



Mastercam X7
DEMO
ENCLOSED

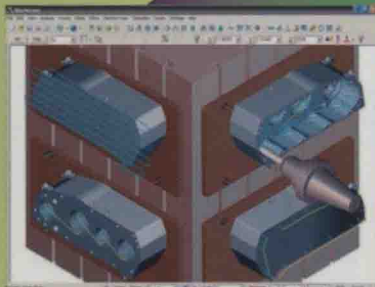
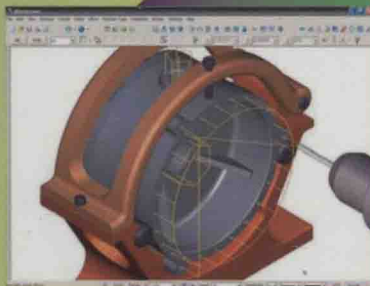


Learning MASTERCAM

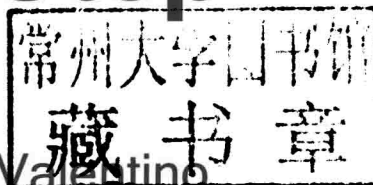
X7 MILL 2D

Step by Step

James Valentino
Joseph Goldenberg



**LEARNING
MASTERCAM
X7
MILL
2D
Step
by
Step**



James Valentino
Joseph Goldenberg

A full catalog record for this book is available from the Library of Congress.
ISBN 978-0-8311-3486-0

Industrial Press, Inc.
32 Haviland Street, Unit 2C
South Norwalk, CT 06854

Sponsoring Editor: John Carleo
Cover Design: Janet Romano
Index Editor: Robert E. Green

Copyright© 2014

by Industrial Press Inc., Printed in the United States of America All rights reserved.
This book, or any parts thereof, may not be reproduced, stored in a retrieval system, or
transmitted in any form without the permission of the publisher.

10 9 8 7 6 5 4 3 2 1

DEDICATION

To my wife Barbara and to my children, Sarah and Andrew.

-James Valentino

To my students past, present and future.

-Joseph Goldenberg

ACKNOWLEDGEMENTS

The authors would like to express their thanks to CNC Software, Inc, especially Mr Ben Mund for his continued support.

We would also like to express our appreciation to Mr Bernard Hunter, the laboratory technician in the manufacturing processes laboratory at Queensborough Community College for proofing many portions of the manuscript.

PREFACE

The CNC programmer now has a powerful tool to assist in the job of creating and verifying part programs. *MasterCam X7* CNC software provides the programmer with a full array of easy to use features. The benefits of using *MasterCAM X7* include: automatic calculation of toolpath coordinates, determination of speeds and feeds, animation of the machining process, off-line, without tying up the CNC machine, and postprocessing the part program.

MasterCAM X7 is a robust PC based package. Its many capabilities must be presented in a clear and logical sequence. This text was written to provide a thorough introduction to *MasterCAM X7*'s MILL package for students with little or no prior experience. Past users of *MasterCAM* will find release *X7* has been upgraded to run on Windows7. Several enhancements such as the new Verifier and Code Expert are also included. LEARNING *MasterCAM X7* MILL-2D Step by Step includes chapters on executing high speed dynamic milling operations and performing feature based machining on solid models. Examples of creating user defined tool planes and machining on those planes have also been included. The Appendix contains step by step instructions users can follow to customize *MasterCAM X7*'s toolbars, drop down menus and key strokes.

Several learning aids have been designed throughout.

- Good graphical displays rather than long text and definitions are emphasised.
- An overview of the process of generating a word address program is presented.
- Key definitions are boxed in.
- Examples provide step-by-step instructions with excellent graphical displays.
- Needless cross-referencing has been eliminated. Each example is presented with all explanations appearing on the same page.
- Exercises are presented at the ends of chapters.
- A process plan is provided for many machining exercises to indicate the machining operations to be performed and the tools to be used.
- A CD provided with the text contains:
 - ▶ *MasterCAM X7*, DEMO version. Students can use the DEMO to practice interactively on their own PC's.
 - ▶ Files now keyed in sequence to the selected examples. Students can follow interactively when learning the procedure with the concepts presented in the text.
 - ▶ Files containing CAD parts for machining exercises.

LEARNING *MasterCAM X7* MILL-2D can be used for many different types of training applications; these include:

- Undergraduate one-semester or two semester CNC programming courses.
- Computer assisted component of a CNC programming course.
- Industrial training courses.
- Trade school courses on computer assisted CNC programming.
- Seminar on computer assisted CNC programming.
- Adult education courses.
- Reference text for self-study.

This text is designed to be used in many types of educational institutions such as:

- Four-year engineering schools.
- Four-year technology schools.
- Community colleges.
- Trade schools.
- Industrial training centers.

CONTENTS

CHAPTER-1	INTRODUCTION TO <i>Mastercam X5</i>	1-1
1-1	Chapter Objectives	1-1
1-2	<i>Mastercam X7</i> CNC Software	1-1
1-3	System Requirements for Version X7	1-1
1-4	Conventions Used Throughout the Text	1-2
1-5	Installation of <i>Mastercam X7</i> Demo Software for Student Use	1-3
1-6	An Overview of Generating A Word Address Program Via <i>Mastercam X7</i>	1-3
1-7	Types of Files Created by <i>Mastercam X7</i>	1-6
1-8	Starting the <i>Mastercam X7</i> Design Package	1-7
1-9	Entering the <i>Mastercam X7</i> Mill Package	1-8
1-10	A Description of the <i>Mastercam X7</i> Mill Main Interface Window	1-9
1-11	A Brief Explanation of the Terms Gview, VIEW, WCS, Cplane, and Tplane	1-19
1-12	<i>Mastercam X7</i> 's Short-Cut keys for Entering Commands	1-22
1-13	Setting Working Parameters Via the System Configuration Dialog Box	1-23
1-14	Using On Line Help	1-30
1-15	Saving a File	1-34
1-16	Opening a File	1-35
1-17	Using the Zip2Go Utility	1-37
1-18	Creating a New File	1-38
1-19	Converting Files from Previous Releases of <i>Mastercam X</i> to X7	1-38
1-20	Exiting the <i>Mastercam X7</i> Design/Mill Package	1-39
	Exercises	1-p1
CHAPTER-2	CREATING 2D WIREFRAME MODELS	2-1
2-1	Chapter Objectives	2-1

2-2 Generating a Wireframe CAD Model of a Part	2-1
2-3 Point Constructions in 2D Space	2-1
2-4 Line Constructions in 2D Space	2-12
2-5 Arc Constructions in 2D Space	2-26
2-6 Rectangle Constructions in 2D Space	2-44
2-7 Polygon Constructions in 2D Space	2-47
2-8 Ellipse Constructions in 2D Space	2-49
2-9 Geometric Letter Constructions in 2D Space	2-51
2-10 Fillet Constructions in 2D Space	2-56
2-11 Chamfer Constructions in 2D Space	2-61
2-12 Spline Constructions in 2D Space	2-62
2-13 Zooming Graphics Window Displays	2-68
2-14 Panning Screen Displays	2-73
2-15 Fitting the Existing Geometry to the Screen Display Area	2-74
2-16 Repainting the Screen	2-75
2-17 Regenerating the Screen	2-75
2-18 The Undo/Redo Functions	2-76
Exercises	2-p1

CHAPTER-3 EDITING 2D GEOMETRY	3-1
--------------------------------------	------------

3-1 Chapter Objectives	3-1
3-2 Deleting/Undeleting Entities	3-1
3-3 Modifying Existing 2D Geometry	3-10
3-4 Using the Xform Functions to Transform Entities	3-25
Exercises	3-p1

CHAPTER-4 ADDITIONAL TOOLS FOR CAD **4-1**

4-1 Chapter Objectives	4-1
4-2 Using Levels to Organize Information in a <i>Mastercam X7</i> Part File	4-1
4-3 Checking the CAD Model for Dimensional Correctness	4-4
4-4 Using the Analyze Function to Check and Edit the CAD Model	4-7
4-5 File Conversion with Other CAD/CAM Packages	4-9
4-6 Sending a File Over the Internet as an E-Mail Attachment	4-19
Exercises	4-p1

CHAPTER-5 HOLE OPERATIONS IN 2D SPACE **5-1**

5-1 Chapter Objectives	5-1
5-2 Specifying Drilling Locations on the CAD Model of a Part	5-3
5-3 Specifying Drill Cycle Parameters	5-14
5-4 Backplotting Machining Operations	5-49
5-5 Verifying Machining Operations	5-55
5-6 Using the Circle Mill Function	5-62
5-7 Machining Holes at Different Depths and Retract Heights	5-71
5-8 Editing Drill Tool Paths	5-78
5-9 Postprocessing	5-81
Exercises	5-p1

CHAPTER-6 PROFILING AND POCKETING IN 2D SPACE **6-1**

6-1 Chapter Objectives	6-1
6-2 Creating a 2D Contour for Profiling	6-1
6-3 Common Problems Encountered in 2D Chaining	6-14

6-4 Specifying 2D Countouring Parameters	6-15
6-5 Specifying Pocketing Parameters	6-52
Exercises	6-p1

CHAPTER-7 EDITING MACHINING OPERATIONS VIA THE OPERATIONS MANAGER	7-1
--	------------

7-1 Chapter Objectives	7-1
7-2 The Operations Manager	7-1
7-3 Creating New Operations	7-3
7-4 Moving Existing Operations	7-4
7-5 Copying Existing Operations	7-6
7-6 Adding Comments to Operation File Names	7-6
7-7 Copying Parts of Existing Operations	7-16
7-8 Deleting Existing Operations	7-17
7-9 Editing Existing Toolpaths	7-20
7-10 Changing the Chaining Order	7-26
7-11 Expanding and Collapsing the Operations Display Listings	7-27
7-12 Displaying the Operations Manager Listings as a Doc File	7-28
Exercises	7-p1

CHAPTER-8 USING TRANSFORM TO TRANSLATE, ROTATE OR MIRROR EXISTING TOOLPATHS	8-1
--	------------

8-1 Chapter Objectives	8-1
8-2 The Transform Toolpaths Function	8-1
8-3 Translating Existing Toolpaths	8-3

8-4 Rotating Existing Toolpaths	8-7
8-5 Mirroring Existing Toolpaths	8-8
8-6 Converting a Transform into New Geometry and Operations	8-9
Exercises	8-p1

CHAPTER-9 USING A LIBRARY TO SAVE OR IMPORT MACHINING OPERATIONS	9-1
---	------------

9-1 Chapter Objectives	9-1
9-2 Advantages of Using <i>Mastercam</i> 's Operations Library	9-1
9-3 Saving Operations to the Operations Library	9-1
9-4 Importing Operations from the Operations Library	9-22
9-5 Editing Data in the Operations Library	9-32
Exercises	9-p1

CHAPTER-10 USING TABS AND WORK OFFSETS	10-1
---	-------------

10-1 Chapter Objectives	10-1
10-2 Applications of <i>Mastercam X7</i> 's Tab Function	10-1
10-3 Specifying Tab Parameters	10-2
10-4 Editing Tabs	10-12
10-5 Work Offsets	10-14
10-6 Applying <i>Mastercam X7</i> to Work Offsets	10-14
Exercises	10-p1

CHAPTER-11 CREATING BASIC SOLID MODELS	11-1
---	-------------

11-1 Chapter Objectives	11-1
-------------------------	------

11-2 Types of CAD Models	11-1
11-3 Creating the Base Feature of the Solid Model	11-3
11-4 Creating Base Features by Extruding	11-3
11-5 Checking when Creating the Solid Model	11-9
11-6 Creating Base Features by Using Primitives	11-11
11-7 Creating Base Features by Importing	11-11
11-8 Creating Additional Features by Extrusion	11-12
11-9 Avoiding Extrusion Errors	11-15
11-10 Creating Additional Features by Revolving	11-16
11-11 Adding Fillet Features to Solid Models	11-18
11-12 Adding Chamfer Features to Solid Models	11-22
11-13 Editing Solid Model Features	11-26
11-14 Creating a Pattern of Solid Features	11-32
11-15 Assigning Colors to Individual Solid Features and Faces	11-38
11-16 Building a History Tree for Imported Solids	11-40
11-17 Trimming/Extending Wireframe Geometry to Solid Edges	11-41
11-18 Modify Solid Feature, Modify Solid Fillet, Remove Solid Fillet	11-44
Exercises	11-p1

CHAPTER- 12 MACHINING WITH 2D HIGH SPEED TOOLPATHS	12-1
---	-------------

12-1 Chapter Objectives	12-1
12-2 MasterCam's 2D High Speed Toolpaths	12-1
12-3 2D High Speed Core Mill Toolpaths	12-2
12-4 2D High Speed Peel Mill Toolpaths	12-8
12-5 2D High Speed Blend Mill Toolpaths	12-12

12-6 2D High Speed Area Mill Toolpaths	12-15
12-7 2D High Speed Rest Mill Toolpaths	12-17
12-8 2D High Speed Dynamic Area Mill Toolpaths	12-77
12-9 2D High Speed Dynamic Rest Mill Toolpaths	12-83
12-10 2D High Speed Dynamic Core Mill Toolpaths	12-85
12-11 2D High Speed Dynamic Contour Mill Toolpaths	12-87
Exercises	12-p1

CHAPTER-13 EXECUTING 2D FEATURE BASED MACHINING (FBM) ON SOLID MODELS	13-1
--	-------------

13-1 Chapter Objectives	13-1
13-2 Feature Based Machining on Solid Models	13-2
13-3 Activating FBM - Drill	13-2
13-4 Activating FBM - Mill	13-9
13-5 Creating a 2D Chained Contour on a Solid Model	13-36
13-6 Activating the Chaining Dialog Box: Solids Mode	13-36
Exercises	13-p1

CHAPTER-14 FILE TRACKING AND CHANGE RECOGNITION	14-1
--	-------------

14-1 Chapter Objectives	14-1
14-2 Tracking Changes in Files	14-1
14-3 Change Recognition	14-4
Exercises	14-p1

APPENDIX	A-1
The Customize Dialog Box	A-1
Customizing Toolbar Menus	A-2
The Toolbar States Dialog Box	A-7
Creating Customized Drop Down Menus	A-10
The Key Mapping Dialog Box	A-16