SOLIDWORKS 2022 Tutorial

A Step-by-Step Project Based Approach Utilizing 3D Solid Modeling



David C. Planchard, CSWP, SOLIDWORKS Accredited Educator

Visit the following websites to learn more about this book:









TABLE OF CONTENTS

Introduction	I-1
About the Author	I-2
Acknowledgements	I-3
Contact the Author	I-4
Note to Instructors	I-4
Trademarks, Disclaimer, and Copyrighted Material	I-4
References	I-5
Table of Contents	I-7
What is SOLIDWORKS?	I-16
Design Intent	I-18
Overview of Chapters	I-21
About the Book	I-28
Windows Terminology in SOLIDWORKS	I-29
Chapter 1 - Overview of SOLIDWORKS and the User Interface	1-1
Chapter Objective	1-3
What is SOLIDWORKS?	1-3
Basic concepts in SOLIDWORKS	1-3
Start a SOLIDWORKS Session	1-4
Tutorial: Start a SOLIDWORKS Session	1-4
Welcome dialog box	1-4
Home Tab	1-5
Recent Tab	1-5
Learn Tab	1-5
Alerts Tab	1-6
SOLIDWORKS User Interface (UI) and CommandManager	1-7
Menu Bar toolbar	1-7
Menu Bar menu (No model open)	1-8
Menu Bar menu (Model open)	1-8
Drop-down menu (Open part document) Create a New Part Document	1-8
Novice Mode	1-9 1-10
Advanced Mode	1-10
Graphic Window (Default)	1-10
View Default Sketch Planes	1-11
Download the SOLIDWORKS folder	1-12
Open the Bracket Part	1-12
Part FeatureManager	1-13
FeatureManager Rollback Bar	1-13
Heads-up View toolbar	1-15
Dynamic Annotation Views	1-15
Zoom to Fit	1-15
Zoom to Area	1-15
Window-Select	1-15
Rotate	1-15
Front View	1-16
Right View	1-16

Top View	1-16
Trimetric view	1-16
SOLIDWORKS Help	1-16
SOLIDWORKS Tutorials	1-17
User Interface Tools	1-17
Right-click	1-18
Consolidated toolbar	1-18
System feedback icons	1-18
Confirmation Corner	1-19
Heads-up View toolbar	1-19
CommandManager (Default Part tab)	1-22
CommandManager (Default Drawing tab)	1-23
CommandManager (Default Assembly tab)	1-24
CommandManager (Float/Fit)	1-25
Collapse the CommandManager	1-25
FeatureManager Design Tree	1-26
FeatureManager design tree tab	1-26
PropertyManager tab	1-26
Configuration Manager tab	1-26
DimXpertManager tab	1-26
DisplayManager tab	1-26
CAM tab	1-26
Hide/Show tab	1-26
Sensors tool	1-26
Tags	1-27
Split	1-27
Fly-out FeatureManager	1-28
Task Pane	1-29
3DEXPERIENCE MARKETPLACE	1-29
SOLIDWORKS Resources	1-30
Design Library	1-30
File Explorer	1-31
View Palette	1-31
Appearances, Scenes and Decals	1-31
Custom Properties	1-32
Motion Study tab	1-32
3D Views tab	1-34
Dynamic Reference Visualization	1-34
Mouse Movements	1-35
Single-Click	1-35
Double-Click	1-35
Right-Click	1-35
Scroll Wheel	1-35
Summary	1-36
Chapter 2 - Parts and Assembly Creation	2-1
Chapter Objective	2-3
Chapter Overview	2-4
Start a SOLIDWORKS Session	2-6
AXLE Part	2-9
AXLE Part-Extruded Boss/Base Feature	2-10

SOLIDWORKS® 2022 Tutorial	Introduction
AXLE Part-Save	2-13
AXLE Part-Edit Appearance	2-14
AXLE Part-View Modes	2-15
SHAFT-COLLAR Part	2-18
SHAFT-COLLAR Part-Extruded Boss/Base Feature	2-18
SHAFT-COLLAR Part-Extruded Cut Feature	2-21
SHAFT-COLLAR-Modify Dimensions and Edit Color	2-23
FLATBAR Part	2-24
FLATBAR Part-Extruded Boss/Base Feature	2-25
FLATBAR Part-Extruded Cut Feature	2-28
FLATBAR Part-Linear Pattern Feature	2-30
LINKAGE Assembly	2-31
Mate Types	2-32
Standard Mates	2-32
Advanced Mates	2-33
Mechanical Mates	2-34
AirCylinder Assembly-Open and Save As option	2-35
LINKAGE Assembly-Insert FLATBAR Part	2-39
LINKAGE Assembly-Insert SHAFT-COLLAR Part	2-42
Motion Study - Basic Motion tool	2-45
LINKAGE Assembly-Basic Motion	2-45
Summary	2-48
Questions	2-49
Exercises	2-50
Chapter 3 - Front Support Assembly	3-1
Chapter Objective	3-3
Chapter Overview	3-4
Reference Planes and Orthographic Projection	3-5
HEX-STANDOFF Part	3-9
HEX-STANDOFF Part-Extruded Boss/Base Feature	3-10
HEX-STANDOFF Part-HOLE Wizard Feature	3-14
ANGLE-13HOLE Part	3-15
ANGLE-13HOLE Part-Documents Properties	3-17
ANGLE-13HOLE Part-Extruded Thin Feature	3-18
ANGLE-13HOLE Part-Extruded Cut Feature	3-20
ANGLE-13HOLE Part-Linear Pattern Feature	3-22
ANGLE-13HOLE Part-Fillet Feature	3-23
ANGLE-13HOLE Part-Second Extruded Cut and Linear Pattern	3-24
ANGLE-13HOLE Part-Third Extruded Cut Feature	3-26
TRIANGLE Part	3-31
TRIANGLE Part-Mirror, Offset and Fillet Sketch Tools	3-33
TRIANGLE Part-Extruded Boss/Base Feature	3-36
TRIANGLE Part-First Extruded Cut Feature	3-37
TRIANGLE Part-Second Extruded Cut Feature	3-39
TRIANGLE Part-Mirror Feature	3-41
TRIANGLE Part-Third Extruded Cut Feature	3-42
TRIANGLE Part-Circular Pattern Feature	3-44
SCREW Part	3-45
SCREW Part-Documents Properties	3-47
SCREW Part-Revolved Feature	3-47

SCREW Part-Extruded Cut Feature SCREW Part-Circular Pattern Feature	3-51 3-53
SCREW Part-Fillet Feature	3-53
SCREW Part-Chamfer Feature	3-54
FRONT-SUPPORT Assembly	3-56
FRONT-SUPPORT Assembly-Insert ANGLE-13HOLE	3-56
FRONT-SUPPORT Assembly-Insert HEX-STANDOFF	3-58
FRONT-SUPPORT Assembly-Insert TRIANGLE	3-61
FRONT-SUPPORT Assembly-Insert SCREW	3-64
Chapter Summary	3-66
Questions	3-68
Exercises	3-69
Chapter 4 - Fundamentals of Drawing	4-1
Chapter Objective	4-3
Chapter Overview	4-4
Drawing Template and Sheet Format	4-5 4-7
Create a new Drawing Drawing-Document Properties	4-7 4-9
Title Block	4-9 4-10
Create a Title Block	4-10 4-11
Company Logo	4-11
Insert a Company Logo	4-15
Save Sheet Format and Save As Drawing Template	4-17
FLATBAR Drawing	4-20
FLATBAR Drawing-Open the FLATBAR Part	4-20
Move views and Properties of the Sheet	4-24
FLATBAR Drawing-Position views	4-26
Detail Drawing	4-27
FLATBAR Drawing-Dimensions and Annotations	4-29
FLATBAR Drawing-Part Number and Document Properties	4-35
FLATBAR Drawing-Linked Note	4-37
LINKAGE Assembly Drawing-Sheet1	4-40
LINKAGE Assembly Drawing-Exploded view	4-44
LINKAGE Assembly Drawing-Animation	4-46
LINKAGE Assembly Drawing-Bill of Materials	4-47
LINKAGE Assembly Drawing-Automatic Balloons	4-49
LINKAGE Assembly Drawing-Sheet2	4-50
LINKAGE Assembly Drawing-Sheet2 Section view	4-52
LINKAGE Assembly Drawing-Sheet2 Detail view	4-52
FLATBAR Part-Design Table	4-54
FLATBAR Drawing-Sheet2	4-58
FLATBAR-SHAFTCOLLAR Assembly	4-60
Insert a Center of Mass Point	4-65
Chapter Summary	4-67
Questions Exercises	4-67 4-69
Chapter 5 - Advanced Features	5-1
Chapter Objective	5-3
Chapter Overview	5-4
WEIGHT Part	5-6

SOLIDWORKS® 2022 Tutorial	Introduction
WEIGHT Part-Lofted Feature	5-12
WEIGHT Part-Instant 3D Extruded Cut Feature	5-13
HOOK Part	5-14
HOOK Part-Swept Base Feature	5-20
HOOK Part-Swept Profile	5-20
HOOK Part-Dome Feature	5-20
HOOK Part-Thread Feature	5-21
WHEEL Part	5-24
WHEEL Part-Extruded Boss/Base Feature	5-27
WHEEL Part-Revolved Cut Feature	5-28
WHEEL Part-First Extruded Cut Feature	5-31
WHEEL Part-Second Extruded Cut Feature	5-33
WHEEL Part-Circular Pattern Feature	5-36
Modify a Part	5-39
HEX-ADAPTER Part	5-39
HEX-ADAPTER Part-Extruded Boss/Base Feature	5-42
HEX-ADAPTER Part-Extruded Cut Feature	5-42
AXLE-3000 Part	5-45
SHAFTCOLLAR-500 Part	5-46
Chapter Summary	5-49
Questions	5-50
Exercises	5-51
Chapter 6 - PNEUMATIC-TEST-MODULE and ROBOT Assembly	6-1
Chapter Objective	6-3
Chapter Overview	6-4
Assembly Techniques	6-6
PNEUMATIC-TEST-MODULE Layout	6-7
FLATBAR Sub-assembly	6-9
3HOLE-SHAFTCOLLAR Assembly	6-9
WHEEL-FLATBAR Assembly	6-16
WHEEL-FLATBAR Assembly-Insert 3HOLE-SHAFT-COLLAR	6-19
WHEEL-FLATBAR Assembly-Insert 5HOLE-SHAFT-COLLAR	6-21
WHEEL-AND-AXLE Assembly	6-25
WHEEL-AND-AXLE Assembly-Insert HEX-ADAPTER	6-28
WHEEL-AND-AXLE Assembly-Insert SHAFTCOLLAR-500	6-30
PNEUMATIC-TEST-MODULE Assembly	6-32
Modify the LINKAGE Assembly	6-33
PNEUMATIC-TEST-MODULE-Insert LINKAGE Assembly	6-42
PNEUMATIC-TEST-MODULE-Insert AIR-RESERVOIR-SUPPORT	6-44
PNEUMATIC-TEST-MODULE-Component Pattern	6-47
PNEUMATIC-TEST-MODULE-Linear Component Pattern	6-48
PNEUMATIC-TEST-MODULE-Insert FRONT-SUPPORT	6-50
PNEUMATIC-TEST-MODULE-Mirrored Component	6-53
PNEUMATIC-TEST-MODULE-MIRRORFRONT-SUPPORT	6-55
Component Properties	6-56
PNEUMATIC-TEST-MODULE-Insert WHEEL-AND-AXLE	6-56
PNEUMATIC-TEST-MODULE-Remove Rigid State	6-58
PNEUMATIC-TEST-MODULE-Review AirCylinder Configurations	6-59

Final ROBOT Assembly Create the Robot Assembly Insert the PNEUMATIC-TEST-MODULE Assembly Insert the basic_integration Assembly Chapter Summary Questions Exercises	6-64 6-65 6-65 6-67 6-68 6-69 6-71
Chapter 7 - CSWA Introduction and Drafting Competencies Introduction Objectives Procedure to Create a Named Drawing view Tutorial: Drawing Named Procedure 7-1 Tutorial: Drawing Named Procedure 7-2 Tutorial: Drawing Named Procedure 7-3 Tutorial: Drawing Named Procedure 7-4 Tutorial: Drawing Named Procedure 7-5 Tutorial: Drawing Named Procedure 7-6 Tutorial: Drawing Named Procedure 7-7 Tutorial: Drawing Named Procedure 7-8 Intended Audience Summary Questions	7-1 7-1 7-7 7-8 7-9 7-9 7-10 7-11 7-11 7-11 7-12 7-13 7-14
Chapter 8 - CSWA Basic and Intermediate Part Creation and Modification Objectives Read and Understand an Engineering Document Build a Basic Part from a Detailed Illustration Tutorial: Volume/Center of Mass 8-1 Tutorial: Volume/Center of Mass 8-2 Tutorial: Mass-Volume 8-3 Tutorial: Mass-Volume 8-4 Tutorial: Mass-Volume 8-5 Build additional Basic Parts Tutorial: Mass-Volume 8-6 Tutorial: Mass-Volume 8-7 Tutorial: Basic/Intermediate-Part 8-1 Tutorial: Basic/Intermediate-Part 8-2 Summary Questions	8-1 8-1 8-2 8-4 8-4 8-5 8-8 8-9 8-11 8-15 8-15 8-17 8-22 8-25 8-26
Chapter 9 - CSWA Advanced Part Creation and Modification Objectives Build an Advanced Part from a Detailed Illustration Tutorial: Advanced Part 9-1 Tutorial: Advanced Part 9-2 Calculate the Center of Mass Relative to a Created Coordinate System Location Tutorial: Coordinate Location 9-1 Tutorial: Coordinate Location 9-2 Tutorial: Advanced Part 9-3 Tutorial: Advanced Part 9-3A Tutorial: Advanced Part 9-3B	9-1 9-1 9-2 9-2 9-7 9-10 9-12 9-13 9-17 9-18

SOLIDWORKS® 2022 Tutorial	Introduction
Tutorial: Advanced Part 9-4	9-20
Tutorial: Advanced Part 9-4A	9-26
Summary	9-27
Questions	9-29
Chapter 10 - CSWA - Assembly Creation and Modification	10-1
Objectives	10-1
Assembly Modeling	10-2
Build an Assembly from a Detailed Dimensioned Illustration	10-3 10-5
Tutorial: Assembly Modeling 10-1 Tutorial: Assembly Modeling 10-2	10-3
Tutorial: Assembly Modeling 10-2 Tutorial: Assembly Modeling 10-3	10-11
Summary	10-10
Questions	10-21
Questions	10-22
Chapter 11 - Additive Manufacturing - 3D Printing	11-1
Chapter Objective	11-3
Additive vs. Subtractive Manufacturing	11-4
3D Printer Technology	11-5
Stages of 3D Printing	11-5
Fused Filament Fabrication (FFF)	11-6
StereoLighography (SLA)	11-9 11-11
Selective Laser Sintering (SLS) Select the Correct Filament Material for FFF	11-11
	11-12
PLA (Polylactic Acid) Flex/Soft PLA	11-13
PLA Storage	11-13
PLA Part Accuracy	11-14
ABS (Acrylonitrile-Butadiene-Styrene)	11-14
ABS Storage	11-14
ABS Part Accuracy	11-15
Nylon	11-16
Nylon 618	11-16
Nylon 645	11-16
Nylon Storage	11-17
Nylon Accuracy	11-17
PVA (Polyvinyl Alcohol)	11-17
STereoLithography (*.stl) file	11-18
Save an STL (*.stl) file	11-18
Additive Manufacturing (*.amf) file	11-19
Save an Additive Manufacturing (*.amf) file	11-19
3D Manufacturing Format (*.3mf) file	11-20
Save a 3D Manufacturing Format (*.3mf) file	11-20
What is a Slicer?	11-21
How does a Slicer Work?	11-21
Slicer Parameters	11-21
Layer Height	11-21
Shell (Wall) Thickness	11-22
Infill Density/Overlap	11-22
Infill Patterns	11-22
Print Speed	11-23

Support Types	11-23
Touching Buildplate	11-23
Everywhere	11-24
Bed Platform Adhesion	11-24
Raft	11-24
Skirt	11-24
Brim	11-24
Part Orientation	11-25
Example 1	11-25
Example 2	11-26
Optimize Print Direction	11-26
Thin Region	11-26
Area of Overhang	11-26
Amount of needed Support	11-26
Remove Model from the Build Plate	11-28
Non-heated Build Plate	11-28
Heated Build Plate	11-28
Know the Printer's Limitations	11-29
Tolerance for Interlocking Parts	11-29
General Printing Tips	11-29
Reduce Infill/Overlap	11-29
Control Build Area Temperature	11-30
Add Pads	11-31
Safe Zone Rule	11-31
First Layer Not Sticking	11-31
Level Build Platform	11-32
Minimize Internal Support	11-32
Design a Water Tight Mesh	11-32
Clearance	11-32
In General	11-33
Print Directly from SOLIDWORKS	11-34
Add-in	11-34
SOLIDWORKS Additive Manufacturing Certification (CSWA-AM)	11-35
Summary	11-36
Appendix	A-1
SOLIDWORKS Keyboard Shortcuts	A-1
Modeling - Best Practices	A-3
Helpful On-Line Information	A-5
SOLIDWORKS Document Types	A-6
CSWA Homework Answers	A-7
Glossary Index	G-1 I-1