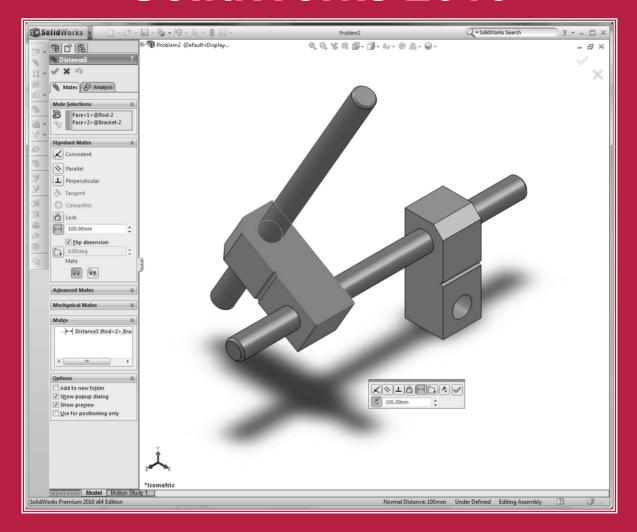
## Parametric Modeling

with

## SolidWorks 2010



Randy H. Shih

Oregon Institute of Technology

Paul J. Schilling

University of New Orleans



www.SDCpublications.com

**Schroff Development Corporation** 

ill Holts broke begge strong of the true broke begge strong of the broke begge strong of the broke begge begging of the broke begging the broke beg

## **Table of Contents**

Preface Acknowledgments Table of Contents Certified SolidWorks Associate (CSWA) Exam Overview	i ii iii xi
Chapter 1 Getting Started	
Introduction Development of Computer Geometric Modeling Feature-Based Parametric Modeling Getting Started with SolidWorks Units Setup SolidWorks Screen Layout Mouse Buttons [Esc] - Canceling Commands On-Line Help Leaving SolidWorks Creating a CAD Files Folder	1-2 1-2 1-6 1-7 1-9 1-11 1-17 1-18 1-18 1-19
Chapter 2 Parametric Modeling Fundamentals	
Introduction The Adjuster design Starting SolidWorks SolidWorks Screen Layout Units Setup Creating Rough Sketches Step 1: Creating a Rough Sketch Graphics Cursors Geometric Relation Symbols	2-3 2-4 2-4 2-5 2-6 2-7 2-8 2-8 2-10
Step 2: Apply/Modify Relations and Dimensions Changing the Dimension Standard Viewing Functions – Zoom and Pan Modifying the Dimensions of the Sketch Step 3: Completing the Base Solid Feature Isometric View Rotation of the 3-D Model – Rotate View Rotation and Panning – Arrow keys Viewing – Quick Keys Viewing Tools – Heads-up View Toolbar View Orientation Display Style	2-11 2-12 2-13 2-14 2-15 2-16 2-16 2-18 2-19 2-21 2-22 2-23

Orthographic vs. Perspective Customizing the Heads-up View Toolbar Sketch Plane	2-23 2-23 2-24
Step 4-1: Adding an Extruded Boss Feature	2-24 2-26
Step 4-1: Adding an Extruded Cut Feature	2-20 2-29
Save the Model	2-31
Questions	2-32
Exercises	2-33
Exercises	2 33
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 SolidWorks	3-7
GRID and SNAP Intervals Setup	3-8
Base Feature	3-9
Modifying the Dimensions of the Sketch	3-11
Repositioning Dimensions	3-11
Completing the Base Solid Feature	3-12
Creating the Next Solid Feature	3-13
Creating an Extruded Cut Feature	3-16
Creating a Hole with the Hole Wizard	3-19
Creating a Rectangular Extruded Cut Feature	3-22
Questions	3-25
Exercises	3-26
Chapter 4	
Feature Design Tree	
Introduction	4-3
Starting SolidWorks	4-4
Creating a User-Defined Part Template	4-5
The Saddle Bracket Design	4-9
Modeling Strategy	4-10
The SolidWorks FeatureManager Design Tree	4-11
Creating the Base Feature	4-11
Adding the Second Solid Feature	4-14
Creating a 2D sketch	4-15
Renaming the Part Features	4-17
Adjusting the Width of the Base Feature	4-18
Adding a Hole	4-19
Creating a Rectangular Extruded Cut Feature	4-22
History-Based Part Modifications	4-23

	Table of Contents
A Design change	4-24
Questions	4-27
Exercises	4-28
Chapter 5 Geometric Relations Fundamentals	
DIMENSIONS and RELATIONS	5-3
Create a Simple Triangular Plate Design	5-3
Fully Defined Geometry	5-4
Starting SolidWorks	5-4
Displaying Existing Relations	5-5
Applying Geometric Relations/Dimensional Constraints	5-6
Over-Defining and Driven Dimensions	5-11
Deleting Existing Relations	5-12
Using the Fully Define Sketch Tool	5-13
Adding Additional Geometry	5-1 <i>3</i>
Relation Settings	5-17
Parametric Relations	5-18
Dimensional Values and Dimensional Variables	5-20
Parametric Equations	5-21
Viewing the Established Equations	5-22
Adding Linked Dimensions	5-24
Saving the Model File	5-28
Questions	5-29
Exercises	5-30
Chapter 6 Geometric Construction Tools	
Geometric Construction Tools	
Introduction	6-3
The Gasket Design	6-3
Modeling Strategy	6-4
Starting SolidWorks	6-5
Creating a 2D Sketch	6-6
Editing the Sketch by Dragging the Entities	6-8
Adding Additional Relations	6-10
Using the <i>Trim</i> and <i>Extend</i> Commands	6-11
Adding Dimensions with the Fully Define Sketch Tool	6-14
Fully Defined Geometry	6-16
Creating Fillets and Completing the Sketch	6-17
Profile Sketch	6-18
Redefining the Sketch and Profile using Contour Selection	6-19
Create an OFFSET Extruded Cut Feature	6-23
Alternate Construction Method - Thin Feature Option	6-27
Questions	6-30
Exercises	6-31

Chapter 7				
Parent/Child	Relationships	and the	<b>BORN</b>	Technique

Introduction	7-3
The BORN Technique	7-3
The U-Bracket Design	7-4
Starting SolidWorks	7-4
Applying the BORN Technique	7-5
Creating the 2-D Sketch of the Base Feature	7-6
Creating the First Extrude Feature	7-12
The Implied Parent/Child Relationships	7-12
Creating the Second Solid Feature	7-13
Creating the First Extruded Cut Feature	7-16
Creating the Second Extruded 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	7-24
Creating a Circular Extruded Cut Feature	7-25
A Flexible Design Approach	7-27
Save Part File	7-28
Questions	7-29
Exercises	7-30
Chapter 8	
Part Drawings and Associative Functionality	
Drawings from Parts and Associative Functionality	8-3
Starting SolidWorks	8-4
Drawing Mode	8-4
Setting Document Properties	8-7
Setting Sheet Properties using the Pre-Defined Sheet Formats	8-8
Open the Drawing Toolbar	8-8
Creating Three Standard Views	8-9
Repositioning Views	8-9
Adding a New Sheet	8-10
Adding a Base View	8-11
Adding an Isometric View using the View Palette	8-13
Adjusting the View Scale	8-14
Displaying Feature Dimensions	8-15
Repositioning, Appearance, and Hiding of Feature Dimensions	8-16
Adding Additional Dimensions – Reference Dimensions	8-18
Tangent Edge Display	8-20
Adding Center Marks, Center Lines, and Sketch Objects	8-20
Edit Sheet vs. Edit Sheet Format	8-24

	Table of Contents
Completing the Drawing Sheet	8-24
Property Links	8-26
Associative Functionality – Modifying Feature Dimensions	8-31
Saving the Drawing File	8-34
Saving a Drawing Template	8-34
Questions	8-36
Exercises	8-37
Chapter 9 Reference Geometry and Auxiliary Views	
•	
Reference Geometry	9-3
Auxiliary Views in 2D Drawings	9-3
The Rod-Guide Design	9-3
Modeling Strategy	9-4
Starting SolidWorks	9-5
Applying the BORN Technique	9-5
Creating the Base Feature	9-6
Creating an Angled Reference Plane	9-8
Creating a 2D sketch on the Reference Plane	9-11
Using the Convert Entities Option	9-11
Completing the Solid Feature	9-15
Creating an Offset Reference Plane	9-16
Creating another Extruded Cut Feature using the Reference Plane	
Starting a New 2D Drawing and Adding a Base View	9-19
Creating an Auxiliary View	9-20
Displaying Feature Dimensions	9-22
Adjusting the View Scale	9-24
Repositioning, Appearance, and Hiding of Feature Dimensions	9-24
Tangent Edge Display	9-27
Adding Center Marks and Center Lines	9-27
Controlling the View and Sheet Scales	9-30
Completing the Drawing Sheet	9-31
	9-31
Editing the Isometric view	9-32 9-34
Questions	
Exercises	9-35
Chapter 10	
Symmetrical Features in Designs	
Introduction	10-3
A Revolved Design: PULLEY	10-3
Modeling Strategy - A Revolved Design	10-4
Starting SolidWorks	10-5
Creating the 2-D Sketch for the Base Feature	10-5
Creating the Revolved Feature	10-9

vii

Mirroring Features Creating an Extruded Cut Feature using Construction Geometry Circular Pattern Drawing Mode – Defining a New Border and Title Block Creating a New Drawing Template Creating Views Retrieve Dimensions – Model Items Command Save the Drawing File Associative Functionality – A Design Change Adding Center lines to the Pattern Feature	10-10 10-11 10-16 10-18 10-21 10-22 10-25 10-26 10-27 10-29
Completing the Drawing Questions Exercises	10-30 10-33 10-34
Chapter 11 Advanced 3D Construction Tools	
Introduction A Thin-Walled Design: Dryer Housing Modeling Strategy Starting SolidWorks Creating the 2-D Sketch for the Base Feature Create a Revolved Boss Feature Creating Offset Reference Planes Creating 2D Sketches on the Offset Reference Planes Creating a Lofted Feature Creating an Extruded Boss Feature Completing the Extruded Boss Feature Create 3D Rounds and Fillets Creating a Shell Feature Create a Rectangular Extruded Cut Feature Creating a Linear Pattern Creating a Swept Feature Questions Exercises	11-3 11-3 11-4 11-5 11-5 11-8 11-9 11-10 11-13 11-15 11-16 11-17 11-18 11-19 11-21 11-24 11-29 11-30
Chapter 12 Assembly Modeling – Putting It All Together	
Introduction Assembly Modeling Methodology The Shaft Support Assembly Parts Creating the Collar using the Chamfer Command Creating the Bearing and Base-Plate Creating the Cap-Screw	12-3 12-3 12-4 12-4 12-4 12-6 12-7

Table of Contents ix

Starting SolidWorks	12-8
Document Properties	12-8
Inserting the First Component	12-9
Inserting the Second Component	12-10
Degrees of Freedom	12-11
Assembly Mates	12-11
Apply the First Assembly Mate	12-13
Apply a Second Mate	12-14
Constrained Move	12-15
Apply a Third Mate	12-16
Inserting the Third Component	12-19
Applying Concentric and Coincident Mates	12-19
Assemble the Cap-Screws using SmartMates	12-21
Exploded View of the Assembly	12-25
Save the Assembly Model	12-27
Editing the Components	12-27
Setup a Drawing of the Assembly Model	12-29
Creating a Bill of Materials	12-30
Editing the Bill of Materials	12-32
Completing the Assembly Drawing	12-34
Exporting the Bill of Materials	12-37
Conclusion	12-37
Summary of Modeling Considerations	12-38
Questions	12-39
Exercises	12-40
Chapter 13	
Design Library and Basic Motion Study	
Introduction	13-3
The Crank-Slider Assembly	13-3
· · · · · · · · · · · · · · · · · · ·	13-4
Creating the Required Parts Mate References	13-4
Starting SolidWorks	13-7
Document Properties	13-9
Inserting First Component	13-10
Apply Assembly Mates	13-10
Apply a Second Mate	13-12
Constrained Move	13-13
	13-14
Placing the Third Component using a Mate Reference Assemble the CS-Rod Part	
	13-15
Inserting Pin from the SolidWorks Toolbox Assemble the CS-Slider Part	13-16
	13-18
Adding an Angle-Mate Collision Detection	13-20
	13-21
Editing the CS-Slider Part in the Assembly	13-23

Parametric Modeling with SolidWorks
-------------------------------------

Basic Motion Analysis Questions	13-24 13-26
Exercises	13-27
Chapter 14	
Design Analysis with SimulationXpress	
Introduction The SimulationXpress Wizard Interface Problem Statement Preliminary Analysis SolidWorks SimulationXpress Study of the Flat Plate Getting Started – Create the SolidWorks Part Create a SimulationXpress Study Viewing SimulationXpress Results Creating an HTML Report and an eDrawings File Accuracy of Results Closing SmiulationXpress and Saving Results Questions Exercises	14-3 14-4 14-5 14-5 14-7 14-7 14-9 14-12 14-17 14-18 14-20 14-21 14-22
Chapter 15 CSWA Exam Preparation	
Tips about Taking the Certified SolidWorks Associate Examination Introduction The Part Problem Strategy for Aligning the Part to the Default Axis System Creating the Base Feature Creating a New View Orientation Completing the Part Selecting the Material and Viewing the Mass Properties The Assembly Problem Creating the Parts Creating the Assembly Creating a Reference Coordinate System View the Mass Properties Questions	15-3 15-4 15-5 15-6 15-6 15-8 15-10 15-16 15-19 15-20 15-21 15-27 15-29 15-32
Exercises	15-33

## Index