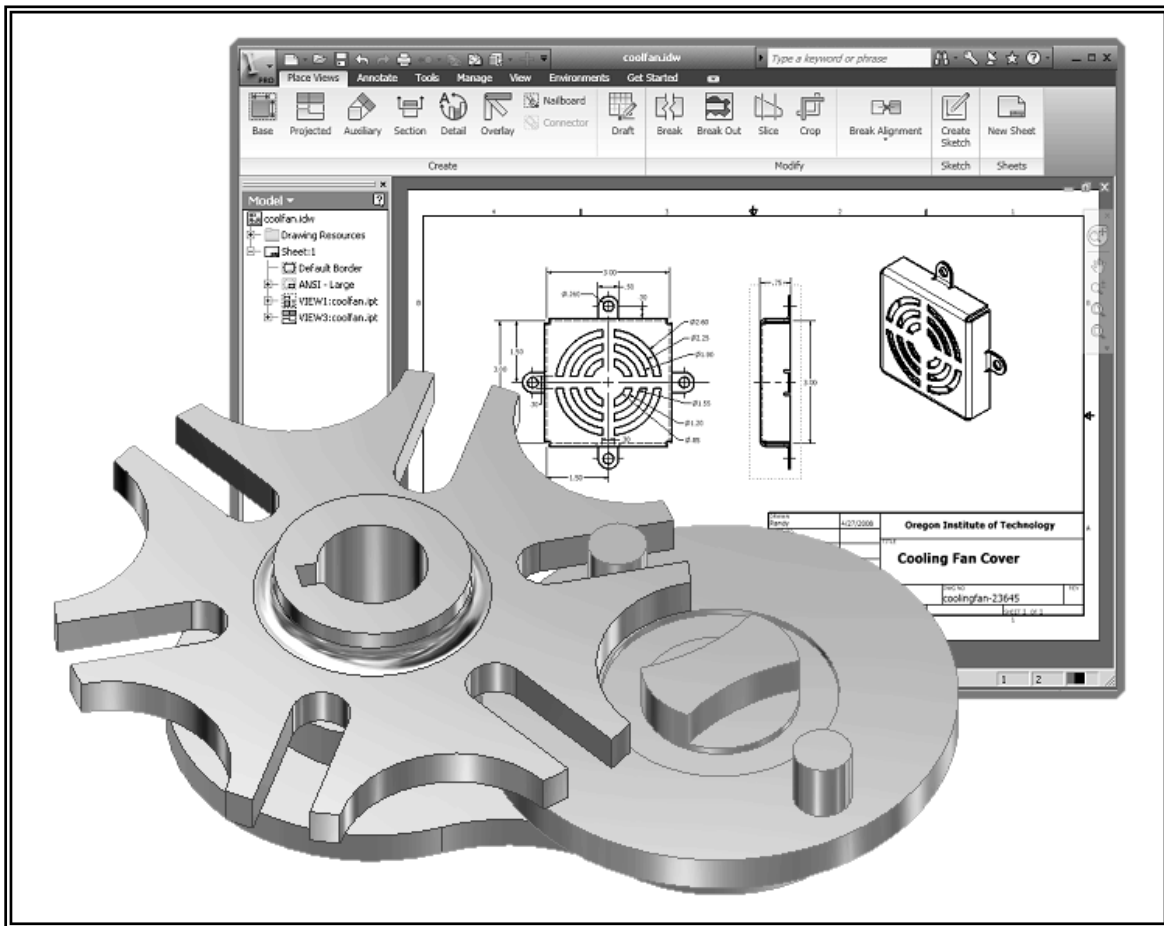


Parametric Modeling with Autodesk Inventor® 2010



Randy H. Shih
Oregon Institute of Technology

SDC
PUBLICATIONS

Schroff Development Corporation
www.schroff.com

Better Textbooks. Lower Prices.

Autodesk Certification Program
The tutorials prepare students for
the Autodesk Inventor 2010
Certified Associate
Examination.

Table of Contents

Preface	i
Acknowledgments	ii
Table of Contents	iii
Autodesk Inventor Certified User Examination Overview	xiii
Chapter 1	
Getting Started	
AutoCAD Certified User Examination Objectives Coverage	1-1
Introduction	1-2
Development of Computer Geometric Modeling	1-2
Feature-Based Parametric Modeling	1-6
Getting Started with 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	2-3
The Adjuster design	2-4
Starting Autodesk Inventor	2-4
Autodesk Inventor Screen Layout	2-5
Creating Rough Sketches	2-6
Step 1: Creating a rough sketch	2-7
Graphics Cursors	2-7
Geometric Constraint Symbols	2-8
Step 2: Apply/modify constraints and dimensions	2-9
Dynamic Viewing Functions – <i>Zoom</i> and <i>Pan</i>	2-12

Modifying the dimensions of the sketch	2-12
Step 3: Completing the Base Solid Feature	2-13
Isometric View	2-14
Dynamic Rotation of the 3-D block - 3D Orbit	2-15
Dynamic Viewing - Quick Keys	2-17
Viewing Tools – Standard Toolbar	2-18
Display Modes	2-22
Orthographic vs. Perspective	2-22
Sketch plane – It is an XY CRT, but an XYZ World	2-23
Step 4-1: Adding an extruded feature	2-25
Step 4-2: Adding a cut feature	2-29
Save the Model	2-32
Questions	2-33
Exercises	2-34

Chapter 3

Constructive Solid Geometry Concepts

Introduction	3-3
Binary Tree	3-4
The Locator Design	3-5
Modeling Strategy - CSG Binary Tree	3-6
Starting Autodesk Inventor	3-7
<i>GRID</i> and <i>SNAP</i> intervals Setup	3-8
Base Feature	3-9
Model Dimensions Format	3-11
Modifying the dimensions of the sketch	3-11
Repositioning Dimensions	3-12
Using the Measure Tools	3-13
Completing the Base Solid Feature	3-16
Creating the next solid feature	3-17
Creating a CUT Feature	3-21
Creating a PLACED FEATURE	3-24
Creating a Rectangular Cut Feature	3-26
Questions	3-28
Exercises	3-29

Chapter 4

Model History Tree

Introduction	4-3
The <i>Saddle Bracket</i> Design	4-4
Starting Autodesk Inventor	4-4
Modeling Strategy	4-5
The <i>Autodesk Inventor Browser</i>	4-6

Creating the Base Feature	4-6
Adding the Second Solid Feature	4-9
Creating a 2D sketch	4-10
Renaming the Part Features	4-12
Adjusting the Width of the Base Feature	4-13
Adding a Placed Feature	4-14
Creating a Rectangular Cut Feature	4-16
History-based Part Modifications	4-17
A Design change	4-18
Assigning and Calculating the Associated Physical Properties	4-21
Questions	4-23
Exercises	4-24

Chapter 5

Parametric Constraints Fundamentals

CONSTRAINTS and RELATIONS	5-3
Create a Simple Triangular Plate Design	5-3
Fully Constrained Geometry	5-4
Starting Autodesk Inventor	5-4
Displaying existing constraints	5-5
Applying Geometric/Dimensional Constraints	5-7
Over-constraining and Driven Dimensions	5-11
Deleting existing constraints	5-12
Using the Auto Dimension command	5-13
Adding Additional Geometry	5-14
Constraint Settings	5-17
Parametric relations	5-18
Dimensional Values and Dimensional Variables	5-20
Parametric Equations	5-21
Viewing the Established Parameters and Relations	5-22
Saving the Model File	5-23
Using the Measure Tools	5-24
Questions	5-28
Exercises	5-29

Chapter 6

Geometric Construction Tools

Introduction	6-3
The Gasket Design	6-3
Modeling Strategy	6-4
Starting Autodesk Inventor	6-5
Creating a 2D Sketch	6-6
Editing the Sketch by Dragging the Sketched Entities	6-8

Adding Additional Constraints	6-10
Using the <i>Trim</i> and <i>Extend</i> Commands	6-11
The <i>Auto Dimension</i> command	6-13
Creating Fillets and Completing the Sketch	6-15
Fully Constrained Geometry	6-16
Profile Sketch	6-19
Redefining the Sketch and the Profile	6-20
Create an OFFSET Cut Feature	6-24
Questions	6-27
Exercises	6-28

Chapter 7

Parent/Child Relationships and the BORN Technique

Introduction	7-3
The BORN Technique	7-3
The U-Bracket Design	7-4
Starting Autodesk Inventor	7-5
Default sketch plane setting	7-5
Applying the BORN Technique	7-6
Creating the 2-D Sketch of the Base feature	7-8
Create the First Extrude Feature	7-12
The Implied Parent/Child Relationships	7-13
Creating the Second Solid Feature	7-13
Creating the First Cut feature	7-17
Creating the Second Cut feature	7-18
Examining the Parent/Child Relationships	7-20
Modify a Parent Dimension	7-21
A Design Change	7-22
Feature Suppression	7-23
A different approach to the CENTER_DRILL feature	7-24
Suppress the Rect_Cut feature	7-26
Creating a Circular Cut Feature	7-27
A Flexible Design Approach	7-29
Creating and Editing Material Properties	7-30
Using the New Material	7-32
Questions	7-34
Exercises	7-35

Chapter 8

Part Drawings and Associative Functionality

Drawings from Parts and Associative Functionality	8-3
Starting Autodesk Inventor	8-4
Drawing Mode - 2D Paper Space	8-4

Drawing Sheet Format	8-6
Using the Pre-defined Drawing Sheet Formats	8-8
Deleting, Activating, and Editing a Drawing Sheet	8-10
Adding a Base View	8-11
Creating Projected Views	8-12
Adjusting the View Scale	8-13
Repositioning Views	8-14
Displaying Feature Dimensions	8-15
Repositioning and Hiding Feature Dimensions	8-17
Adding Additional Dimensions – Reference Dimensions	8-19
Adding Center Marks and Center Lines	8-20
Completing the Drawing Sheet	8-23
Associative Functionality – Modifying Feature Dimensions	8-24
3D Annotations in Isometric Views	8-27
Questions	8-35
Exercises	8-36

Chapter 9

Datum Features and Auxiliary Views

Work Features	9-3
Auxiliary Views in 2D Drawings	9-3
The <i>Rod-Guide</i> Design	9-3
Modeling Strategy	9-4
Starting Autodesk Inventor	9-5
Applying the BORN Technique	9-5
Creating the Base feature	9-7
Creating an Angled Work Plane	9-9
Creating a 2D sketch on the work plane	9-10
Using the Projected Geometry option	9-10
Completing the Solid feature	9-14
Creating an Offset Work Plane	9-15
Creating another cut feature using the work plane	9-16
Starting a new 2D drawing	9-18
Adding a Base View	9-19
Creating an Auxiliary View	9-20
Displaying Feature Dimensions	9-22
Adjusting the View Scale	9-24
Adding Additional Dimensions	9-25
Adding Center Marks and Center Lines	9-27
Completing the Drawing Sheet	9-30
Editing the Isometric view	9-31
Questions	9-32
Exercises	9-33

Chapter 10

Symmetrical Features in Designs

Introduction	10-3
A Revolved Design: PULLEY	10-3
Modeling Strategy - A Revolved Design	10-4
Starting Autodesk Inventor	10-5
Setup the display of the Sketch Plane	10-5
Creating the 2-D Sketch for the Revolved feature	10-6
Creating the Revolved Feature	10-10
Mirroring Features	10-11
Creating A Pattern Leader Using Construction Geometry	10-13
Circular Pattern	10-18
Examining the design parameters	10-20
Drawing Mode – Defining New Border and Title Block	10-20
Creating a Drawing Template	10-23
Creating Views	10-24
Retrieve Dimensions – Features option	10-27
Associative Functionality – A Design Change	10-29
Adding Center lines to the Pattern feature	10-31
Completing the Drawing	10-32
Questions	10-35
Exercises	10-36

Chapter 11

Advanced 3D Construction Tools

Introduction	11-3
A Thin-Walled Design: <i>Dryer Housing</i>	11-3
Modeling Strategy	11-4
Starting Autodesk Inventor	11-5
Set up the display of the Sketch Plane	11-5
Creating the 2-D Sketch for the Base Feature	11-6
Create a Revolved Feature	11-9
Creating Offset Work Planes	11-10
Creating 2D sketches on the Offset Work Planes	11-11
Creating a Lofted Feature	11-14
Creating an Extruded Feature	11-16
Completing the Extruded Feature	11-18
Create 3D Rounds and Fillets	11-19
Using the Shell Operation	11-20
Create a Pattern Leader	11-21
Creating a Rectangular Pattern	11-24
Creating a Swept Feature	11-26
Define a 2D Sweep path	11-26

Define the Sweep Section	11-28
Completing the Swept Feature	11-30
Questions	11-32
Exercises	11-33

Chapter 12

Sheet Metal Designs

Sheet Metal Processes	12-3
Sheet Metal Modeling	12-5
K-Factor	12-6
The Actuator Bracket Design	12-7
Starting Autodesk Inventor	12-8
Sheet Metal Defaults	12-9
Creating the Base Face Feature of the Design	12-12
Using the Flange Command	12-15
Mirroring Features	12-19
Creating a Cut Feature	12-20
Creating a Fold Feature	12-21
Creating the Associated Flat Pattern	12-25
Confirm the Flattened Length	12-26
Creating a 2D Sheet Metal drawing	12-27
Questions	12-34
Exercises	12-35

Chapter 13

Assembly Modeling - Putting It All Together

Introduction	13-3
Assembly Modeling Methodology	13-4
The Shaft Support Assembly	13-5
Additional <i>Parts</i>	13-5
(1) Collar	13-5
(2) Bearing	13-6
(3) Base-Plate	13-6
(4) Cap-Screw	13-7
Starting Autodesk Inventor	13-8
Placing the First Component	13-9
Placing the Second Component	13-10
Degrees of Freedom and Constraints	13-11
Assembly Constraints	13-12
Apply the First Assembly Constraint	13-14
Apply a Second Mate Assembly Constraint	13-16
Constrained Move	13-17
Apply a Flush Constraint	13-18

Placing the Third Component	13-20
Applying an Insert Constraint	13-20
Assemble the Cap-Screws	13-22
Exploded View of the Assembly	13-23
Editing the Components	13-25
Adaptive Design Approach	13-26
Delete and Re-apply Assembly Constraints	13-30
Setup a Drawing of the Assembly Model	13-32
Creating a Parts List	13-34
Editing the Parts List	13-35
Changing the Material Type	13-37
Completing the Assembly Drawing	13-39
Bill of Materials	13-40
(a) BOM from Parts List	13-40
(b) BOM from Assembly Model	13-41
Questions	13-43
Exercises	13-44

Chapter 14

Content Center and Basic Motion Analysis

Introduction	14-3
The Crank-Slider Assembly	14-4
Creating the required Parts	14-4
Starting Autodesk Inventor	14-6
Placing the First Component	14-7
Placing the Second Component	14-8
Applying the Assembly Constraints	14-9
Apply a Second MATE Constraint	14-10
Constrained Move	14-11
Placing the Third Component	14-11
Assemble the CS-Rod part	14-13
Making a Copy of the PIN part	14-14
Assemble the CS-Slider Part	14-15
Adding an Angle Constraint to Fully Constrain the Assembly	14-18
Interference Analysis	14-20
Basic Motion Analysis	14-21
3D Grip Editing the CS-Slider Part	14-24
Questions	14-28
Exercises	14-29

Chapter 15

2D Design Reuse, Collision and Contact

Introduction	15-3
The Geneva CAM Assembly	15-4
Internet Downloading the Geneva-Wheel DWG file	15-4
Opening AutoCAD DWG file in Inventor	15-5
Using the Measuring Tools	15-6
Opening the AutoCAD DWG Layout	15-8
2D Design Reuse	15-10
Completing the Imported Sketch	15-14
Creating the First Solid Feature	15-16
Creating a Mirrored Feature	15-17
Circular Pattern	15-18
Circular Pattern	15-19
Additional Parts	15-20
Starting a New Assembly	15-22
Placing the Second Component	15-23
Applying the Assembly Constraints	15-24
Apply a Second MATE Constraint	15-25
Assemble the Geneva-Driver	15-26
Assemble the Geneva-Pin	15-27
Adding an Angle Constraint to Constrain the Driver	15-28
Animation with Drive Constraint Tool	15-29
Using the Inventor Contact Solver	15-31
Constrained Move with Suppressed Constraints	15-33
Conclusion	15-34
Summary of Modeling Considerations	15-34
Questions	15-35
Exercises	15-36

Appendix

Index