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2020

A detailed 3D wireframe rendering of a complex mechanical assembly, possibly a turbine or engine component, shown in a blue wireframe style against a dark background. The design features multiple curved and straight surfaces, with some parts highlighted in a lighter blue. The overall aesthetic is technical and industrial.

# DESIGN

# ***Mastercam***<sup>®</sup> 2020

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## DESIGN TRAINING TUTORIAL

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## **Mastercam 2020 Design Training Tutorial**

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Authors: Mariana Lendel

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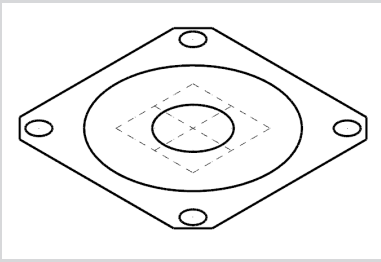
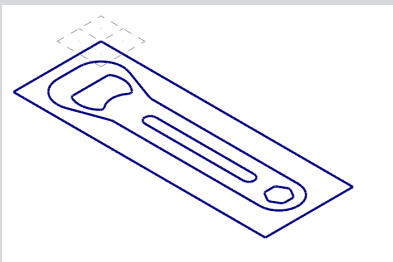
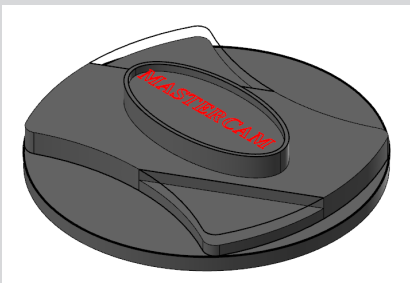
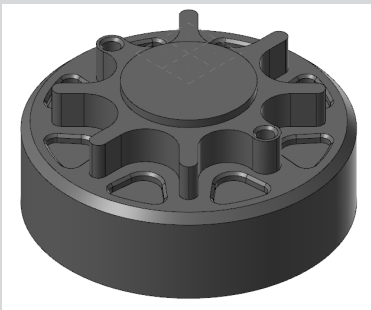
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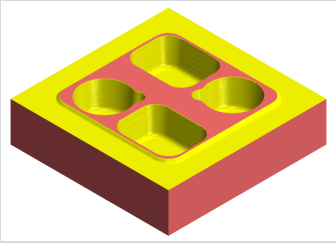
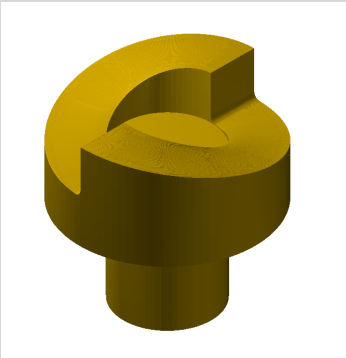
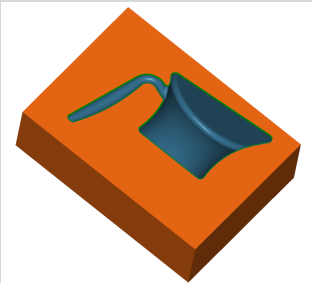



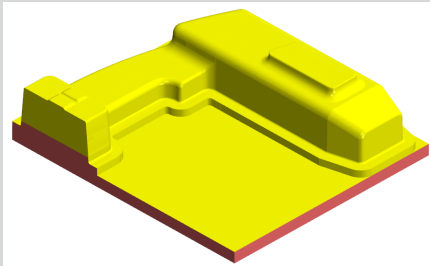
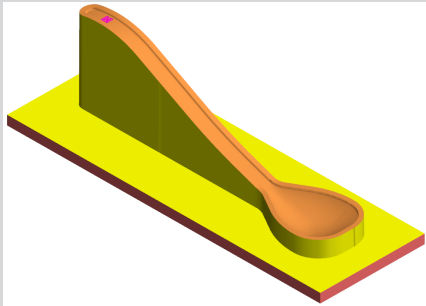
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<p>#2</p> 	<p>Rectangle. Rectangular Shapes. Polygon. Fillet Entities. Fillet Chains. Line Endpoints. Trim Divide.</p>
<p>#3</p> 	<p>Polar Arcs. Circle Center Point. Line Tangent. Fillet Entities. Mirror. Arc Tangent to 2 Entities. Trim 3 Entities. Ellipse. Offset. Letters. Bounding Box. Translate.</p>
<p>#4</p> 	<p>Circle Center Point. Line Tangent. Mirror. Arc Tangent. Arc Polar. Trim. Fillet. Rotate. Translate. Solids Extrude. Chamfer.</p>





3D Tutorials		Geometry Functions
#1		Solid Extrude Create Body Solid Extrude Cut Body Solid Fillet Solid Chamfer
#2		Swept Surface Solid Extrude Solid Trim To Surface Solid Boolean Add Use Levels
#3		Wireframe for Solid Solid Extrude Solid Revolved Swept Surface Solid Trim to face Solid Fillet Solid Draft Face Boolean Remove Boolean Add

3D Tutorials	Geometry Functions
<p data-bbox="151 262 183 289">#4</p> 	<p data-bbox="914 352 1240 609">Revolved Surface Project Curve Onto Surface Ruled/Draft Surface Curve At Intersection Trim Surface To Curves Surface Fillet Fillet Blend Surface</p>
<p data-bbox="151 714 183 741">#5</p> 	<p data-bbox="914 766 1240 982">Solid Extrude Solid Draft to Face Solid Constant Radius Fillet Solid Shell Curves All Edges Solid Impression</p>
<p data-bbox="151 1052 183 1079">#6</p> 	<p data-bbox="914 1182 1179 1285">Net Surface Loft Surface Flat Boundary Surface</p>



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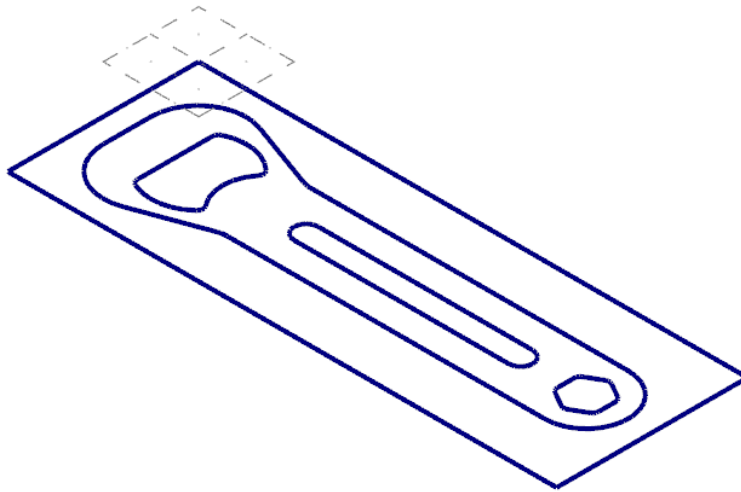
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## Tutorial 2: Geometry Creation



## OVERVIEW OF STEPS TAKEN TO CREATE THE PART GEOMETRY:

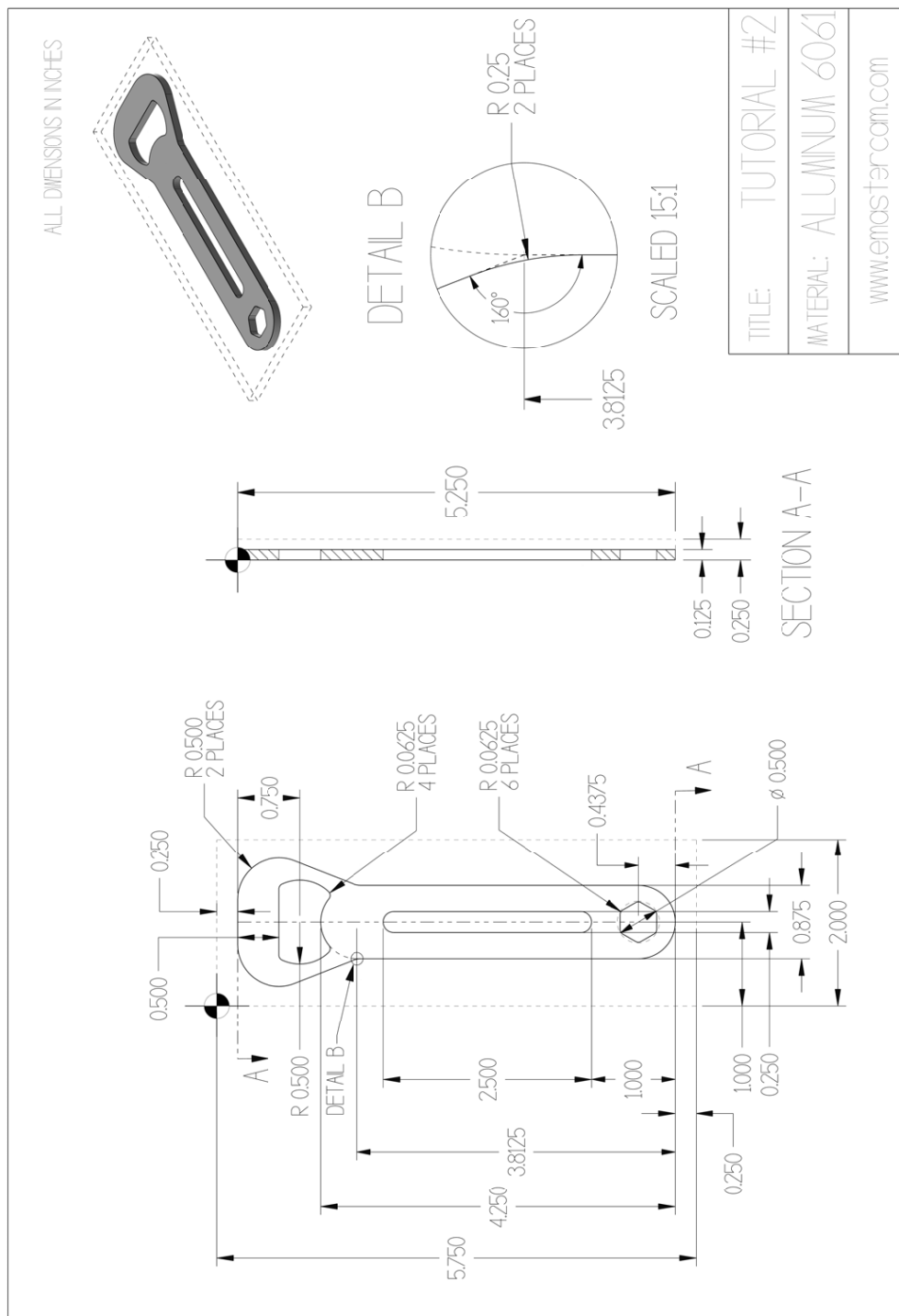
### From Drawing to CAD Model:

- ◆ 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 Top 2D geometry needed to create the toolpaths.
- ◆ Geometry creation commands such as Rectangle, Polygon, Fillet Entities, Fillet Chain, Circle Center Point, Line Endpoints, Rectangular Shapes, and Trim Break Extend will be used.

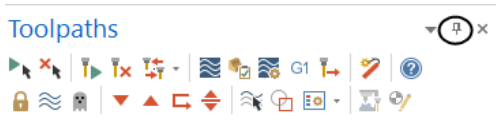
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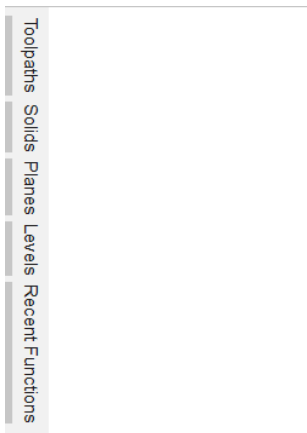
## STEP 1: SETTING UP THE GRAPHICAL USER INTERFACE

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.

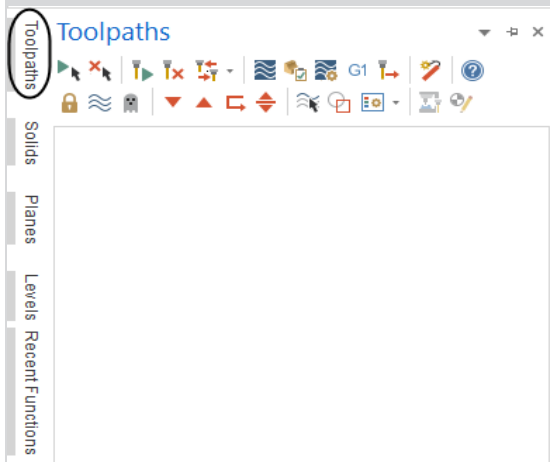
- ◆ Use **Auto Hide** icon to hide all **Manager** panels.



- ◆ 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.*

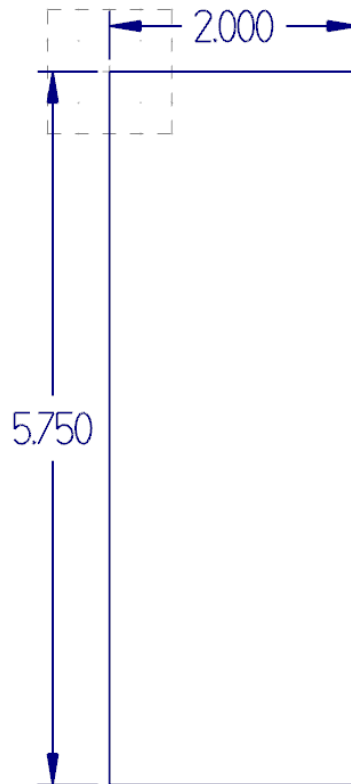


*While creating the geometry, keep the Manager panels hidden. This ensures more space in the graphics window for the geometry.*

## STEP 2: CREATE A RECTANGLE

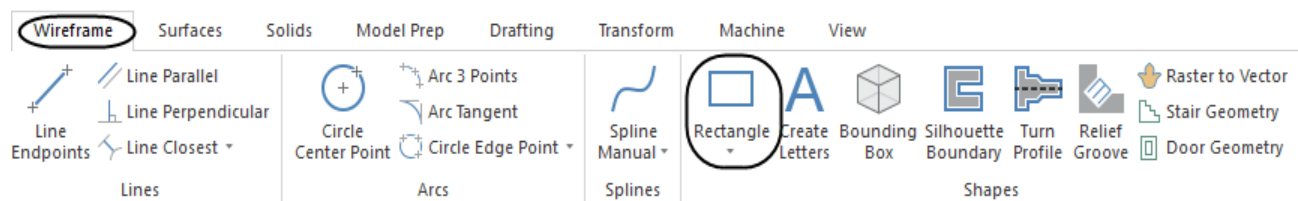
In this step, you will learn how to create a rectangle given the width, the height, and the anchor position.

*Step Preview:*

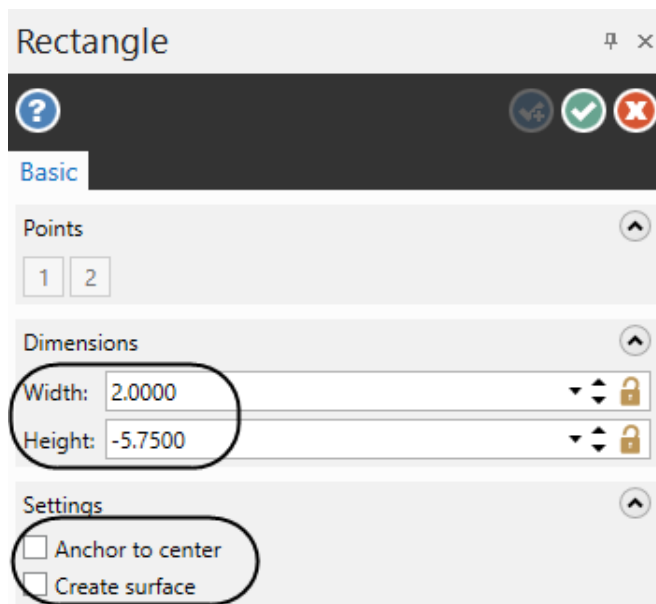


### Wireframe

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



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

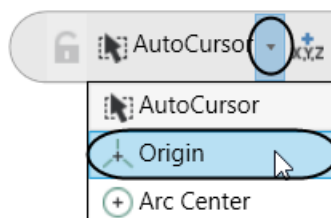


*Note: Make sure the **Anchor to center** and **Create surface** are disabled as shown.*

- ◆ Press **Enter** after typing the values to see a preview of the rectangle.
- ◆ To select the position of the base point, from the **General Selection** toolbar, click on the drop down arrow next to the **AutoCursor** as shown.



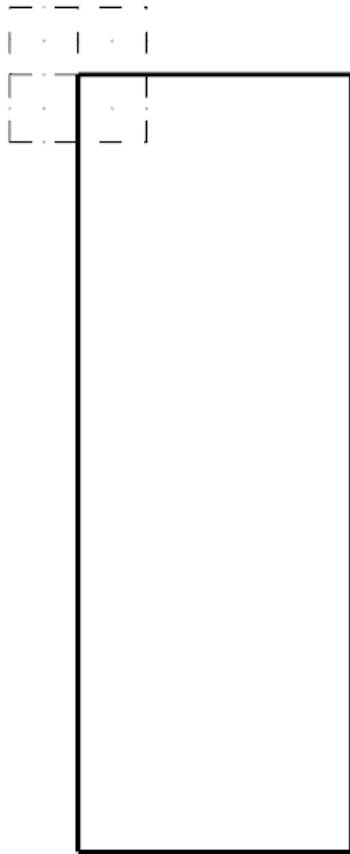
- ◆ From the fly-out menu, select **Origin**.





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



- ◆ Press **Alt + F1** to fit the geometry to the screen.
- ◆ The geometry should look as shown.



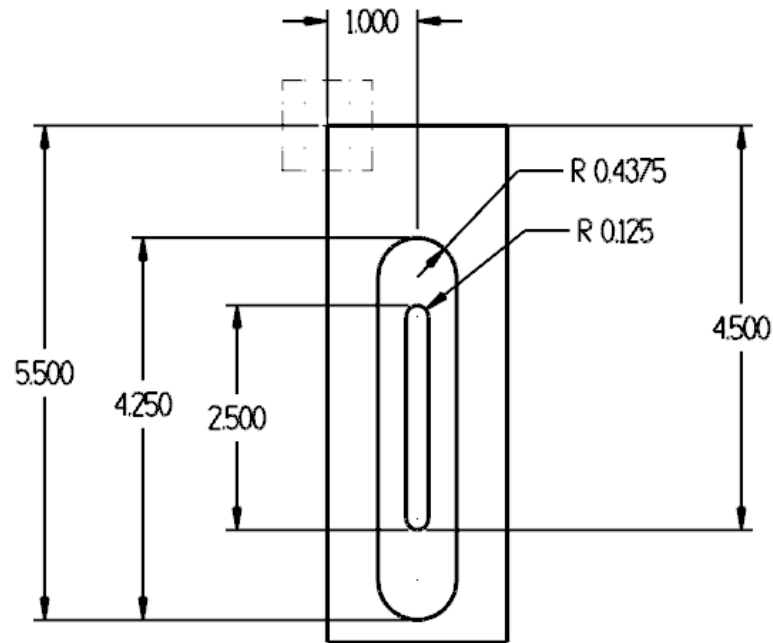
*Note: While creating geometry for this tutorial, if you make a mistake, you can undo the last step using the **Undo** icon.  You can undo as many steps as needed. If you delete or undo a step by mistake, just use the **Redo** icon.  To delete unwanted geometry, select the geometry first and then press **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.*



## STEP 3: CREATE TWO OBROUND SHAPES

In this step, you will learn how to create two obround shapes. To create an obround, you need to specify the width and height of the obround, as well as radius of the fillet and any rotation angles if applicable.

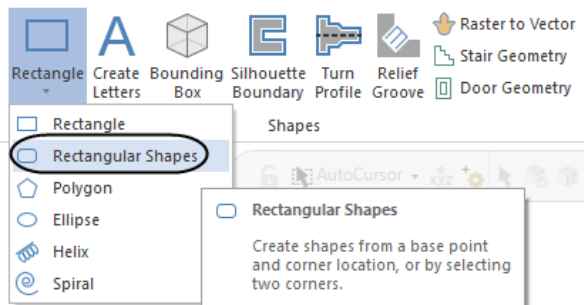
*Step Preview:*



### 3.1 Create the large obround

#### Wireframe

- ◆ From the **Shapes** group, click on the drop down arrow below **Rectangle** and select **Rectangular Shapes** as shown.



- ◆ [Select position of base point]: Select **AutoCursor Fast Point** icon from the **General Selection** toolbar.

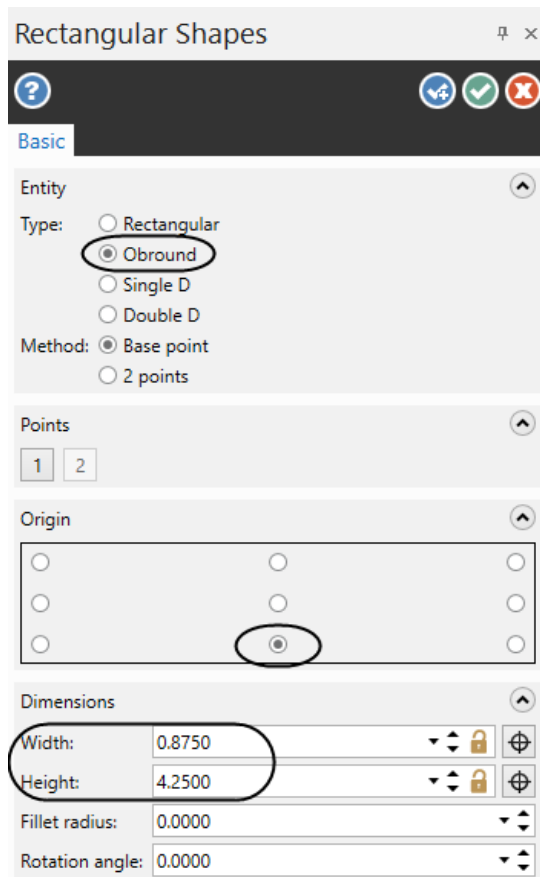


- ◆ Enter the coordinates as shown. Press **Enter**.

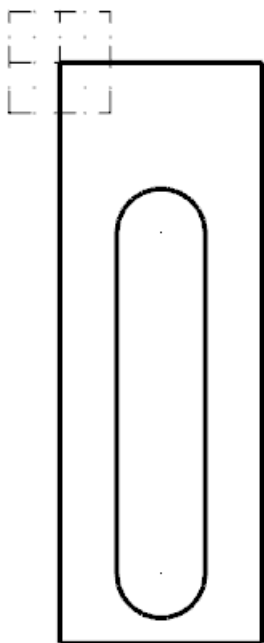
1,-5.5

*Note: When entering the coordinates for the center point, the first value is the **X** coordinate value, then the **Y** value follow by the **Z** value only if it is different from zero. The coordinate values are separated by a comma. You do not need to use the coordinate labels if you enter the values in this order.*

- ◆ [Enter width and height or select position of corner]: Choose the **Obround** option for the **Type**, and select the lower middle radio button under **Origin**.
- ◆ Change the settings in the **Rectangular Shapes** panel to create an obround with the width **0.875** and height **4.25** as shown.



- ◆ Press **Enter** to see the correctly dimensioned shape created in the graphics window as shown.



- ◆ Press **Enter** or select the **OK and Create New Operation** button to continue with the same command.



### 3.2 Create the small obround

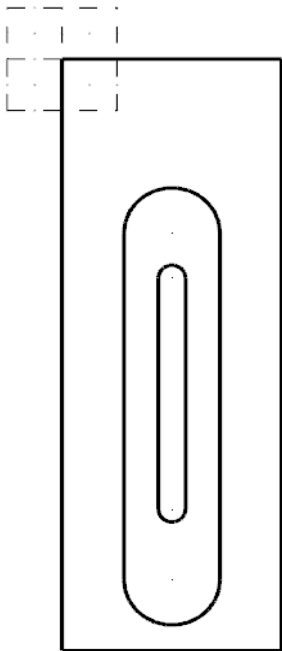
- ◆ [Select position of base point]: Select **AutoCursor Fast Point** icon  and enter the coordinates as shown.

1,-4.5

- ◆ Press **Enter**.
- ◆ [Enter width and height or select position of corner]: Enter the width **0.25** and the height **2.5** into the appropriate fields as shown.

Dimensions			
Width:	0.2500	▼ ▲ 🔒	⊕
Height:	2.5000	▼ ▲ 🔒	⊕
Fillet radius:	0.0000	▼ ▲	
Rotation angle:	0.0000	▼ ▲	

- ◆ Press Enter to see the correctly dimensioned shape created in the graphics window as shown.



- ◆ Select the **OK** button to exit the command.





# In-House Solutions **Mastercam**® 2020



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# TRAINING TUTORIALS

Our popular line of Mastercam Training Tutorials cover every Mastercam application, offering the most extensive collection of Mastercam training solutions available. Each book contains a series of tutorials that guide you through creating geometry, applying then verifying toolpaths and generating G-Code. Helpful hints, review exercises and quizzes complete the learning experience.



The Home Learning Edition (HLE) Demo Software is available for download with each eBook, and can be purchased on DVD for \$5.

## ARE YOU AN INSTRUCTOR?

Buy 10 or more of the Mill Essentials, Mill Advanced or Lathe Training Tutorials, get the corresponding Instructor Guide for Free! (see page 5)



### Mill Essentials

The Mill Essentials Training Tutorial takes a very comprehensive look at 2D machining with Mastercam.

This book begins with the absolute basics by introducing the Mastercam user interface and will have you creating geometry, mastering 2D toolpaths and posting code before you know it.

- 7 Step-by-Step Tutorials with Review Exercises
- Includes Video Training DVD and Mastercam HLE Demo Software

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ISBN: 978-1-77146-870-1

**Price \$90 (Print)**

ISBN: 978-1-77146-833-6



### Lathe

The Lathe Training Tutorial is ideal for both beginners and current Mastercam users.

This book introduces 2D geometry creation and lathe 2D toolpaths providing an excellent foundation for many lathe applications.

- 7 Step-by-Step Tutorials with Review Exercises
- Includes Video Training DVD and Mastercam HLE Demo Software

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## Mill Advanced

The Mill Advanced Training Tutorial picks up where Mill Essentials leaves off, introducing 3D concepts including surface high speed toolpaths.

It is strongly recommended that you have a good understanding of 2D machining before beginning this book.

- 6 Step-by-Step Tutorials with Review Exercises
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**Price \$80 (Print)**

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## Multiaxis Essentials

The Multiaxis Essentials Training Tutorial is intended for the advanced Mastercam user looking to learn Mastercam multiaxis programming.

A firm grasp on both 2D and 3D machining is required which can be attained by completing the Mill Essentials and Mill Advanced Training Tutorials.

- 10 Step-by-Step Tutorials
- Includes Video Training DVD and Mastercam HLE Demo Software

**Price \$85 (eBook)**

ISBN: 978-1-77146-878-7

**Price \$90 (Print)**

ISBN: 978-1-77146-841-1



## Multiaxis Advanced

The Multiaxis Advanced Training Tutorial is intended for the advanced Mastercam user.

This book contains projects demonstrating a variety of Multiaxis Advanced milling applications such as pattern application toolpaths.

- 6 Step-by-Step Tutorials
- Includes Mastercam HLE Demo Software

**Price \$75 (eBook)**

ISBN: 978-1-77146-879-4

**Price \$80 (Print)**

ISBN: 978-1-77146-842-8



## Lathe C & Y Axis

The Mastercam 2020 Lathe C & Y Axis Training Tutorial is intended for the advanced lathe user that wants to learn how to program lathe parts that include milling operations.

Advanced C-Axis toolpaths as well as the Y-Axis rotation will be described in this book. Examples on how to use the Mill toolpaths on a Lathe with Live Tooling are also incorporated.

**Price \$65 (eBook)**

ISBN: 978-1-77146-887-9

**Price \$85 (Print)**

ISBN: 978-1-77146-848-0



## Solids

The Solids Training Tutorial provides concise step-by-step instructions on creating and manipulating 3D wireframe and solid geometry.

This book details commands such as extrude, loft, revolve, sweep, boolean add, fillet, chamfer and more.

- 9 Step-by-Step Tutorials with Review Exercises
- Includes Mastercam HLE Demo Software

**Price \$40 (eBook)**

ISBN: 978-1-77146-873-2

**Price \$60 (Print)**

ISBN: 978-1-77146-836-7



## Mastercam for SOLIDWORKS

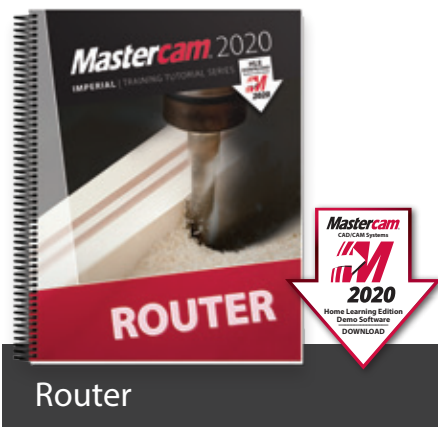
The Mastercam 2020 for SOLIDWORKS Programming Exercises book provides a comprehensive "hands on" method of learning Mastercam for SOLIDWORKS. You will learn how to program a variety of different parts that require most of the toolpath types available in Mastercam for SOLIDWORKS. Extensive emphasis is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

**Price \$65 (eBook)**

ISBN: 978-1-77146-881-7

**Price \$85 (Print)**

ISBN: 978-1-77146-844-2



## Router

The Router Training Tutorial offers detailed coverage of 2D geometry creation, drilling, contouring, pocketing, nesting, block drilling and importing graphics to machine.

Instruction on tool settings, stock setup and custom profile tool creation are also included.

- 8 Step-by-Step Tutorials with Review Exercises
- Includes Mastercam HLE Demo Software

**Price \$65 (eBook)**

ISBN: 978-1-77146-876-3

**Price \$85 (Print)**

ISBN: 978-1-77146-839-8



## Beginner

The Beginner Training Tutorial provides a comprehensive step-by-step approach to learning the basics of three Mastercam modules: Mill Essentials (2D), Lathe and Solids.

It is an excellent choice for new Mastercam users looking to get a broader overview of the software.

- 8 Step-by-Step Tutorials with Review Exercises
- Includes Mastercam HLE Demo Software

**Price \$65 (eBook)**

ISBN: 978-1-77146-874-9

**Price \$85 (Print)**

ISBN: 978-1-77146-837-4



## Design

The Design Training Tutorial provides a comprehensive step-by-step approach to learning geometry creation within Mastercam.

Its focus is 2D and 3D geometry creation with explanations given on how to dimension the parts.

- 12 Step-by-Step Tutorials with Review Exercises
- Includes Mastercam HLE Demo Software

**Price \$45 (eBook)**

ISBN: 978-1-77146-875-6

**Price \$65 (Print)**

ISBN: 978-1-77146-838-1



## CAD Import & Mill Essentials

The CAD Import & Mill Essentials Toolpaths Training Tutorial is intended for anyone looking to understand the ins and outs of Mastercam Mill Essentials toolpaths, while learning the best practices for importing geometry from various CAD software packages.

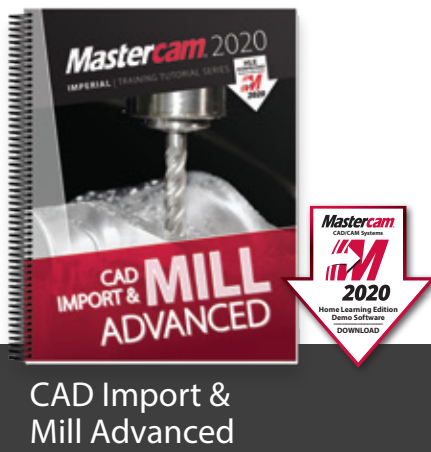
- 7 Step-by-Step Tutorials with Review Exercises
- Includes Mastercam HLE Demo Software

**Price \$70 (eBook)**

ISBN: 978-1-77146-878-7

**Price \$90 (Print)**

ISBN: 978-1-77146-846-6



## CAD Import & Mill Advanced

The CAD Import & Mill Advanced Toolpaths Training Tutorial consists of 6 projects and 6 accompanying practice exercises. It is intended for intermediate to experienced Mastercam users who are primarily importing 3D geometry from another CAD software package.

- 6 Step-by-Step Tutorials with Review Exercises
- Includes Mastercam HLE Demo Software

**Price \$60 (eBook)**

ISBN: 978-1-77146-884-8

**Price \$80 (Print)**

ISBN: 978-1-77146-847-3



## Wire

The Wire Training Tutorial provides users with an excellent resource for learning how to use Mastercam to program wire EDM machines.

In addition to geometry creation, the book focuses on wirepaths for dies, taper angle projects and more.

- 6 Step-by-Step Tutorials with Review Exercises
- Includes Mastercam HLE Demo Software

**Price \$40 (eBook)**

ISBN: 978-1-77146-877-0

**Price \$60 (Print)**

ISBN: 978-1-77146-840-4





## 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

**Price \$60 (eBook)**

ISBN: 978-1-77146-880-0

**Price \$75 (Print)**

ISBN: 978-1-77146-843-5



## 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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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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eBook

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Print

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ISBN: 978-1-77146-864-0

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ISBN: 978-1-77146-865-7

**\$100 Lathe Kit**

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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.

**Price \$100**

ISBN: 978-1-77146-867-1



Part 2 –  
Solids

Part 2 – Solids will teach a variety of useful solids commands, that include extrude, loft, revolve, sweep, boolean add and remove, fillet, chamfer, shell, trimming, and creating solid patterns. You will learn how to change a solids color and create a solid geometry from surfaces, as well as how to manipulate a solid by using commands from the Model Prep menu such as Push-Pull, Move and Split Solid Face. You will use create Layout and learn how to dimension parts to create blueprints.

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Part 3 –  
Advanced  
Mill 2D

Part 3 – Advanced Mill 2D is dedicated to the power user. You will learn how to machine an imported solid model using the WCS for multiple setups. To better organize the parts, you will master how to use levels and view sheets. You will practice indexing a 4-axis part using the tool planes defined in the Plane manager. Fixtures will be used and the part will be align to their faces. You will learn how to save operations to a library and how to import them for different parts. A brief introduction to the basic 3D machining will be also covered.

**Price \$100**

ISBN: 978-1-77146-869-5



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

**Price \$250**

ISBN: 978-1-77146-904-3

# 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.

**Price \$90 (eBook)**

ISBN: 978-1-77146-894-7

**Price \$98 (Print)**

ISBN: 978-1-77146-856-5



## 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)**

ISBN: 978-1-77146-895-4

**Price \$98 (Print)**

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The In-House Solutions support specialists take note of the questions that are asked. We realize that if you're asking a question there are ten more people who want to know the answer but haven't asked. Our goal is to make your life easier, so we've collected the answers to your most popular questions here, in one convenient eBook.

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## Horizontal Machining with Indexing

The Indexing Training Tutorial explains how to use the Plane Manager for working with tool planes and work offsets.

Examples include horizontal machining using the WCS and a multiple fixtured tombstone project.

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Approximate completion time ranges from 7.5 to 15 hours depending on the eCourse, making it possible for employees or students to gain new skills outside of work or studies.

### Highlights:

- Online previews with table of contents including the time it takes to complete each session.
- Mastercam 2020 Home Learning Edition Demo Software download is included so you can follow along with our instructors.
- Corresponding eBook is provided.
- Quizzes follow each tutorial.
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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)**

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**Price \$65 (Print)**

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## 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.

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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.

- Active user forums with an education-specific sub forum
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[www.eMastercam.com/forums](http://www.eMastercam.com/forums)

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