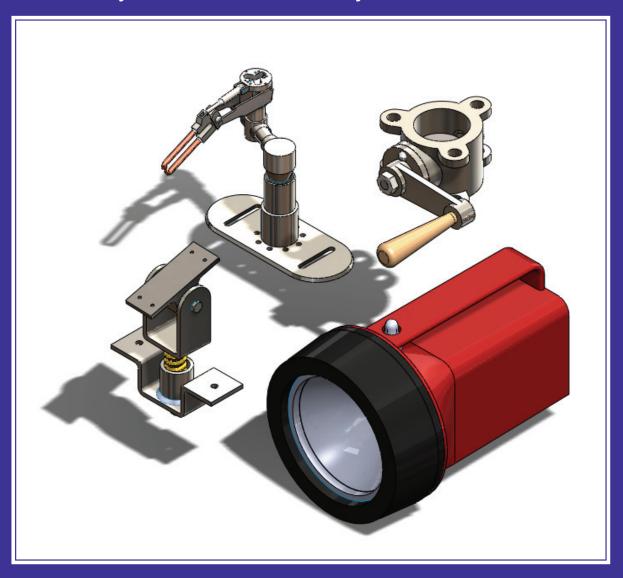


Engineering Design

with SolidWorks 2012 and Video Instruction

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

Introductory Level ◆ Tutorial Style ◆ Video Instruction



David C. Planchard & Marie P. Planchard, CSWP



www.SDCpublications.com

Table of Contents

Introduction	I-1
About the Cover	I-2
About the Authors	I-2
Acknowledgements	I-3
Contact the Authors	I-3
Note to Instructors	I-3
Trademarks, Disclaimer and Copyrighted Material	I-3
References	I-4
Table of Contents	I-6
Overview of Projects	I-14
What is SolidWorks?	I-19
About the Book	I-21
Windows Terminology in SolidWorks	I-22
Project 1 - Fundamentals of Part Modeling	1-1
Project Objective	1-3
Project Situation	1-4
Project Overview	1-6
File Management	1-7
Start a SolidWorks 2012 Session	1-9
Understand the SolidWorks User Interface and CommandManager	1-10
Menu bar toolbar	1-10
Menu bar menu	1-10
Drop-down menu	1-11
Right-click	1-11
Consolidated toolbar	1-12
System feedback icons	1-12
Confirmation Corner	1-12
Heads-up View toolbar	1-13
SolidWorks CommandManager	1-15
FeatureManager Design Tree	1-19
Fly-out FeatureManager	1-21
Task Pane	1-22
Design Library	1-22
File Explore	1-23
Search	1-23
View Palette	1-23
Appearances, Scenes, and Decals	1-24
Custom Properties	1-24
Document Recovery	1-24
Motion Study tab	1-25
MotionManager	1-25
Animation	1-25
Basic Motion	1-25
System Options	1-31
Part Document Template and Document Properties	1-32
PLATE Part Overview	1-35
PLATE Part-New SolidWorks Document	1-37

	Introduction
PLATE Base Feature	1-38
Machined Part	1-39
Reference Planes and Orthographic Projection	1-40
PLATE Part-Extruded Boss/Base Feature	1-44
PLATE Part-Modify Dimensions and Rename	1-52
Display Modes, View Modes, View tools, and Appearances	1-54
Fasteners	1-56
PLATE Part-Extruded Cut Feature	1-58
PLATE Part-Fillet Feature	1-63
PLATE Part-Hole Wizard	1-65
ROD Part Overview	1-68
ROD Part-Extruded Boss/Base Feature	1-70
ROD Part-Hole Wizard Feature	1-72
ROD Part-Chamfer Feature	1-73
ROD Part-Extruded Cut Feature & Convert Entities Sketch Tool	1-74
ROD Part-View Orientation, Named Views & Viewport option	1-79
ROD Part-Copy/Paste Function	1-80
ROD Part-Design Changes with Rollback Bar	1-81
ROD Part-Recover from Rebuild Errors	1-83
ROD Part-Edit Part Color	1-87
GUIDE Part Overview	1-89
GUIDE Part-Extruded Boss/Base Feature and Dynamic Mirror Feature	1-91
GUIDE Part-Extruded Cut Slot Profile	1-94
GUIDE Part-Mirror Feature	1-98
GUIDE Part-Holes	1-99
GUIDE PART-Linear Pattern Feature	1-102
GUIDE Part-Materials Editor and Mass Properties	1-104
Manufacturing Considerations	1-106
Sketch Entities and Sketch Tools	1-109
Project Summary	1-110
Project Terminology	1-110
Questions / Exercises	1-114
Project 2 - Fundamentals of Assembly Modeling	2-1
Project Objective	2-3
Project Situation	2-4
Project Overview	2-5
Bottom-up Assembly Modeling Approach	2-5
Linear Motion and Rotational Motion	2-6
GUIDE-ROD assembly	2-7
GUIDE-ROD assembly - Insert Components	2-11
FeatureManager Syntax	2-13
Mate Types	2-16
Standard Mates	2-16
Advanced Mates	2-17
Mechanical Mates	2-17
GUIDE-ROD Assembly - Mate the ROD Component	2-18
GUIDE-ROD Assembly - Mate the PLATE Component	2-23
GUIDE-ROD Assembly - Mate Errors	2-27
Collision Detection	2-30
Modify Component Dimension	2-31

SolidWorks Design Library	2-32
GUIDE-ROD Assembly - Inert Mates for Flange bolts	2-35
Socket Head Cap Screw Part	2-39
SmartMates	2-39 2-44
Coincident/Concentric SmartMate	2-44
Tolerance and Fit	2-47
Exploded View	2-51
Section View	2-56
Analyze an Interference Problem	2-58
Save As Copy Option	2-59
GUIDE-ROD Assembly-Feature Driven Component Pattern	2-62
Redefining Mates and Linear Components Pattern	2-64
Folders and Suppressed Components	2-68
Make-Buy Decision	2-69
CUSTOMER Assembly	2-71
Copy the CUSTOMER Assembly - Pack and Go	2-77
Project Summary	2-79
Project Terminology	2-80
Questions / Exercises	2-87
Questions / Exercises	2-07
Project 3 - Fundamentals of Drawing	3-1
Project Objective	3-3
Project Situation	3-4
Project Overview	3-4
Drawing Template and Sheet Format	3-5
Sheet Format and Title Block	3-12
	3-17
Company Logo	
Save Sheet Format and Save As Drawing Template	3-19
GUIDE Part-Modify	3-22
GUIDE Part - Drawing	3-23
Move Views and Properties of the Sheet	3-26
Auxiliary View, Section View and Detail View	3-29
Auxiliary View	3-30
Section View	3-31
Detail View	3-32
Partial Auxiliary View - Crop View	3-33
Display Modes and Performance	3-35
Detail Drawing	3-37
Move Dimensions in the Same View	3-40
Partial Auxiliary View-Crop View	3-40
Move Dimensions to a Different View	3-44
Dimension Holes and the Hole Callout	3-45
Center Marks and Centerlines	3-48
Modify the Dimension Scheme	3-50
GUIDE Part-Insert an Additional Feature	3-54
General Notes and Parametric Notes	
	3-56
Revision Table Part Number and Decument Properties	3-59
Part Number and Document Properties	3-61
Exploded View	3-67
Balloons	3-69
Bill of Materials	3-71

	Introduction
Project Summary	3-76
Project Terminology	3-77
Questions / Exercises	3-80
Project 4 - Extrude and Revolve Features	4-1
Project Objective	4-3
Project Overview	4-4
Design Intent	4-6
Project Situation	4-9
Part Template	4-11
BATTERY Part	4-15
BATTERY Part - Extruded Boss/Base Feature	4-17
BATTERY Part - Fillet Feature Edge	4-22
BATTERY Part - Extruded Cut Feature	4-23
BATTERY Part - Fillet Feature Face	4-25
BATTERY Part - Extruded Boss/Boss Feature	4-27
Injection Molded Process	4-32
BATTERYPLATE Part	4-33
Save As, Delete, Modify and Edit Feature	4-34
BATTERYPLATE Part - Extruded Boss/Base Feature	4-36
BATTERYPLATE Part - Fillet Features-Full Round, options	4-37
Multi-body Parts and the Extruded Boss/Base Feature	4-40
LENS Part	4-42
LENS Part-Revolved Base Feature	4-43
LENS Part-Shell Feature	4-46
Extruded Boss Feature and Convert Entities Sketch tool	4-47
LENS Part-Hole Wizard	4-48
LENS Part - Revolved Boss Thin Feature	4-51
LENS Part - Extruded Boss/Boss Feature and Offset Entities	4-53
LENS Part - Extruded Boss/Boss Feature and Transparent Optical Property	4-55
BULB Part	4-57
BULB Part - Revolved Base Feature	4-58
BULB Part - Revolved Boss Feature and Spline Sketch tool	4-60
BULB Part - Revolved Cut Thin Feature	4-62
BULB Part - Dome Feature	4-64
BULB Part - Circular Pattern Feature	4-65
Customizing Toolbars and Short Cut Keys	4-69
Design Checklist and Goals before Plastic Manufacturing	4-71
Mold Base	4-73
Applying SolidWorks Features for Mold Tooling Design	4-74
Manufacturing Design Issues	4-83
Project Summary	4-84
Project Terminology	4-85
Questions / Exercises	4-89
Project 5 - Swept, Lofted and Additional Features	5-1
Project Objective	5-3
Project Overview	5-4
Project Situation	5-5
O-RING Part - Swept Base Feature	5-7

O-RING Part - Design Table	5-9
SWITCH Part - Lofted Base Feature	5-13
SWITCH Part - Dome Feature	5-18
Four Major Categories of Solid Features	5-20
LENSCAP Part	5-20
LENSCAP Part - Extruded Boss/Base, Extruded Cut and Shell Features	5-21
LENSCAP Part - Revolved Cut Thin Feature	5-24
LENSCAP Part - Thread, Swept Feature and Helix/Spiral Curve	5-25
HOUSING Part	5-31
HOUSING Part - Lofted Boss Feature	5-34
HOUSING Part - Second Extruded Boss/Base Feature	5-38
HOUSING Part - Second Extraded Boss/Base Feature	5-39
HOUSING Part - Third Extruded Boss/Base Feature	5-40
HOUSING Part - Draft Feature	5-40 5-41
	5-41 5-43
HOUSING Part - Thread with Swept Feature	
HOUSING Part - Handle with Swept Feature	5-48
HOUSING Part - Extruded Cut Feature with Up To Surface	5-53
HOUSING Part - First Rib and Linear Pattern Feature	5-55
HOUSING Part - Second Rib Feature	5-58
HOUSING Part - Mirror Feature	5-61
FLASHLIGHT Assembly	5-64
Assembly Template	5-65
LENSANDBULB Sub-assembly	5-65
BATTERYANDPLATE Sub-assembly	5-70
CAPANDLENS Sub-assembly	5-72
FLASHLIGHT Assembly	5-76
Addressing Interference Issues	5-82
Export Files and eDrawings	5-83
Project Summary	5-86
Project Terminology	5-86
Questions / Exercises	5-89
Project 6 - Top-Down Assembly Modeling and Sheet Metal	6-1
Project Objective	6-3
Project Situation	6-4
Top-Down Assembly Modeling	6-5
BOX Assembly Overview	6-8
InPlace Mates and In-Context features	6-10
Part Template and Assembly Template	6-12
Box Assembly and Layout Sketch	6-13
Global Values and Equations	6-17
MOTHERBOARD - Insert Component	6-20
POWERSUPPLY - Insert Component	6-26
Sheet Metal Overview	6-34
Bends	6-34
Relief	6-37
CABINET - Insert Component	6-37
CABINET - Rip Feature and Sheet Metal Bends	6-40
CABINET - Edge Flange	6-42
CABINET - Hole Wizard and Linear Pattern	6-45
CABINET - Sheetmetal Library Feature	6-49
	0.7

	Introduction
CABINET - Louver Forming tool	6-53
Manufacturing Considerations	6-54
Additional Pattern Options	6-60
CABINET - Formed and Flat States	6-62
CABINET - Sheet Metal Drawing with Configurations	6-64
PEM Fasteners and IGES Components	6-70
Derived Component Pattern	6-74
MOTHERBOARD - Assembly Hole Feature	6-76
Assembly FeatureManager and External References	6-77
Replace Components	6-79
Equations	6-82
Design Tables	6-86
BRACKET Part - Sheet Metal Features	6-89
BRACKET Part - In-Content Features	6-91
BRACKET Part - Edge, Tab, Break Corner and Miter Features	6-93
BRACKET Part - Mirror Component	6-98
MirrorBRACKET Part - Bends, Fold, Unfold and Jog Features	6-102
Project Summary	6-106
Project Terminology	6-107
Questions / Exercises	6-109
Project 7 - SimulationXpress, Sustainability and DFMXpress	7-1
Project Objective	7-3
SolidWorks SimulationXpress	7-3
SolidWorks SimulationXpress Wizard	7-7
Welcome	7-7
Fixtures	7-7
Loads	7-8
Materials	7-8
Run	7-8
Results	7-8
Optimize	7-8
Analyze the MGPMRod Part	7-9
Review of SolidWorks SimulationXpress	7-12
SolidWorks Sustainability	7-13
Life Cycle Assessment	7-14
Key Elements	7-15
Carbon Footprint	7-16
Energy Consumption	7-16
Air Acidification	7-16
Water Eutrophication	7-16
SustainabilityXpress Wizard	7-15
Material Class	7-15
Material Name	7-15
Manufacturing Process	7-16
Generate a Report	7-17
References - Sustainability	7-18
Methodology	7-18
SolidWorks DFMXpress	7-26

DFMXpress Wizard	7-26
Run	7-27
Settings	7-27
Close	7-27
Help	7-28
Project Summary	7-28
Questions / Exercises	7-28
Project 8 - Intelligent Modeling Techniques	8-1
Project Objective	8-3
Design Intent	8-4
Sketch	8-4
Geometric relations	8-4
Full Defined Sketch tool	8-5
SketchXpert	8-8
Equations	8-11
Dimension driven equations	8-11
Equation Driven Curve	8-14
Explicit Driven Equation Curve	8-14
Parametric Driven Equation Curve	8-16
Curves	8-18
Curve Through XYZ Points	8-19
Projected Composite Curves	8-21
Feature - End Conditions	8-23
Along A Vector	8-26
FeatureXpert (Constant Radius)	8-27
Symmetry	8-28
Bodies to mirror	8-28
Planes	8-30
Conic Sections	8-31
Assembly	8-32
Assembly Visualization	8-32
SolidWorks Sustainability	8-33
MateXpert	8-34
Drawing	8-34
DimXpert	8-35
Summary	8-35
Appendix	A-1
ECO Form	A-1
Types of Decimal Dimensions (ASME Y14.5M)	A-1
SolidWorks Keyboard Shortcuts	A-3
Windows Shortcuts	A-3
CSWA Certification Introduction	A-5
Intended Audience	A-9
Helpful On-Line information	A-10
Index	I-1