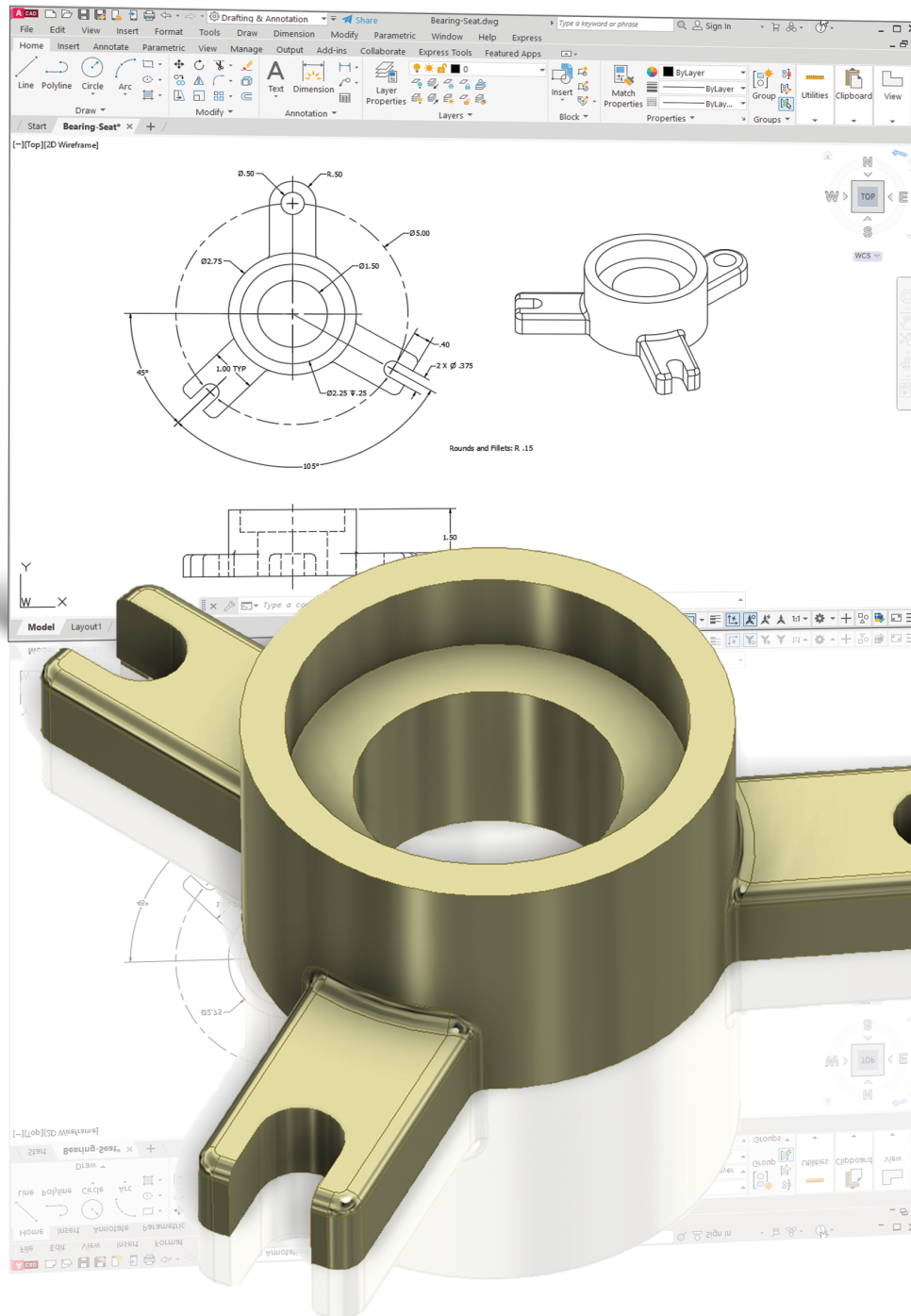


# AutoCAD® 2023 Tutorial

## Second Level 3D Modeling



Randy H. Shih

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

## **Preface**

## **Acknowledgments**

## **Introduction**

## **Getting Started**

Introduction	Intro-2
Development of Computer Geometric Modeling	Intro-2
Why Use AutoCAD 2023?	Intro-5
Getting Started with AutoCAD 2023	Intro-7
AutoCAD 2023 Screen Layout	Intro-8
Application Menu	Intro-9
Quick Access Toolbar	Intro-9
AutoCAD Menu Bar	Intro-9
Layout Tabs	Intro-9
Drawing Area	Intro-10
Graphics Cursor or Crosshairs	Intro-10
Command Prompt Area	Intro-10
Cursor Coordinates	Intro-10
Status Toolbar	Intro-10
Ribbon Tabs and Panels	Intro-11
Draw and Modify Toolbar Panels	Intro-11
Layers Control Toolbar Panel	Intro-11
Viewport/View/Display Controls	Intro-11
Mouse Buttons	Intro-12
[Esc] - Canceling commands	Intro-12
Online Help	Intro-13
Leaving AutoCAD 2023	Intro-14
Creating a CAD File Folder	Intro-14

## **Chapter 1**

## **User Coordinate Systems and the Z-Axis**

Introduction	1-2
The Floor Plan Design	1-2
Starting Up AutoCAD 2023	1-3
3D Basic Modeling WorkSpace	1-4
Drawing Units Setup	1-5
Drawing Area Setup	1-6
Grid and Snap Intervals Setup	1-7
Create Polylines	1-9
Create an Offset Polyline	1-10
Create Interior Walls	1-11

Complete the Doorway Using the Trim Command	1-14
User Coordinate System – It is an XY CRT, but an XYZ World	1-16
Viewing the 2D Design in 3D Space	1-17
Add the 3rd Dimension to the Floor Plan Design	1-18
View the Design Using the Hide Option	1-20
Add New Layers	1-21
Move Entities to a Different Layer	1-23
Reposition the UCS	1-23
Create the Roof	1-25
Rotating the UCS	1-27
Sketching on the Rotated UCS	1-28
View the Design Using the Hidden Option	1-29
Review Questions	1-30
Exercises	1-31

## **Chapter 2**

### **3D Wireframe Modeling**

Introduction	2-2
The Locator Design	2-3
Starting Up AutoCAD 2023	2-4
Activate the Startup Option	2-4
Create the Rectangular Base of the Design	2-6
Create a 3D Box	2-7
Object Snap Toolbar	2-10
Use the Snap Options to Locate the Top Corners	2-10
Use the Copy Option to Create Additional Edges	2-12
Use the Trim Command	2-14
Use the View Toolbar	2-16
Dynamic Rotation – Free Orbit	2-16
Use the Offset Command to Create Parallel Edges	2-17
Create a Circle above the UCS Sketch Plane	2-19
Complete the Wireframe Model	2-20
Review Questions	2-22
Exercises	2-23

## **Chapter 3**

### **UCS, Viewports and Wireframe Modeling**

Introduction	3-2
The V-Block Design	3-2
Starting Up AutoCAD 2023	3-3
3D Modeling Workspace	3-3
Layers Setup	3-4
Create the Rectangular Base of the Design	3-5
Create a Wireframe Box	3-6

Using the View and UCS Toolbars	3-7
Create Construction Lines in the Front View	3-8
Copy Objects in the Negative Z Direction	3-10
Create an Inclined Line at the Base of the Model	3-11
Create Object Lines	3-12
Multiple Viewports	3-14
Use the Mirror Command	3-15
Turn Off the Construction Lines	3-17
Create a New UCS	3-18
Create a New Named View	3-20
Create the V-Cut Feature on the Inclined Plane	3-22
Extend the Cut and GRIP Editing	3-23
Review Questions	3-25
Exercises	3-26

## **Chapter 4**

### **Classical Faceted Surface Modeling**

Introduction	4-2
Starting Up AutoCAD 2023	4-4
The UCS Toolbar and the Meshes Commands	4-5
Create a Mesh Surface Using the 2D Solid Command	4-5
Using the Visual Styles Toolbar	4-8
Create a Mesh Surface Using the 3D Face Command	4-10
The ViewCube	4-12
Create a Faceted Surface of Irregular Shape	4-14
Use the Invisible Edge Option	4-16
Repositioning with the Grip Editing Tools	4-17
The Locator Wireframe Model	4-18
Moving Objects to a Different Layer	4-18
Advanced Meshed Surface Modeling Commands	4-20
Use the Faceted Tabulated Surface Option	4-23
Use the Faceted Ruled Surface Option	4-24
Review Questions	4-27
Exercises	4-28

## **Chapter 5**

### **Procedural and NURBS Surface Modeling**

Introduction	5-2
Starting Up AutoCAD 2023	5-3
Turn on the UCS II Toolbar	5-3
Layers Setup	5-4
Create a Thin Surface Using the Extrude Command	5-5
Create another Profile	5-8
Complete the Profile Using Object Snap	5-9

Create another Thin Surface Using the Extrude Command	5-11
Create a Flat Planar Surface	5-13
Use the Trim option to adjust the Top Surface	5-14
Create another Planar Surface	5-16
Use the Trim option to adjust the New Surface	5-17
Combining two Overlapping Surfaces	5-19
Create a 3D Free Form NURBS Surface Model	5-21
AutoCAD Spline Curves	5-22
Start a New Drawing and Layers Setup	5-23
Create Two sets of Splines	5-24
Display the Control Vertices and Edit the Splines	5-28
Create a Network Surface	5-29
Convert the Network surface to a NURBS surface	5-31
Review Questions	5-32
Exercises	5-33

## Chapter 6

### **Solid Modeling - Constructive Solid Geometry**

Introduction	6-2
The Guide-Block Design	6-2
Constructive Solid Geometry Concept	6-3
Binary Tree	6-4
The Guide-Block CSG Binary Tree	6-5
Starting Up AutoCAD 2023	6-6
Layers Setup	6-7
Create the First 3D Object	6-7
Create the Second Solid Feature	6-9
Boolean Operation - Union	6-10
Create the Second Cylinder Feature	6-11
Boolean Operation - Subtract	6-12
Create another Solid Feature	6-13
Visual Styles Options	6-14
Create the Final Feature	6-15
Rotating the Rectangular Block	6-16
Reposition the Rectangular Block	6-17
The SteeringWheels	6-18
Review Questions	6-20
Exercises	6-21

## Chapter 7

### **Regions, Extrude and Solid Modeling**

Introduction	7-2
The V-Block-Solid Design	7-2
Starting Up AutoCAD 2023	7-3

Layers Setup	7-4
Setting Up a 2D Sketch	7-5
Defining the Front Edges of the Design	7-7
Create a Region	7-10
Extruding the Created Region	7-11
Create a 2D Sketch at the Base of the Model	7-13
Create a Mirrored Copy of the 2D Sketch	7-14
Create the Cutter Solids	7-15
Boolean Operation - Subtract	7-16
Mass Properties of the Solid Model	7-17
Align the UCS to the Inclined Face	7-18
Create the V-Cut	7-19
Review Questions	7-22
Exercises	7-23

## **Chapter 8**

### **Multiview Drawings from 3D Models**

Introduction	8-2
The V-Block Design	8-2
Starting Up AutoCAD 2023	8-3
AutoCAD Paper Space	8-4
Delete the Displayed Viewport	8-5
Add Borders and Title Block in the Layout	8-6
Setting Up Viewports inside the Title Block	8-7
Setting Up the Standard Views	8-8
Determine the Necessary 2D Views	8-10
Establish an Auxiliary View in Model Mode	8-11
Add a Viewport for an Auxiliary View	8-13
Use the DVIEW Command	8-16
Adjust the Viewport Scale	8-17
Lock the Base View	8-18
Align the 2D Views	8-18
Create 2D Projected Entities - SOLPROF	8-21
Complete the 2D Drawing	8-23
Review Questions	8-25
Exercises	8-26

## **Chapter 9**

### **Symmetrical Features in Designs**

Introduction	9-2
A Revolved Design: Pulley	9-2
Modeling Strategy - A Revolved Design	9-3
Starting Up AutoCAD 2023	9-4
Layers Setup	9-5

Set Up a 2D Sketch for the Revolved Feature	9-6
Perform 2D Boolean Operations	9-8
Create the Revolved Feature	9-12
Mirrored Image of the Part	9-13
Combine Two Parts into One	9-14
Use the 3D Array command	9-15
Position and Perform the Cut	9-18
Review Questions	9-20
Exercises	9-21

## **Chapter 10**

### **Advanced Modeling Tools & Techniques**

Introduction	10-2
A Thin-Walled Design: Oil Sink	10-2
Modeling Strategy	10-3
Starting Up AutoCAD 2023	10-4
Layers Setup	10-5
The First Extruded Feature	10-6
Create an Offset Geometry from an Extracted Surface	10-8
Extrude with Draft Angle	10-10
Align the Parts	10-11
Create another Extracted Surface	10-12
Combining Parts – Boolean Union	10-15
Create 3D Rounds and Fillets	10-16
Create a Shell Feature	10-18
Create a Rectangular Array Cut Feature	10-19
Create another Rectangular Array Cut Feature	10-21
Making a Design Change	10-23
Grip Editing Approach	10-23
Dynamic UCS Approach	10-24
Review Questions	10-27
Exercises	10-28

## **Chapter 11**

### **Conceptual Design Tools & Techniques**

Introduction	11-2
A Bird House Design	11-3
Starting Up AutoCAD 2023	11-4
Layers Setup	11-5
The Base Plate	11-6
Create the Compartments for the 1 <sup>st</sup> Floor	11-7
Using the Press/Pull Command	11-8
Using the Press/Pull Command as an Editing Tool	11-10
Create another Cut Feature	11-11



Adjust the Compartments	11-13
Add Additional Compartments	11-14
Create the Doors	11-15
Create the 2 <sup>nd</sup> Floor	11-16
Reposition the 2 <sup>nd</sup> Floor	11-18
Modeling the Roof Section with the Press/Pull Command	11-19
Use the Imprint Command	11-21
Review Questions	11-24
Exercises	11-25

## **Chapter 12**

### **Introduction to Photorealistic Rendering**

Introduction	12-2
Start Up AutoCAD 2023 and Retrieve the Pulley Design	12-3
Environment Setup	12-4
Use the Render Command	12-7
Available Lighting Simulation Modes in AutoCAD	12-8
Use the Materials Options	12-9
Activate the Sun & Sky Background Option	12-11
Add Additional Walls	12-14
Create a Point Light	12-17
Changing the Applied Materials	12-19
Create a Spotlight	12-20
Removing a Light	12-22
Create a Distant Light	12-23
Create New Materials	12-26
Save the Rendered Images	12-29
Conclusion	12-30
Review Questions	12-31
Exercises	12-32

## **Index**