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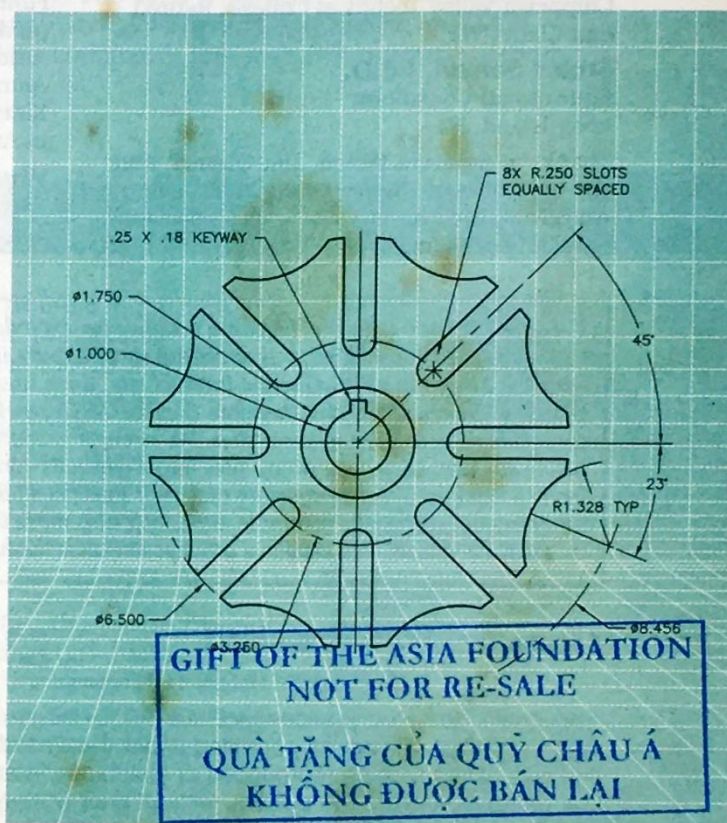
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TERRY T. WOHLERS

APPLYING AutoCAD® 2002 FUNDAMENTALS

Terry T. Wohlers

Applying AutoCAD 2002:
Fundamentals is a textbook for those who wish to learn how to use AutoCAD software. AutoCAD is a computer-aided drafting and design package produced by Autodesk, Inc. For information on how to obtain AutoCAD software, contact Autodesk.



This text was created using the AutoCAD® 2002 software.

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Applying AutoCAD Expands into Two Books

Since the first edition was published in 1986, *Applying AutoCAD* has provided clear, step-by-step instruction in using the AutoCAD® computer-aided drafting and design software. Now, that tradition continues in a new, more convenient format.

- *Applying AutoCAD 2002: Fundamentals* is targeted for those who are new to AutoCAD. It covers the AutoCAD commands and functions used to create, edit, store, and print engineering drawings.
- *Applying AutoCAD 2002: Advanced* assumes a basic knowledge of AutoCAD. It covers surface modeling, rendering, and solid modeling. This edition also provides instruction in customizing AutoCAD's menus, introduces AutoLISP, and explains how to use AutoCAD's commands and features to import, export, and share files.

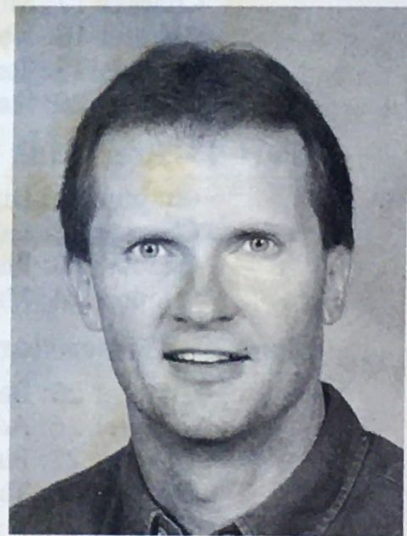
About the Author

For more than two decades, Terry Wohlers has focused his education, research, and practice on design and manufacturing. He has authored more than 250 books, articles, reports, and technical papers on engineering and manufacturing automation. He has presented to thousands of engineers and managers and has been a keynote speaker at major industry events in Asia, Europe, the Middle East, North and South America, and South Africa.

Wohlers is a renowned CAD educator. He developed and taught the first graduate and undergraduate courses on CAD at Colorado State University in 1983. Since then, he has taught many courses and given countless lectures on CAD and related subjects. In 1986, he founded Wohlers Associates, Inc., an independent consulting firm that provides organizations with technical and strategic advice on the new developments and trends in CAD/CAM, rapid prototyping, and manufacturing.

He was also the author and instructor of the first self-instructional university independent study courses on AutoCAD and CADKEY. An estimated 2,000 practicing design professionals from around the world have enrolled in them.

Wohlers holds an affiliate faculty position at Colorado State University's Department of Manufacturing Technology & Construction Management and has worked on various projects in cooperation with the university's Department of Mechanical Engineering.



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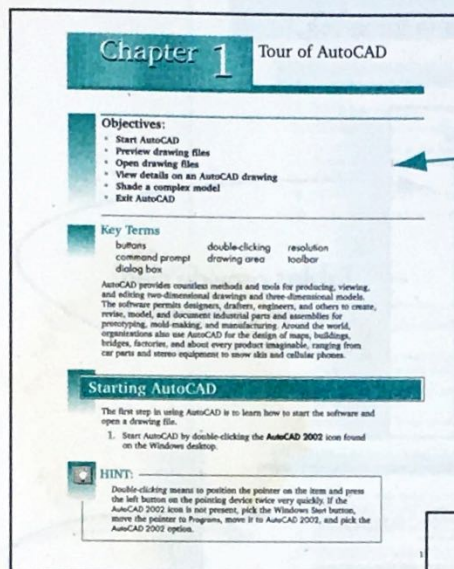
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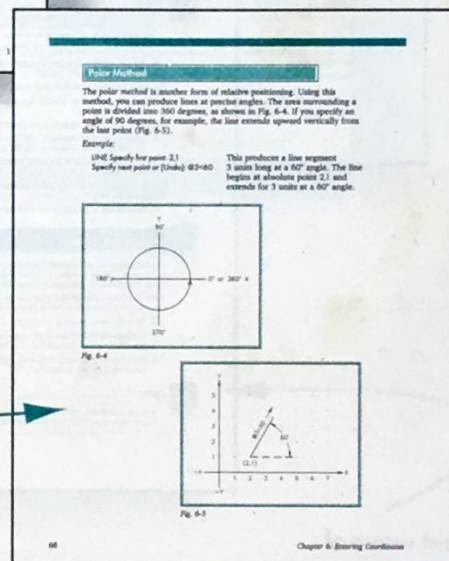
A Practical Approach

Applying AutoCAD 2002: Fundamentals presents each feature of the AutoCAD® 2002 software in a logical, sequential format. You will build skills as you read about and apply techniques, solve problems, and practice computer-aided drafting and design.



Each chapter begins with **objectives and key terms**. The content consists of step-by-step exercises that present key concepts based on the chapter's objectives.

Explanatory **illustrations** clarify challenging concepts.



User's Guide (Continued)

Controlling Object Fill

With the **FILL** command, you can control the appearance of solids, wide polylines, rectangles, and hatches. FILL is either on or off. When FILL is off, only the outline of a solid is regenerated on the screen. This saves time when the screen is regenerated.

1. Enter the **FILL** command.
 2. Enter **OFF**.
- After you turn FILL on or off, you must regenerate the screen before the change will take place.
3. Enter the **REGEN** command to force a screen regeneration. The objects are no longer solid filled.
 4. Reenter the **FILL** command and turn it **ON**.
 5. Enter **REGEN** to force another screen regeneration.
 6. Erase all objects on the screen.

InfoLink

You will learn more about this feature in Chapter 15 and Chapter 20.

"InfoLinks" alert you to related information elsewhere in the book.

Polylines

A polyline is a connected sequence of line and arc segments that is treated by AutoCAD as a single object. Polylines are often used in lieu of conventional lines and arcs because they are more versatile.

Continuity or Snap Polylines

Let's use the **PLINE** command to create the object shown in Fig. 14-3.

1. Set snap at **J**.
2. Pick the **Polyline** button in the **PLINE** command alias.



Fig. 14-3

Chapter 14: Solid and Curved Objects

Object	Setting	Function
Affected intersection	<input checked="" type="checkbox"/>	Snap to the apparent intersection of two objects that may not actually intersect in 3D space
Center	<input checked="" type="checkbox"/>	Center of arc or circle
Endpoint	<input checked="" type="checkbox"/>	Closest endpoint of line or arc
Extension	<input checked="" type="checkbox"/>	Snap to objects along the extension paths of objects
Insertion	<input checked="" type="checkbox"/>	Insertion point of text, block, or attribute
Intersection	<input checked="" type="checkbox"/>	Intersection of lines, arcs, or circles
Midpoint	<input checked="" type="checkbox"/>	Midpoint of line or arc
Nearest	<input checked="" type="checkbox"/>	Nearest point on a line, arc, circle, ellipse, polyline, spline, and other objects
Node	<input checked="" type="checkbox"/>	Nearest point entry or dimension definition point
Ortho	<input checked="" type="checkbox"/>	Temporarily cancels all running object snaps (for one operation only)
Parallel	<input checked="" type="checkbox"/>	
Perpendicular	<input checked="" type="checkbox"/>	
Quadrant	<input checked="" type="checkbox"/>	
Tangent	<input checked="" type="checkbox"/>	

Table 9-1

Table 9-1 contains a list of object snaps to enter an object snap mode of capitalized letters.

1. Press and hold the **Temporary Standard** toolbar.
2. Release the button without

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Tables provide clear, concise summaries of vital information.

NOTE:

Keyboards have function keys called F1, F2, F3, and so on. AutoCAD has assigned specific functions, such as the coordinate display and the ortho feature, to many of these keys.

4. Press the **F6** function key once, draw another line segment, and notice the coordinate display.
5. Press **F6** again, draw another line segment or two, and watch the coordinate display.

As you can see, it now displays polar coordinate information.

6. While in the **LINE** command, click the coordinate display and note the change in the coordinate display as you move the crosshairs.
7. Create additional line segments, clicking the coordinate display between each.

As you can see, clicking the coordinate display serves the same function as pressing the **F6** key.

8. Press **ENTER** to terminate the **LINE** command.

The Ortho Mode

Now let's focus on an AutoCAD feature called ortho. Ortho, short for "orthogonal," allows you to draw horizontal or vertical lines quickly and easily. Ortho, in this context, means to draw at right angles.

1. Turn off object snap if it is currently on.
2. Click the **ORTHO** button in the status bar or press the **F8** function key (both actions perform the same function.)
3. Experiment by drawing lines with ortho turned on and then with ortho off. Note the difference.

HINT:

Like the coordinate display feature, ortho can be toggled on and off at any time, even while you're in the middle of a command.

Notes placed throughout the chapters highlight relevant information and identify alternate commands or methods available to perform a function.

Hints suggest efficient ways of accomplishing steps or remind you of procedures you may have forgotten.

Chapter Review & Activities

Each chapter concludes with activities that review, reinforce, and expand learning.

Chapter 10 Review & Activities

Review Questions

1. Which function key turns on the coordinate display feature?
2. Of what value is the coordinate display?
3. What is the name of the feature that forces all lines to be drawn only vertically or horizontally? What function key controls this feature?
4. Of what value is the TIME command?
5. Briefly explain each of the following components of the TIME command.
 - a. Current time
 - b. Created
 - c. Last updated
 - d. Total editing time
 - e. Elapsed time
 - f. Next automatic save in
6. Which function key toggles the display of the AutoCAD text window on and off?
7. Explain how you would copy a few lines from the AutoCAD text window to a text editor such as Notepad.
8. Describe two methods to back up or undo your last five operations quickly.
9. Explain the use of the UNDO Mark and Back options.

Challenge Your Thinking

1. Experiment with ortho in combination with various object snap modes using the LINE command. What happens when you try to snap to a point that is not exactly horizontal or vertical to the previous point?
2. Why might you want to copy parts of the AutoCAD text window or command line window to the Windows Clipboard?

Review Questions at the end of each chapter allow you to check your comprehension of basic chapter content.

Challenge Your Thinking

questions require you to reason, research, and explore concepts in further detail.



Applying AutoCAD Skills

Problems at the end of each chapter help you gauge your understanding of the skills taught in the chapter.

Chapter 6 Review & Activities continued

6. Draw the front view of the locking end cap shown in Fig. 6-14. Start the drawing at the center of the object using absolute coordinates of 5,5. Use absolute coordinates to locate the centers of the four holes, and use polar tracking with the RECTANG command to draw the rectangular piece.

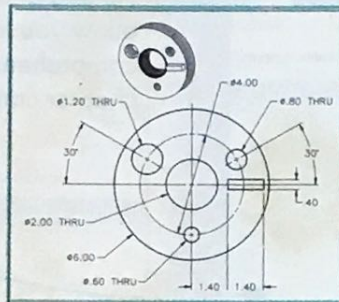


Fig. 6-14

Problem 6 courtesy of Gary J. Henderson, Georgia University

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Chapter 6: Entering Coordinates

Problems include **real-world objects and concepts** to help you practice and apply chapter skills and concepts in a work-related context.

Chapter 20 Review & Activities



Applying AutoCAD Skills

Work the following problems to practice the commands and skills you learned in this chapter.

1. Draw the wall shown in Fig. 20-7. Replace the angled break line on the right with an irregular line drawn with the SKETCH command to indicate a continuing edge. Hatch the wall in the brick pattern. Save the drawing as brickwall.dwg.

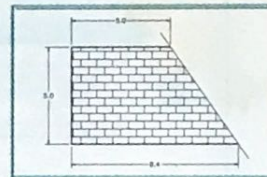


Fig. 20-7

2. Create the simplified house elevation shown in Fig. 20-8. Use the SKETCH command to define temporary boundaries for the hatch patterns on the roof.

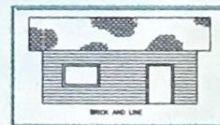


Fig. 20-8

Chapter 20: Hatching and Sketching

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Using Problem-Solving Skills

Problem-solving activities use representative tasks that you might encounter in industry. These problems require you to synthesize the AutoCAD skills presented throughout the text to arrive at practical solutions.

Chapter 31 Review & Activities



Using Problem-Solving Skills

Complete the following problem using problem-solving skills and your knowledge of AutoCAD.

1. Your company wants to make the revisions box you created in problem 8 (on the previous page) available to all the designers in the company. Open `revisions.dwg` from your named folder, create a block of the revisions box, and save it as a DWG file. Be sure to give the file a descriptive name so that the designers will know what is in the file.
2. Draw the electric circuit shown in Fig. 31-6 as follows: Draw the resistor using the mesh shown, then save it as a block. Draw the circuit, inserting the blocks where appropriate. Grid and snap are handy for drawing the resistor and circuit. Finish the circuit by inserting small donuts at the connection points. Add the text. The letter omega (Ω), which is used to represent the resistance in ohms, can be found under the text style GREEK (character W).

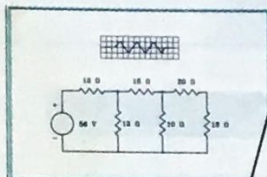


Fig. 31-6

Problem 2 courtesy of Gary J. Hordeman, Gonzaga University

Chapter 31: Building Blocks

Chapter 24 Review & Activities



Using Problem-Solving Skills

Complete the following activities using problem-solving skills and your knowledge of AutoCAD.

1. Draw the locking receptacle (Fig. 24-7) for the alarm system to be installed in the administration building. Create three right viewports in paper space, and show the top and front views. In the large right viewport, show the SW isometric view. Plot the views.

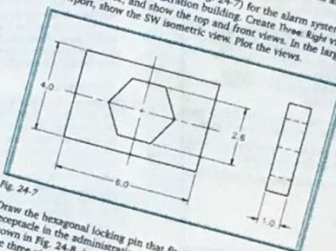


Fig. 24-7

2. Draw the hexagonal locking pin that fits into the alarm system receptacle in the administration building from problem 1. The pin, shown in Fig. 24-8, is 2" long and measures 2.5" across the flats. Use three viewports in paper space, and show the same views that you used for the locking receptacle in problem 1. Plot the views.

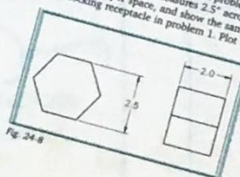


Fig. 24-8

Chapter 24: Multiple Viewports