<p style="text-align:center">Lecture: 1</p>

Introduction to Computer Graphics:

One of the most popular recent inventions for home use is the video game. One such invention, a simulated game of ping-pong, is shown in Figure 1-1; it is played by two people with a pair of levers and a home television set. When the game is switched on, a small bright spot, representing a ball, is seen bouncing to and fro across the screen. Each player uses his lever to position a "paddle" to bounce the ball back to his opponent. A player who hits the ball past his opponent wins a point; the game is won by the first player to reach 15 points.

Figure 1-1 Computer graphics in the home: a video game based on ping-pong.
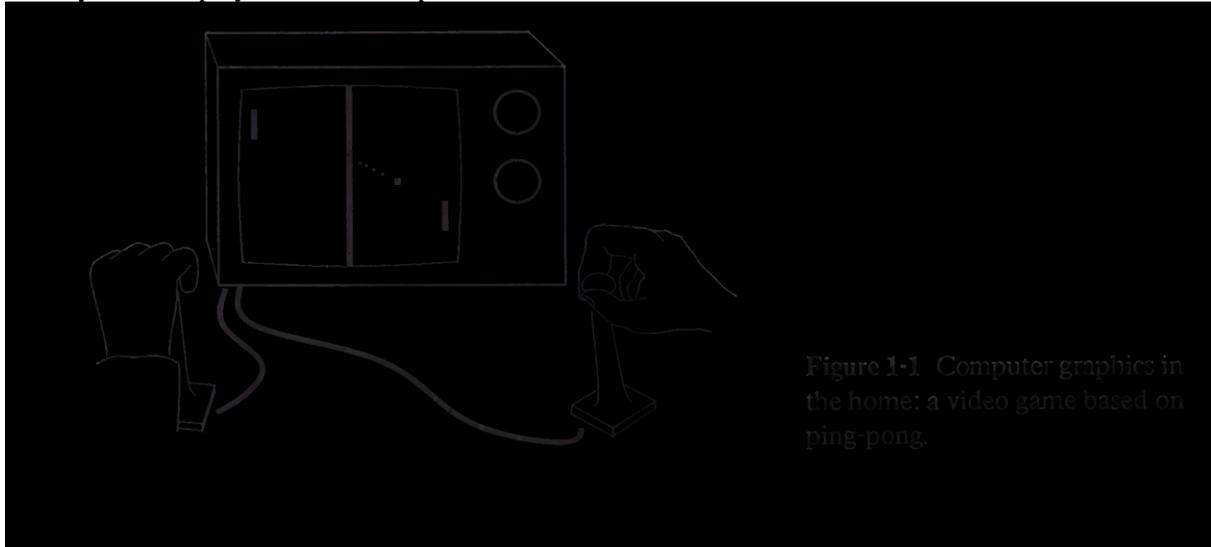
Video games represent the first major use in the home of computer graphics, i.e., the creation and manipulation of pictures with the aid of a computer. Such pictures may be generated on paper or film, using a computer-controlled plotter; familiar examples of this form of computer graphics include the titles shown on TV and other forms of computer art.

Images like these are examples of non-interactive or passive computer graphics; the observer has no control over the image. We can give the observer some control over the image by providing him with an input device, such as the lever of the ping-pong game, so that he can signal his requests to the computer. We then have an example of **Interactive computer graphics**.

Interactive computer graphics involves two-way communication between computer and user. The computer, upon receiving signals from the input device, can modify the displayed picture appropriately. To the user it appears that the picture is changing instantaneously in response to his commands. He can give a series of commands, each one generating a graphical response from the computer. In this way he maintains a conversation, or dialogue, with the computer.

Computers have become a powerful tool for the rapid and economical production of pictures. There is virtually no area in which graphical displays cannot be used to some advantage, and so it is not surprising to find the use of computer graphics so widespread. Although early applications in engineering and science had to rely on expensive and cumbersome equipment, advances in computer technology have made interactive computer graphics a practical tool. Today, we find computer graphics used routinely in such diverse areas as science, engineering, medicine, business**,** industry, government, art, entertainment, advertising, education, and training.

Graphics Applications:

1. Computer Aided-Design: A major use of computer graphics is in design processes, particularly for engineering and architectural systems, but almost all products are now computer designed. Generally referred to as CAD, computer-aided design methods are now routinely used in the design of buildings, automobiles, aircraft, watercraft, spacecraft, computers, textiles, and many, many other products. Circuits and networks for communications, water supply, or other utilities are constructed with repeated placement of a few graphical shapes. The shapes used in a design represent the different network or circuit components. Standard shapes for electrical, electronic, and logic circuits are often supplied by the design package.

2. Presentation Graphics: Another major application area is presentation graphics, used to produce illustrations for reports or to generate 35-mm slides or transparencies for use with projectors. Presentation graphics is commonly used to summarize financial, statistical, mathematical, scientific, and economic data for research reports, managerial reports, consumer information bulletins, and other types of reports. Workstation devices and service bureaus exist for converting screen displays into 35-mm or overhead transparencies for use in presentations. Typical examples of presentation graphics are bar charts, line graphs, surface graphs, pie charts, and other displays showing relationships between multiple parameters.

3. **Computer Art:** Computer graphics methods are widely used in both fine art and commercial art applications. Artists use a variety of computer methods, including special-purpose hardware, artist's paintbrush (such as Lumens), other paint packages (such as Pixelpaint and Superpaint), specially developed software, symbolic mathematics packages (such as Mathematica), CAD packages, desktop publishing software, and animation packages that provide facilities for designing object shapes and specifying object motions.

4. Entertainment: Computer graphics methods am now commonly used in making motion pictures, music videos, and television shows. Sometimes the graphics scenes are displayed by themselves, and sometimes graphics objects are combined with the actors and live scenes. Examples are Star Trek, Avatar etc.

5. Education & Training: Computer-generated models of physical, financial, and economic systems are often used as educational aids. Models of physical systems, physiological systems, population trends, or equipment, such as the color-coded diagram, can help trainees to understand the operation of the system. For some training applications, special systems are designed. Examples of such specialized systems are the simulators for practice sessions or training of ship captains, aircraft pilots, heavy-equipment operators, and air-traffic control personnel.

6. Visualization: Scientists, engineers, medical personnel, business analysts, and others often need to analyse large amounts of information or to study the behaviour of certain processes. Numerical simulations carried out on supercomputers frequently produce data files containing thousands and even millions of data values. Similarly, satellite cameras and other sources are amassing large data files faster than they can be interpreted. Scanning these large sets of numbers to determine trends and relationships is a tedious and ineffective process. But if the data are converted to a visual form, the trends and patterns are often immediately apparent. Producing graphical representations for scientific, engineering, and medical data sets and processes is generally referred to as scientific visualization. And the term business visualization is used in connection with data sets related to commerce, industry, and other non-scientific areas.

7. Image Processing: Although methods used in computer graphics and Image processing overlap, the areas are concerned with fundamentally different operations. In computer graphics, a computer is used to create a picture. Image processing, on the otherhand applies techniques to modify or interpret existing pictures, such as photographs and TV scans. Two principal applications of image processing are (1) improving picture quality and (2) machine perception of visual information, as used in robotics. To apply image processing methods, we first digitize a photograph or other picture into an image file. Then

digital methods can be applied to rearrange picture parts, to enhance colour separations, or to improve the quality of shading.

8. Graphical User Interface: It is common now for software packages to provide a graphical interface. A major component of a graphical interface is a window manager that allows a user to display multiple-window areas. Each window can contain a different process that can contain graphical or non-graphical displays. To make a particular window active, we simply click in that window using an interactive pointing device. Interfaces also display menus and icons for fast selection of processing options or parameter values. An icon is a graphical symbol that is designed to look like the processing option it represents. The advantages of icons are that they take up less screen space than corresponding textual descriptions and they can be understood more quickly if well designed. Menus contain lists of textual descriptions and icons.