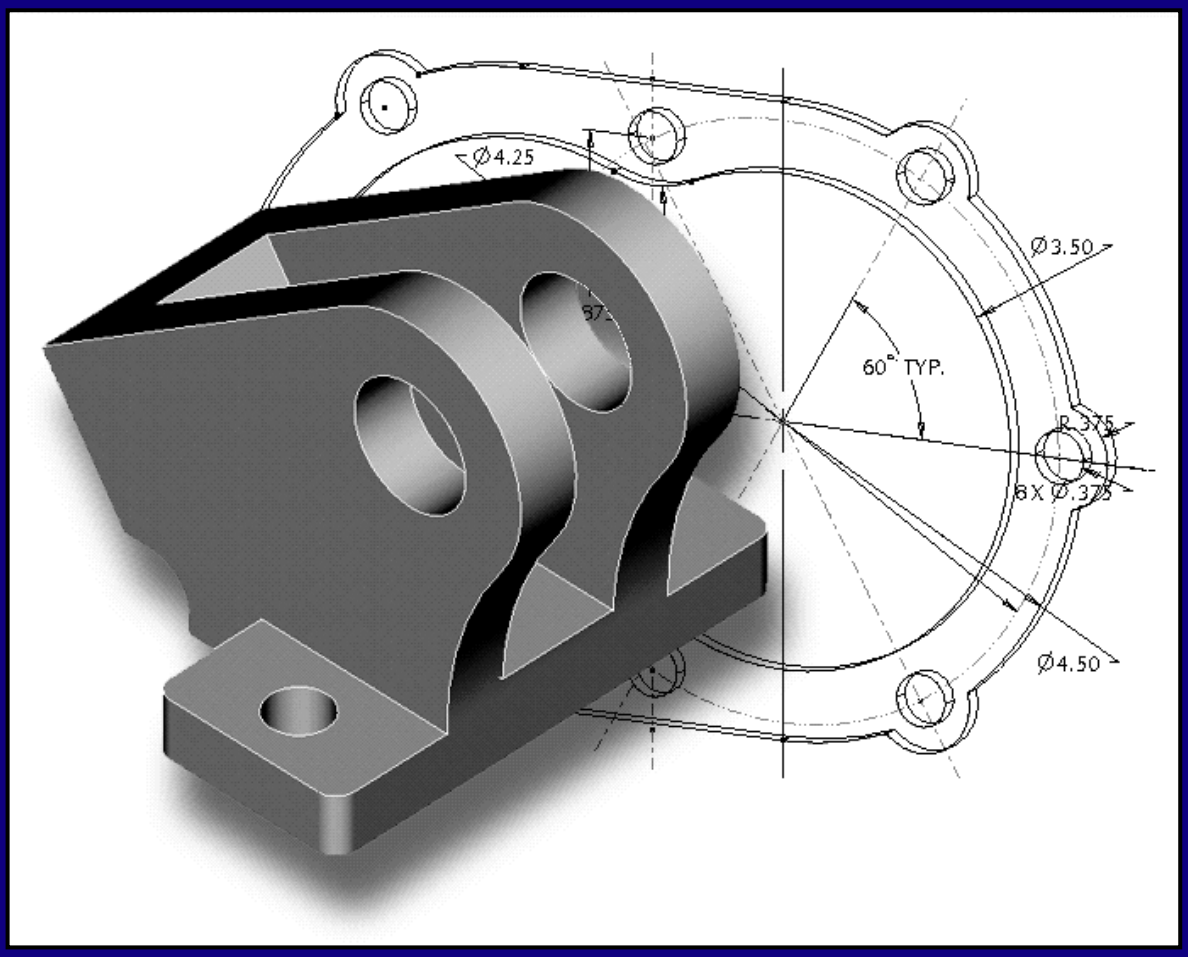
An Introduction to Autodesk Inventor 2010 and AutoCAD 2010



Randy H. Shih

SDC PUBLICATIONS

Schroff Development Corporation

www.schroff.com

Table of Contents

Autodesk Inventor 2010

Chapter 1
Getting Started

Introduction	1-2
Development of Computer Geometric Modeling	1-2
Feature-Based Parametric Modeling	1-6
Getting Started with Autodesk Inventor	1-7
The Startup dialog box and Units Setup	1-8
Autodesk Inventor Screen Layout	1-9
Pull-down Menus	1-10
Standard Toolbar	1-10
Part Feature Toolbar	1-10
Help Options	1-10
2D Sketch Toolbar	1-10
Graphics Window	1-11
Graphics Cursor or Crosshairs	1-11
Message and Status Bar Area	1-11
Browser	1-11
Mouse Buttons	1-12
[Esc] - Canceling commands	1-12
On-Line Help	1-13
Leaving Autodesk Inventor	1-13
Creating a CAD files folder	1-14

Chapter 2
Parametric Modeling Fundamentals

Introduction	2-2
The Adjuster design	2-3
Starting Autodesk Inventor	2-3
Autodesk Inventor Screen Layout	2-4
Creating Rough Sketches	2-5
Step 1: Creating a rough sketch	2-6
Graphics Cursors	2-6
Geometric Constraint Symbols	2-7
Step 2: Apply/modify constraints and dimensions	2-8
Dynamic Viewing Functions – *Zoom* and *Pan*	2-11
Modifying the dimensions of the sketch	2-11
Step 3: Completing the Base Solid Feature	2-12
Isometric View	2-13

Dynamic Rotation of the 3-D block - 3D Orbit 2-14
Dynamic Viewing - Quick Keys 2-16
Viewing Tools – Standard Toolbar 2-17
Display Modes 2-21
Orthographic vs. Perspective 2-21
Sketch plane – It is an XY CRT, but an XYZ World 2-22
Step 4-1: Adding an extruded feature 2-24
Step 4-2: Adding a cut feature 2-28
Save the Model 2-31
Questions 2-32
Exercises 2-33

Chapter 3
Constructive Solid Geometry Concepts

Introduction 3-2
Binary Tree 3-4
The Locator Design 3-4
Modeling Strategy - CSG Binary Tree 3-5
Starting Autodesk Inventor 3-6
GRID and *SNAP* intervals Setup 3-7
Base Feature 3-8
Model Dimensions Format 3-10
Modifying the dimensions of the sketch 3-10
Repositioning Dimensions 3-11
Using the Measure Tools 3-12
Completing the Base Solid Feature 3-15
Creating the next solid feature 3-16
Creating a CUT Feature 3-20
Creating a PLACED FEATURE 3-23
Creating a Rectangular Cut Feature 3-25
Questions 3-27
Exercises 3-28

Chapter 4
Model History Tree

Introduction 4-2
The *Saddle Bracket* Design 4-3
Starting Autodesk Inventor 4-3
Modeling Strategy 4-4
The *Autodesk Inventor Browser* 4-5
Creating the Base Feature 4-5
Adding the Second Solid Feature 4-8
Creating a 2D sketch 4-9

Renaming the Part Features 4-11
Adjusting the Width of the Base Feature 4-12
Adding a Placed Feature 4-13
Creating a Rectangular Cut Feature 4-15
History-based Part Modifications 4-16
A Design change 4-17
Assigning and Calculating the Associated Physical Properties 4-21
Questions 4-22
Exercises 4-23

Chapter 5
Parametric Constraints Fundamentals

CONSTRAINTS and RELATIONS 5-2
Create a Simple Triangular Plate Design 5-2
Fully Constrained Geometry 5-3
Starting Autodesk Inventor 5-3
Displaying existing constraints 5-4
Applying Geometric/Dimensional Constraints 5-6
Over-constraining and Driven Dimensions 5-10
Deleting existing constraints 5-11
Using the Auto Dimension command 5-12
Adding Additional Geometry 5-13
Constraint Settings 5-16
Parametric relations 5-17
Dimensional Values and Dimensional Variables 5-19
Parametric Equations 5-20
Viewing the Established Parameters and Relations 5-21
Saving the Model File 5-22
Using the Measure Tools 5-23
Questions 5-27
Exercises 5-28

Chapter 6
Geometric Construction Tools

Introduction 6-2
The Gasket Design 6-2
Modeling Strategy 6-3
Starting Autodesk Inventor 6-4
Creating a 2D Sketch 6-5
Editing the Sketch by Dragging the Sketched Entities 6-7
Adding Additional Constraints 6-9
Using the *Trim* and *Extend* Commands 6-10
The *Auto Dimension* command 6-12

Creating Fillets and Completing the Sketch 6-14
Fully Constrained Geometry 6-15
Profile Sketch 6-18
Redefining the Sketch and the Profile 6-19
Create an OFFSET Cut Feature 6-23
Questions 6-26
Exercises 6-27

Chapter 7
Parent/Child Relationships and the BORN Technique

Introduction 7-2
The BORN Technique 7-2
The U-Bracket Design 7-3
Starting Autodesk Inventor 7-4
Default sketch plane setting 7-4
Applying the BORN Technique 7-5
Creating the 2-D Sketch of the Base feature 7-7
Create the First Extrude Feature 7-11
The Implied Parent/Child Relationships 7-12
Creating the Second Solid Feature 7-12
Creating the First Cut feature 7-16
Creating the Second Cut feature 7-17
Examining the Parent/Child Relationships 7-19
Modify a Parent Dimension 7-20
A Design Change 7-21
Feature Suppression 7-22
A different approach to the CENTER_DRILL feature 7-23
Suppress the Rect_Cut feature 7-25
Creating a Circular Cut Feature 7-26
A Flexible Design Approach 7-28
Creating and Editing Material Properties 7-29
Using the New Material 7-31
Questions 7-32
Exercises 7-33

Chapter 8
Part Drawings and Associative Functionality

Drawings from Parts and Associative Functionality 8-2
Starting Autodesk Inventor 8-3
Drawing Mode - 2D Paper Space 8-3
Drawing Sheet Format 8-5
Using the Pre-defined Drawing Sheet Formats 8-7
Deleting, Activating, and Editing a Drawing Sheet 8-9

Adding a Base View 8-10
Creating Projected Views 8-11
Adjusting the View Scale 8-12
Repositioning Views 8-13
Displaying Feature Dimensions 8-14
Repositioning and Hiding Feature Dimensions 8-16
Adding Additional Dimensions – Reference Dimensions 8-18
Adding Center Marks and Center Lines 8-19
Completing the Drawing Sheet 8-22
Associative Functionality – Modifying Feature Dimensions 8-23
3D Annotations in Isometric Views 8-26
Questions 8-34
Exercises 8-35

Chapter 10
Symmetrical Features in Designs

Introduction 10-2
A Revolved Design: PULLEY 10-2
Modeling Strategy - A Revolved Design 10-3
Starting Autodesk Inventor 10-1
Setup the display of the Sketch Plane 10-1
Creating the 2-D Sketch for the Revolved feature 10-5
Creating the Revolved Feature 10-9
Mirroring Features 10-10
Creating A Pattern Leader Using Construction Geometry 10-12
Circular Pattern 10-17
Examining the design parameters 10-19
Drawing Mode – Defining New Border and Title Block 10-19
Creating a Drawing Template 10-22
Creating Views 10-23
Retrieve Dimensions – Features option 10-26
Associative Functionality – A Design Change 10-28
Adding Center lines to the Pattern feature 10-30
Completing the Drawing 10-31
Questions 10-34
Exercises 10-35

Chapter 13
Assembly Modeling – Putting It All Together

Introduction 13-2
Assembly Modeling Methodology 13-3
The Shaft Support Assembly 13-4
Additional *Parts* 13-4

(1) Collar 13-4
(2) Bearing 13-5
(3) Base-Plate 13-5
(4) Cap-Screw 13-6
Starting Autodesk Inventor 13-7
Placing the First Component 13-8
Placing the Second Component 13-9
Degrees of Freedom and Constraints 13-10
Assembly Constraints 13-11
Apply the First Assembly Constraint 13-13
Apply a Second Mate Assembly Constraint 13-15
Constrained Move 13-16
Apply a Flush Constraint 13-17
Placing the Third Component 13-19
Applying an Insert Constraint 13-19
Assemble the Cap-Screws 13-21
Exploded View of the Assembly 13-22
Editing the Components 13-24
Adaptive Design Approach 13-25
Delete and Re-apply Assembly Constraints 13-29
Setup a Drawing of the Assembly Model 13-31
Creating a Parts List 13-33
Editing the Parts List 13-34
Changing the Material Type 13-36
Completing the Assembly Drawing 13-38
Bill of Materials 13-39
(a) BOM from Parts List 13-39
(b) BOM from Assembly Model 13-40
Questions 13-42
Exercises 13-43

AutoCAD 2010

Introduction
Getting Started

Introduction	Intro-2
Development of Computer Aided Design	Intro-2
Why use AutoCAD® 2010	Intro-5
Getting started with AutoCAD® 2010	Intro-7
AutoCAD® 2010 Screen Layout	Intro-8
Menu Browser	Intro-9
Quick Access Toolbar	Intro-9
Graphics Window	Intro-9
Graphics Cursor or Crosshairs	Intro-9
Command prompt Area	Intro-9
Cursor Coordinates	Intro-10
Status Toolbar	Intro-10
Ribbon Tabs and Panels	Intro-10
Draw and Modify Toolbar Panel	Intro-10
Layers Control Toolbar Panel	Intro-11
Annotation Toolbar Panel	Intro-11
Layout/Model Toolbar	Intro-11
Viewing Toolbar	Intro-11
Workspace switching	Intro-11
Mouse Buttons	Intro-12
[Esc] – Canceling commands	Intro-12
On-Line Help	Intro-13
Leaving AutoCAD® 2010	Intro-14
Creating a CAD file folder	Intro-15

Chapter 1
AutoCAD Fundamentals

Introduction	1-2
Starting Up AutoCAD® 2010	1-2
Drawing Units display Setup	1-3
Drawing Area Setup	1-5
Using the *InfoCenter* to get more information	1-6
Drawing Lines with the *LINE* command	1-7
Visual reference	1-9
GRID ON	1-10
SNAP ON	1-11
Using the *ERASER*	1-12

Repeat the last command 1-13
The CAD Database and the User Coordinate System 1-14
Changing to the 2D UCS icon Display 1-15
Cartesian and Polar Coordinate Systems 1-16
Absolute and Relative coordinates 1-16
Defining Positions 1-17
The *Guide Plate* 1-17
Creating *Circles* 1-21
Save the CAD file 1-23
Exit AutoCAD 1-24
Review Questions 1-25
Exercises 1-26

Chapter 2
Basic Object Construction Tools

Introduction 2-2
Starting Up AutoCAD® 2010 2-3
Dynamic Input 2-3
The RockerArm Design 2-6
Activate the Startup option 2-7
Drawing Units Display Setup 2-8
GRID and *SNAP* intervals Setup 2-9
Drawing Area Setup 2-10
Referencing the World Coordinate System 2-11
Creating *Circles* 2-12
Object Snap Toolbar 2-13
Using the *LINE* command 2-14
Creating a *TTR circles* 2-16
Using the *TRIM* Command 2-18
Using the *Polygon* command 2-20
Creating a Concentric *Circle* 2-22
Using the QuickCal calculator to Measure Distance and Angle 2-23
Saving the CAD file 2-27
Exit AutoCAD 2-27
Review Questions 2-28
Exercises 2-29

Chapter 3
Geometric Construction and Editing Tools

Geometric Constructions 3-2
Starting Up AutoCAD® 2010 3-3
Geometric Construction - CAD Method 3-4
- Bisection of a Line or Arc 3-4
- Bisection of An Angle 3-7
- Transfer of An Angle 3-9

- Dividing a Given Line into A Number of Equal Parts 3-13
- Circle Through Three Points 3-15
- Line Tangent To A circle from A Given Point 3-16
- Circle of a Given Radius Tangent To Two Given Lines 3-17

The *Gasket* design 3-20
Drawing Units Display Setup 3-21
GRID and *SNAP* intervals Setup 3-22
Using the *LINE* command 3-23
Object Snap Toolbar 3-25
Using the *EXTEND* Command 3-28
Using the *TRIM* Command 3-29
Creating a *TTR circle* 3-30
Using the *FILLET* command 3-31
Converting objects into a *Polyline* 3-32
Using the *OFFSET* command 3-33
Using the Area Inquiry Tool to Measure Area and Perimeter 3-34
Using the *EXPLODE* command 3-36
Create another *FILLET* 3-36
Saving the CAD file 3-37
Exit AutoCAD 3-37
Review Questions 3-38
Exercises 3-39

Chapter 5
Orthographic Views in Multiview Drawings

Introduction 5-2
The LOCATOR Design 5-2
The *Locator* part 5-3
Starting Up AutoCAD® 2010 5-3
GRID and *SNAP* intervals Setup 5-4
Layers setup 5-5
Drawing *Construction Lines* 5-6
Using the *OFFSET* command 5-6
Set Layer *Object* as the current layer 5-8
Using the *Running Object Snaps* 5-8
Creating *Object lines* 5-10
Turn *OFF* the construction Lines 5-11
Adding more objects in the Front View 5-11
AutoCAD's AutoSnap ™ and AutoTrack ™ features 5-12
Adding more objects in the Top View 5-14
Drawing using the *Miter Line* method 5-18
More *Layers setup* 5-20
Top View to Side View Projection 5-21
Completing the Front View 5-23

Object Information Using the List command 5-25
Object Information Using the Properties command 5-26
Review Questions 5-27
Exercises 5-28

Chapter 6
Basic Dimensioning and Notes

Introduction 6-2
The Bracket Design 6-2
Starting Up AutoCAD® 2010 6-3
GRID and SNAP intervals Setup 6-4
Layers setup 6-5
The Bracket Design 6-6
Drawing Construction Lines 6-7
Using the *OFFSET* command 6-7
Set Layer *Object_Lines* as the *current layer* 6-8
Creating Object lines 6-8
Creating Hidden lines 6-9
Creating Center lines 6-10
Turn *OFF* the Construction Lines 6-10
Using the *FILLET* command 6-11
Saving the Completed CAD Design 6-12
Accessing the Dimensioning Commands 6-14
The *Dimension toolbar* 6-15
Using *Dimension Style Manager* 6-15
Dimensions Nomenclature and Basics 6-16
Using the *Center Mark* command 6-19
Adding *Linear* Dimensions 6-20
Adding *Angular* Dimensions 6-21
Adding *Radius* and *Diameter* Dimensions 6-22
Using the *SINGLE LINE TEXT* command 6-23
Adding Special Characters 6-24
Saving the design 6-25
A Special Note on Layers containing Dimensions 6-25
Review Questions 6-26
Exercises 6-27