Lesson 1
Getting Started

Learning Objectives

- Development of Computer Aided Design
- Why use AutoCAD 2004
- Getting started with AutoCAD 2004
- Access the AutoCAD Online Help
- AutoCAD 2004 Screen Layout
- Mouse Buttons
- Start and Exit AutoCAD
Introduction

Computer Aided Design (CAD) is the process of doing designs with the aid of computers. This includes the generation of computer models, analysis of design data, and the creation of the necessary drawings. AutoCAD® 2004 is a computer aided design software developed by Autodesk Inc. The AutoCAD® 2004 software is a tool that can be used for design and drafting activities. The two-dimensional and three-dimensional models created in AutoCAD® 2004 can be transferred to other computer programs for further analysis and testing. The computer models can also be used in manufacturing equipment such as machining centers, lathes, mills, or rapid prototyping machines to manufacture the product.

The rapid changes in the field of computer aided engineering (CAE) have brought exciting advances in industry. Recent advances have made the long-sought goal of reducing design time, producing prototypes faster, and achieving higher product quality closer to a reality.

![Diagram of Computer Aided Engineering (CAE)]

Development of Computer Aided Design

Computer Aided Design is a relatively new technology and its rapid expansion in the last fifty years is truly amazing. Computer-modeling technology has advanced along with the development of computer hardware. The first generation CAD programs, developed in the 1950s, were mostly non-interactive; CAD users were required to create program codes to generate the desired two-dimensional (2D) geometric shapes. Initially, the development of CAD technology occurred mostly in academic research facilities. The Massachusetts Institute of Technology, Carnegie-Mellon University, and Cambridge University were the lead pioneers at that time. The interest in CAD technology spread quickly and several major industry companies, such as General Motors, Lockheed, McDonnell, IBM, and Ford Motor Co., participated in the development of interactive CAD programs in the 1960s. Usage of CAD systems was primarily in the automotive industry, aerospace industry, and government agencies that developed their own programs for their specific needs. The 1960s also marked the beginning of the
development of finite element analysis methods for computer stress analysis and computer aided manufacturing for generating machine toolpaths.

The 1970s are generally viewed as the years of the most significant progress in the development of computer hardware, namely the invention and development of microprocessors. With the improvement in computing power, new types of 3D CAD programs that were user-friendly and interactive became reality. CAD technology quickly expanded from very simple computer aided drafting to very complex computer aided design. The use of 2D and 3D wireframe modelers was accepted as the leading edge technology that could increase productivity in industry. The developments of surface modeling and solid modeling technology were taking shape by the late 1970s; but the high cost of computer hardware and programming slowed the development of such technology. During this time period, the available CAD systems all required extremely expensive room-sized mainframe computers.

In the 1980s, improvements in computer hardware brought the power of mainframes to the desktop at less cost and with more accessibility to the general public. By the mid-1980s, CAD technology had become the main focus of a variety of manufacturing industries and was very competitive with traditional design/drafting methods. It was during this period of time that 3D solid modeling technology had major advancements, which boosted the usage of CAE technology in industry.

In the 1990s, CAD programs evolved into powerful design/manufacturing/management tools. CAD technology has come a long way, and during these years of development, modeling schemes progressed from two-dimensional (2D) wireframe to three-dimensional (3D) wireframe, to surface modeling, to solid modeling and, finally, to feature-based parametric solid modeling.

The first generation CAD packages were simply 2D Computer Aided Drafting programs, basically the electronic equivalents of the drafting board. For typical models, the use of this type of program would require that several to many views of the objects be created individually as they would be on the drafting board. The 3D designs remained in the designer's mind, not in the computer database. The mental translation of 3D objects to 2D views is required throughout the use of the packages. Although such systems have some advantages over traditional board drafting, they are still tedious and labor intensive. The need for the development of 3D modelers came quite naturally, given the limitations of the 2D drafting packages.

The development of the 3D wireframe modeler was a major leap in the area of computer modeling. The computer database in the 3D wireframe modeler contains the locations of all the points in space coordinates and it is sufficient to create just one model rather than multiple models. This single 3D model can then be viewed from any direction as needed. The 3D wireframe modelers require the least computer power and achieve reasonably good representation of 3D models. But because surface definition is not part of a wireframe model, all wireframe images have the inherent problem of ambiguity.
Surface modeling is the logical development in computer geometry modeling to follow
the 3D wireframe modeling scheme by organizing and grouping of the edges that define
polygonal surfaces. Surface modeling describes the part surfaces but not the interiors.
Designers are still required to interactively examine surface models to insure that the
various surfaces on a model are contiguous throughout. Many of the concepts used in 3D
wireframe and surface modelers are incorporated in the solid modeling scheme, but it is
solid modeling that offers the most advantages as a design tool.

In the solid modeling presentation scheme, the solid definitions include nodes, edges, and
surfaces, and it is a complete and unambiguous mathematical representation of a
precisely enclosed and filled volume. Unlike the surface modeling method, solid
modelers start with a solid or use topology rules to guarantee that all of the surfaces are
stitched together properly.

In this text, we will follow a logical order, parallel to the development of computer
gemetric modeling, in learning the fundamental concepts and commands of AutoCAD®
2004. We will begin with basic geometric constructions, orthographic projections, and
then move toward the more advanced features of AutoCAD® 2004. We will also discuss
and demonstrate the general procedures required in creating three-dimensional solid
models. The techniques presented in this text will also serve as the foundation to enter the
world of advanced three-dimensional solid modeling using packages such as AutoCAD
Mechanical Desktop and AutoCAD Architectural Desktop.

Why use AutoCAD® 2004?

AutoCAD® was first introduced to the public in late 1982, and was one of the first CAD
software products available for personal computers. Since 1984, AutoCAD® has
established a reputation for being the most widely used PC-based CAD software around
the world. By 2002, it was estimated that there were over 3.5 million AutoCAD® users in
more than 150 countries worldwide. AutoCAD® 2004 is the eighteenth release, with
many added features and enhancements, of the original AutoCAD® software produced by
Autodesk Inc.

CAD provides us with a wide range of benefits; in most cases, the result of using CAD is
increased accuracy and productivity. First of all, the computer offers much higher
accuracy than the traditional method of drafting and design. Traditionally, drafting and
detailing are the most expensive cost element in a project and the biggest bottleneck.
With CAD systems, such as AutoCAD® 2004, the tedious drafting and detailing tasks are
simplified through the use of many of the CAD geometric construction tools, such as
grids, snap, trim, and auto-dimensioning. Dimensions and notes are always legible in
CAD drawings and, in most cases, CAD systems can produce higher quality prints
compared to traditional hand drawings.

CAD also offers much-needed flexibility in design and drafting. A CAD model generated
on a computer consists of numeric data that describe the geometry of the object. This
allows the designers and clients to see something tangible and to interpret the ramifications of the design. In many cases, it is also possible to simulate operating conditions on the computer and observe the results. Any kind of geometric shape stored in the database can be easily duplicated. For large and complex designs and drawings, particularly those involving similar shapes and repetitive operations, CAD approaches are very efficient and effective. Because computer designs and models can be altered easily, a multitude of design options can be examined and presented to a client before any construction or manufacturing actually takes place. Making changes to a CAD database is generally much faster than making changes to a traditional hand drawing. Only the affected components of the design need to be modified and the drawings can be plotted again. In addition, the greatest benefit is that, once the CAD model is created, it can be used over and over again. The CAD models can also be transferred into manufacturing equipment such as machining centers, lathes, mills, or rapid prototyping machines to manufacture the product directly.

CAD, however, does not replace every design activity. CAD may help, but it does not replace the designer’s experience with geometry, graphical conventions and standards for the specific field. CAD is a powerful tool, but the use of this tool does not guarantee correct results; the designer is still responsible for using good design practice and applying good judgment. CAD will supplement these skills to ensure that the best design is obtained.

CAD designs and drawings are stored in binary form, usually as CAD files, on magnetic devices such as diskettes and hard disks. The information stored in CAD files usually requires much less physical space in comparison to traditional hand drawings. However, the information stored inside the computer is not indestructible. On the contrary, the electronic format of information is very fragile and sensitive to the environment. Heat or cold can damage the information stored on magnetic storage devices. A power failure while you are creating a design could wipe out the many hours you spent working in front of your computer monitor. It is a good habit to save your work periodically, just in case something might and probably will go wrong while you are working on your design. In general, you should save your work onto the disk at an interval of every 15 to 20 minutes. You should also save your work before you make any major modifications to the design. It is also a good habit to periodically make backup copies of your work and put them in a safe place.

This textbook contains a series of ten tutorial style lessons designed to introduce students to AutoCAD® 2004. The new improvements and key enhancements of the software are incorporated into the lessons. You will learn to use the new AutoCAD user interface, which enables you to focus on the design and be more productive. We will also cover the Internet-Driven Design approach, which allows us to upload/download projects to a web-based storage location and access productivity tools. The AutoCAD AutoTrack™ feature, the onscreen lineweight feature, the WYSIWYG (What You See Is What You Get) plotting feature, the Named Plot Style feature and Layout plotting feature are also introduced in the lessons.
Now that you are ready to move on, let us begin the learning experience with AutoCAD® 2004, which you will find interesting and fun. And welcome to the exciting world of Computer Aided Design.

Getting started with AutoCAD® 2004

How to start AutoCAD® 2004 depends on the type of workstation and the particular software configuration you are using. With most Windows systems, you may select the AutoCAD 2004 option on the Start menu or select the AutoCAD 2004 icon on the Desktop. Consult with your instructor or technical support personnel if you have difficulty starting the software.

The program takes a while to load, so be patient. Eventually the AutoCAD® 2004 main drawing screen will appear on the screen. The tutorials in this text are based on the assumption that you are using AutoCAD® 2004's default settings. If your system has been customized for other uses, some of the settings may not work with the step-by-step instructions in the tutorials. Contact your instructor and/or technical support personnel to restore the default software configuration.
AutoCAD® 2004 Screen Layout

The default AutoCAD® 2004 drawing screen contains the pull-down menus, the Standard toolbar, the Object Properties toolbar, the Draw toolbar, the Modify toolbar, the command prompt area, the Status Bar and the Tool Palettes window. A line of quick help text appears at the bottom of the window as you move the mouse cursor over different icons. You may resize the AutoCAD® 2004 drawing window by click and drag at the edges of the window, or relocate the window by click and drag at the window title area.
• **Pull-down Menus**

The *pull-down* menus at the top of the main window contain operations that you can use for all modes of the system.

• **Standard Toolbar**

The *Standard* toolbar at the top of the AutoCAD window allows us quick access to frequently used commands. We can customize the toolbar by adding and removing sets of options or individual commands.

• **Object Properties Toolbar**

The *Object Properties* toolbar contains tools to help manipulate the graphical object properties, such as color, line type, and layer.

• **Graphics Window**

The *graphics window* is the area where models and drawings are displayed.

• **Graphics Cursor or Crosshairs**

The *graphics cursor*, or *crosshairs*, shows the location of the pointing device in the graphics window. The coordinates of the cursor are displayed at the bottom of the screen layout. The cursor’s appearance depends on the selected command or option.

• **Command Prompt Area**

The bottom section of the screen layout provides status information for an operation and it is also the area for data input.
• Draw Toolbar and Modify Toolbar
Additional toolbars are available in AutoCAD® 2004, and contain groups of buttons that allow us to pick commands quickly, without searching through a menu structure. The Draw toolbar and Modify toolbar contain icons for basic draw and modify commands.

Mouse Buttons

AutoCAD® 2004 utilizes the mouse buttons extensively. In learning AutoCAD® 2004's interactive environment, it is important to understand the basic functions of the mouse buttons. It is highly recommended that you use a mouse or a tablet with AutoCAD® 2004 since the package uses the buttons for various functions.

• Left mouse button
The left-mouse-button is used for most operations, such as selecting menus and icons, or picking graphic entities. One click of the button is used to select icons, menus and form entries, and to pick graphic items.

• Right mouse button
The right-mouse-button is used to bring up additional available options. The software also utilizes the right-mouse-button as the same as the ENTER key, and is often used to accept the default setting to a prompt or to end a process.
[Esc] - Canceling commands

The [Esc] key is used to cancel a command in AutoCAD® 2004. The [Esc] key is located near the top-left corner of the keyboard. Sometimes, it may be necessary to press the [Esc] key twice to cancel a command; it depends on where we are in the command sequence. For some commands, the [Esc] key is used to exit the command.

On-Line Help

- Several types of on-line help are available at any time during an AutoCAD® 2004 session. The AutoCAD® 2004 software provides many on-line help options:

- **Active Assistance:**

![Active Assistance](image)

The Active Assistance option provides an instant help that dynamically displays information on the activated command. The guidance from the Active Assistance system enables users to quickly get started on performing desired tasks. In the Active Assistance window, links to additional information are also available. Clicking a blue-text link expands the current Active Assistance topic.

- To turn off the Active Assistance, right-click the **Active Assistance** icon located in the system tray and choose **Exit**.

- **Online Resources:** Click on the HELP option in the pull-down menu to access the AutoCAD® 2004 Help menu system. Notice the different online resources available in the pull-down list.
- **Standard Toolbar**: Click on the [?] icon in the Standard toolbar to access Autodesk On-line Help: User Documentation.

- **Command line and function key** [F1]: Press the [F1] key or enter a question mark [?] at the command prompt to access the AutoCAD On-line Help system.

### Leaving AutoCAD® 2004

- To leave AutoCAD® 2004, use the left-mouse-button and click on File at the top of the AutoCAD® 2004 screen window, then choose Exit from the pull-down menu or type QUIT in the command prompt area.