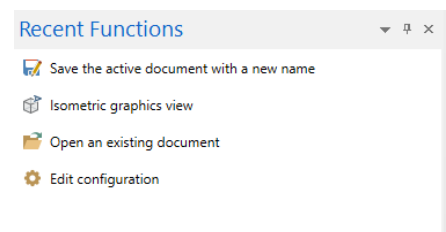
- ◆ F9
- ◆ Alt+F9

### 10. The Manager Panel

(Preview of the location and purpose only. Functions to be covered when needed.)

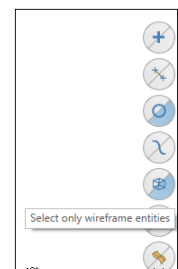


### 11. MRU (Most Recently Used) Panel Preview

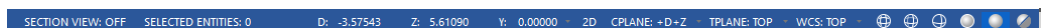


### 12. Quick Mask Preview

(Select all versus Select only)

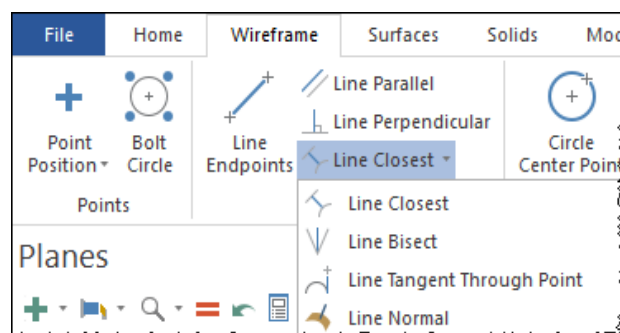


### 13. Status Bar



## 14. Wireframe Tab preview

(We will focus on Lines icons )

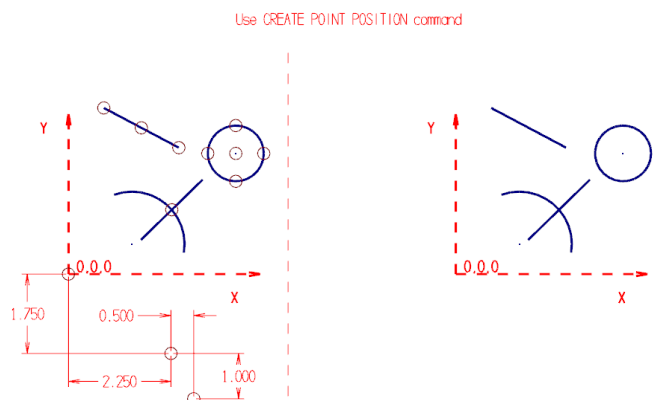


## POINT POSITION COMMAND

*Note: The following instructor led training exercises cover different basic geometry creation commands. The student has to complete the right side geometry based on the left side geometry and dimensions.*

Resources - Download the file from [www.EMASTERCAM.COM/TRAININGFILES/](http://www.EMASTERCAM.COM/TRAININGFILES/)

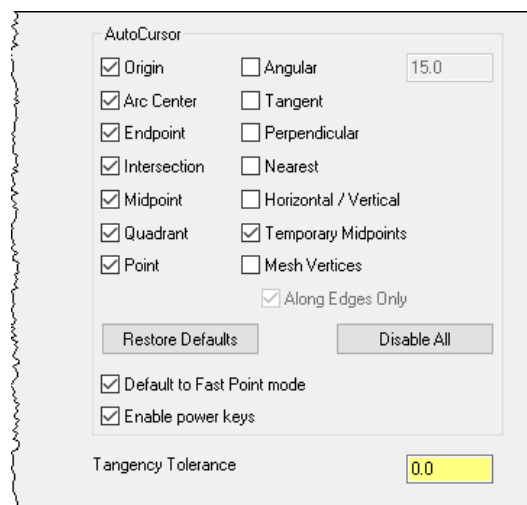
- ◆ From the **QAT**, select the **Open** icon.
- ◆ Select **CREATE\_POINT\_POS.MCAM**.



## 15. Set Auto Cursor in the Selection Bar

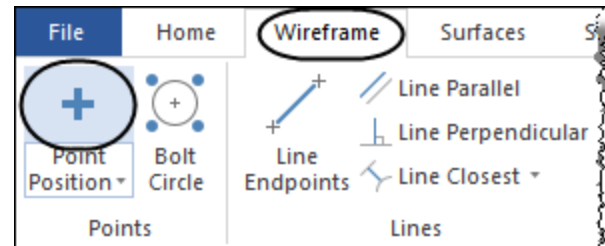
Instructor recommended settings:

- ◆ From the **General Selection Toolbar** select the **AutoCursor Configuration** icon.
- ◆ Set the settings as shown.



## 16. Point Position

*Note: Make sure that you are in the **Lathe +D+Z** plane. Create the points on the right side of the drawing to match the left side.*

**Wireframe**

- ◆ Select **Point Position**.

- ◆ Use the **AutoCursor** options to insert the points at the **Endpoint, Midpoint, Intersection, Quadrant, Origin** and **Center** locations. As Mastercam detects and snaps to the points, it displays a temporary square over the point and the corresponding cursor icon.

- ◆ Enter the coordinate values for the first point as shown.
- ◆ Press **Enter** from the keyboard to see the point created.

2.25,-1.75

- ◆ Enter the coordinate values for the second point as shown.
- ◆ Press **Enter** from the keyboard to see the point created.

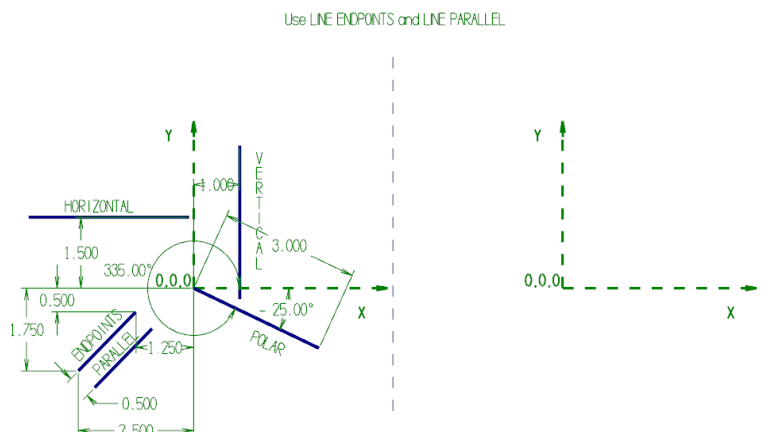
*Note: Mastercam can perform simple math operations such as addition, subtracting, multiplications and divisions. The instructor can also demonstrate how to change to Relative when entering the coordinates.*

2.25+0.5,-1.75-1.0

**LINE ENDPOINTS & PARALLEL COMMANDS**

Resources - Download the file from [www.EMASTERCAM.COM/TRAININGFILES/](http://www.EMASTERCAM.COM/TRAININGFILES/)

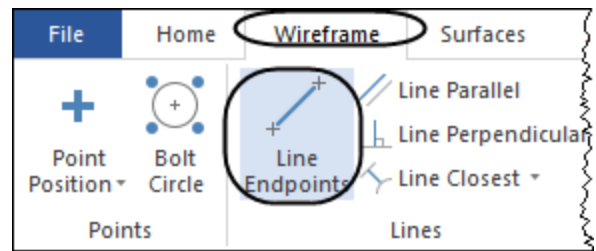
- ◆ From the **QAT**, select the **Open** icon.
- ◆ Select **CREATE LINES.MCAM**.



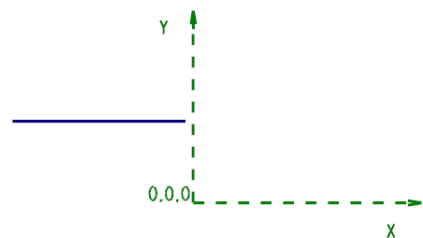
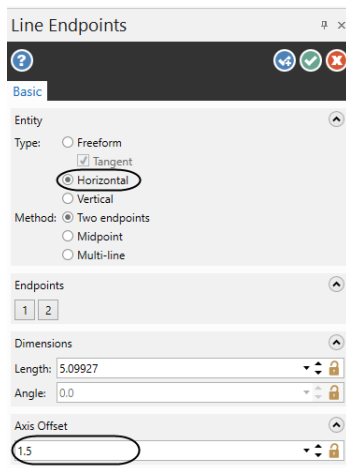
## 1. Line Endpoints

### Wireframe

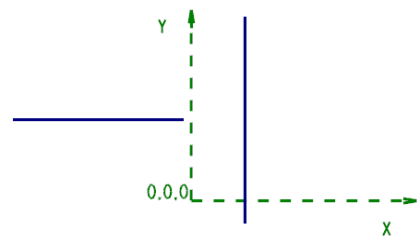
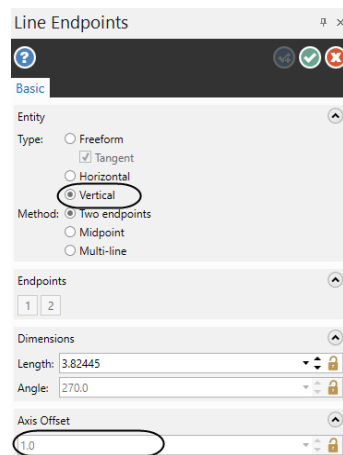
- ◆ Select **Line Endpoints**.



- ◆ Enable the **Horizontal** option in the **Line Endpoints** panel.
- ◆ Sketch the endpoints of the horizontal line approximately at the same location from the X and Y axes as per the left side drawing.
- ◆ In the **Axis Offset** box enter **1.5** as the **Y coordinate**.
- ◆ Press the **Enter** key to position the line.
- ◆ Press **Enter** again to finish the line or select the **OK and Create New Operation** button to continue in the same command.

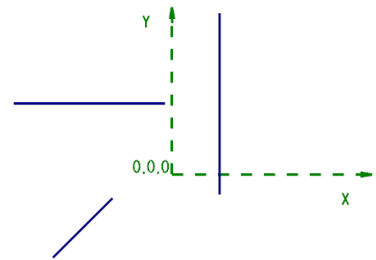
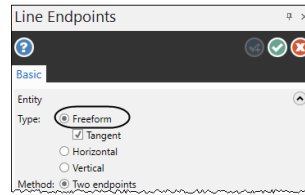
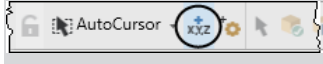


- ◆ Enable the **Vertical** option in the **Line Endpoints** panel.
- ◆ Sketch the endpoints of the vertical line approximately at the same location from the X and Y axes as per the left side drawing.
- ◆ In the **Axis Offset** box enter **1.0** as the **X coordinate**.
- ◆ Press the **Enter** key to position the line.
- ◆ Press **Enter** again to finish the line or select the **OK and Create New Operation** button to continue in the same command.



- ◆ Select the **Freeform** button in the **Line Endpoints** panel.
- ◆ Type the coordinate values for the first point **(-1.25,-0.5)** and press **Enter**.

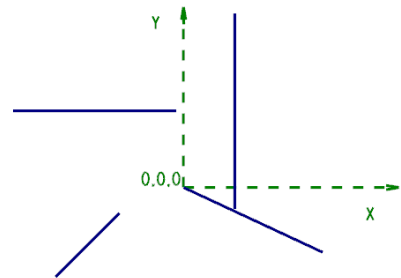
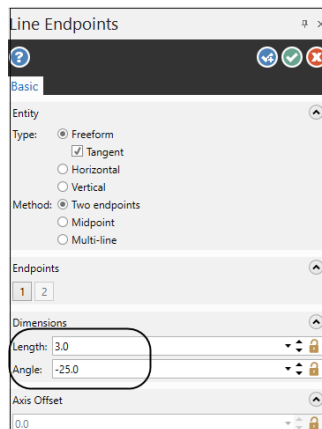
*Note: Select the **AutoCursor Fast Point** icon if needed to open the coordinates' field.*



- ◆ Type the coordinate values for the second point **(-2.5,-1.75)** and press **Enter**.
- ◆ Select the **OK** and **Create New Operation** button to continue in the same command.



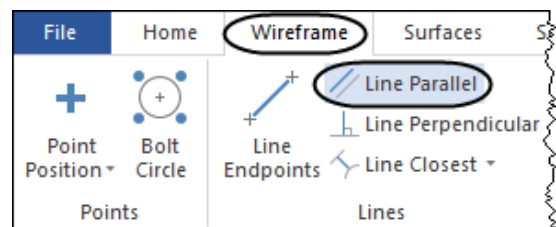
- ◆ In the **Line Endpoints** panel, input a **Length** of **3.0** and an **Angle** of **-25.0**.
- ◆ Pick the **Origin** (center of the **Grid**) as the first endpoint.
- ◆ Select the **OK** button to exit the command.



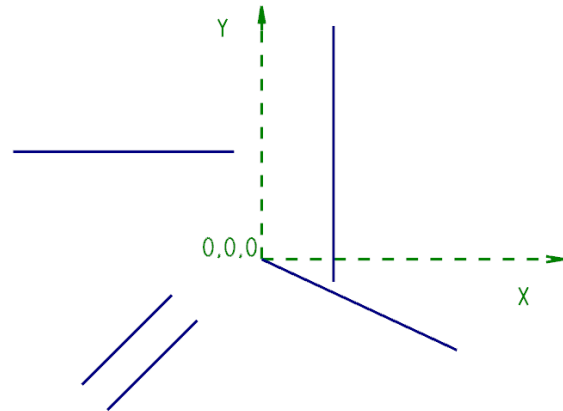
## 2. Line Parallel

### Wireframe

- ◆ Select **Line Endpoints**.



- ◆ Select the existing line and indicate the offset direction by clicking below the existing line
- ◆ In the **Line Parallel** panel, enter an **Offset Distance** of **0.5**. Press **Enter**.
- ◆ Select the **OK** button to exit the command.

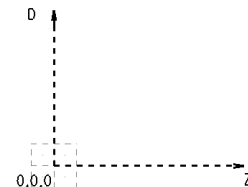
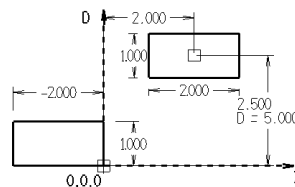


## RECTANGLE COMMANDS

Resources - Download the file from [www.EMASTERCAM.COM/TRAININGFILES/](http://www.EMASTERCAM.COM/TRAININGFILES/)

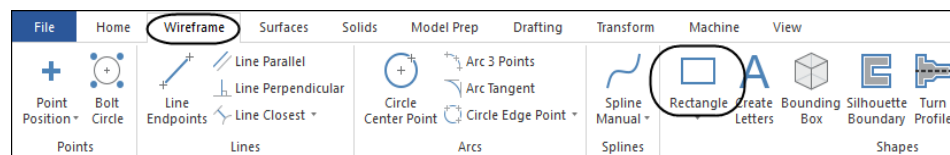
CREATE - RECTANGLE

- ◆ From the **QAT**, select the **Open** icon.
- ◆ Select **CREATE\_RECTANGLE.MCAM**.
- ◆ Ensure that you are in the **+D+Z** plane.



### 3. Rectangles

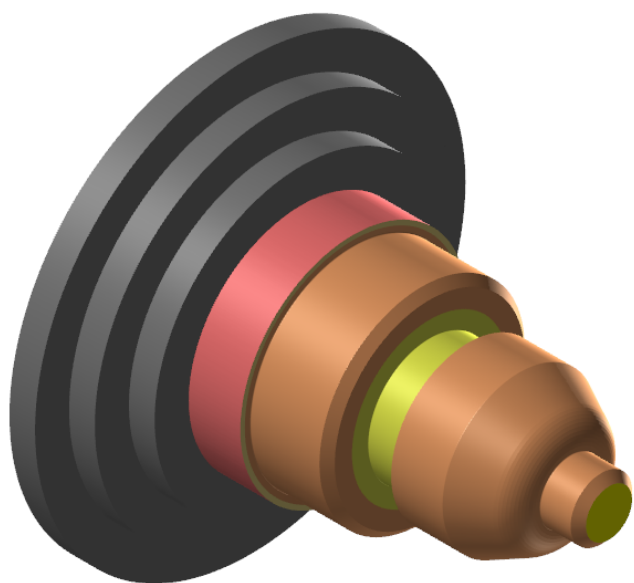
- ◆ From the **Shapes** group, select **Rectangle** icon as shown.



- ◆ Type the **Width** and the **Height** values, and make sure that you select the point placement that you know the coordinate values as per the drawing (0,0).
- ◆ Reselect the command to change the anchor to **Center** and press **Space** to enter the coordinates: (5,2.5).



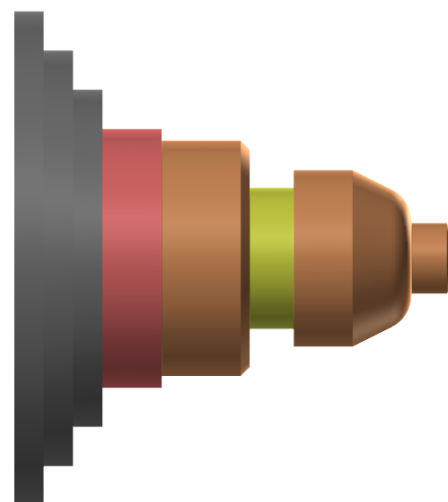
## Groove Toolpath



## NEW TOOLPATH INFORMATION

The following is brief description of the toolpath used in this exercise.

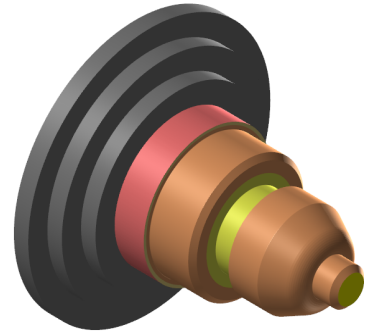
**Grooving** for machining indented or recessed areas that are not otherwise machinable by roughing toolpaths or tools. You can machine several grooves in a single operation, even if their geometry never connects. Mastercam integrates roughing and finishing passes, each with separate parameters, in a single operation.



## INSTRUCTOR DEMONSTRATION

### Topics:

- ◆ Locate Geometry and Job Setup
- ◆ Facing Operation
- ◆ Roughing Operation
- ◆ Finishing Operation
- ◆ Grooving Operation



### NOTES:

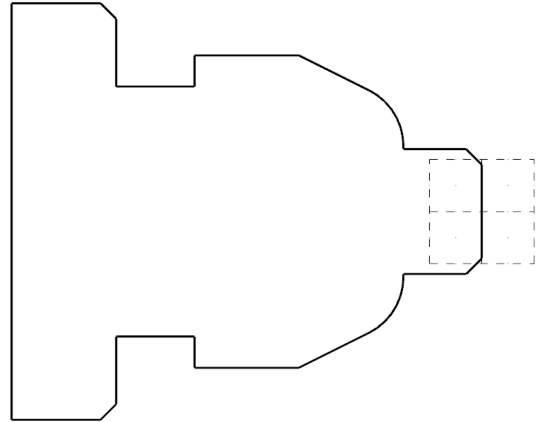
---

## EXERCISE: DRAWING #3

### STEP 1: OPEN PART GEOMETRY

#### 1.1 Open the file

- ◆ From the **QAT**, select the **Open** icon.
- ◆ Select **DRAWING 3.MCAM**.

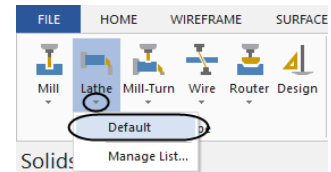


### STEP 2: CREATE THE JOB SETUP

In this step you will supply Mastercam with information about tool settings, stock size and chuck jaw before starting to create the toolpaths.

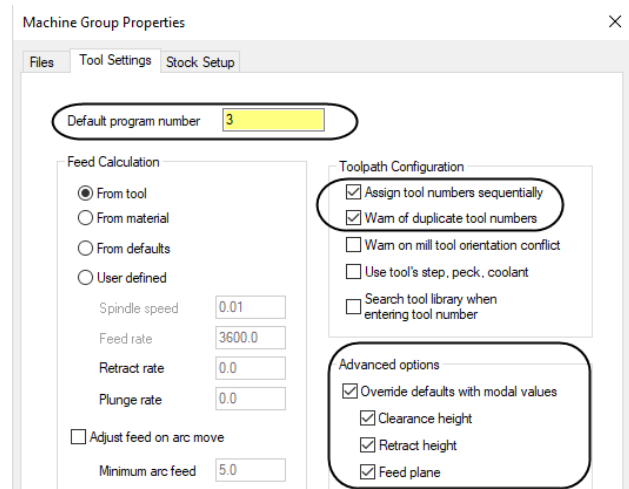
#### 2.1 Load the Lathe Default if needed

- ◆ From the **Machine** tab, select **Lathe** and **Default**.



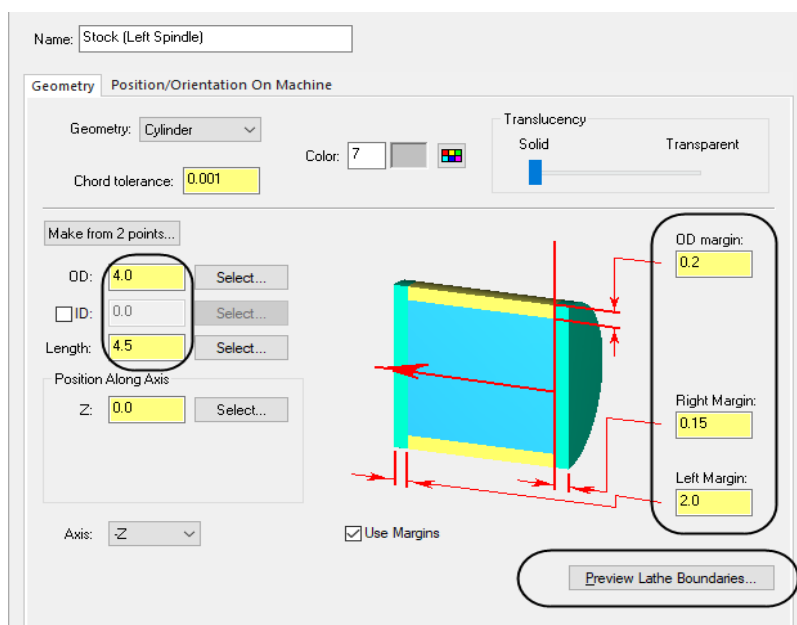
#### 2.2 Set the Tool settings

- ◆ Select the **Tool settings** icon.
- ◆ Set the **Program #** to **3**.
- ◆ Enable **Assign tool numbers sequentially**.
- ◆ Enable **Warn of duplicate tool numbers**.
- ◆ Enable **Feed Calculation From tool**.

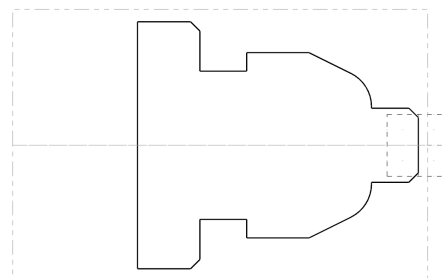


### 2.3 Set the Stock settings

- ◆ Set the **OD** to **4.0"**.
- ◆ Set the **ID** to **4.5"**.
- ◆ Establish the stock as a bar giving extra margins: **OD margin = 0.2"**; **Right margin = 0.15"**.
- ◆ **Left margin = 2.0"**.
- ◆ Select the **Preview Lathe Boundaries** button to check the stock.
- ◆ Press **Enter** to continue.

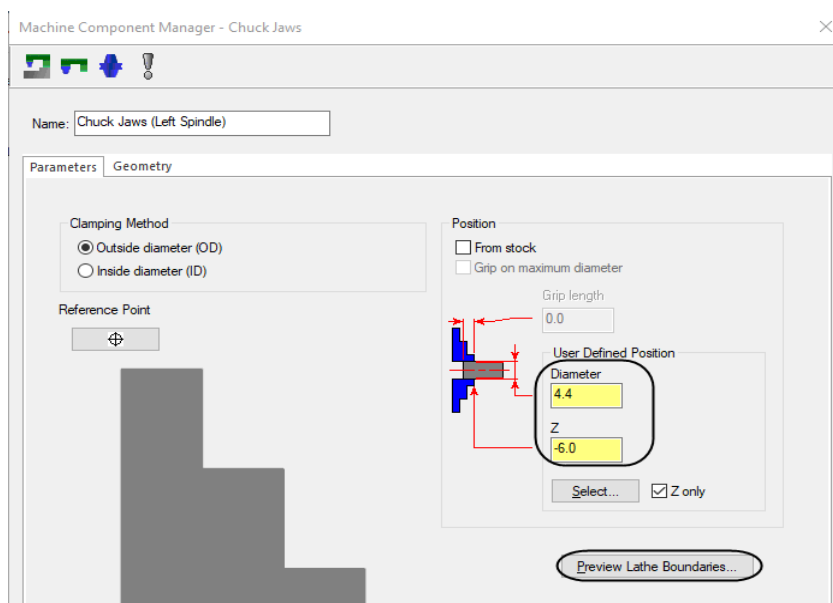


- ◆ Press **Enter** to continue.

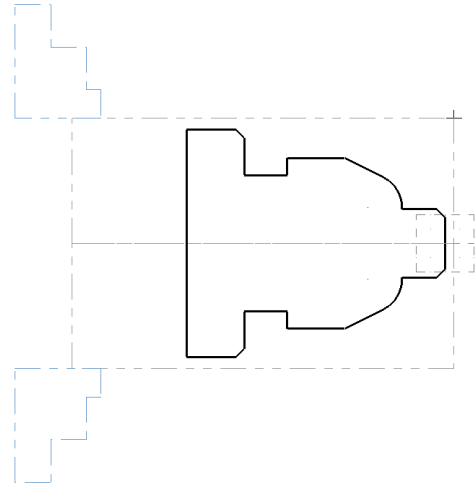


### 2.4 Set the Chuck Jaws settings

- ◆ **Clamping Method** set to **Outside diameter (OD)**.
- ◆ Set the chuck **Position** to **Diameter = 4.4"**; **Z = -6.0"**.
- ◆ Select the **Preview Lathe Boundaries** button to check the chuck.



- ◆ Press **Enter** to continue.



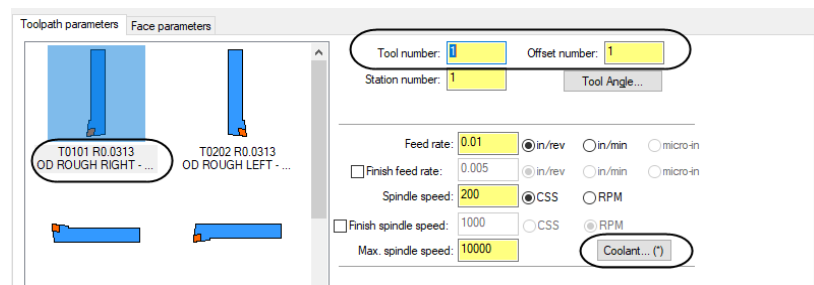
### STEP 3: LATHE FACE TOOLPATH

#### Turning

- ◆ From the **General** group, select the **Face** icon.

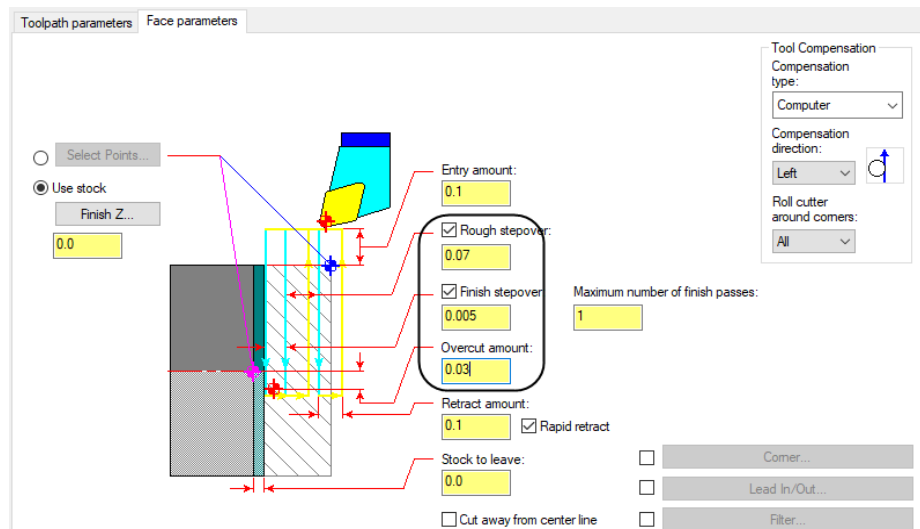
##### 3.1 Set the Toolpath Parameters

- ◆ Select a **OD Rough Right 80 deg** tool.
- ◆ Set the **Tool/Offset Number** to **1**.
- ◆ Set the **Coolant On**.



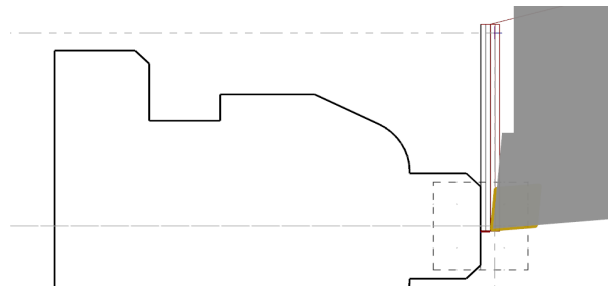
##### 3.2 Set the Face Parameters

- ◆ Make sure that **Use stock** is enabled.
- ◆ **Finish Z = 0.0"**.
- ◆ **Entry amount = 0.1"**.
- ◆ **Rough stepover = 0.07"**.
- ◆ **Finish stepover = 0.005"**.
- ◆ **Overcut amount = 0.03"**.
- ◆ **Retract amount = 0.1"**.
- ◆ **Stock to leave = 0.0"**.
- ◆ Set the **Cutter compensation** to **Computer** and to the **Left**.



### 3.3 Backplot the Face operation

- ◆ Press Alt +T to remove the toolpath display.




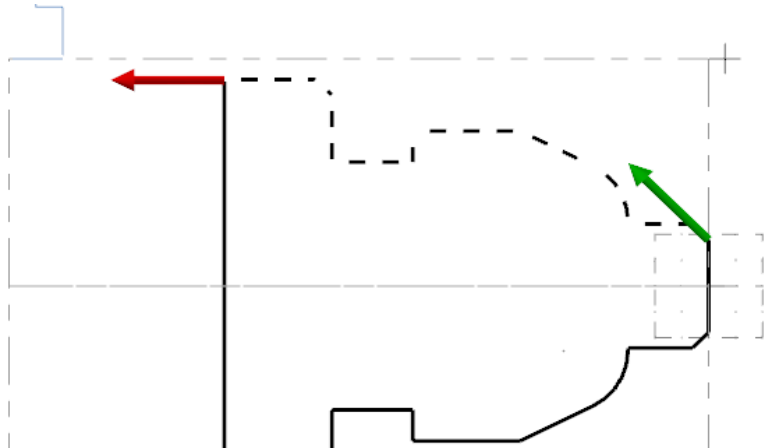
## STEP 4: LATHE ROUGH TOOLPATH

### Turning

- ◆ From the **General** group, select the **Rough** icon.

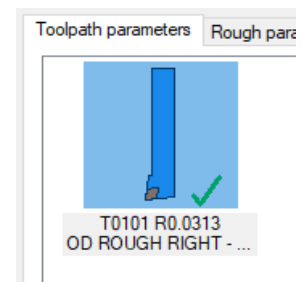
#### 4.1 Select the geometry

- ◆ In the Selection Method, enable Partial button  and select the first entity of the chain and the last one to complete the chaining.



#### 4.2 Set the Toolpath Parameters

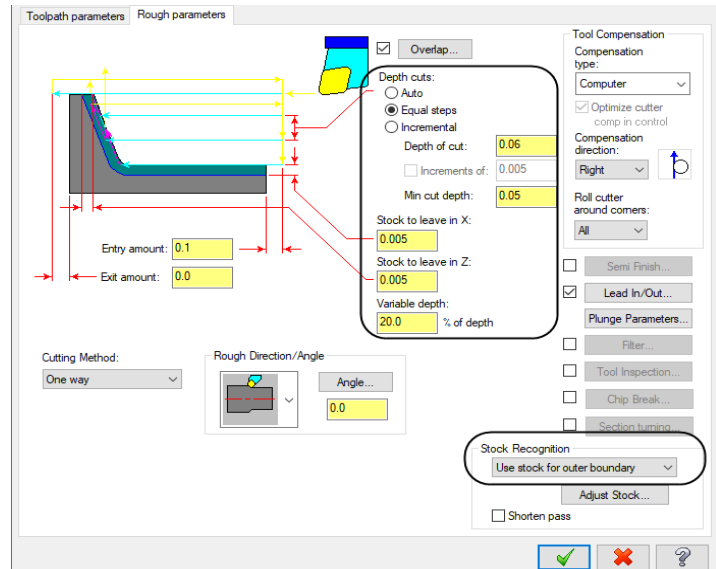
- ◆ Select an existing **OD Rough Right 80 deg** tool.
- ◆ Set the **Tool/Offset Number** to 1.
- ◆ Set the **Coolant On**.



### 4.3 Set the Rough Parameters

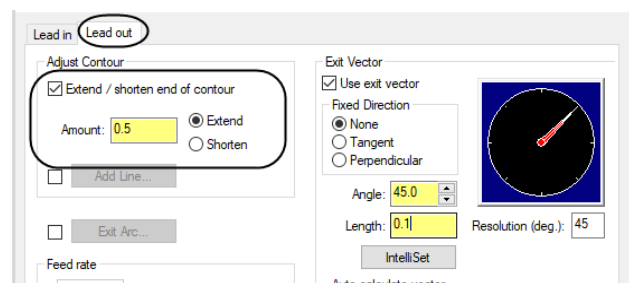
- ◆ Make sure that **Overlap** is enabled.
- ◆ **Entry amount** = 0.1".
- ◆ Enable **Equal steps**.
- ◆ **Depth of cut** = 0.06".
- ◆ **Minimum cut depth** = 0.05".
- ◆ **Stock to leave in X** = 0.005".
- ◆ **Stock to leave in Z** = 0.005".
- ◆ **Variable depth** = 20% of depth.
- ◆ Enable **Use stock for outer boundary**.

**Note:** *Variable depth* allows you to vary the point that the surface contacts the tool insert to prevent notching and improve tool life. The variable depth can vary up to 25% of the depth of cut. The actual depth of cut can vary from 75% to 125% of the nominal depth of cut. The valid range is -25% to 25%. A positive value will result in an upward cut and a negative value will result in a downward cut. Zero will result in a straight cut.



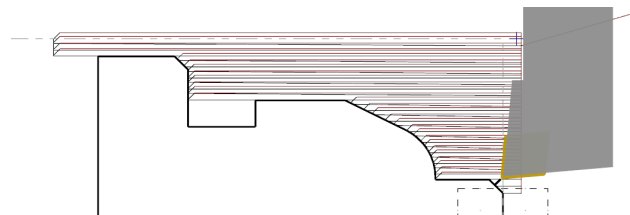
- ◆ **Cutting method** set to **One-way** and the **Rough Direction/Angle** = 0.
- ◆ Set the **Cutter compensation** to **Computer** and to the **Right**.

- ◆ Set proper **Lead In/out** parameters.
- ◆ **Extend** the end contour 0.5".



### 4.4 Backplot the Rough operation

**Note:** The tool does not attempt to cut inside of the groove. This is a result of the **Plunge** parameters being set to none in the **Rough** parameters page.



- ◆ Pres **Alt + T** to remove the toolpath display.




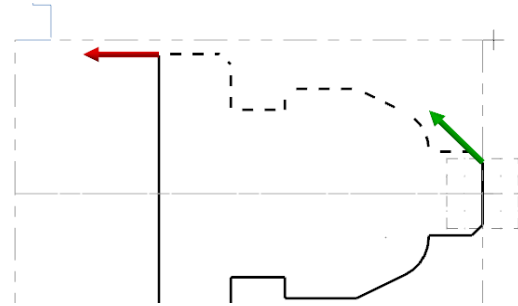
## STEP 5: LATHE FINISH TOOLPATH

### Turning

- ◆ From the **General** group, select the **Finish** icon.

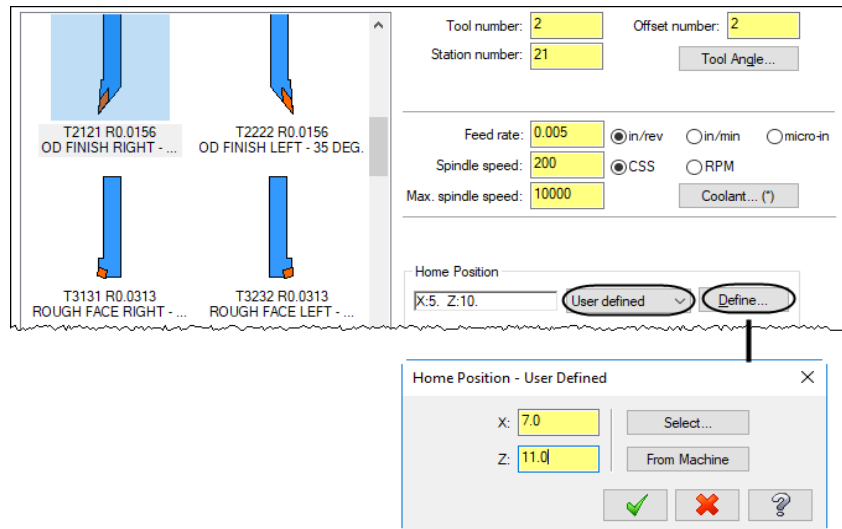
#### 5.1 Select the geometry

- ◆ In the Wireframe Chaining dialog box, click on the **Last** button . Mastercam selects the same chain as the one selected in the previous operation.



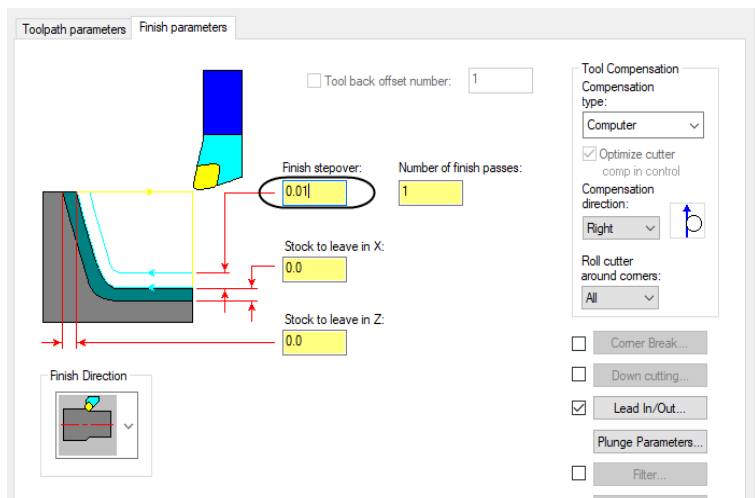
#### 5.2 Set the Toolpath Parameters

- ◆ Select a **OD Finish Right 35 deg** tool.
- ◆ Set the **Tool/Offset Number** to **2**.
- ◆ Set the **Coolant** **On**.
- ◆ Set the **Home Position** as **User define; X 7.0, Z 11.0**.



#### 5.3 Set the Finish Parameters

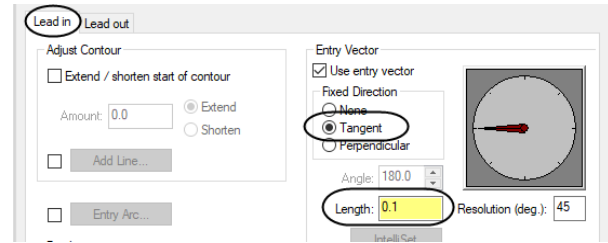
- ◆ **Finish stepover** = **0.01"**.
- ◆ **Number of finish passes** = **1**.
- ◆ **Stock to leave in X** = **0.0"**.
- ◆ **Stock to leave in Z** = **0.0"**.
- ◆ **Finish direction** set to **OD**.
- ◆ Set the **Cutter compensation** to **Computer** and to the **Right**.



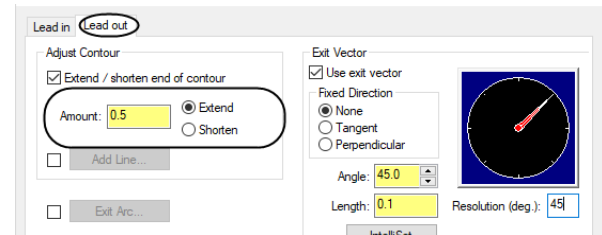
- ◆ Set proper **Lead In/Out** parameters.
- ◆ Use for **Lead In** only **Tangent entry; Length = 0.1"**.

**Note:** This ensures that the entry will be extended with the length to better machine the chamfer.

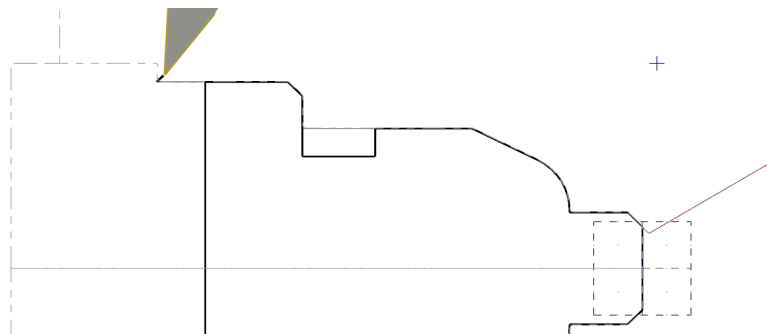
- ◆ **Extend** the end contour **0.5"**.
- ◆ Set proper **Lead In/Out** parameters; Use for **Lead In** only **Tangent entry; Length = 0.1"**.



- ◆ **Extend** the end contour **0.5"**.



#### 5.4 Backplot the Finish operation



## STEP 6: LATHE GROOVE TOOLPATH

**Lathe Groove** toolpaths are useful for machining indented or recessed areas that are not otherwise machinable by roughing toolpaths or tools.

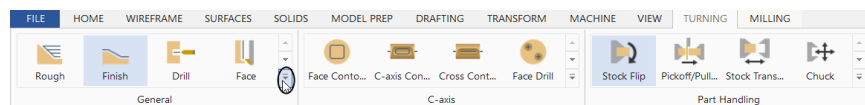
Mastercam can machine many types of grooves based on the location of just a corner point or points; this lets you create groove toolpaths without having to create or chain geometry.

You can also use chained geometry if you prefer, or to specify complicated or intricate groove contours.

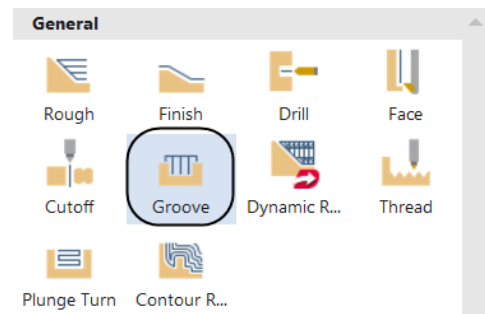
### 6.1 Select the toolpath

#### Turning

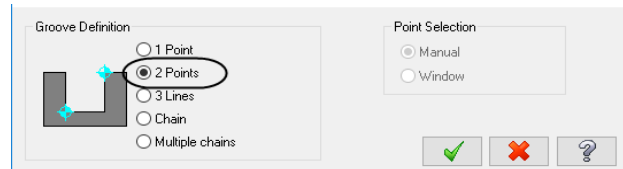
- ◆ From the **General** group, select the **Expand gallery** arrow as shown.



- ◆ From the **Toolpath gallery**, click on the **Groove** icon as shown.

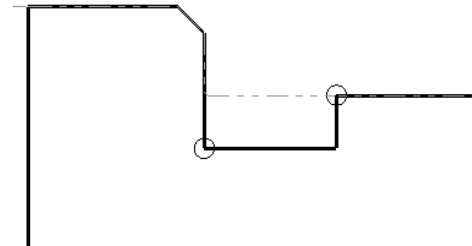


- ◆ Select **2 Points** in the **Groove Definition**.



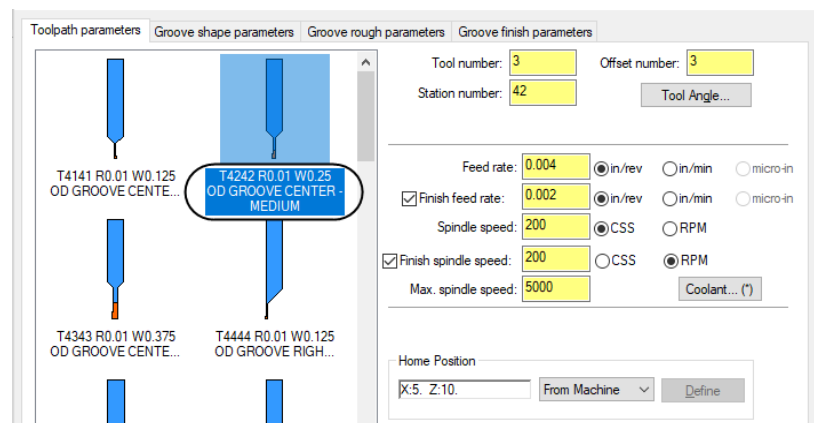
**Note:** The first point should be the upper right corner of the groove and the second point should be the lower left corner.

- ◆ Select the points as shown.
- ◆ Press **Enter** when finish.



## 6.2 Set the Toolpath Parameters

- ◆ Select a **OD Groove Center width** of **0.25"**.
- ◆ Set the **Tool/Offset Number** to **3**.
- ◆ Set the **Coolant On**.



The background of the entire page is a high-contrast, close-up photograph of a CNC lathe. A polished metal workpiece is being machined by a tool, with bright sparks and reflections visible. The top of the image is a dark grey banner containing the 'In-House Solutions' logo and the 'Mastercam 2020' text.

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## Mastercam for SOLIDWORKS

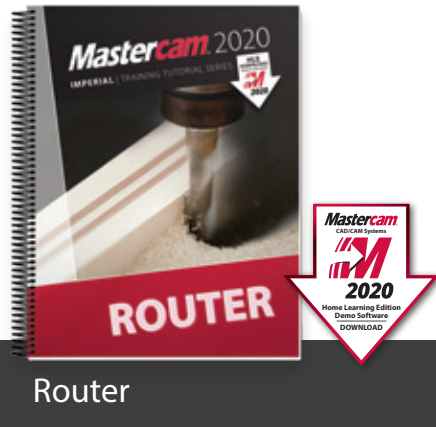
The Mastercam 2020 for SOLIDWORKS Programming Exercises book provides a comprehensive "hands on" method of learning Mastercam for SOLIDWORKS. You will learn how to program a variety of different parts that require most of the toolpath types available in Mastercam for SOLIDWORKS. Extensive emphasis is put on making parametric changes and toolpath updates to match the SOLIDWORKS model changes. Primary focus is on toolpath creation on SOLIDWORKS models.

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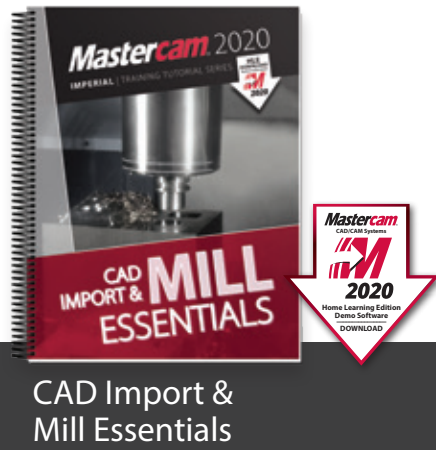
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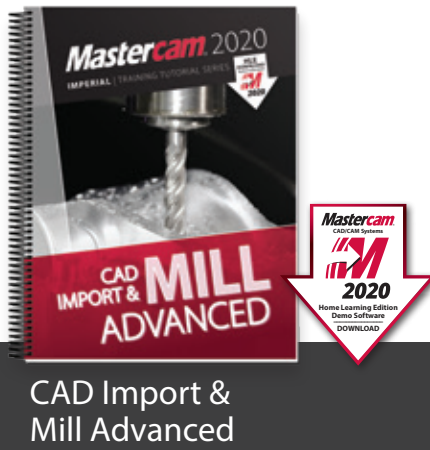
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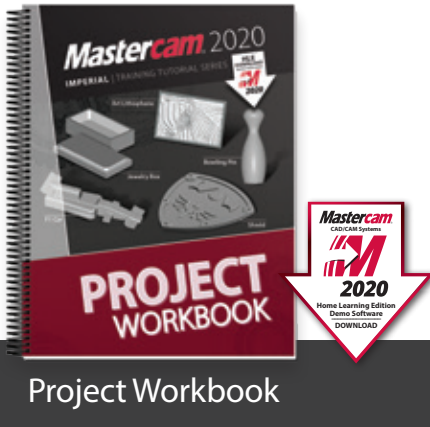
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## Project Workbook

The Mastercam 2020 Project Workbook is ideal for High School students, hobbyists and those who prefer engaging in project-based learning. The Workbook includes an overview of CAD/CAM and basic machining followed by a series of step-by-step projects for both mills and lathes. *Note: no machining instructions included.*

- Five projects included: Art Lithophane, Bowling Pin, Shield, F1 Car, and Jewelry Box
- Includes Mastercam HLE Demo Software

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## Nesting eBook

This tutorial includes a variety of projects that are using Nesting options in Mastercam to fit parts onto a sheet of material for best yield.

You will learn how Nesting operates on geometry and how you can create and use tabs to assist in holding down the nested parts. You will also learn how Nesting operates on toolpaths and how you can use WCS (Work Coordinate System) to set the parts of an assembly in the proper view for machining.

**Price \$35 (eBook only)**

ISBN: 978-1-77146-885-5

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# INSTRUCTOR KITS

These are the ultimate toolkits for instructors looking to enhance their 2D mill, 3D mill and lathe classes while minimizing prep time. Each kit contains tests, quizzes, mid-terms, finals, powerpoint presentations, lesson plans, answer sheets, and more.



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## MASTERCAM PROFESSIONAL CERTIFICATION CURRICULUM

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.



Part 1 –  
Mill 2D

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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# HANDBOOKS

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 Mill 2D & Solids

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.

**Price \$90 (eBook)**

ISBN: 978-1-77146-893-0

**Price \$98 (Print)**

ISBN: 978-1-77146-855-8



## Handbook Volume 2 3D Modeling & Machining

The Mastercam 2020 Handbook Volume 2 takes an academic approach to teaching Mastercam 3D modeling and machining. The material is most suitable for intermediates (including individuals that have completed Volume 1). The book teaches more advanced CAD modeling techniques and explains surface creation.

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## Handbook Volume 3 Multiaxis & Machining

The Mastercam 2020 Handbook Volume 3 is an excellent resource that teaches the theory of multiaxis machining with Mastercam. This book covers the classic family of multiaxis toolpaths including drill 5-axis, curve 5-axis, swarf 5-axis, multiaxis flowline and multiaxis multi-surfaces as well as the drill & circle mill family.

**Price \$90 (eBook)**

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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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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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eMastercam is one of the largest and oldest online forums for swapping knowledge of CNC machines, tools, manufacturing processes and technology. After hours, eMastercam continues to be a place for Machinists, Engineers and others in the manufacturing industry to connect, share stories, opinions and get to know each other beyond the parts we make and the tools we use.

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