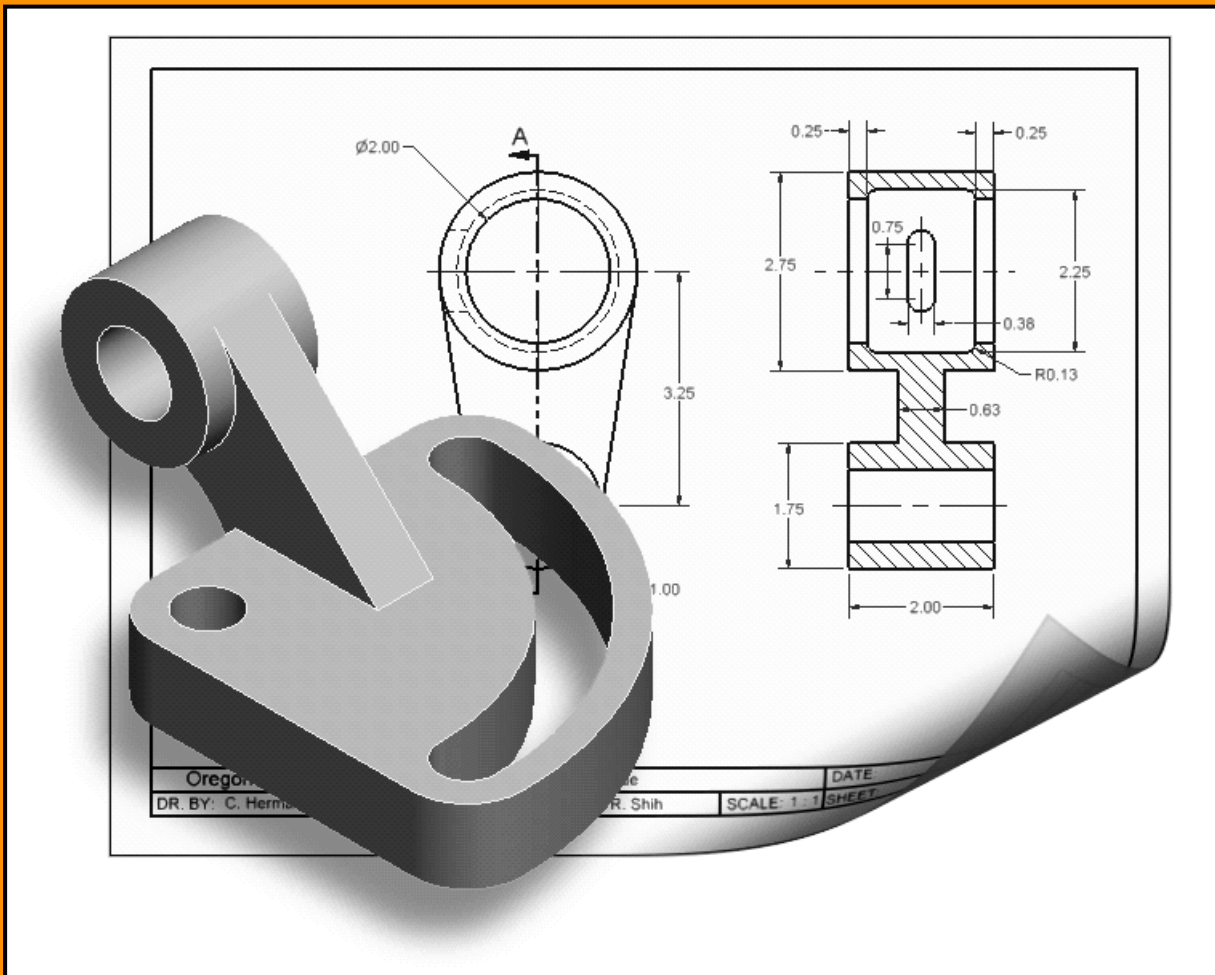


Parametric Modeling With Autodesk Inventor® R9



Randy H. Shih
Oregon Institute of Technology

SDC
PUBLICATIONS

Schroff Development Corporation

www.schroff.com
www.schroff-europe.com

Table of Contents

Preface

Acknowledgments

Chapter 1

Getting Started

Introduction	1-2
Development of Computer Geometric Modeling	1-2
Feature-Based Parametric Modeling	1-6
Getting Started with Autodesk Inventor	1-7
Starting Autodesk Inventor	1-7
The Startup Dialog box and Units Setup	1-8
Autodesk Inventor Screen Layout	1-9
Pull-down Menus	1-10
Standard Toolbar	1-10
Part Feature Toolbar	1-10
Help Options	1-10
2D Sketch Toolbar	1-10
Graphics Window	1-11
Graphics Cursor or Crosshairs	1-11
Message and Status Bar Area	1-11
Browser	1-11
Mouse Buttons	1-12
[Esc] - Canceling Commands	1-12
On-Line Help	1-13
Leaving Autodesk Inventor	1-13
Creating a CAD Files Folder	1-14

Chapter 2

Parametric Modeling Fundamentals

Introduction	2-2
The Adjuster Design	2-3
Starting Autodesk Inventor	2-3
Autodesk Inventor Screen Layout	2-4
Creating Rough Sketches	2-5
Step 1: Creating a Rough Sketch	2-6
Graphics Cursors	2-6
Geometric Constraint Symbols	2-7
Step 2: Apply/Modify Constraints and Dimensions	2-8
Modifying the Dimensions of the Sketch	2-11
Step 3: Completing the Base Solid Feature	2-12

Isometric View	2-13
Dynamic Viewing Functions - <i>Zoom and Pan</i>	2-13
Dynamic Rotation of the 3-D Block - 3D Rotate	2-14
Dynamic Viewing - Quick Keys	2-16
Display Modes	2-17
Orthographic vs. Perspective	2-17
Sketch plane – It is an XY CRT, but an XYZ World	2-18
Step 4-1: Adding an Extruded Feature	2-20
Step 4-2: Adding a Cut Feature	2-24
Save the Model	2-27
Questions	2-28
Exercises	2-29

Chapter 3

Constructive Solid Geometry Concepts

Introduction	3-2
Binary Tree	3-3
The Locator Design	3-4
Starting Autodesk Inventor	3-5
<i>GRID</i> and <i>SNAP</i> Intervals Setup	3-6
Modeling Strategy - CSG Binary Tree	3-7
Base Feature	3-8
Model Dimensions Format	3-10
Modifying the Dimensions of the Sketch	3-10
Repositioning Dimensions	3-11
Completing the Base Solid Feature	3-12
Creating the Next Solid Feature	3-13
Creating a CUT Feature	3-17
Creating a PLACED FEATURE	3-20
Creating a Rectangular Cut Feature	3-22
Questions	3-26
Exercises	3-27

Chapter 4

Model History Tree

Introduction	4-2
The <i>Saddle Bracket</i> Design	4-3
Starting Autodesk Inventor	4-3
Modeling Strategy	4-4
The <i>Autodesk Inventor Browser</i>	4-5
Creating the Base Feature	4-5
Adding the Second Solid Feature	4-8
Creating a 2D Sketch	4-9

Renaming the Part Features	4-11
Adjusting the Width of the Base Feature	4-12
Adding a Placed Feature	4-13
Creating a Rectangular Cut Feature	4-15
History-based Part Modifications	4-16
A Design Change	4-17
What Happened?	4-19
Questions	4-23
Exercises	4-24

Chapter 5

Parametric Constraints Fundamentals

CONSTRAINTS and RELATIONS	5-2
Create a Simple Triangular Plate Design	5-2
Fully Constrained Geometry	5-3
Starting Autodesk Inventor	5-3
Displaying Existing Constraints	5-4
Applying Geometric/Dimensional Constraints	5-6
Over-constraining and Driven Dimensions	5-10
Deleting existing constraints	5-11
Using the Auto Dimension Command	5-12
Adding Additional Geometry	5-13
Constraint Settings	5-16
Parametric relations	5-17
Dimensional Values and Dimensional Variables	5-19
Parametric Equations	5-20
Viewing the Established Parameters and Relations	5-21
Saving the Model File	5-22
Questions	5-23
Exercises	5-24

Chapter 6

Geometric Construction Tools

Introduction	6-2
The Gasket Design	6-2
Modeling Strategy	6-3
Starting Autodesk Inventor	6-4
Creating a 2D Sketch	6-5
Editing the Sketch by Dragging the Entities	6-7
Adding Additional Constraints	6-9
Using the <i>Trim</i> and <i>Extend</i> Commands	6-10
The <i>Auto Dimension</i> Command	6-12
Creating Fillets and Completing the Sketch	6-14

Fully Constrained Geometry	6-15
Profile Sketch	6-18
Redefining the Profile	6-19
Create an OFFSET Cut Feature	6-23
Questions	6-26
Exercises	6-27

Chapter 7

Parent/Child Relationships and the BORN Technique

Introduction	7-2
The BORN Technique	7-2
The U-Bracket Design	7-3
Starting Up Autodesk Inventor	7-4
Default Sketch Plane Setting	7-4
Applying the BORN Technique	7-5
Creating the 2-D Sketch of the Base Feature	7-7
Create the First Extrude Feature	7-11
The Implied Parent/Child Relationships	7-12
Creating the Second Solid Feature	7-12
Creating the First Cut Feature	7-16
Creating the Next Cut Feature	7-17
Examining the Parent/Child Relationships	7-19
Modify a Parent Dimension	7-20
A Design Change	7-21
Feature Suppression	7-22
A Different Approach to the CENTER_DRILL Feature	7-23
Suppress the Rect_Cut Feature	7-25
Creating the Circular Cut Feature	7-26
A Flexible Design Approach	7-28
Questions	7-29
Exercises	7-30

Chapter 8

Part Drawings and Associative Functionality

Drawings from Parts and Associative Functionality	8-2
Starting Autodesk Inventor	8-3
Drawing Mode - 2D Paper Space	8-3
Drawing Sheet Format	8-5
Using the Pre-defined Drawing Sheet Formats	8-7
Deleting, Activating, and Editing a Drawing Sheet	8-9
Adding a Base View	8-10
Creating Projected Views	8-11

Adjusting the View Scale	8-12
Repositioning Views	8-13
Displaying Feature Dimensions	8-14
Repositioning and Hiding Feature Dimensions	8-16
Adding Additional Dimensions – Reference Dimensions	8-18
Adding Center Marks and Center Lines	8-19
Completing the Drawing Sheet	8-22
Associative Functionality – Modifying Feature Dimensions	8-23
Questions	8-26
Exercises	8-27

Chapter 9

Datum Features and Auxiliary Views

Work Features	9-2
Auxiliary Views in 2D Drawings	9-2
The <i>Rod-Guide</i> Design	9-2
Modeling Strategy	9-3
Applying the BORN Technique	9-5
Creating the Base feature	9-6
Creating an Angled Work Plane	9-8
Creating a 2D Sketch on the Work Plane	9-9
Using the Projected Geometry option	9-9
Completing the Solid feature	9-13
Creating an Offset Work Plane	9-14
Creating Another Cut Feature Using the Work Plane	9-15
Starting a New 2D Drawing	9-17
Adding a Base View	9-18
Creating an Auxiliary View	9-19
Displaying Feature Dimensions	9-21
Adjusting the View Scale	9-23
Adding Additional Dimensions	9-24
Adding Center Marks and Center Lines	9-26
Completing the Drawing Sheet	9-29
Editing the Isometric view	9-30
Questions	9-31
Exercises	9-32

Chapter 10

Symmetrical Features in Designs

Introduction	10-2
A Revolved Design: PULLEY	10-2
Modeling Strategy - A Revolved Design	10-3

Starting Autodesk Inventor	10-4
Setup the display of the Sketch Plane	10-4
Creating the 2-D Sketch for the Revolved Feature	10-5
Creating the Revolved Feature	10-9
Mirroring Features	10-10
Creating a Pattern Leader Using Construction Geometry	10-12
Circular Pattern	10-17
Examining the Design Parameters	10-19
Drawing Mode – Defining New Border and Title Block	10-19
Creating a Drawing Template	10-22
Automatically Retrieve Dimensions	10-23
Creating Views	10-23
Retrieve Dimensions – Features Option	10-27
Associative Functionality – A Design Change	10-29
Adding Center lines to the Pattern Feature	10-30
Completing the Drawing	10-31
Questions	10-33
Exercises	10-34

Chapter 11

Advanced 3D Construction Tools

Introduction	11-2
A Thin-Walled Design: <i>Dryer Housing</i>	11-2
Modeling Strategy	11-3
Starting Autodesk Inventor	11-4
Set up the Display of the Sketch Plane	11-4
Creating the 2-D Sketch for the Base Feature	11-5
Create a Revolved Feature	11-8
Creating Offset Work Planes	11-9
Creating 2D Sketches on the Offset Work Planes	11-10
Creating a Lofted Feature	11-13
Creating an Extruded Feature	11-15
Completing the Extruded Feature	11-17
Create 3D Rounds and Fillets	11-18
Using the Shell Operation	11-19
Create a Pattern Leader	11-20
Creating a Rectangular Pattern	11-23
Creating a Swept Feature	11-25
Define a 2D Sweep Path	11-25
Define the Sweep Section	11-27
Completing the Swept Feature	11-29
Questions	11-31
Exercises	11-32

Chapter 12

Assembly Modeling - Putting It All Together

Introduction	12-2
Assembly Modeling Methodology	12-3
The Shaft Support Assembly	12-4
Additional <i>Parts</i>	12-4
(1) Collar	12-4
(2) Bearing	12-5
(3) Base-Plate	12-5
(4) Cap-Screw	12-6
Starting Autodesk Inventor	12-7
Placing the First Component	12-8
Placing the Second Component	12-9
Degrees of Freedom and Constraints	12-10
Assembly Constraints	12-11
Apply the First Assembly Constraint	12-13
Apply a Second Mate Assembly Constraint	12-15
Constrained Move	12-16
Apply a Flush Constraint	12-17
Placing the Third Component	12-19
Applying an Insert Constraint	12-19
Assemble the Cap-Screws	12-21
Exploded View of the Assembly	12-22
Editing the Components	12-24
Adaptive Design Approach	12-25
Delete and Re-apply Assembly Constraints	12-28
Setup a Drawing of the Assembly Model	12-31
Creating a Parts List	12-33
Editing the Parts List	12-34
Changing the Material Type	12-36
Completing the Assembly Drawing	12-39
Bill of Materials	12-40
Conclusion	12-41
Summary of Modeling Considerations	12-41
Questions	12-42
Exercises	12-43

Index

Notes: