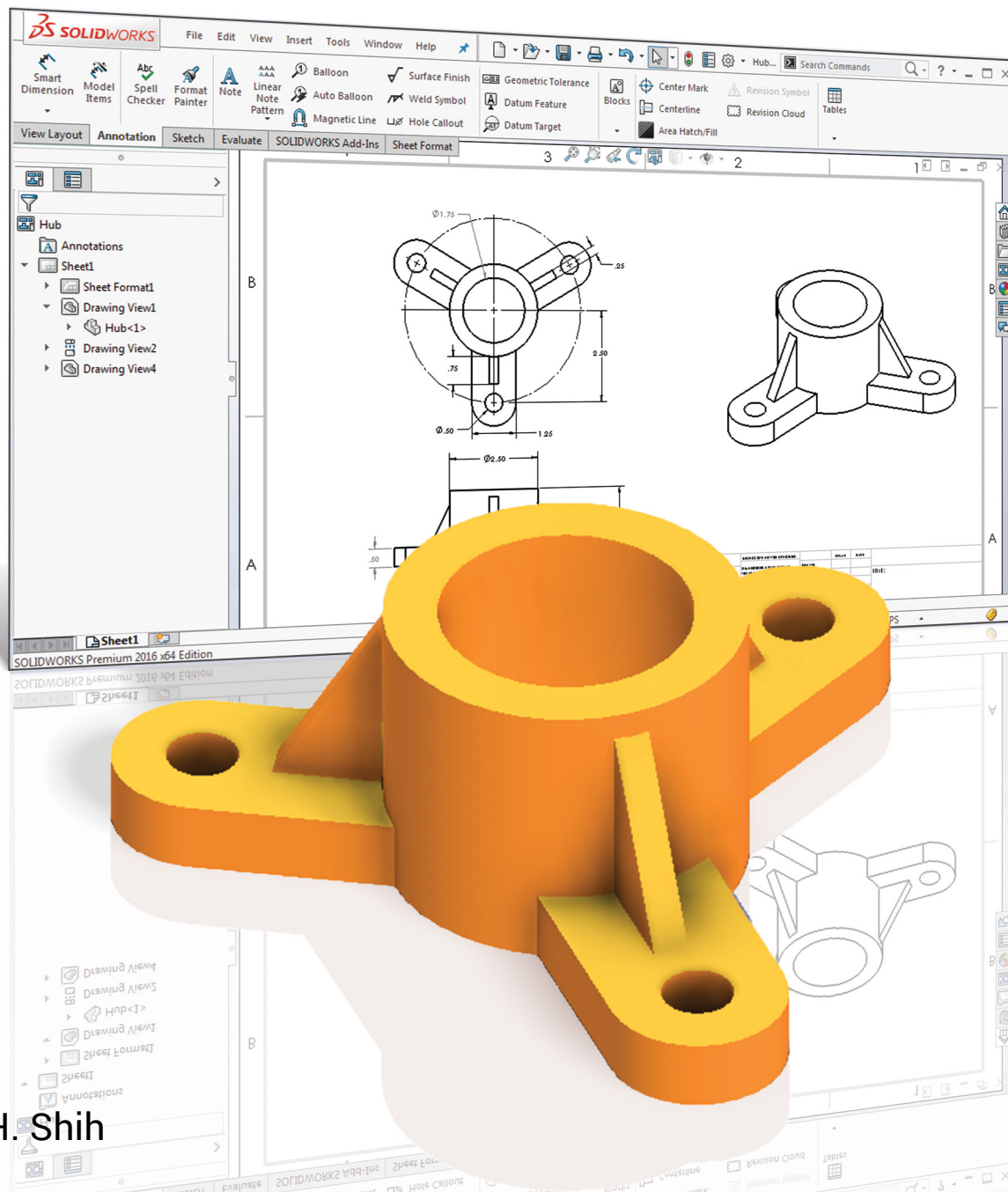


SOLIDWORKS® 2016 and Engineering Graphics

An Integrated Approach



Randy H. Shih

Visit the following websites to learn more about this book:



amazon.com

Google books

BARNES&NOBLE

Table of Contents

Preface	i
Acknowledgments	ii
Table of Contents	iii
Certified SOLIDWORKS Associate Examination Reference Guide	xiv
Tips about Taking the SOLIDWORKS Certified Associate Examination	xx

Chapter 1

Introduction

Introduction	1-2
Drawing in CAD Systems	1-4
Development of Computer Geometric Modeling	1-4
Feature-Based Parametric Modeling	1-8
Getting Started with SOLIDWORKS	1-9
Starting SOLIDWORKS	1-9
Units Setup	1-11
SOLIDWORKS Screen Layout	1-13
Menu Bar	1-13
Menu Bar Pull-down Menus	1-14
Heads-up View Toolbar	1-14
Features Toolbar	1-14
Sketch Toolbar	1-14
Feature Manager-Design Tree/Property Manager	1-15
Configuration Manager/DimXpert Manager/Display Manager	1-15
Graphics Area	1-16
Reference Triad	1-16
Origin	1-16
Confirmation Corner	1-16
Graphics Cursor or Crosshairs	1-16
Message and Status Bar	1-16
Using the SOLIDWORKS Command Manager	1-17
Mouse Buttons	1-18
[Esc] - Canceling Commands	1-18
SOLIDWORKS Help System	1-19
Leaving SOLIDWORKS	1-19
Creating a CAD File Folder	1-20

Chapter 2

Parametric Modeling Fundamentals

Introduction	2-3
The Adjuster Design	2-4
Starting SOLIDWORKS	2-4
SOLIDWORKS Part Modeling Window Layout	2-5

Step 1: Determine/Setup the Base Feature	2-7
Sketching Plane – It is an XY CRT, but an XYZ world	2-7
Creating Rough Sketches	2-9
Step 2: Creating a Rough Sketch	2-10
Graphics Cursors	2-10
Geometric Relation Symbols	2-12
Step 3: Apply/Modify Relations and Dimensions	2-13
Viewing Functions – Zoom and Pan	2-15
Delete an Existing Geometry of the Sketch	2-16
Modifying the Dimensions of the Sketch	2-17
Step 4: Completing the Base Solid Feature	2-18
Isometric View	2-19
Rotation of the 3-D Model – Rotate View	2-19
Rotation and Panning – Arrow keys	2-21
Dynamic Viewing – Quick Keys	2-22
3D Rotation	2-24
Viewing Tools – Heads-up View Toolbar	2-24
View Orientation	2-25
Display Style	2-26
Orthographic vs. Perspective	2-26
Customizing the Heads-up View Toolbar	2-26
Step 5-1: Adding an Extruded Boss Feature	2-27
Step 5-2: Adding an Extruded Cut Feature	2-31
Step 5-3: Adding another Cut Feature	2-33
Save the Model	2-35
Questions	2-36
Exercises	2-37

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 and Activating the Command Manager	3-7
<i>GRID</i> and <i>SNAP</i> Intervals Setup	3-9
Base Feature	3-10
Repositioning Dimensions	3-12
Completing the Base Solid Feature	3-13
Creating the Next Solid Feature	3-14
Creating an Extruded Cut Feature	3-17
Creating a Hole with the Hole Wizard	3-20
Creating a Rectangular Extruded Cut Feature	3-23
Using the View Selector	3-25
Questions	3-27

Exercises	3-28
-----------	------

Chapter 4

Geometric Constructions

Geometric Constructions	4-3
Geometric Constructions - Classical Methods	4-4
• Bisection of a Line or Arc	4-4
• Bisection of an Angle	4-5
• Transfer of an Angle	4-6
• Dividing a Given Line into a Number of Equal Parts	4-7
• Circle through Three Points	4-8
• A Line Tangent to a Circle	4-9
• Line Tangent to a circle from a Given Point	4-10
• Circle of a Given Radius Tangent to Two Given Lines	4-11
• Circle of a Given Radius Tangent to an Arc and a Line	4-12
• Circle of a Given Radius Tangent to Two Arcs	4-13
Starting SOLIDWORKS	4-14
Geometric Construction – CAD Method	4-16
• Bisection of a Line or Arc	4-16
Dimensions and Relations	4-18
Geometric Symbols available in parametric sketching	4-19
• Bisection of an Angle	4-20
• Dividing a Given Line into a Number of Equal Parts	4-22
• Circle through Three Points	4-29
• Line Tangent to a circle from a Given Point	4-30
• Circle of a Given Radius Tangent to Two Given Lines	4-31
Adding Geometric Relations and Fully Defined Geometry	4-34
Starting SOLIDWORKS	4-34
Over-Defining and Driven Dimensions	4-41
Deleting Existing Relations	4-42
Using the Fully Define Sketch Tool	4-43
Adding Additional Geometry	4-44
Adding New Equations	4-49
Questions	4-51
Exercises	4-52

Chapter 5

Feature Design Tree

Introduction	5-3
Starting SOLIDWORKS	5-4
Creating a User-Defined Part Template	5-5
The <i>Saddle Bracket</i> Design	5-9
Modeling Strategy	5-10
The SOLIDWORKS <i>Feature Manager Design Tree</i>	5-11

Creating the Base Feature	5-11
Adding the Second Solid Feature	5-14
Creating a 2D Sketch	5-15
Renaming the Part Features	5-17
Adjusting the Width of the Base Feature	5-18
Adding a Cut Feature	5-19
Creating a Rectangular Extruded Cut Feature	5-22
History-Based Part Modifications	5-23
A Design Change	5-24
Feature Manager Design Tree Views	5-26
Questions	5-28
Exercises	5-29

Chapter 6

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
Questions	6-27
Exercises	6-28

Chapter 7

Orthographic Projections and Multiview Constructions

Introduction	7-3
Basic Principles of Projection	7-4
Orthographic Projection	7-4
Multiview Orthographic Projection	7-5
First-Angle Projection	7-6
Rotation of the Horizontal and Profile Planes	7-7
The 3D Adjuster Model and 1 st angle projection	7-8
General Procedure: 1 st Angle Orthographic Projection	7-9
Example 2: 1 st Angle Orthographic Projection	7-10
Chapter 7 - 1 st Angle Orthographic Sketching Exercise 1	7-11
Chapter 7 - 1 st Angle Orthographic Sketching Exercise 2	7-13

Chapter 7 - 1 st Angle Orthographic Sketching Exercise 3	7-15
Chapter 7 - 1 st Angle Orthographic Sketching Exercise 4	7-17
Chapter 7 - 1 st Angle Orthographic Sketching Exercise 5	7-19
Chapter 7 - 1 st Angle Orthographic Sketching Exercise 6	7-21
Third-Angle Projection	7-23
Rotation of the Horizontal and Profile Planes	7-24
The 3D Adjuster Model and 3 rd angle projection	7-25
The Glass Box and the Six Principal Views	7-26
General Procedure: 3 rd Angle Orthographic Projection	7-28
Example 2: 3 rd Angle Orthographic Projection	7-29
Example 3: 3 rd Angle Orthographic Projection	7-30
Chapter 7 - 3 rd Angle Orthographic Sketching Exercise 1	7-31
Chapter 7 - 3 rd Angle Orthographic Sketching Exercise 2	7-33
Chapter 7 - 3 rd Angle Orthographic Sketching Exercise 3	7-35
Chapter 7 - 3 rd Angle Orthographic Sketching Exercise 4	7-37
Chapter 7 - 3 rd Angle Orthographic Sketching Exercise 5	7-39
Chapter 7 - 3 rd Angle Orthographic Sketching Exercise 6	7-41
Alphabet of Lines	7-43
Precedence of Lines	7-45
The U-Bracket Design	7-46
Starting SOLIDWORKS	7-46
Applying the BORN Technique	7-47
Creating the 2D Sketch of the Base Feature	7-48
Creating the First Extrude Feature	7-55
The Implied Parent/Child Relationships	7-55
Creating the Second Solid Feature	7-56
Creating the First Extruded Cut Feature	7-59
Creating the Second Extruded Cut Feature	7-60
Examining the Parent/Child Relationships	7-62
Modify a Parent Dimension	7-63
A Design Change	7-64
Feature Suppression	7-65
A Different Approach to the CENTER_DRILL Feature	7-66
Suppress the Rect_Cut Feature	7-67
Creating a Circular Extruded Cut Feature	7-68
A Flexible Design Approach	7-70
Drawings from Parts and Associative Functionality	7-71
Drawing Mode	7-72
Setting Document Properties	7-74
Setting Sheet Properties using the Pre-Defined Sheet Formats	7-75
Creating Three Standard Views	7-76
Repositioning Views	7-76
Adding a New Sheet	7-78
Adding a Base View	7-79
Adding an Isometric View using the View Palette	7-82
Adjusting the View Scale	7-83

Questions	7-85
Exercises	7-86

Chapter 8

Dimensioning and Notes

Introduction	8-3
Dimensioning Standards and Basic Terminology	8-4
Selection and Placement of Dimensions and Notes	8-5
Machined Holes	8-12
Baseline and Chain Dimensioning	8-15
Dimensioning and Tolerance Accumulation	8-16
(1) Tolerance Accumulation - Baseline Dimensioning	8-17
(2) Tolerance Accumulation - Chain Dimensioning	8-18
(3) Avoid Tolerance Accumulation Feature Functionality Manufacturing	8-19
Dimensioning Tools in SOLIDWORKS	8-20
The U-Bracket Design	8-20
Starting SOLIDWORKS	8-21
Displaying Feature Dimensions	8-22
Repositioning, Appearance, and Hiding of Feature Dimensions	8-23
Adding Additional Dimensions – Reference Dimensions	8-25
Tangent Edge Display	8-27
Adding Center Marks, Center Lines, and Sketch Objects	8-27
Edit Sheet vs. Edit Sheet Format	8-32
Modify the Title Block	8-32
Property Links	8-35
Associative Functionality – Modifying Feature Dimensions	8-39
Saving the Drawing File	8-42
Saving a Drawing Template	8-42
Questions	8-45
Exercises	8-46

Chapter 9

Tolerancing and Fits

Precision and Tolerance	9-2
Methods of Specifying Tolerances – English System	9-3
Nomenclature	9-4
Example 9.1	9-5
Fits between Mating parts	9-6
Selective Assembly	9-7
Basic Hole and Basic Shaft Systems	9-7
American National Standard Limits and Fits – Inches	9-8
Example 9.2 Basic Hole System	9-13
Example 9.3 Basic Hole System	9-14
Example 9.4 Basic Shaft System	9-15
Example 9.5 Basic Shaft System	9-16

Tolerancing – Metric System	9-17
Metric Tolerances and Fits Designation	9-18
Preferred ISO Metric Fits	9-19
Example 9.6 Metric Hole Basis System	9-20
Example 9.7 Shaft Basis System	9-21
Updating the U-Bracket Drawing	9-22
Determining the Tolerances Required	9-23
Questions	9-25
Exercises	9-26

Chapter 10

Pictorials and Sketching

Engineering Drawings, Pictorials and Sketching	10-2
Isometric Sketching	10-7
Chapter 10 - Isometric Sketching Exercise 1	10-9
Chapter 10 - Isometric Sketching Exercise 2	10-11
Chapter 10 - Isometric Sketching Exercise 3	10-13
Chapter 10 - Isometric Sketching Exercise 4	10-15
Chapter 10 - Isometric Sketching Exercise 5	10-17
Chapter 10 - Isometric Sketching Exercise 6	10-19
Chapter 10 - Isometric Sketching Exercise 7	10-21
Chapter 10 - Isometric Sketching Exercise 8	10-23
Chapter 10 - Isometric Sketching Exercise 9	10-25
Chapter 10 - Isometric Sketching Exercise 10	10-27
Oblique Sketching	10-29
Chapter 10 - Oblique Sketching Exercise 1	10-31
Chapter 10 - Oblique Sketching Exercise 2	10-33
Chapter 10 - Oblique Sketching Exercise 3	10-35
Chapter 10 - Oblique Sketching Exercise 4	10-37
Chapter 10 - Oblique Sketching Exercise 5	10-39
Chapter 10 - Oblique Sketching Exercise 6	10-41
Perspective Sketching	10-43
One-Point Perspective	10-44
Two-Point Perspective	10-45
Chapter 10 - Perspective Sketching Exercise 1	10-47
Chapter 10 - Perspective Sketching Exercise 2	10-49
Chapter 10 - Perspective Sketching Exercise 3	10-51
Chapter 10 - Perspective Sketching Exercise 4	10-53
Chapter 10 - Perspective Sketching Exercise 5	10-55
Chapter 10 - Perspective Sketching Exercise 6	10-57
Questions	10-59
Exercises	10-60

Chapter 11**Section Views & Symmetrical Features in Designs**

Introduction	11-3
General Rules of Section Views	11-5
Section Drawing Types	11-6
• Full Section	11-6
• Half Section	11-6
• Offset Section	11-7
• Broken-Out Section	11-7
• Aligned Section	11-8
• Half Views	11-8
• Thin Sections	11-8
• Revolved Section	11-9
• Removed Section	11-9
• Conventional Breaks	11-10
• Ribs and Webs in Sections	11-10
• Parts Not Sectioned	11-10
Section Views in SOLIDWORKS	11-11
A Revolved Design: PULLEY	11-11
Modeling Strategy - A Revolved Design	11-12
Starting SOLIDWORKS	11-13
Creating the Base Feature	11-13
Creating the Revolved Feature	11-17
Mirroring Features	11-17
Creating an Extruded Cut Feature using Construction Geometry	11-19
Circular Pattern	11-24
Drawing Mode – Defining a New Border and Title Block	11-26
Creating a New Drawing Template	11-30
Creating Views	11-31
Retrieve Dimensions – Model Items Command	11-34
Save the Drawing File	11-35
Associative Functionality – A Design Change	11-36
Adding Centerlines to the Pattern Feature	11-38
Completing the Drawing	11-40
Questions	11-43
Exercises	11-44

Chapter 12**Auxiliary Views and Reference Geometry**

Introduction	12-3
Normal View of an Inclined Surface	12-4
Construction Method I – Folding Line Method	12-6
Construction Method II – Reference Plane Method	12-8
Partial Views	12-10

Reference Geometry in SOLIDWORKS	12-11
Auxiliary Views in 2D Drawings	12-11
The <i>Rod-Guide</i> Design	12-11
Modeling Strategy	12-12
Starting SOLIDWORKS	12-13
Applying the BORN Technique	12-13
Creating the Base Feature	12-14
Creating an Angled Reference Plane	12-16
Creating an Extruded Feature on the Reference Plane	12-19
Using the Convert Entities Option	12-19
Completing the Solid Feature	12-25
Creating an Offset Reference Plane	12-26
Creating another Extruded Cut Feature using the Reference Plane	12-27
Starting a New 2D Drawing and Adding a Base View	12-29
Creating an Auxiliary View	12-30
Displaying Feature Dimensions	12-32
Adjusting the View Scale	12-34
Repositioning, Appearance, and Hiding of Feature Dimensions	12-34
Tangent Edge Display	12-37
Adding Center Marks and Center Lines	12-37
Controlling the View and Sheet Scales	12-40
Completing the Drawing Sheet	12-41
Editing the Isometric view	12-42
Adding a General Note	12-42
Questions	12-44
Exercises	12-45

Chapter 13

Threads and Fasteners

Introduction	13-2
Screw-Thread Terminology	13-3
Thread Forms	13-5
Thread Representations	13-6
• Detailed Representation	13-7
• Schematic Representation	13-8
• Simplified Representation	13-9
Thread Specification – English Units	13-10
Unified Thread Series	13-11
Thread Fits	13-12
Thread Specification – Metric	13-12
Thread Notes Examples	13-13
Specifying Fasteners	13-14
Commonly Used Fasteners	13-15
Drawing Standard Bolts	13-17
Bolt and Screw Clearances	13-17

Fasteners using SOLIDWORKS' Design Library	13-18
ANSI Inch - Machine Screw	13-18
ANSI Metric - Machine Screw	13-20
Questions	13-22

Chapter 14

Working Drawings

General Engineering Design Process	14-3
Working Drawings	14-4
Detail Drawings	14-4
Assembly Drawings	14-5
Bill of Materials (BOM) and Parts List	14-5
Drawing Sizes	14-6
Drawing Sheet Borders and Revisions Block	14-6
Title Blocks	14-7
Working Drawings with SOLIDWORKS	14-8
Assembly Modeling Methodology	14-8
The Shaft Support Assembly	14-9
Parts	14-9
Creating the Collar with the Chamfer Command	14-9
Creating the Bearing and Base-Plate	14-11
Creating the Cap-Screw	14-12
Starting SOLIDWORKS	14-13
Document Properties	14-13
Inserting the First Component	14-14
Inserting the Second Component	14-15
Degrees of Freedom	14-16
Assembly Mates	14-16
Apply the First Assembly Mate	14-18
Apply a Second Mate	14-19
Constrained Move	14-21
Apply a Third Mate	14-22
Inserting the Third Component	14-24
Applying Concentric and Coincident Mates	14-24
Assemble the Cap-Screws using SmartMates	14-26
Exploded View of the Assembly	14-30
Save the Assembly Model	14-32
Editing the Components	14-32
Setup a Drawing of the Assembly Model	14-34
Creating a Bill of Materials	14-35
Editing the Bill of Materials	14-37
Completing the Assembly Drawing	14-41
Exporting the Bill of Materials	14-43
Questions	14-44
Exercises	14-45

Chapter 15**CSWA Exam Preparation**

Tips about Taking the Certified SOLIDWORKS Associate Examination	15-3
Introduction	15-4
The Part Problem	15-5
Strategy for Aligning the Part to the Default Axis System	15-6
Creating the Base Feature	15-6
Creating a New View Orientation	15-9
Create Reference Planes and a Reference Axis	15-10
Selecting the Material and Viewing the Mass Properties	15-16
The Assembly Problem	15-19
Creating the Parts	15-20
Creating the Assembly	15-21
Creating a Reference Coordinate System	15-27
View the Mass Properties	15-29
Questions	15-31
Exercises	15-32

Appendix

- A. Running and Sliding Fits – American National Standard
- B. Preferred Metric Fits –ISO standard
- C. UNIFIED NATIONAL THREAD FORM
- D. METRIC THREAD FORM
- E. FASTENERS (INCH SERIES)
- F. METRIC FASTENERS
- G. BOLT AND SCREW CLEARANCE HOLES
- H. REFERENCES

Index