

Mastercam 2019

METRIC – TRAINING TUTORIAL SERIES



Demo Software Download Instructions Included

MILL ADVANCED

Mastercam 2019

MILL ADVANCED METRIC TRAINING TUTORIAL

Mastercam 2019 Mill Advanced Metric Training Tutorial

Copyright: 1998 - 2019 In-House Solutions Inc. All rights reserved

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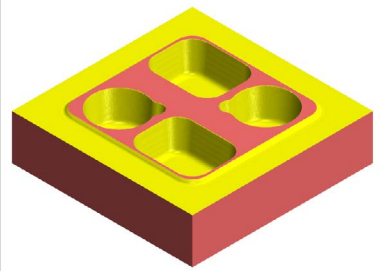
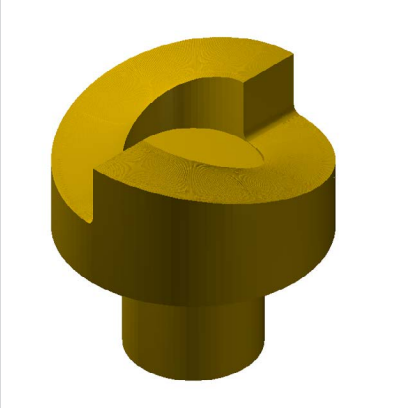
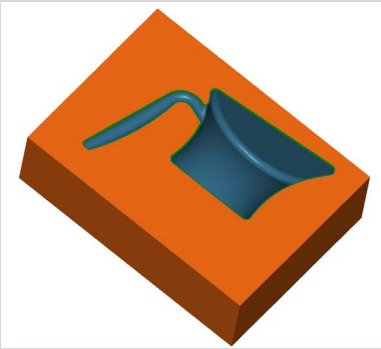
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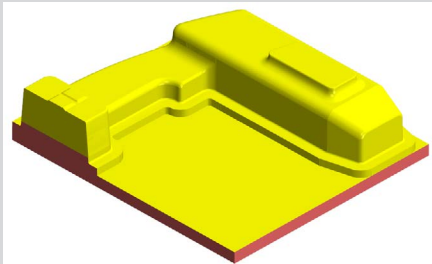
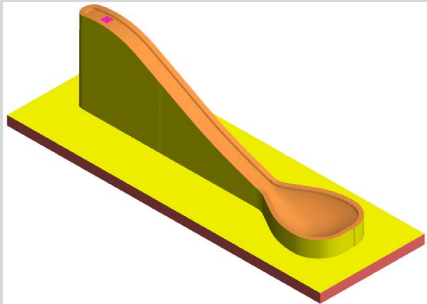
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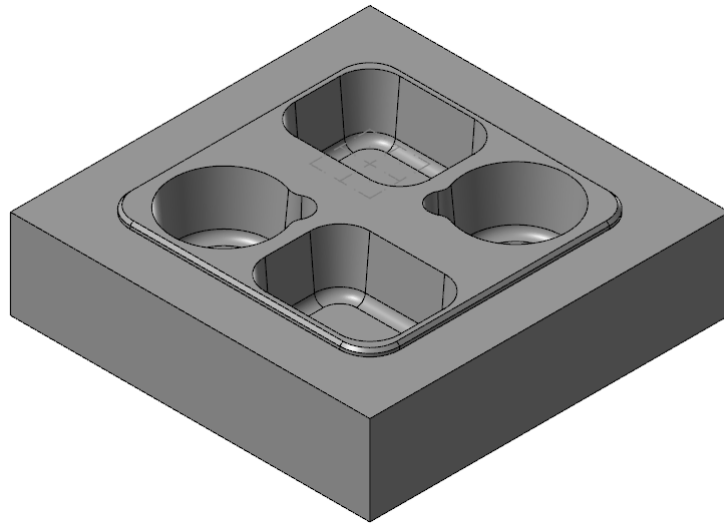
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Mill Advanced Projects

Tutorial	Geometry Functions	Toolpath Creation
<p>#1</p> 	<p>Solid Extrude Create Body Solid Extrude Cut Body Solid Fillet Solid Chamfer</p>	<p>High Speed Area Roughing High Speed Horizontal High Speed Waterline</p>
<p>#2</p> 	<p>Swept Surface Solid Extrude Solid Trim To Surface Solid Boolean Add Use Levels.</p>	<p>High Speed Surface Area Roughing Rest Material High Speed Surface Radial Surface Finish Blend Transform - Rotate By Coordinate</p>
<p>#3</p> 	<p>Wireframe for Solid Solid Extrude Solid Revolved Swept Surface Solid Trim to face Solid Fillet Solid Draft Face Boolean Remove Boolean Add</p>	<p>High Speed Surface Dynamic OptiRough High Speed Surface Dynamic OptiRough with Rest Material High Speed Surface Hybrid Edit Projection.</p>

Tutorial	Geometry Functions	Toolpath Creation
#4 	Revolved Surface Project Curve Onto Surface Ruled/Draft Surface Curve At Intersection Trim Surface To Curves Surface Fillet Fillet Blend Surface	High Speed Surface Area Roughing High Speed Surface Spiral High Speed Surface Scallop Transform- Rotate High Speed Surface Waterline
#5 	Solid Extrude Solid Draft to Face Solid Constant Radius Fillet Solid Shell Curves All Edges Solid Impression	2D High Speed Dynamic Surface High Speed OptiRough Surface High Speed Hybrid Surface High Speed Pencil 2D High Speed Contour Dynamic
#6 	Net Surface Loft Surface Flat Boundary Surface	2D High Speed Dynamic Surface High Speed OptiRough Surface High Speed Scallop Surface High Speed Pencil Surface High Speed Project

Tutorial 1: Geometry Creation



OVERVIEW OF STEPS TAKEN TO CREATE THE PART GEOMETRY:

From Drawing to CAD Model:

- ◆ The student should examine the drawing on the following page to understand what part is being created in the tutorial.
- ◆ From the drawing we can decide how to create the geometry in Mastercam.

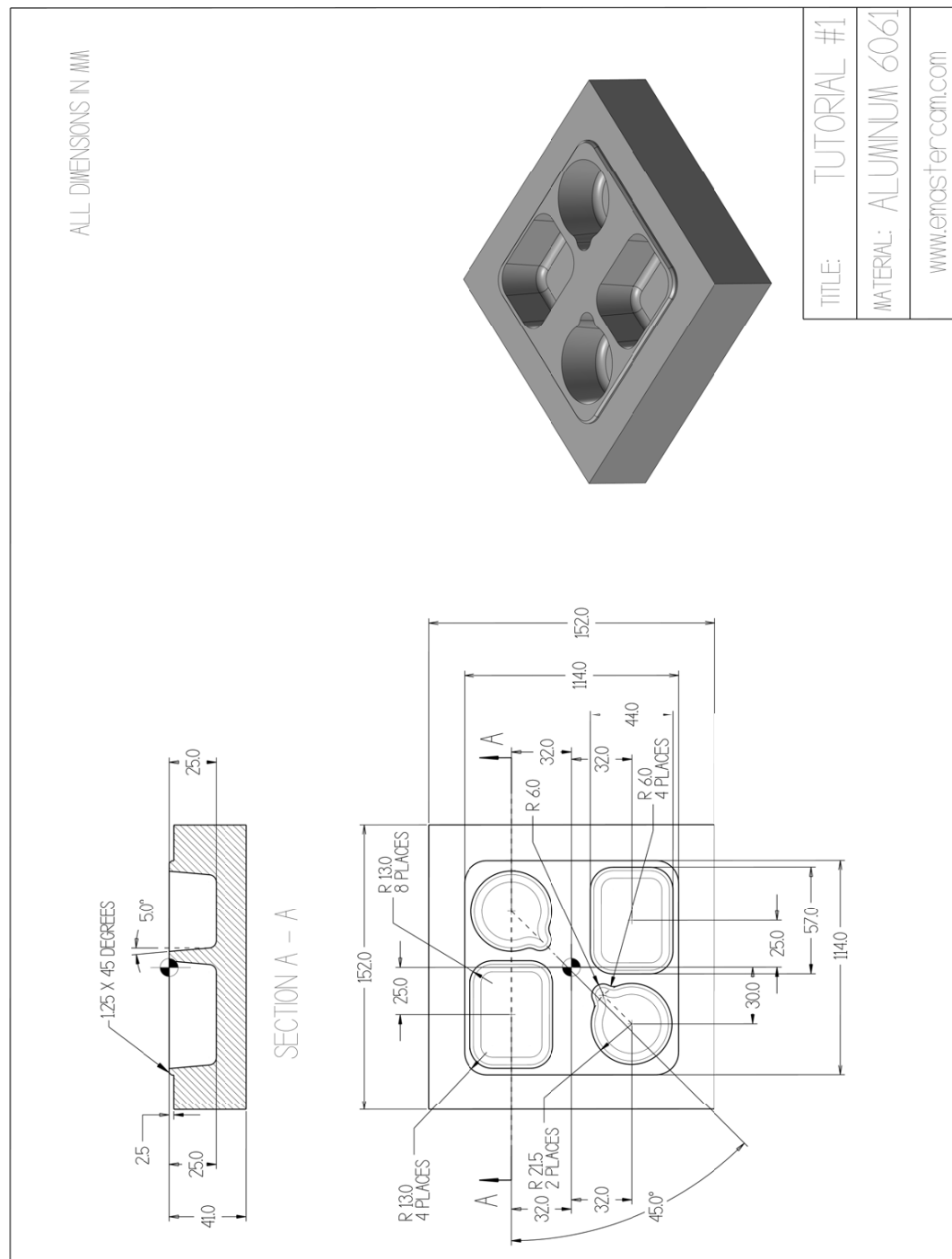
Create the 2D CAD Model:

- ◆ The student will create the wireframe needed to create the solid.
- ◆ Geometry creation commands such as Extrude Create Body, Extrude Cut Body, Fillet and Chamfer will be used.



This tutorial takes approximately sixty minutes to complete.

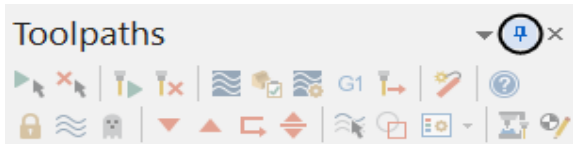
TUTORIAL #1 DRAWING



STEP 1: SETTING UP THE GRAPHICAL USER INTERFACE

Please refer to the Getting Started section for more info on how to set up the graphical user interface. In this step, you will learn how to hide the manager panels to gain more space in the graphics window.

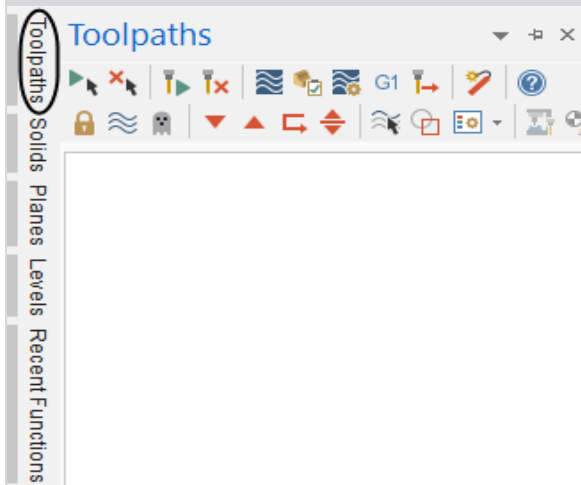
- ◆ Use **Auto Hide** icon to hide all **Manager** panels.



- ◆ The panels will be hidden to the left of the graphics window as shown.



Note: To un-hide them temporarily, you can click on one of the Managers to open it as shown.

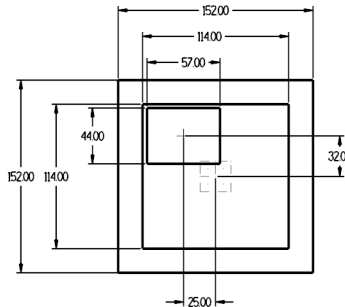


While creating the geometry, keep the Manager panels hidden. This ensures more space in the graphics window for the geometry.

STEP 2: CREATE RECTANGLES

In this step you will learn how to create rectangles given the width, the height, and the anchor position.

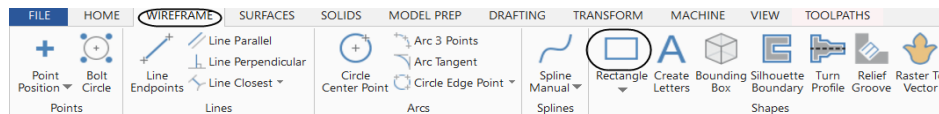
Step Preview:



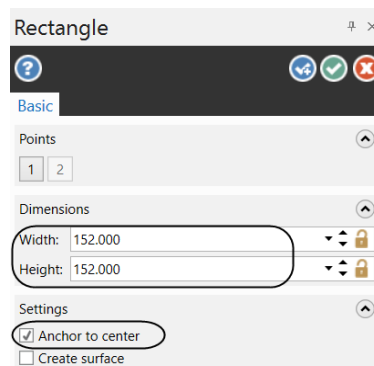
2.1 Create the 152.0mm by 152.0mm rectangle

WIREFRAME

- ◆ From the **Shapes** group, select **Rectangle**.



- ◆ In the **Rectangle** panel, enter the **Width** and **Height** and enable **Anchor to center** as shown.



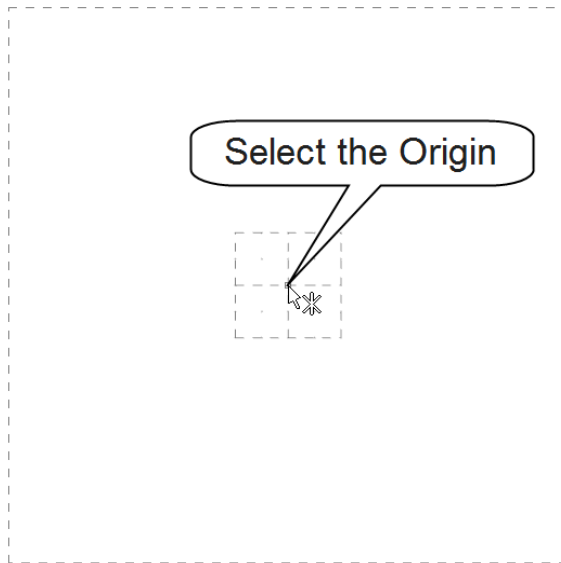
*Note: **Anchor to center** sets the base point of the rectangle to its center and draws the rectangle outward from the center.*

***Create surface** creates a surface inside of the rectangle. Surface creation and Surface toolpath are covered in Mill Advanced. A surface can be described as the skin on the top of a 3D wireframe. If the **Create surface** option is on, in addition to the four lines of the rectangle, you will also see extra lines which represent the surface display while it is not shaded.*

- ◆ Press Enter after typing the values to see a preview of the rectangle.



- ◆ [Select position of base point]: Select the Origin as shown in [Figure: 2.1.1](#).

Figure: 2.1.1



- ◆ Make sure that when selecting the origin, the visual cue of the cursor changes as shown.
- ◆ Select the **OK and Create New Operation** button to stay in the same command.
- ◆ To fit the drawing to the screen, press **Alt + F1**.

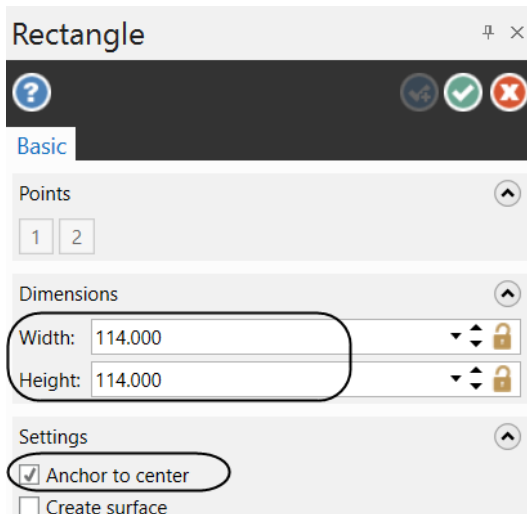


*Note: While creating geometry for this tutorial, if you make a mistake, you can undo the last step using the **Undo** icon.  You can undo as many steps as needed. If you delete or undo a step by mistake, just use the **Redo** icon.  To delete unwanted geometry, select the geometry first and then press **Delete** from the keyboard. To zoom or un-zoom, move the cursor in the center of the geometry and scroll up or down the mouse wheel.*

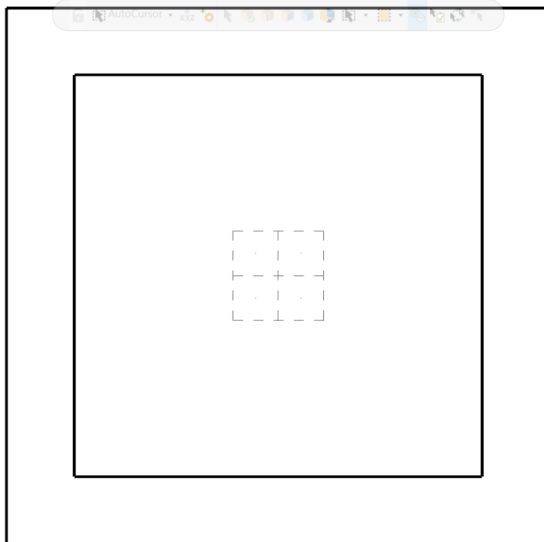
- ◆ To zoom in and out, hover the cursor approximately above the center of the part and scroll up and down the mouse wheel.

2.2 Create the 114mm by 114mm rectangle

- ◆ Enter the **Width**, the **Height** and leave **Anchor to center** enabled as shown.



- ◆ Make sure that the **Create surface** button is not selected.
- ◆ [Select position of base point]: Select the **Origin** as shown in [Figure: 2.1.1](#)
- ◆ The drawing should look as shown below.

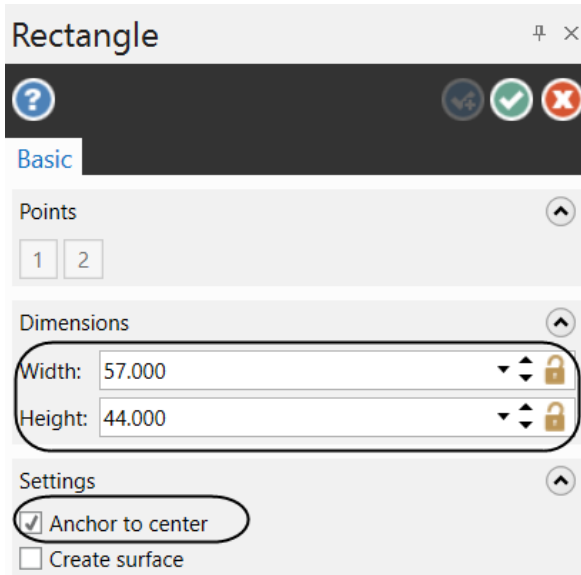


- ◆ Select the **OK** and **Create New Operation** button to stay in the same command.



2.3 Create the 57mm by 44mm rectangle

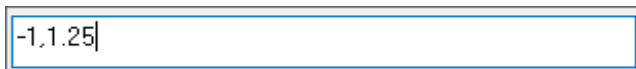
- ◆ Enter the **Width** and the **Height** as shown.



- ◆ Press **Enter**.
- ◆ Press **Space bar** or click on the **AutoCursor Fast Point** icon from the **General Selection** toolbar.



- ◆ Enter the coordinates for the **Rectangle** as shown.

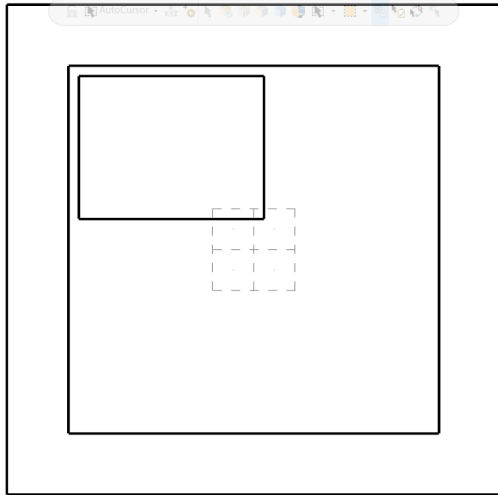


Note: When you enter the coordinates of a point in Mastercam, the first value is the X coordinate value followed by comma. The second value is the Y coordinate value followed by comma and the third value is the Z coordinate value. If you enter the values in this order you do not need to enter the coordinates labels (X, Y or Z) in front of the values.

- ◆ Press **Enter**.
- ◆ Select the **OK** button to exit the **Rectangle** command.



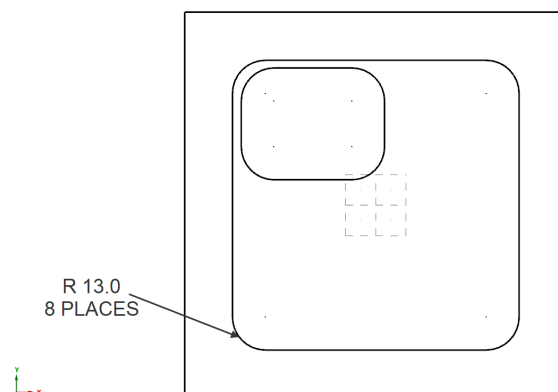
- ◆ The geometry should appear as shown.



STEP 3: CREATE FILLETS FOR TWO OF THE RECTANGLES

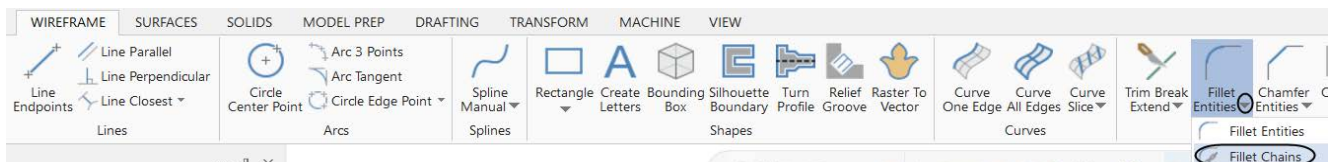
In this step you will learn how to create fillets to all corners of the inside rectangle using the Fillet chain command.

Step Preview:

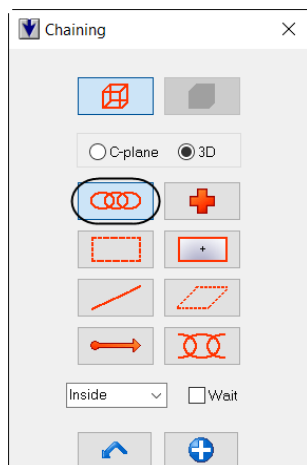


WIREFRAME

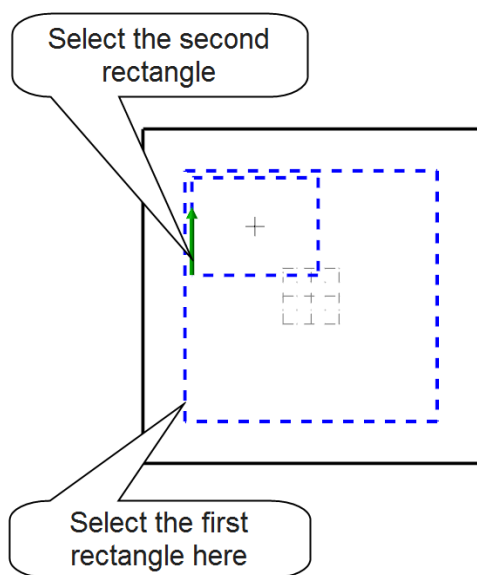
- ◆ From the **Modify** area, select the drop down arrow next to **Fillet Entities** and select **Fillet Chains** as shown.



- ◆ Make sure that in the **Chaining** dialog box, the **Chain** button is enabled as shown.



- ◆ [Select chain 1]: Select the rectangle as shown.

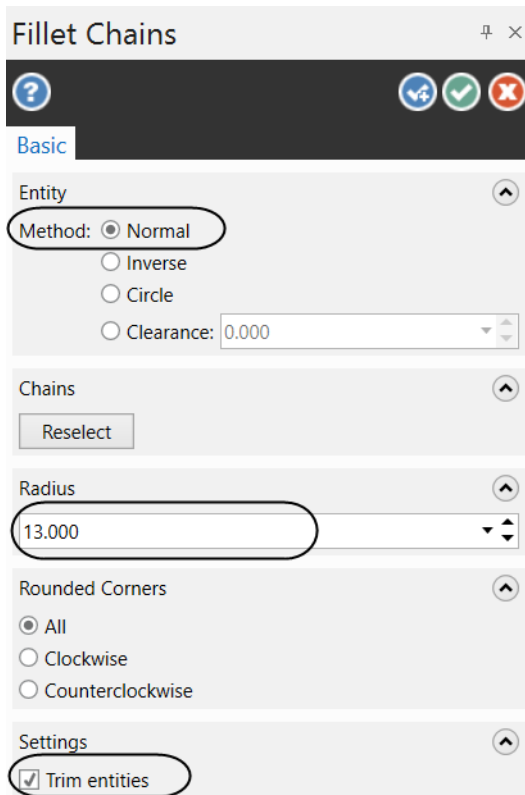


- ◆ Select the **OK** button to exit the **Chaining** dialog box.

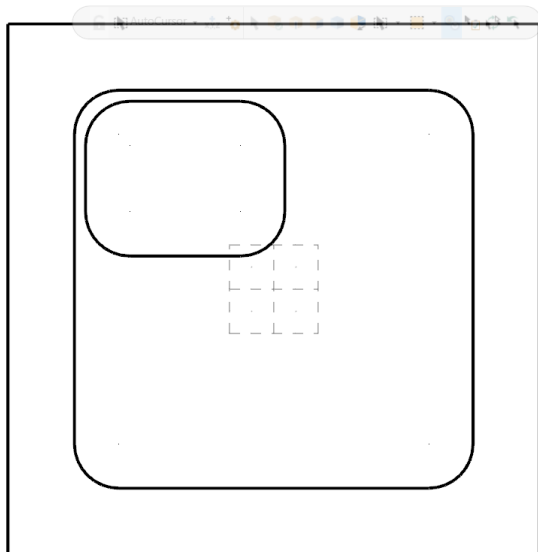


Note: Mastercam will automatically insert fillets at all four corners with the radius set as the default value or the last value that was used in the current Mastercam session. The value can then be changed as shown.

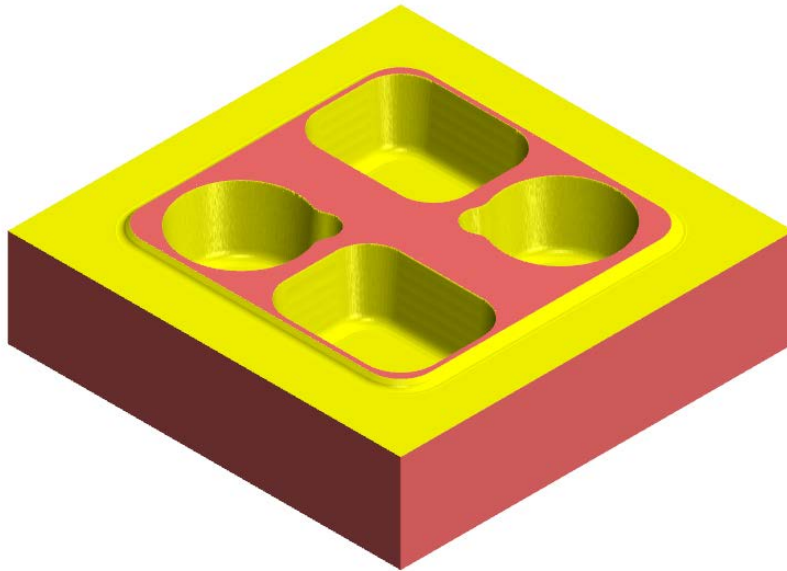
- ◆ Change the **Radius** to **13mm** and make sure the rest of the parameters are set as shown (press **Enter**).



- ◆ Select the **OK** button to exit the command.
- ◆ The geometry should look as shown.



Tutorial 1: Toolpath Creation



OVERVIEW OF STEPS TAKEN TO CREATE THE FINAL PART:

Create the necessary Toolpaths to machine the part:

- ◆ The student will set up the stock size to be used and the clamping method used.
- ◆ A Surface High Speed Area Roughing toolpath will be created to rough out the part.
- ◆ A Surface High Speed Horizontal toolpath will be created to machine the floors.
- ◆ A Surface High Speed Waterline toolpath will be created to machine the walls.

Backplot and Verify the file:

- ◆ Backplot will be used to simulate a step-by-step process of the tool's movements.
- ◆ Verify will be used to watch a tool machine the part out of a solid model.

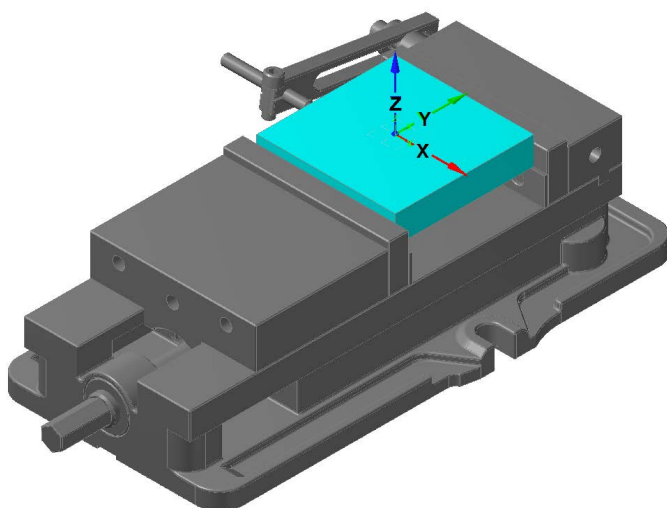
Post Process the file to generate the G-code:

- ◆ The student will then post process the file to obtain an NC file containing the necessary code for the machine.



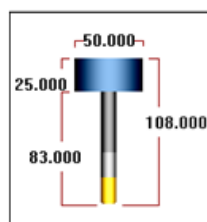
This tutorial takes approximately thirty minutes to complete.

SUGGESTED FIXTURE



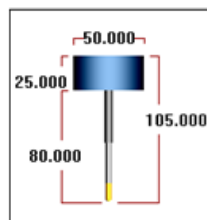
SETUP SHEET

TOOL LIST



TYPE: Endmill3 Bull
FLUTE LENGTH: 19.0
DIA OFFSET: 1
OVERALL LENGTH: 83.0
HOLDER: Default Holder
CORNER RAD: 2.0
NUMBER: 1
OF FLUTES: 4
LENGTH OFFSET: 1

#1 - M12.00 ENDMILL3 BULL - END MILL WITH RADIUS - 12 / R2.0



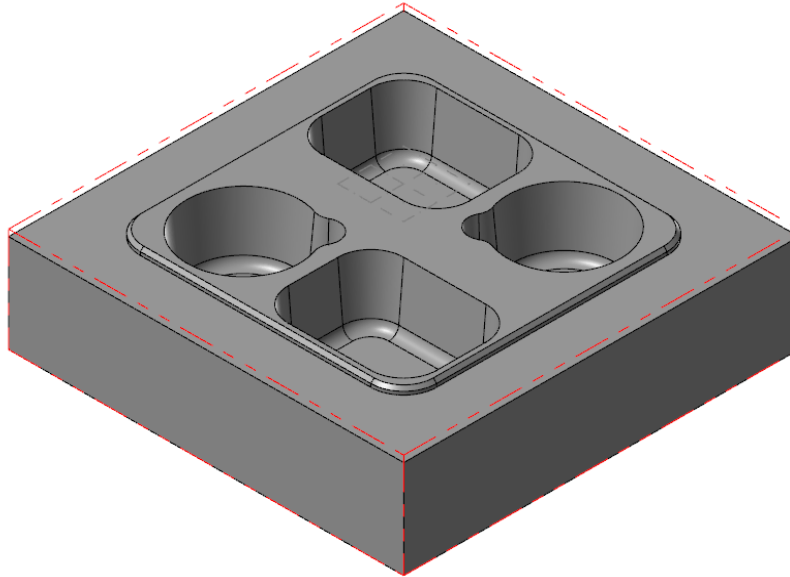
TYPE: Endmill2 Sphere
FLUTE LENGTH: 13.0
DIA OFFSET: 2
OVERALL LENGTH: 80.0
HOLDER: Default Holder
CORNER RAD: 2.5
NUMBER: 2
OF FLUTES: 4
LENGTH OFFSET: 2

#2 - M5.00 ENDMILL2 SPHERE - BALL-NOSE END MILL - 5

STEP 1: SELECT THE MACHINE AND SET UP THE STOCK

In Mastercam, you select a **Machine Definition** before creating any toolpath. The **Machine Definition** is a model of your machine's capabilities and features. It acts like a template for setting up your machine. The machine definition ties together three main components: the schematic model of your machine's components, the control definition that models your control capabilities, and the post processor that will generate the required machine code (G-code). For a Mill Essentials exercise (2D toolpaths), we need just a basic machine definition.

Step Preview:



Note: For the purpose of this tutorial, we will be using the Mill Default MM.MCAM-MMD machine.

- ◆ Press **Alt + F1** to fit the drawing to the screen.

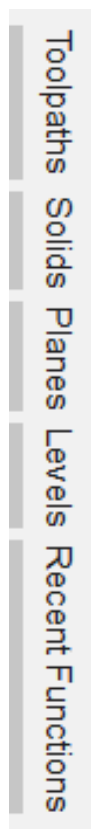
1.1 Open the file if needed

- ◆ From the **Quick Access Toolbar**, select the **Open** icon as shown.
- ◆ Find and select "Your Name_1" file.

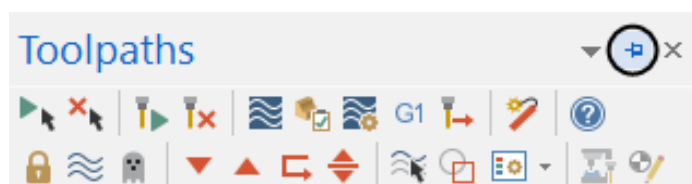


1.2 Unhide the Toolpaths Manager panel and lock it

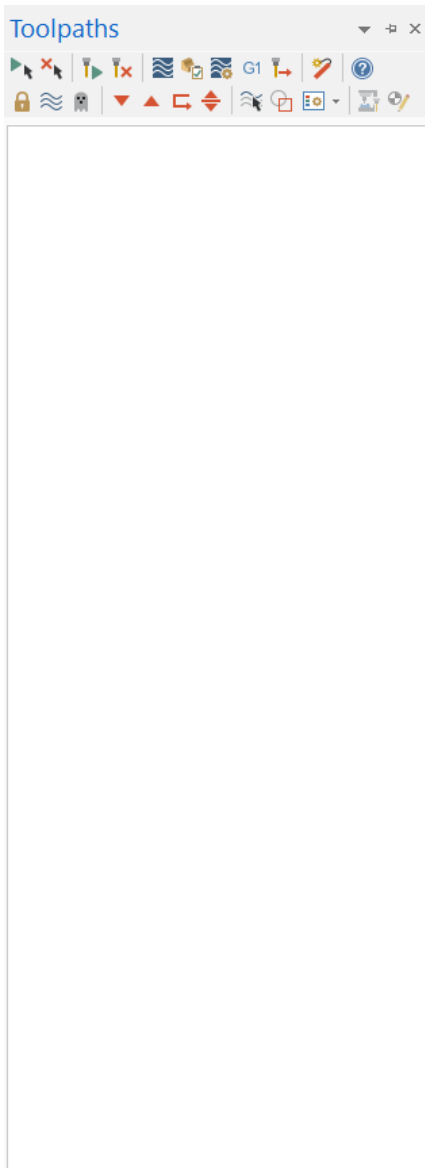
- ◆ The **Toolpaths Manager** will be hidden to the left of the graphics window as shown.



- ◆ To lock it, click on the **Toolpaths** tab and then click on the **Auto Hide** icon as shown.



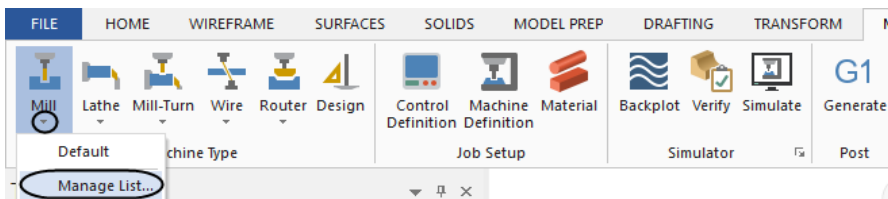
- ◆ The **manager panels** will be translated to the lower left corner of the graphics window.



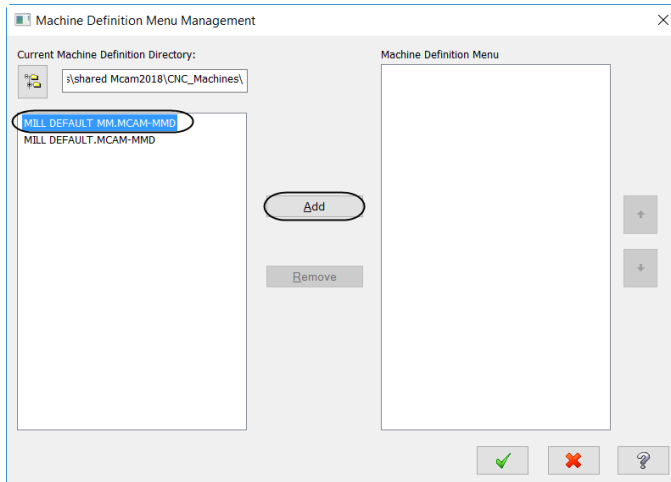
*Note: If a **Machine Group** already exist in the Toolpaths Manager, skip the next step.*


MACHINE

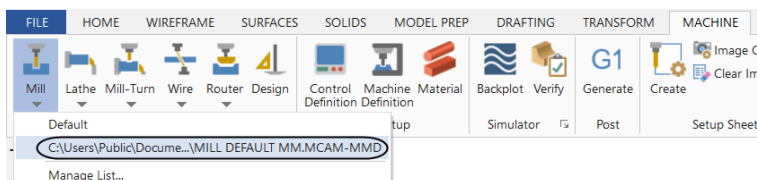
- ◆ From the **Machine Type** group, select the drop down arrow below **Mill**.
- ◆ Select Manage List.



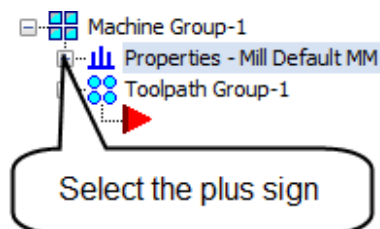
- ◆ Scroll down the list and select **MILL DEFAULT MM.MCAM-MMD** as shown.



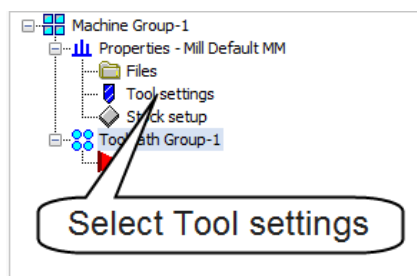
- ◆ Click on **Add** button as shown above.
- ◆ Select the **OK** button to exit **Machine Definition Menu Management**. 
- ◆ Select **MILL DEFAULT MM.MCAM-MMD** as shown.



- ◆ Select the plus sign (+) in front of **Properties** in the **Toolpaths Manager** to expand the **Toolpaths Group Properties**.



- ◆ Select **Tool settings** to set the tool parameters.



- ◆ Change the parameters to match the screen shot as shown.

Default program number is used to enter a number if your machine requires a number for a program name.

Assign tool numbers sequentially allows you to overwrite the tool number from the library with the next available tool number. (First operation tool number 1; second operation tool number 2, etc.).

Warn of duplicate tool numbers allows you to get a warning if you enter two tools with the same number.

Override defaults with modal values enables the system to keep the values that you enter.

Feed Calculation set to **From tool** uses feed rate, plunge rate, retract rate, and spindle speed from the tool definition.

Machine Group Properties

Files Tool Settings Stock Setup

Default program number: 1

Feed Calculation

- ☒ From tool
- ☐ From material
- ☐ From defaults
- ☐ User defined

Spindle speed: 5000.0

Feed rate: 100.0

Retract rate: 150.0

Plunge rate: 25.0

☐ Adjust feed on arc move

Minimum arc feed: 125.0

Toolpath Configuration

- ☒ Assign tool numbers sequentially
- ☐ Warn of duplicate tool numbers
- ☐ Use tool's step, peck, coolant
- ☐ Search tool library when entering a tool number

Advanced options

- ☒ Override defaults with modal values
 - ☒ Clearance height
 - ☒ Retract height
 - ☒ Feed plane

Sequence number

Start: 100.0

Increment: 10.0

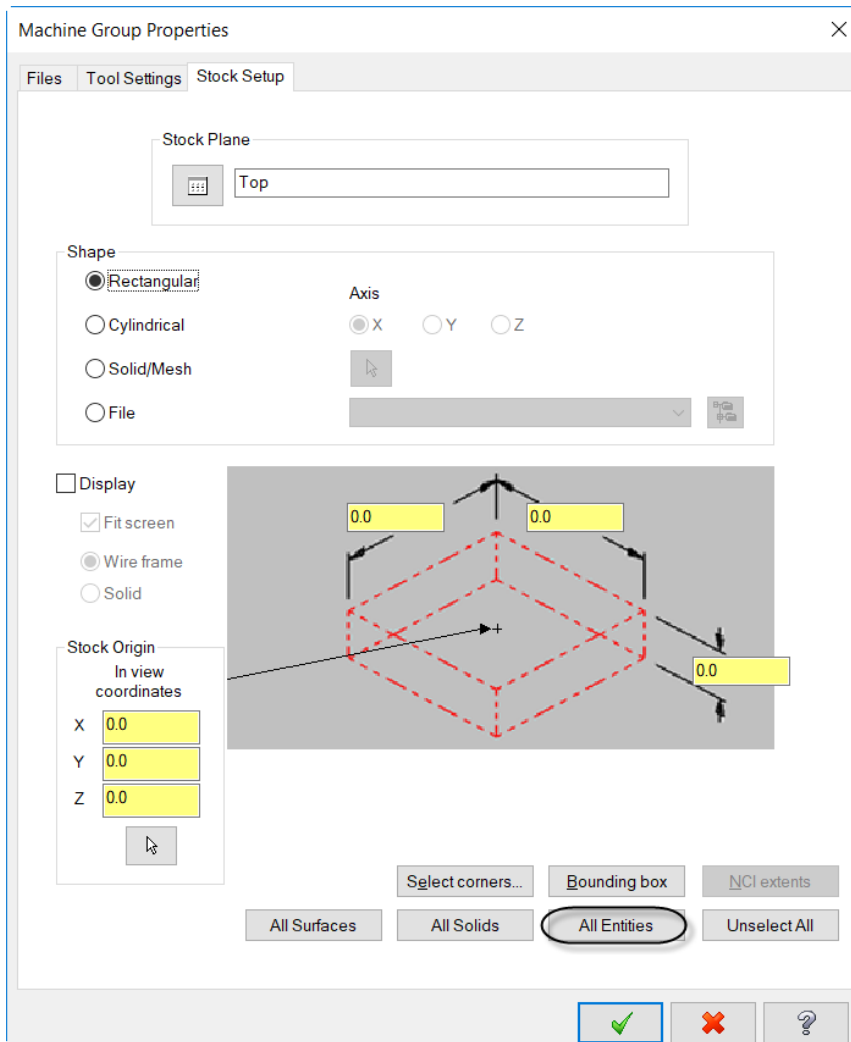
Material

ALUMINUM mm - 2024

Edit... Select...

✓ ✗ ?

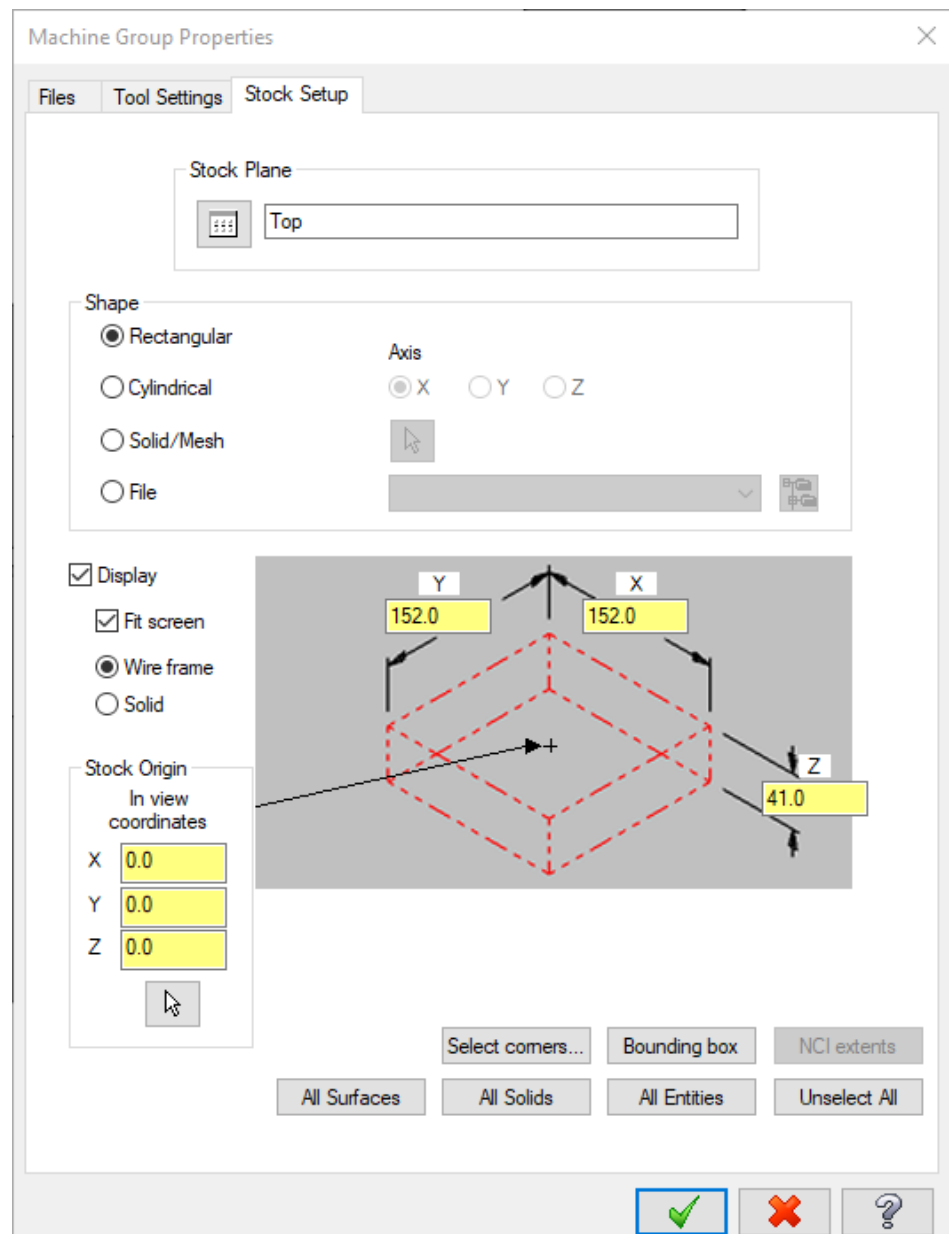
- ◆ Select the **Stock Setup** tab to define the stock.
- ◆ Select the **All Entities** button to allow Mastercam to establish the necessary stock based on the existing geometry as shown.



- ◆ The stock value should be set as shown.

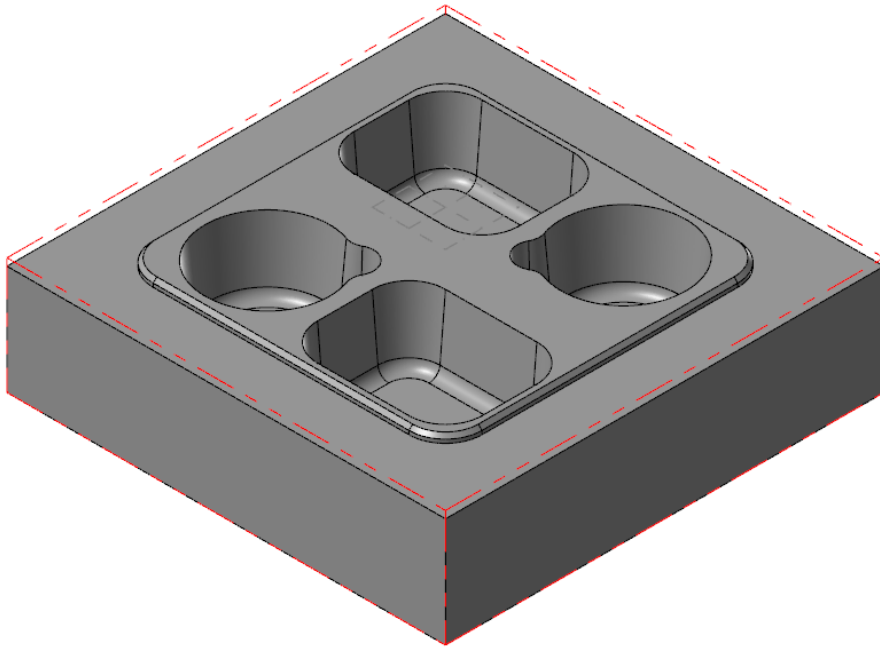
The **Stock Origin** values adjust the positioning of the stock, ensuring that you have an equal amount of extra stock around the finished part.

Display options allow you to set the stock as **Wireframe** and to fit the stock to the screen. (Fit Screen)



- ◆ Select the **OK** button to exit **Machine Group Properties**.
- ◆ Press **Alt + F1** to fit the drawing to the screen.

- ◆ The stock model will appear as shown.



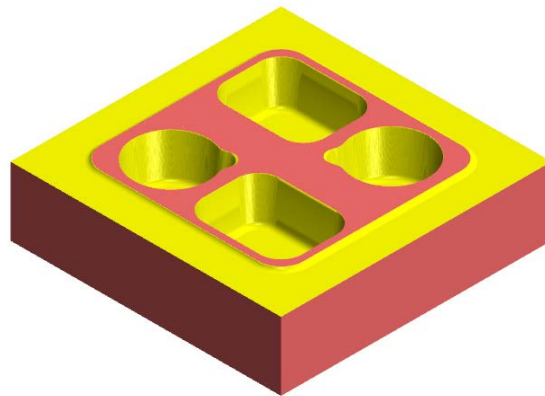
Note: Remember that the stock is not geometry and thus cannot be selected.

This tutorials utilize a suggested set of High Speed Surface toolpaths to machine the part.

STEP 2: ROUGH OUT THE PART USING SURFACE HIGH SPEED AREA ROUGHING

Area Roughing is designed to rough boss shapes, cavities, and pockets. When going from the outside inward, Mastercam changes the machining strategy as needed if the part includes some cavities. Area Roughing is a 3D Surface High Speed toolpath that efficiently removes the material using smaller depth of cuts.

Toolpath Preview:



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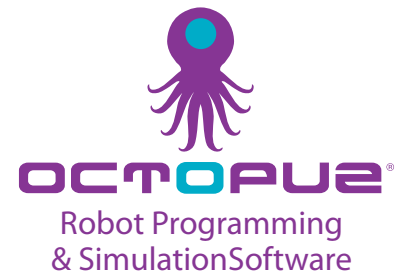
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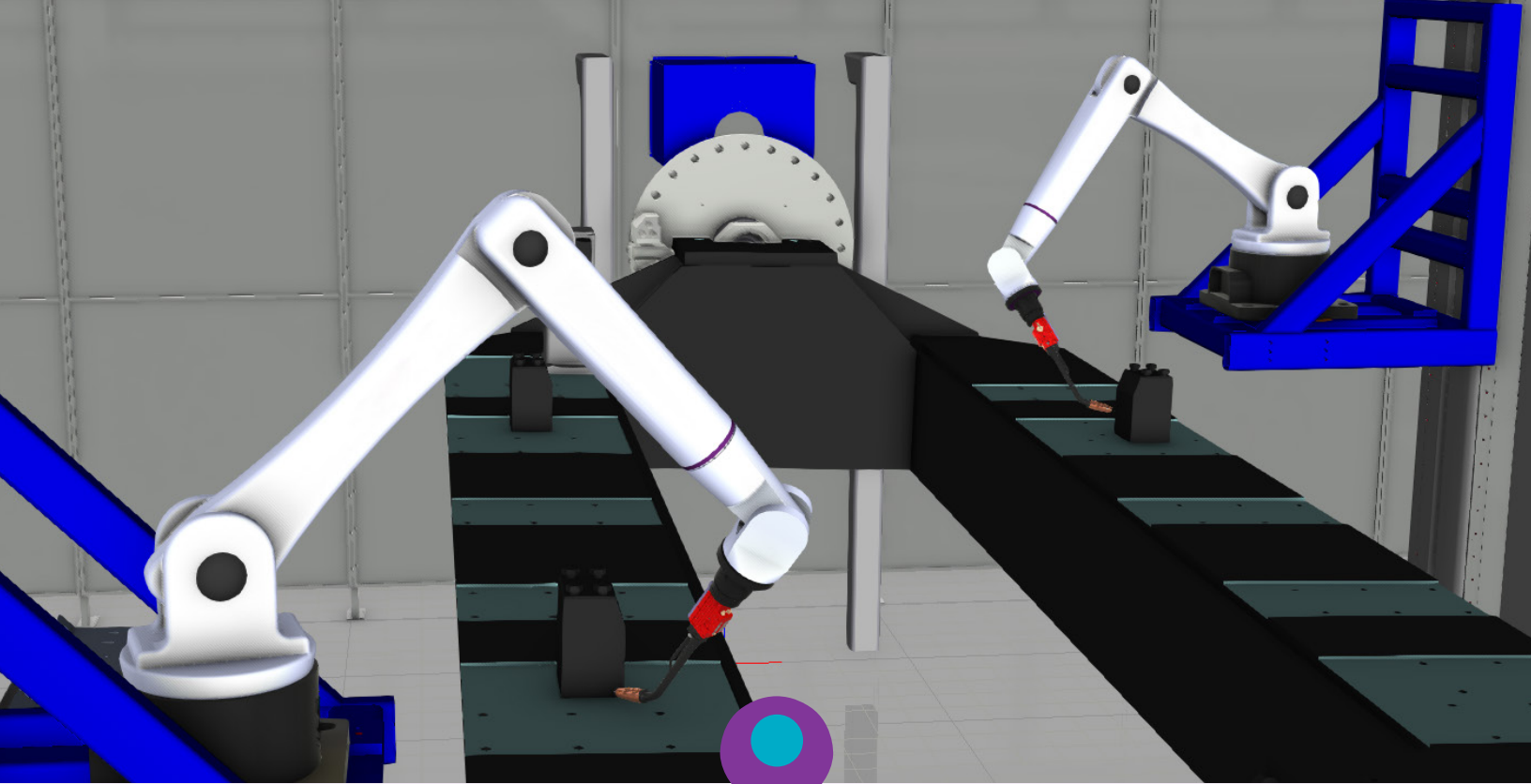
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