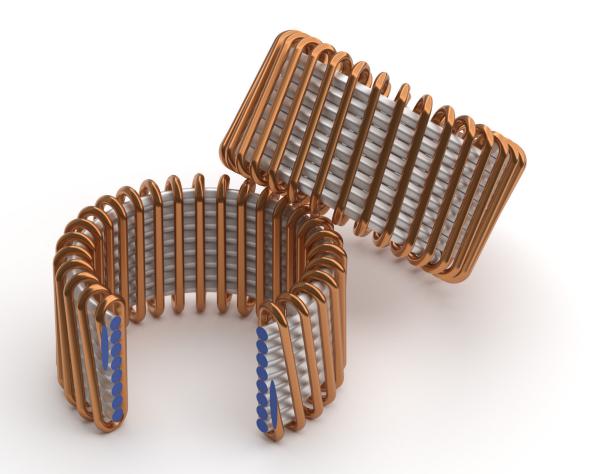
# SOLIDWORKS<sup>®</sup> 2019 Advanced Techniques

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:





# SOLIDWORK Z019

Copyrights Notices Disclaimer Trademarks

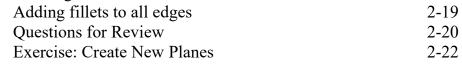
Introductio	on SOLIDWORKS 2019 User Interface	XXIII
	The 3 references planes	XXIV
	The toolbars	XXIV
	The system feedback symbols	XXVI
10000	The status bar	XXVI
	2D sketch examples	XXVII
4	3D feature examples	XXVIII

### **Advanced Modeling Topics**

Introduction to 3D Sketch	1-1
Tools Needed	1-2
Creating a 3D Sketch	1-3
Completing the profile	1-4
Adding dimensions	1-5
Adding the sketch fillets	1-6
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
Plane Creation	2-1
Advanced Topics	2-1
Tools Needed	2-2
Revolving the base profile	2-3
Creating a tangent plane	2-4
Creating a flat surface	2-5
Extruding a cut	2-6
	Creating a 3D Sketch Completing the profile Adding dimensions Adding the sketch fillets Creating the swept feature Questions for review Exercise: Sweep with 3D Sketch Exercise: 3D Sketch & Planes Exercise: 3D Sketch & Composite Curve <b>Plane Creation</b> <b>Advanced Topics</b> Tools Needed Revolving the base profile Creating a tangent plane Creating a flat surface

2-7 2-8 2-9 2-10 2-11 2-12 2-12 2-13 2-14 2-15 2-17

Creating an at-angle plane Showing the sketches Creating a coincident plane Creating a parallel plane Creating the recess Creating an offset-distance plane Creating the bore holes Creating the bore holes Creating a perpendicular plane Creating the side-grips Creating a circular pattern of the grips Creating a Mid-Plane Adding fillets to all edges	
Adding fillets to all edges	
	Showing the sketches Creating a coincident plane Creating a parallel plane Creating the recess Creating an offset-distance plane Creating the bore holes Creating a perpendicular plane Creating the side-grips Creating a circular pattern of the grips Creating a Mid-Plane Adding fillets to all edges



Chapter 3	Advanced Modeling	3-1
-	5/8" Spanner	3-1
	Tools needed	3-2
	Opening the spanner sketch document	3-3
	Creating the transition sketch	3-4
	Creating a new work plane	3-6
	Creating the closed-end sketch	3-7
3	Extruding the closed-end feature	3-7
AD THE	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
	Helical Extension Spring	4-2
	Tools needed	4-2
- )	Converting the circle into a helix	4-3
	Creating a 2-degree plane	4-4
	Sketching the large loop	4-5
C	Sketching the large hook	4-5
	Creating a parallel plane	4-6
	Creating a Composite Curve	4-8







Chapter 5

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
Using Variable Pitch	4-17
Multi-Pitch Spring with Closed Ends	<b>4-1</b> 7 4-18
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 a trimmed sketch	4-22
Creating the flat ends	4-22
Extruding a cut	4-22
Questions for Review	4-23
Exercise: Projected Curve & Composite Curve	4-24
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
	5-12 5-12
Sketching the rear inlet port	
Sketching the rear inlet port Revolving the rear inlet port Adding face Fillets	5-12
Sketching the rear inlet port Revolving the rear inlet port	5-12 5-13
Sketching the rear inlet port Revolving the rear inlet port Adding face Fillets Mirroring the rear inlet port	5-12 5-13 5-15
Sketching the rear inlet port Revolving the rear inlet port Adding face Fillets Mirroring the rear inlet port Shelling the part	5-12 5-13 5-15 5-16

Chapter 6	Loft vs. Sweep	6-1
	Water Meter Housing	6-2
	Tools Needed	6-2
	Sketching the loft profile	6-3



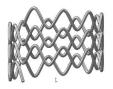


Constructing loft profiles / features	6-5
Creating the inlet feature	6-6
Constructing the Inlet / outlet profiles	6-6
Constructing the centerline parameter	6-10
Creating the outlet loft feature	6-11
Shelling the part	6-13
Extruding the left / right brackets	6-14
Constructing the upper ring	6-15
Adding fillets	6-17
Adding chamfers	6-18
Questions for Review	6-19
Exercise: Loft	6-20

7-32 7-33

Chapter 7







Loft with Guide Curves	7-1
Waved Washer	7-2
Tools Needed	7-2
Creating the construction profile	7-3
Creating an offset distance plane	7-4
Positioning the derived sketch	7-5
Creating a curve through reference points	7-5
Sketching the loft sections	7-7
Creating the loft section using derived sketch	7-7
Creating a loft with guide curve	7-10
Hiding the construction sketches	7-11
Questions for review	7-12
Exercise: Using Curve Driven Pattern	7-13
Advanced Sweep	7-19
Wire Form	7-20
Tools Needed	7-20
Creating the sweep path	7-21
Creating the sweep profile	7-22
Creating a sweep feature	7-23
Creating a circular Sketch pattern	7-25
Converting to construction geometry	7-26
Creating a derived sketch	7-27
Creating a 3D sketch	7-28
Creating the sweep feature	7-32
Exercise: Using Curve Through Reference Points	7-33

Chapter 8	Using Surfaces	8-1
	Advanced Modeling	8-2
	Tools Needed	8-2
	Constructing a new work plane	8-3
	Sketching the loft profiles	8-3
	Creating a surface-loft	8-6
	Splitting the surface	8-7
	Deleting surfaces	8-8
M	Thickening the surface	8-9
	Calculating the angle between the faces	8-10
	Adding a full round fillet	8-12
	Sketching the slot contours	8-13
	Extruding cut the contour	8-15
	Questions for Review	8-17
	Lofted Surface	8-19
	Creating new offset planes	8-19
	Sketching 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
A.	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	9-1
	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



Chapter 10

Exercise: Advanced Surfaces	9-13
Exercise: Advanced Surfacing Techniques	9-15





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 filled surfaces	10-7
Creating a planar surface	10-9
Creating a Knit surface	10-10
Creating fillets	10-11
Using Filled Surfaces	10-13
Patch with Curvature Controls	10-13
Tools Needed	10-14
Enabling the surfaces toolbar	10-15
Creating a planar surface	10-16
Creating a surface fill with tangent control	10-16
Creating a surface fill with curvature control	10-18
Knitting all surfaces	10-19
Creating a solid body	10-19
Patch Types	10-20
Questions for Review	10-22
<b>Boundary and Freeform Surfaces</b>	10-23
Creating the 1st boundary surface	10-23
Creating the 2nd boundary surface	10-26
Creating the Freeform feature	10-28



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
A //	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

L L	Creating a section view Adding an extruded cut feature Adding a revolve cut feature Adding the side cut features Creating the Cut-out slot Creating the sweep cut Adding fillets Exercise: Advanced Loft – Turbine Blades Exercise: Advanced Sweep – Candle Holder	11-7 11-7 11-9 11-10 11-11 11-13 11-13 11-15 11-16
	Advanced: Final Exam	11-23
Chapter 12	SimulationXpress	12-1
	Using the Analysis Wizard	12-2
P	Tools Needed	12-2
	Starting SimulationXpress	12-3
C	Setting up the units	12-4
- 1990 HU - 1990	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
15 Mara (p) 5 Mara (p) 6 Anore 5 Mara (p) 6 Mara (p) 6 Mara (p) 6 Mara (p) 6 Mara (p) 7 Mara (p) 6 Mara (p) 7 Mara (p) 7 Mara (p) 6 Mara (p) 7 Mara (	Viewing the report	12-12
4.019e00 3.55ee00 3.55ee00 3.29ee00 3.29ee00 3.29ee00	Generating the eDrawings file	12-16
1 (micro) 1 (micro) 1 (micro) 1 (micro) 1 (micro)	Questions for Review	12-19
	Exercise 1: SimulationXpress: Force	12-20
	Exercise 2: SimulationXpress: Pressure	12-21

D

## **Sheet Metal Topics**

Chapter 13	Sheet Metal Parts	13-1
	Post Cap	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 the Side Holes	13-11
	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
	Vents	13-18
-	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	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 Form 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
Contra >	Creating an Axis	13-38
and the second second	Creating a Circular Pattern	13-39
	Questions for Review	13-40



Chapter 14

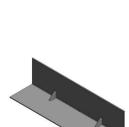
L

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 Tray14-13Tools Needed14-14



	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
2-11/	Adding Chamfers	14-30
	Switching to the Flat Pattern	14-31
	Questions for Review	14-32
Chapter 15	Sheet Metal Conversions	15-1
•	From IGES to SOLIDWORKS	15-2
-	Tools Needed	15-2
6	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
	Sheet Metal Gussets	15-9
	Opening a sheet metal document	15-9
a	Creating a gusset	15-9
	Viewing the resulted gusset	15-11
	Mirroring the gusset	15-12
	Flat Pattern Stent	15-13
	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
$\times \times \times \times \times$	Switching to Flatten Mode	15-21
	Questions for Review	15-22
	Exercise: Stent Sample - Sheet Metal Approach	15-23

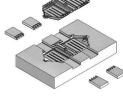




Chapter 16	Working with Sheet Metal STEP Files	16-1
	Tools Needed	16-2 16-3
	Opening an Assembly Step File	16-3 16-4
	Mating the components Adding the Sheet Metal tool tab	16-4 16-7
	•	16-8
	Inserting Sheet Metal parameters Viewing the Flat Pattern	16-8 16-9
	Converting other components	16-9 16-9
	Using 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
	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
	Weldments Platform	17-2
AL A	Tools Needed	17-2
	Adding the weldments toolbar	17-3
	Adding the structural members	17-4
EB BAR	Viewing the overlapped areas	17-8
Det Av	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
	Setting the Corner Treatments	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
<b>V</b>	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
THE A	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
o hitse	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
-	Mold-Tooling Design	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
	<b>Creating Slides and Cores</b>	19-21
	Tools Needed	19-22
	Opening a part document	19-23
	Analyzing the undercuts	19-23
and the second	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



1

	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
Chapter 20	Top-Down Assembly – Part 1	20-1
•	Miniature Vise	20-2
	Tools Needed	20-2
	Creating the Base part	20-3
	Adding the side flanges	20-5
9	Creating an offset distance plane	20-7
And	Creating the 3D Guide Curves	20-9
SMATT	Creating the fixed jaw clamp	20-11
	Creating a new component: The slide jaw	20-14
	Using the offset entities command	20-15
	Creating the Guide Curve to connect the two sketches	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

Chapter 21	Top-Down Assembly – Part 2	21-1
	Water Control Valve	21-2
	Tools Needed	21-2
	Starting a New Assembly Template	21-3
	Creating the 1st Component	21-4
	Adding the Inlet Flange	21-5
t t	Adding the Mounting Holes	21-6
0	Adding Chamfers and Fillets	21-8
	Saving as Virtual Component	21-10
	Creating the 2nd Component	21-10
0000	Creating the Transition Body	21-12
	Adding another mounting Flange	21-13
0,00	Adding an Offset-Distance plane	21-14
6	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



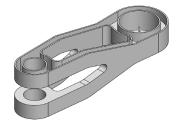
External References & Repair Errors	22-1
External Reference Symbols	22-2
Understanding & Removing External References	22-3
Removing External References	22-3
Understanding the External Symbols	22-4
Repairing the Sketches	22-5
Rebuilding the model	22-7
Questions for Review	22-8
Understanding and Repairing Part Errors	22-9
Repair Errors & External References	22-16
Level 4: Final Exam	22-24
Using Appearances	23-1
Modeling diamond knurls	23-1
Applying the knurl appearance	23-5
Applying the wire mesh appearance	23-8
Flatten surfaces	23-11
,	23-15
	External Reference Symbols Understanding & Removing External References Removing External References Understanding the External Symbols Repairing the Sketches Rebuilding the model Questions for Review Understanding and Repairing Part Errors Repair Errors & External References <b>Level 4: Final Exam</b> <b>Using Appearances</b> Modeling diamond knurls Applying the knurl appearance Applying the wire mesh appearance

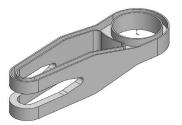
#### **Certification Practice for the CSWP Mechanical Design Exam 24-1**



Flactice for the CSWF Mechanical Design LAam 24-1	
Challenge I: Part Modeling & Modifications	24-2
Challenge II: Part Modifications & Configurations	24-27
Challenge III: Bottom Up Assembly & Mates	24-48







# **Glossary**, **Index, and SOLIDWORKS 2019 Quick-Guides** Quick Reference Guide to SOLIDWORKS 2019 Command Icons and Toolbars.