

# SOLIDWORKS® 2022 Advanced Techniques

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



Paul Tran CSWE, CSWI

Visit the following websites to learn more about this book:



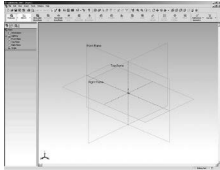
[amazon.com](https://www.amazon.com)

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

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

# Table of Contents

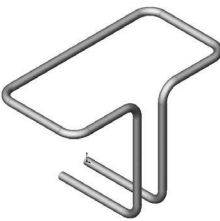
## Introduction SOLIDWORKS 2022 User Interface



The 3 reference planes	XXI
The toolbars	XXII
The system feedback symbols	XXII
The status bar	XXIV
2D sketch examples	XXIV
3D feature examples	XXV
	XXVI

## Advanced Modeling Topics

### Chapter 1 Introduction to 3D Sketch



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

### Chapter 2 Plane Creation



Advanced Topics	2-1
Tools Needed	2-1
Revolving the base	2-2
Creating a tangent plane	2-3
Creating a flat surface	2-4
Extruding a cut	2-5
Creating an at-angle plane	2-6
Showing the sketches	2-7
Creating a coincident plane	2-8
Creating a parallel plane	2-9
Creating the recess	2-10
Creating an offset-distance plane	2-11
Creating the bore holes	2-12
Creating a perpendicular plane	2-13

Creating the side-grips	2-14
Creating a circular pattern of the grips	2-15
Creating a Mid-Plane	2-17
Adding fillets to all edges	2-19
Questions for Review	2-20
Exercise: Create New Planes	2-22

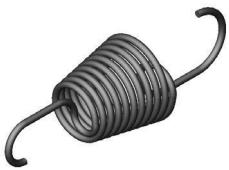
**Chapter 3    Advanced Modeling    3-1**

<b>5/8" Spanner</b>	3-1
Tools needed	3-2
Opening the spanner sketch document	3-3
Creating the transition sketch	3-4
Creating a new work plane: Plane at Angle	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



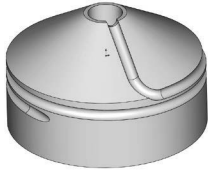
**Chapter 4    Sweep with Composite Curves    4-1**

<b>Helical Extension Spring</b>	4-2
Tools needed	4-2
Converting to a helix	4-3
Creating a 2-degree plane	4-4
Sketching the large loop	4-5
Sketching the large hook	4-5
Creating a parallel plane	4-6
Creating a Composite Curve	4-8
Sweeping the profile along the path	4-11
Other spring examples	4-12
Questions for review	4-13
Exercise: Circular Spring – 180 deg.	4-14



<b>Using Variable Pitch</b>	4-17
Multi-Pitch Spring with Closed Ends	4-18
Tools Needed	4-18





Creating the base sketch	4-19
Creating a helix with variable pitch	4-19
Sweeping the profile along the path	4-21
Creating a trimmed sketch	4-22
Extruding a cut	4-22
Questions for Review	4-23
Exercise: Using Equation Driven Curve	4-24
Exercise: Projected Curve & Composite Curve	4-30

**Chapter 5 Advanced Modeling with Sweep & Loft**

**5-1**

**Water Pump Housing**

5-2

Tools Needed

5-2

Understanding the draft options

5-3

Extruding the base with draft

5-4

Sketching the upper inlet port

5-5

Revolving the upper inlet port

5-5

Adding fillets

5-6

Creating offset-distance planes

5-7

Creating a loft feature

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 the rear inlet port

5-15

Shelling the part

5-16

Adding a rib

5-17

Mirroring the rib

5-18

Adding fillets

5-19



**Chapter 6 Loft vs. Sweep**

**6-1**

**Water Meter Housing**

6-2

Tools Needed

6-2

Sketching the loft profile

6-3

Constructing the Inlet's 1st Loft Profile

6-5

Creating the inlet feature

6-6

Constructing the centerline parameter

6-10

Creating the outlet loft feature

6-11

Shelling the part

6-13

Extruding the left brackets

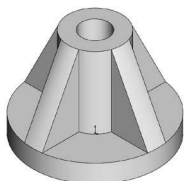
6-14

Constructing the upper ring

6-15

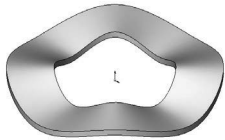
Adding fillets

6-17

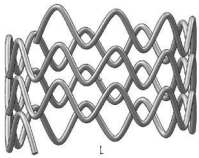


Adding chamfers	6-18
Questions for Review	6-19
Exercise: Loft	6-20

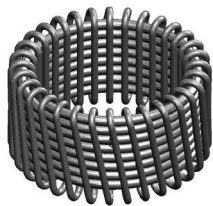
**Chapter 7 Loft with Guide Curves**



<b>Waved Washer</b>	7-1
Tools Needed	7-2
Creating the construction profile	7-2
Creating an offset distance plane	7-3
Positioning the derived sketch	7-4
Creating a curve through reference points	7-5
Sketching the loft sections	7-5
Creating the loft section using derived sketch	7-7
Creating a loft with guide curve	7-7
Hiding the construction sketches	7-10
Questions for review	7-11
Exercise: Using Curve Driven Pattern	7-12

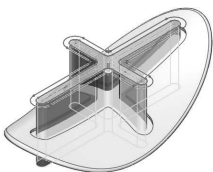


<b>Advanced Sweep</b>	7-19
3D Sketch Sweep Path	7-20
Tools Needed	7-20
Creating the sweep path	7-21
Creating the sweep profile	7-21
Creating a sweep feature	7-22
Creating a circular Sketch pattern	7-23
Converting to construction geometry	7-25
Creating a derived sketch	7-26
Creating a 3D sketch	7-27
Creating the sweep feature	7-28
Exercise: Using Curve Through Reference Points	7-32



**Chapter 8 Using Surfaces**

<b>Advanced Modeling</b>	8-1
Tools Needed	8-2
Constructing a new work plane	8-2
Sketching the loft profiles	8-3
Creating a surface-loft	8-3
Splitting the surface	8-6
Deleting surfaces	8-7
Thickening the surface	8-8
Calculating the angles between the faces	8-9

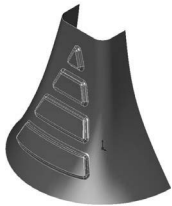




Adding a full round fillet	8-12
Sketching the slot contours	8-13
Extruding cut the contour	8-15
Questions for Review	8-17



<b>Lofted Surface</b>	<b>8-19</b>
Creating new offset planes	8-19
Sketch the first profile	8-20
Selecting the loft profiles	8-21
Lofting between the profiles	8-22
Creating a revolved sketch	8-23
Copying the revolved surface	8-24
Trimming the base part	8-25
Hiding the surfaces	8-25
Filling the openings with surface-fill	8-26
Creating a Surface-Knit	8-29
Adding fillets	8-30
Creating a solid from the surface model	8-31
Removing the upper half	8-32
Questions for Review	8-36
Exercise: Loft & Delete Face	8-37



**Chapter 9    Offset Surface & Ruled Surface**

<b>Chapter 9    Offset Surface &amp; Ruled Surface</b>	<b>9-1</b>
Tools Needed	9-2
Using offset & ruled surface options	9-3
Creating the base loft	9-4
Creating split lines	9-5
Creating offset surfaces	9-6
Creating a ruled surface	9-7
Knitting the 2 surfaces	9-8
Showing the solid body	9-10
Creating the surface cut	9-10
Exercise: Using Loft	9-13
Exercise: Advanced Surfacing Techniques	9-15
Exercise: Using Split	9-25
Creating a split line	9-25
Adding a ruled surface	9-26
Deleting a surface	9-27
Trimming surfaces	9-27
Knitting the surfaces	9-28
Adding fillets	9-29



**Chapter 10 Advanced Surfaces 10-1**

**Computer Mouse 10-2**

Tools Needed 10-2

Sketching the profiles 10-3

Extruding a surface 10-4

Trimming the surfaces 10-5

Mirroring the surfaces 10-6

Creating a new plane 10-9

Making a 3-Point Arc 10-9

Creating a planar surface 10-12

Creating a knit surface 10-13



**Using Filled Surfaces 10-16**

Patch with Curvature Controls 10-15

Tools Needed 10-16

Enabling the surfaces toolbar 10-17

Creating a planar surface 10-18

Creating a surface fill with tangent control 10-18

Creating a surface fill with curvature control 10-20

Knitting all surfaces 10-21

Patch Types 10-22

Questions for Review 10-24



**Using Ruled Surfaces 10-25**

Creating a split line 10-25

Creating an offset surface 10-26

Adding a ruled surface 10-26

Knitting the surfaces 10-27

Shelling the model 10-29



**Chapter 11 Surfaces vs. Solid Modeling 11-1**

**Safety Helmet 11-2**

Tools Needed 11-2

Constructing the body of Helmet 11-3

Creating a new work plane 11-4

Sketching the sweep-profile 11-4

Creating the sweep path 11-5

Adding a planar surface 11-6

Knitting the three surfaces bodies into one 11-6

Creating a section view 11-7

Adding an extruded cut feature 11-7

Adding a revolve cut feature 11-9







Adding the side cut features	11-10
Creating the Cutout slot	11-11
Creating the sweep cut	11-13
Adding fillets	11-13
Exercise: Advanced Loft – Turbine Blades	11-15
Exercise: Advanced Sweep – Candle Holder	11-16
<b>Advanced: Final Exam</b>	<b>11-23</b>

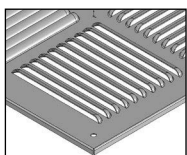
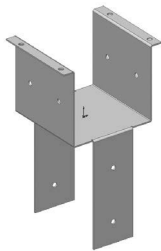
**Chapter 12 SimulationXpress 12-1**



<b>Using the Analysis Wizard</b>	12-2
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 the material	12-8
Analyzing the model	12-9
Viewing the Results	12-10
Creating the report	12-12
Generating the eDrawings file	12-16
Questions for Review	12-19
Exercise 1: SimulationXpress: Force	12-20
Exercise 2: SimulationXpress: Pressure	12-21

**Sheet Metal Topics**

**Chapter 13 Sheet Metal Parts 13-1**



<b>Post Cap</b>	13-2
Tools Needed	13-2
Starting with the Base Profile	13-3
Extruding the Base Flange	13-3
Creating an Edge Flange	13-4
Editing the Edge Flange Profile	13-5
Viewing the Flat Pattern	13-6
Changing the Fixed Face	13-6
Creating a Sketch Bend	13-7
Adding Holes	13-9
Making the Flat Pattern	13-12
Using Sheet Metal Costing	13-13
Inputting the information	13-14
Setting the Baseline	13-15

Questions for Review 13-17

**Sheet Metal Parts 13-18**

Vents 13-19

Tools Needed 13-19

Sketching the first profile 13-20

Extruding the Base-Flange 13-21

Creating the Miter-Flanges 13-22

Flattening the Part 13-24

Creating a new Forming Tool – The Louver 13-25

Other Rectangle Options 13-26

Extruding the Base 13-27

Building the louver body 13-27

Creating the Positioning Sketch 13-31

Saving the Forming Tool 13-33

Applying the Form Tool 13-34

Positioning the Form Tool 13-35

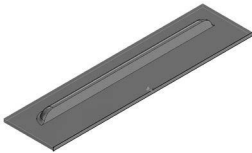
Adding a mounting hole 13-36

Creating a Linear Pattern 13-37

Creating an Axis 13-38

Creating a Circular Pattern 13-39

Questions for Review 13-40



**Chapter 14 Sheet Metal Forming Tools 14-1**

**Button with Slots 14-2**

Tools Needed 14-2

Creating the Base Block 14-3

Revolving the Body 14-4

Sketching Slot Profiles 14-5

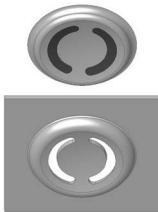
Creating the Split Lines 14-7

Adding more fillets 14-9

Inserting the forming tool feature 14-9

Saving the forming tool 14-10

Questions for Review 14-12



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

Tools Needed 14-14

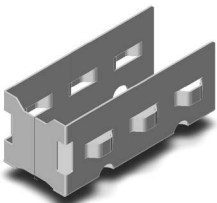
Starting with the Base Sketch 14-15

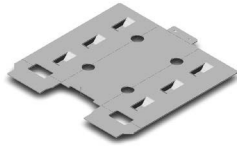
Creating an Edge Flange 14-16

Adding Cut features 14-17

Extruding a cut 14-17

Using the Unfold Command 14-18



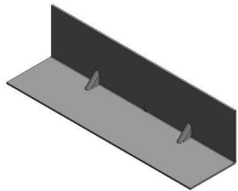


Using the Fold Command	14-20
Inserting a Sheet Metal Forming Tool	14-23
Locating the Bridge Lance	14-25
Creating the Linear Pattern of the Bridge Lance	14-26
Mirroring the Body	14-27
Adding Chamfers	14-30
Switching to the Flat Pattern	14-31
Questions for Review	14-32

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



<b>From IGES to SOLIDWORKS Flat Pattern</b>	15-2
Tools Needed	15-2
Opening an IGES Document	15-3
Creating the Rips	15-4
Inserting the Sheet Metal Parameters	15-5
Adding Fillets	15-6
Switching to a Flat Pattern	15-7
Questions for Review	15-8



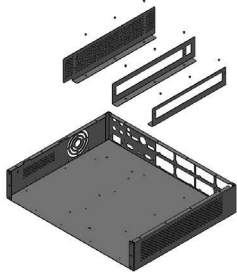
<b>Sheet Metal Gussets</b>	<b>15-9</b>
Opening a sheet metal part document	15-9
Creating a gusset	15-9
Viewing the resulted gusset	15-11
Mirroring the gusset	15-12



<b>Flat Pattern Stent</b>	<b>15-13</b>
Tools Needed	15-14
Converting to Sheet Metal	15-16
Unfolding the Part	15-16
Adding the Sketch Pattern	15-17
Folding the Part	15-19
Creating a new Configuration	15-20
Adding Fillets	15-20
Switching to Flatten Mode	15-21
Questions for Review	15-22
Exercise: Stent Sample - Sheet Metal Approach	15-23

**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



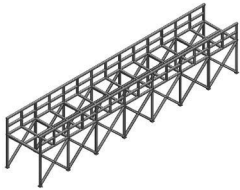
Viewing the Flat Pattern	16-9
Converting other components	16-9
Using the Hole Series	16-11
Using the Hole Wizard	16-13
Adding the Smart Fasteners	16-15
Creating an Exploded View	16-17



<b>Adding Parts to the Toolbox Library</b>	<b>16-18</b>
Starting the Toolbox Settings Utility	16-18
Activating Toolbox	16-21
Locating the new part	16-22
Viewing the new part	16-22
Adding a Part Number and Description	16-23

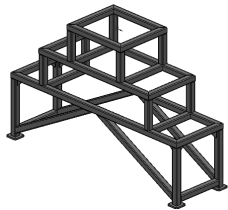
**Chapter 17**

**Advanced Weldments** **17-1**



<b>Weldments Platform</b>	17-2
Tools Needed	17-2
Adding the weldments toolbar	17-3
Adding the structural members	17-4
Viewing the overlapped areas	17-8
Trimming the overlapped areas	17-9
Updating the cut list	17-12

**Using Weldments – Structural Members** **17-14**



Enabling the Weldment Toolbar	17-14
Adding Structural Members	17-15
Adding Structural Members to Contiguous Groups	17-16
Adding Structural Members to the Parallel Groups	17-17
Trimming the Structural Members	17-19
Adding the foot pads	17-26
Adding the Gussets	17-27
Adding the Fillet Beads	17-29
Viewing the Weldment Cut List	17-31
Updating the Cut List	17-32
Creating a drawing	17-33

**Mold Tools Design Topics**

**Chapter 18**

**Creating a Core and Cavity** **18-1**

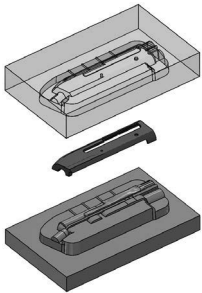
Linear Parting Lines	18-2
Tools Needed	18-2
Opening an existing Parasolid document	18-3



Creating the Parting Lines	18-4
Creating the Shut-Off Surfaces	18-5
Creating the Parting Surfaces	18-6
Sketching the profile of the mold blocks	18-7
Creating the Tooling Split	18-8
Saving the bodies as part files	18-10
Separating the 2 blocks	18-11
Exercise: Linear Parting Lines	18-13
Questions for Review	18-19

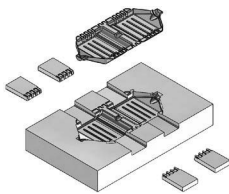
**Chapter 19 Non-Planar Parting Lines 19-1**

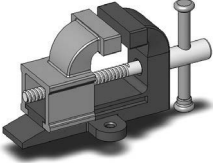
<b>Mold-Tooling Design</b>	19-2
Tools Needed	19-2
Enabling the Mold Tools toolbar	19-3
Creating the Parting Lines	19-4
Creating the Shut-Off Surfaces	19-5
Creating the Parting Surfaces	19-6
Creating a Ruled Surface	19-7
Creating the patches	19-9
Knitting the surfaces	19-13
Trimming the bottom of the ruled surface	19-15
Creating the Tooling Split sketch	19-16
Separating the solid bodies	19-18
Making the body transparent	19-19

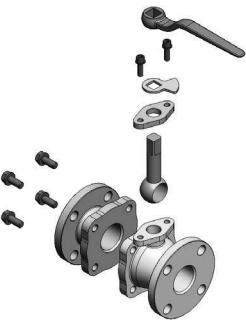


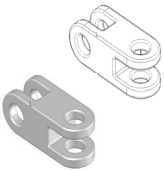
**Creating Slides and Cores 19-21**

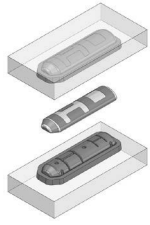
Tools Needed	19-22
Opening a part document	19-23
Analyzing the undercuts	19-23
Analysis parameters explained	19-24
Scaling the part	19-25
Creating the parting lines	19-26
Creating the parting surfaces	19-27
Creating a new sketch	19-28
Creating the tooling split	19-29
Finalizing the block sizes	19-29
Renaming the bodies and assigning materials	19-32
Creating the front slide core	19-32
Creating the back slide core	19-34
Creating an exploded view	19-35



	<b>Chapter 20 Top Down Assembly – Part 1</b>	<b>20-1</b>
	<b>Miniature Vise</b>	20-2
	Tools Needed	20-2
	Creating the Base part	20-3
	Adding the side flanges	20-5
	Creating an offset distance plane	20-7
	Creating the 3D Guide Curves	20-9
	Creating the fixed jaw clamp	20-11
	Creating a new component: The slide jaw	20-14
	Using the offset entities command	20-15
	Sketching the Guide Curve	20-20
	Creating the clamp block	20-22
	Extruding the clamp block	20-23
	Creating the Internal threads	20-26
	Creating a Section View	20-29
Questions for Review	20-32	

	<b>Chapter 21 Top-Down Assembly – Part 2</b>	<b>21-1</b>
	<b>Water Control Valve</b>	21-2
	Tools Needed	21-2
	Starting with a New Assembly Template	21-3
	Creating the 1st Component	21-4
	Adding the Inlet Flange	21-5
	Adding the Mounting Holes	21-6
	Adding Chamfers and Fillets	21-8
	Saving as Virtual Component	21-10
	Creating the 2nd Component	21-10
	Creating the Transition Body	21-12
	Adding another mounting Flange	21-13
	Adding an Offset-Distance plane	21-14
	Exiting the Edit Component Mode	21-20
	Applying dimension changes	21-20
Viewing the External Reference Symbols	21-22	
Inserting other components	21-23	
Questions for Review	21-25	

	<b>Chapter 22 External References &amp; Repair Errors</b>	<b>22-1</b>
	External Reference Symbols	22-2
	Understanding & Removing External References	22-3
	Removing External References	22-3
	Understanding the External Symbols	22-4
	Repairing the Sketches	22-5
	Rebuilding the model	22-7



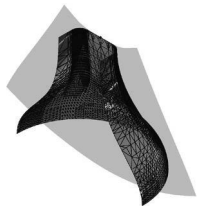
Questions for Review	22-8
Understanding and Repairing Part Errors	22-9
Repair Errors & External References	22-16
<b>Level 4: Final Exam_1 of 2_Handle Mold</b>	<b>22-24</b>
<b>Level 4: Final Exam_2 of 2_Mouse Mold</b>	<b>22-28</b>

**Chapter 23 Using Appearances 23-1**

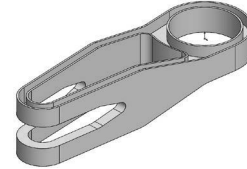
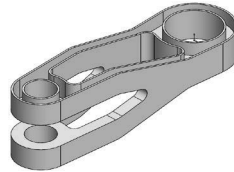
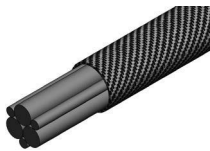


Modeling diamond knurls	23-1
Applying the knurl appearance	23-5
Applying wire mesh appearance	23-8
Applying the Car-Paint Appearance	23-11
Flatten Surfaces	23-16
Exercise: Flattening a shoe sole	23-20

**Certification Practice for the CSWP Mechanical Design Exam 24-1**



Challenge I: Part Modeling & Modifications	24-2
Challenge II: Part Modifications & Configurations	24-18
Challenge III: Bottom Up Assembly & Mates	24-39



**Glossary, Index, and SOLIDWORKS 2022 Quick-Guide**

Quick Reference Guide to SOLIDWORKS 2022 Command Icons and Toolbars.

