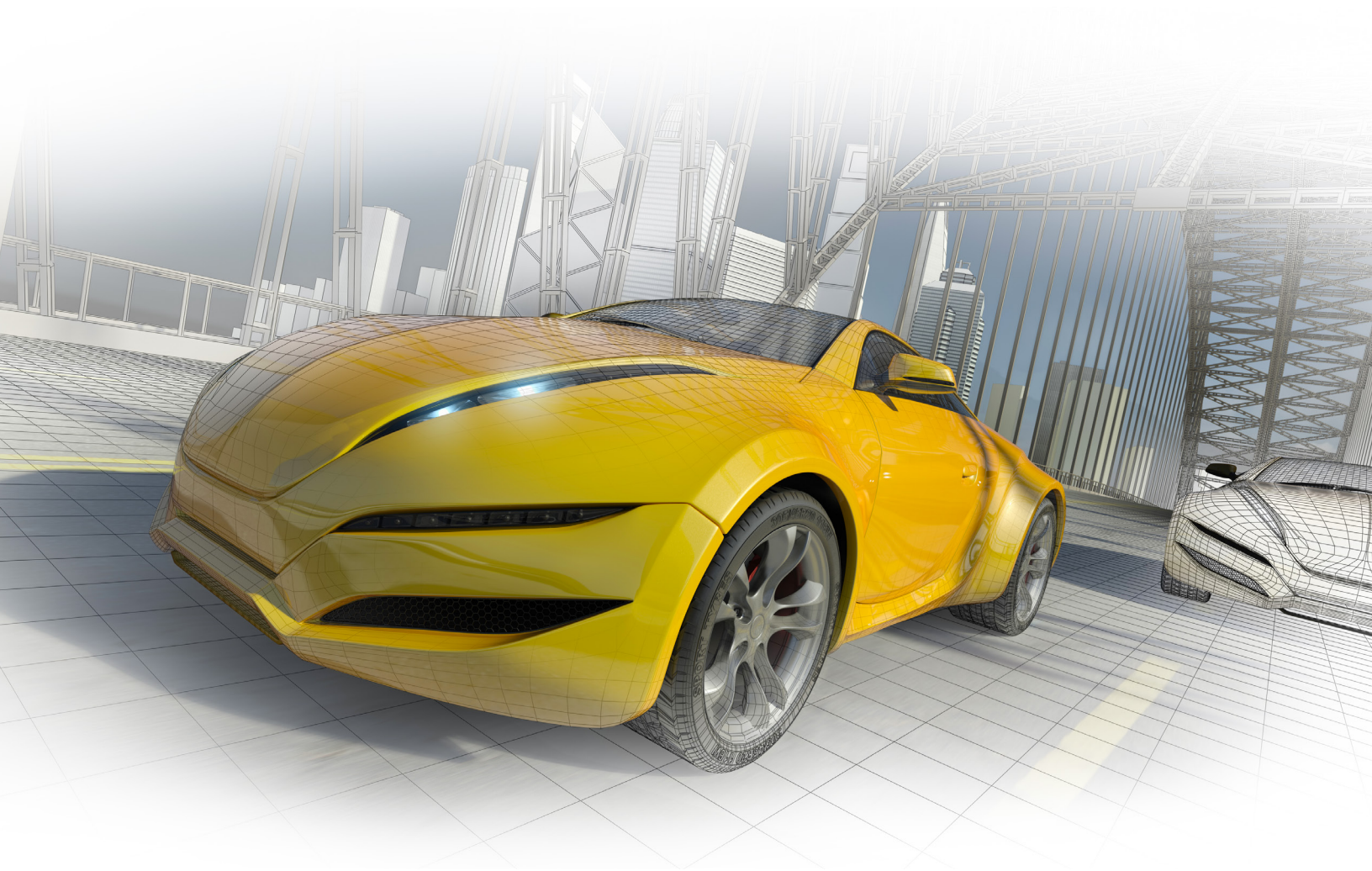


# SOLIDWORKS® 2016

## Advanced Techniques

Mastering Parts, Surfaces, Sheet Metal, SimulationXpress,  
Top Down Assemblies, Core & Cavity Molds



Paul Tran CSWE, CSWI



Better Textbooks. Lower Prices.  
[www.SDCpublications.com](http://www.SDCpublications.com)

Visit the following websites to learn more about this book:



[amazon.com](https://www.amazon.com)

[Google books](https://books.google.com)

[BARNES & NOBLE](https://www.barnesandnoble.com)

# Table of Contents

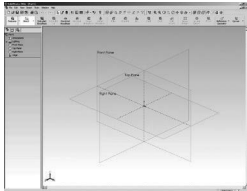
---



---

Copyrights Notices  
 Disclaimer  
 Trademarks

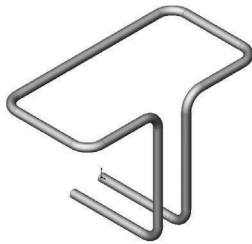
## Introduction: SOLIDWORKS 2016 User Interface



The 3 references planes	XXIII
The toolbars	XXIV
The system feedback symbols	XXIV
The status bar	XXVI
2D sketch examples	XXVI
3D feature examples	XXVII
	XXVIII

## Advanced Modeling Topics

### Chapter 1: Introduction to 3D Sketch



	1-1
Tools Needed	1-2
Adding 3D lines	1-3
Using the reference axis indicator	1-4
Using the tab key	1-4
Completing the profile	1-4
Adding dimensions	1-5
Adding the sketch fillets	1-6
Sketching the Sweep profile	1-7
Creating the swept feature	1-7
Questions for review	1-8
Exercise: Sweep with 3D Sketch	1-9
Exercise: 3D Sketch & Planes	1-10
Exercise: 3D Sketch & Composite Curve	1-17

### Chapter 2: Plane Creation

	2-1
Tools Needed	2-2
Sketching the base profile	2-3
Creating a tangent plane	2-4



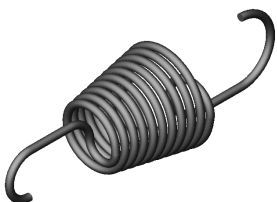
Creating a flat surface	2-5
Extruding with flip side to cut	2-6
Creating an at-angle plane	2-7
Showing the sketches	2-8
Creating a coincident plane	2-9
Creating a parallel plane	2-10
Creating the recess	2-11
Creating an offset-distance plane	2-12
Creating the bore holes	2-12
Creating a perpendicular plane	2-13
Creating the side-grips	2-14
Creating a circular pattern	2-15
Creating a Mid-Plane	2-17
Adding fillets to all edges	2-19
Questions for Review	2-20
Viewing the sections	2-21
Exercise: Create new work planes	2-22

**Chapter 3: Advanced Modeling – 5/8” Spanner** 3-1

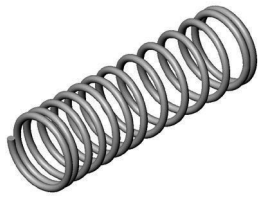


Tools needed	3-2
Opening the part document	3-3
Using min / max arc conditions	3-3
Creating the transition sketch	3-4
Creating a new work plane	3-6
Creating the closed-end sketch	3-7
Extruding the closed-end feature	3-7
Adding a 12-sided polygon hole	3-8
Creating the recess profile	3-9
Mirroring the recessed feature	3-10
Adding fillets	3-11
Adding text	3-13
Extruding the text	3-14
Questions for Review	3-17
Exercise: Circular text wraps	3-19

**Chapter 4: Sweep with Composite Curves – Helical Ext. Spring** 4-1



Tools needed	4-2
Creating the sweep path	4-3
Defining the helix	4-3
Creating a plane at angle	4-4
Adding other hook features	4-5
Adding a pierce relation	4-5



Creating a parallel plane	4-6
Combining sketches using Composite Curve	4-8
Sketching the Sweep profile	4-9
Creating the base sweep	4-9
Other spring examples	4-12
Questions for review	4-13
Exercise: Circular Spring – Expanded	4-14
Sketching the sweep profile	4-14

**Using Variable Pitch** 4-17

Tools Needed	4-18
Creating the base sketch	4-19
Creating a helix using variable pitch	4-19



Sweeping the profile along the path	4-21
Creating the flat ends	4-22
Extruding a cut	4-22
Questions for Review	4-23
Exercise: Projected Curve & Composite Curve	4-24

**Chapter 5: Advanced Modeling with Sweep & Loft** 5-1

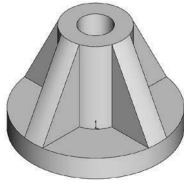
Tools Needed	5-2
Understanding the draft options	5-3
Opening the base	5-4
Sketching the upper inlet port - revolve	5-5
Adding constant fillets	5-6
Creating offset-distance planes	5-7
Creating the outlet port - loft	5-10
Creating the mounting bosses	5-11
Sketching the rear inlet port	5-12
Revolving the rear inlet port	5-12
Adding face Fillets	5-13
Mirroring features	5-15
Shelling the part	5-16
Adding the ribs	5-17
Mirroring the ribs	5-18
Removing the sharp edges	5-19



**Chapter 6: Loft vs. Sweep – Water Meter Housing** 6-1

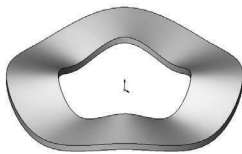
Tools Needed	6-2
Constructing the body	6-3
Creating an offset distance plane	6-5



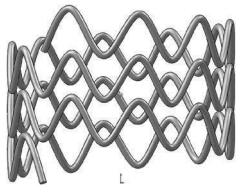


Constructing loft profiles / features	6-6
Constructing the Inlet / outlet profiles	6-6
Using split entities	6-6
Constructing the centerline parameter	6-10
Creating the solid loft feature	6-11
Using the shell command	6-13
Adding the left / right brackets	6-14
Adding a seal-ring	6-15
Adding fillets / chamfers	6-17
Questions for Review	6-19
Exercise: Loft	6-20

**Chapter 7: Loft with Guide Curves – Waved Washer** 7-1

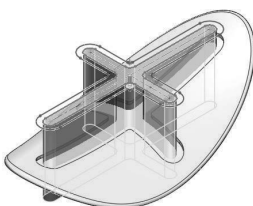


Tools Needed	7-2
Adding the construction geometries	7-3
Creating an offset distance plane	7-4
Creating a derived sketch	7-5
Creating a curve through reference points	7-5
Constructing the loft sections	7-7
Creating the derived sketches	7-7
Creating the loft feature	7-10
Showing / hiding sketches	7-11
Questions for review	7-12
Exercise: V-Shape – 3 revolutions	7-13



<b>Advanced Sweep - Wire Form</b>	<b>7-19</b>
Tools Needed	7-20
Creating a helix	7-21
Creating the sweep profile	7-22
Creating a solid sweep	7-23
Creating a circular Sketch pattern	7-25
Creating a derived sketch	7-27
Creating a 3D sketch	7-28
Creating the wire form sweep	7-31
Exercise: Using Curve Through Reference Points	7-33

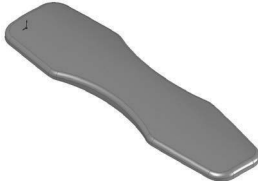
**Chapter 8: Using Surfaces – Advanced Modeling** 8-1



Tools Needed	8-2
Creating offset distance plane	8-3
Constructing the loft profiles	8-3
Creating a surface-loft	8-6
Setting the start/end constraints	8-6



Splitting the surface	8-7
Deleting surfaces	8-8
Thickening the surface	8-9
Calculating the angle between the faces	8-10
Adding a full round fillet	8-12
Sketching / extruding the slot contours	8-14
Questions for Review	8-17



**Lofted Surface – Remote Control Casing 8-19**

Creating offset distance planes	8-19
Sketching the loft sections	8-20
Creating the loft surface	8-22
Twisting the loft profiles	8-23
Adding revolved surface	8-23
Copying / moving surfaces	8-24
Trimming surfaces	8-25
Hiding surfaces	8-25
Filling surfaces	8-26
Knitting surfaces	8-29
Adding fillets	8-30
Thickening surfaces	8-31
Removing the upper half	8-32
Creating the lower half	8-33
Questions for Review	8-36
Exercise: Loft & Delete Face	8-37



**Chapter 9: Advanced Surfaces—Offset Surface & Ruled Surface 9-1**

Tools Needed	9-2
Using offset surface and ruled surface	9-3
Creating the base loft	9-4
Using the splitting lines	9-5
Using offset surfaces	9-6
Using ruled surface	9-7
Using knit surfaces	9-8
Creating a cut with surface	9-10
Exercise: Advanced Surfaces	9-13
Exercise: Advanced Surfacing Techniques	9-15



**Chapter 10: Using Filled Surfaces 10-1**

Tools Needed	10-2
Enabling the surfaces toolbar	10-3



Creating a planar surface	10-4
Creating a surface fill with tangent control	10-4
Creating a surface fill with curvature control	10-6
Knitting all surfaces	10-7
Creating a solid body	10-7
Questions for Review	10-10

**Boundary and Freeform Surfaces** **10-11**



Creating the 1st boundary surface	10-11
Creating the 2nd boundary surface	10-14
Creating the Freeform feature	10-16
Dragging with the triad	10-18
Displaying the curvature comb	10-19

**Chapter 11: Surfaces vs. Solid Modeling – Safety Helmet** **11-1**



Tools Needed	11-2
Constructing the body of Helmet – surface loft	11-3
Creating a perpendicular plane	11-4
Sketching the sweep profile	11-4
Creating the sweep path	11-5
Adding a planar surface	11-6
Knitting the surfaces bodies	11-6
Thickening the surface Knit	11-7
Adding an extruded cut feature	11-7
Adding a revolve cut feature	11-9
Creating the Cut-out slot with draft	11-11
Creating a sweep cut	11-13
Adding fillets	11-13
Exercise: Advanced Loft – Turbine Blades	11-15
Exercise: Advanced Sweep – Candle Holder	11-16



**Level 3: Final Exam** **11-29**

**Chapter 12: SimulationXpress – 5/8” Spanner** **12-1**



Tools Needed	12-2
Starting SimulationXpress	12-3
Setting up the units	12-4
Adding a fixture	12-5
Applying a force	12-7
Selecting material	12-8
Analyzing the model	12-9
Viewing the Results	12-10

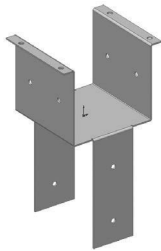




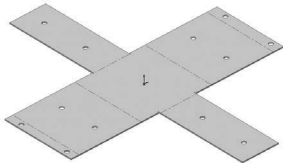
Stress distribution	12-10
Displacement distribution	12-11
Factor of Safety (FOS)	12-11
HTML report	12-12
Viewing the report	12-14
eDrawings	12-16
Questions for Review	12-19
Exercise: SimulationXpress: Force	12-20
Exercise: SimulationXpress: Pressure	12-21

## **Sheet Metal Topics**

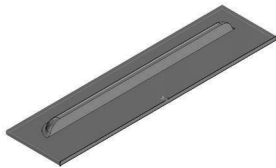
### **Chapter 13: Sheet Metal Parts – Post Cap** **13-1**



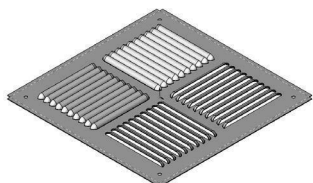
Tools Needed	13-2
Creating the Base Sketch	13-3
Extruding the Base Flange	13-3
Creating an Edge Flange	13-4
Editing the Edge Flange	13-5
Creating a Sketch Bend	13-7
Adding Holes in Sheet Metal Parts	13-11
Making the Flat Pattern	13-12
Using the Sheet Metal Costing application	13-13
Inputting the Costing information	13-14
Setting the Baseline	13-15
Questions for Review	13-17



### **Sheet Metal Parts – Vents** **13-18**

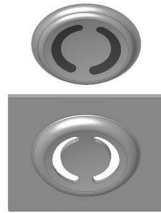


Tools Needed	13-19
Creating the Base Sketch	13-20
Extruding the Base-Flange	13-21
Setting the Auto-Relief	13-21
Creating the Miter-Flange	13-22
Flattening the Part	13-24
Creating a Forming Tool	13-25
The Rectangle Options	13-26
Revolve the Form Body	13-28
The Position Sketch	13-31
Saving the Forming Tool	13-33
Applying the Forming Tools onto Sheet Metal Part	13-34
Position the Form Tool	13-35
Adding other Sheet Metal Features	13-36
Creating a Linear Pattern of the Forming Tools	13-37



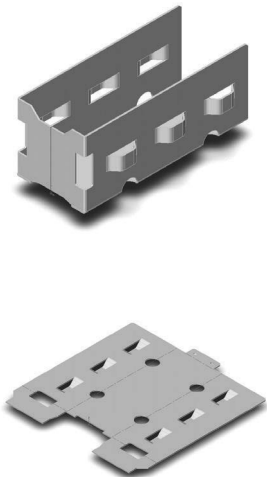
Creating an Axis	13-38
Creating a Circular Pattern	13-39
Questions for Review	13-40

**Chapter 14: Sheet Metal Forming Tools – Button with Slots** 14-1



Tools Needed	14-2
Sketching the Base	14-3
Revolving the Body	14-4
Adding Slots	14-5
Creating the Split Lines	14-7
Defining the Stopping & Removing Faces	14-9
Saving in the Design Library	14-10
Questions for Review	14-12

**Designing Sheet Metal Parts – Mounting Tray** 14-13



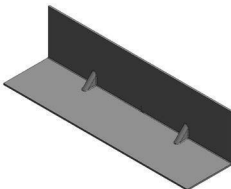
Tools Needed	14-14
Creating the Base Flange	14-15
Creating an Edge Flange	14-16
Adding Sheet Metal Cuts	14-17
Unfolding a Sheet Metal Part	14-18
Linking to thickness	14-19
Folding the Sheet Metal Part	14-20
Accessing the Design Library	14-23
Adding the Bridge Lance	14-24
Creating a Linear Pattern	14-26
Mirroring the Body	14-27
Sheet Metal Chamfers	14-30
Switching to the Flat Pattern	14-31
Questions for Review	14-32

**Chapter 15: Sheet Metal Conversions** 15-1



Tools Needed	15-2
Opening an IGES Document	15-3
Using the Rip Command	15-4
Inserting the Sheet Metal Parameters	15-5
Adding Fillets	15-6
Creating a Flat Pattern	15-7
Questions for Review	15-8

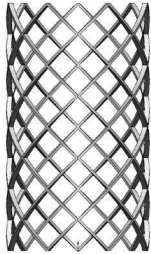
**Sheet Metal Gussets** 15-9



Opening a sheet metal document	15-9
Creating a new gusset	15-10

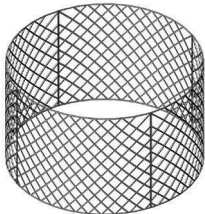
Applying the parameters	15-11
Mirroring the gusset	15-12

**Flat Pattern Stent 15-13**



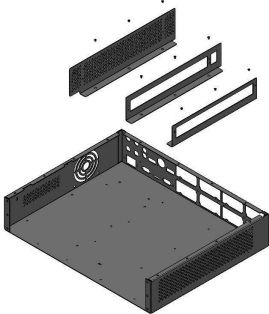
Tools Needed	15-14
Revolving the Main Body	15-15
Converting to Sheet Metal	15-16
Unfolding the Sheet Metal Part	15-16
Sketching the 2D Pattern	15-17
Creating the 2D Linear Pattern	15-18
Folding the Sheet Metal Part	15-19
Creating a Configuration	15-20
Adding Fillets	15-20
Switching to Flatten Mode	15-21

**Stent Sample - Sheet Metal Approach 15-23**



Revolving the Main Body	15-23
Shelling the Solid Body	15-24
Creating an Offset Plane	15-25
Creating a Rib Feature	15-25
Patterning the Rib Feature	15-26
Creating a Second Rib	15-27
Using Combine Common	15-28
Making an assembly from the part	15-28
Creating a Circular Component pattern	15-29

**Chapter 16: Working with Sheet Metal STEP Files 16-1**



Tools Needed	16-2
Opening an Assembly Step File	16-3
Mating the components	16-4
Adding the Sheet Metal tool tab	16-7
Inserting Sheet Metal parameters	16-8
Viewing the Flat Pattern	16-9
Converting other components	16-9
Using the Hole Series	16-11
Using the Hole Wizard	16-13
Adding the Smart Fasteners	16-15
Creating an Exploded View	16-17

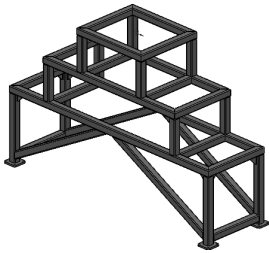
**Adding Parts to the Toolbox Library 16-18**

Starting the Toolbox Settings Utility	16-18
Setting the Standards	16-20



Adding a new part	16-20
Activating Toolbox	16-21
Using the Taskpane	16-21
Locating the new part	16-22
Viewing the new part	16-22
Adding a Part Number and Description	16-23

**Weldments – Structural Members 16-24**



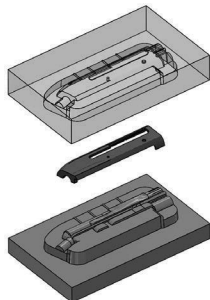
Opening a Weldments Frame Document	16-24
Enabling the Weldment Toolbar	16-24
Adding Structural Members	16-25
Setting the Corner Treatments	16-25
Adding Structural Members to Contiguous Groups	16-26
Adding Structural Members to the Parallel Groups	16-27
Trimming the Structural Members	16-29
Adding the foot pads	16-36
Adding the Gussets	16-37
Adding the Fillet Beads	16-39
Viewing the Weldment Cut List	16-41
Updating the Cut List	16-42
Creating a drawing	16-43

**Top-Down Assembly Topics**

**Chapter 17: Core & Cavity – Linear Parting Lines 17-1**



Tools Needed	17-2
Opening an existing Parasolid document	17-3
Creating the Parting Lines	17-4
Adding the Shut-Off Surfaces	17-5
Creating Parting Surfaces	17-6
Sketching the profile of the mold block	17-7
Using Tooling Split	17-8
Saving the Parts	17-10
Separating the 2 blocks	17-11
Questions for Review	17-13

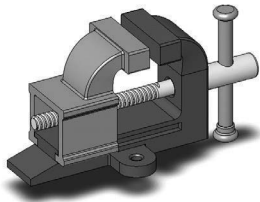


**Core & Cavity – Linear Parting Lines 17-14**

Tools Needed	17-15
Opening an existing Parasolid document	17-16
Creating the Non-Planar Parting Lines	17-17
Adding the Shut-Off Surfaces	17-18

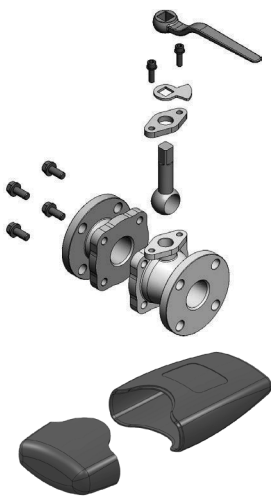
Adding the Parting Surfaces	17-19
Creating the Ruled Surfaces	17-20
Adding the surfaces patches	17-22
Knitting all surfaces	17-26
Trimming surfaces	17-28
Creating the Tooling Split	17-29
Separating the solid bodies	17-31
Making the transparent bodies	17-32

**Chapter 18: Top-Down Assembly: Miniature Vise** **18-1**



Tools Needed	18-2
Creating the Base part	18-3
Adding side flanges	18-5
Creating an offsetting distance plane	18-7
Creating Loft Profiles and Guide Curves	18-8
Creating a Loft with Guide Curves	18-11
Creating a new part in an assembly	18-14
Understanding the Inplace mates	18-15
Offsetting existing geometry	18-15
Creating a Loft with Guide Curve	18-20
Using loft with guide curve in an assembly	18-22
Extruding with Up-to-Surface option	18-24
Creating Internal threads	18-26
Creating a Section View	18-29
Adding the sub-components	18-30
Questions for Review	18-32

**Chapter 19: Top-Down Assembly – Water Control Valve** **19-1**

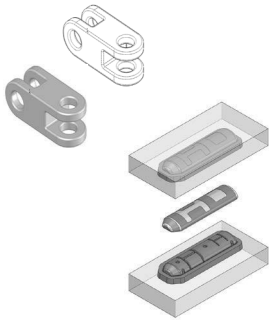


Tools Needed	19-2
Starting a New Assembly Template	19-3
Changing the Units to IPS	19-3
Creating the 1st Component	19-4
Revolving the Base	19-5
Adding a Flange	19-5
Adding Mounting Holes	19-6
Adding Chamfers and Fillets	19-8
Saving as Virtual Component	19-10
Creating the 2nd Component	19-10
Extruding the Boss	19-12
Adding the Transition Body	19-12
Adding a Flange	19-13
Adding other Features	19-14



Exiting the Edit Part Mode	19-20
Applying dimension changes	19-20
Viewing the External References	19-22
Inserting other components	19-23
Mating the components	19-24
Creating an assembly exploded view	19-24
Questions for Review	19-25

**Chapter 20: External References & Repair Errors** **20-1**

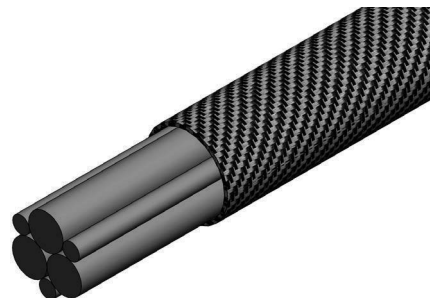
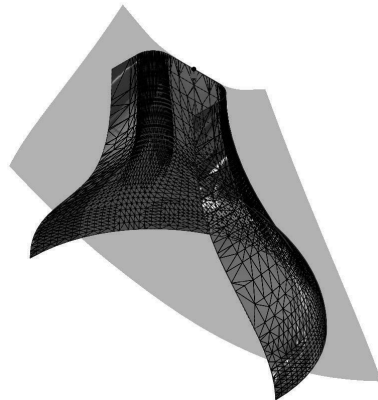


External Reference Symbols	20-2
Removing External References	20-3
Understanding External Reference Symbols	20-4
Repairing Sketch level	20-5
Repairing / replacing relations and dimensions	20-6
Questions for Review	20-8
Understanding and Repairing Part Errors	20-9
<b>Level 4: Final Exam</b>	<b>20-24</b>

**Chapter 21: Using Appearances and Textures** **21-1**



Modeling diamond knurls	21-1
Applying the knurl appearance	21-5
Applying the wire mesh appearance	21-8
Flatten surfaces	21-11



**CSWP Core Preparation Practice**

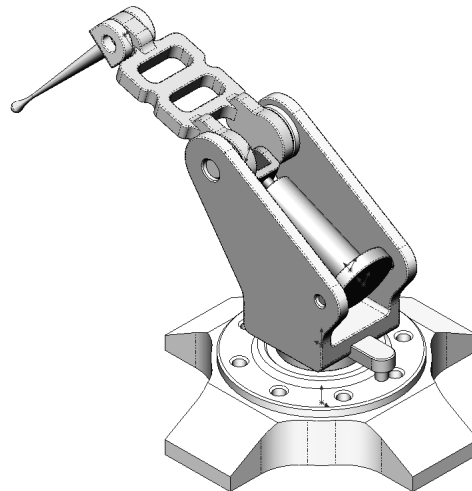
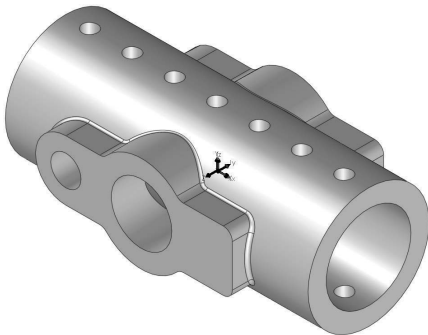
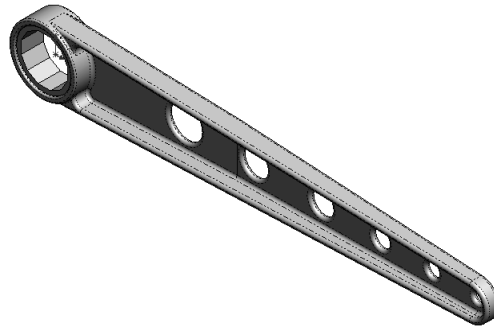
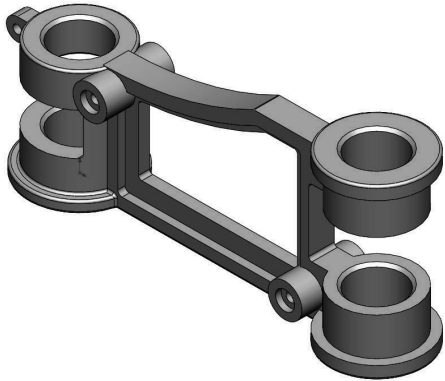
Preparation Materials for the CSWP-Core Examination	<b>22-1</b>
Part Modeling & Modifications	22-2
Part Configurations & Design Tables	22-22
Part Modifications	22-28
Bottom Up assembly	22-37

**Glossary**

**Index**

**SOLIDWORKS 2016 Quick-Guides:**

Quick Reference Guide to SOLIDWORKS 2016 Command Icons  
and Toolbars.



Includes: CSWP – Certified SOLIDWORKS Professional Core  
Preparation Practice Material