Chapter 1
A surveys of Computer Graphics
Computer Graphics Applications

- Graphs and Charts
- Computer-Aided Design
- Virtual-Reality Environments
- Data Visualizations
- Educations and Training
- Computer Art
- Entertainment
- Image Processing
- Graphical User Interface
Graphs and charts

• Graphs and charts
  – Early application of computer graphic: data plotting
  – Typical examples
    • Line graphs, bar charts, pie charts, surface graph
  – Application areas
    • Summarize data for research reports
    • Managerial summaries
    • Consumer information
Graphs and Charts

Fig a. 2D graphs and charts

Fig b. 3D graphs for dramatic effect

Fig c. 3D bar charts on the surface of a geographical region
Computer Aided Design

- Computer Aided Design
  - Referred as CAD (computer-aided design) or CADD (computer-aided drafting and design)
  - Allow to see the effects of interactive adjustments
  - Application areas
    • Design of automobiles, computers, textiles……
    • Architecture design: floor plan, wiring or electronic outlets, lighting simulations……
Multiple windows, color coded CAD workstation displays
Fig a.
Simulation of vehicle performance

Fig b.
Architectural visualization of an atrium
Virtual Reality Environment

- Virtual reality environment
  - Interact with the objects in a three-dimensional environments
  - Animations in virtual reality environments helps in analyzing interactive effects
  - e.g. Train heavy-equipment operators
Data Visualization

- Data visualization
  - Scientific visualization: representation for engineering, mathematical and medical data
  - Business visualization: data sets related to commerce and industry
  - Helps in dealing with large amount of information or studying the behavior of highly complex processes
Data Visualization

Fig a.
Mathematical curve functions plotted in various color combinations

Fig b.
Color-coded plot of relative brightness observed for the Whirlpool Nebula reveals two distinct galaxies
Data Visualization

Fig a. Numerical model of airflow inside a thunderstorm

Fig b. Visualization of stream surfaces flowing past a space shuttle

Education and training

- Education and training
  - Educations aids: computer-generated models of physical, financial and economic systems
  - Special hardware devices are designed
  - Examples
    - Training of ship captains, aircraft pilots, heavy-equipment operators......
Various special hardware setting for simulation
The interior of automobile simulation and street-scene view
• Computer art
  – Variety of computer methods and tools
    • Specialized hardware, commercial software, symbolic mathematics programs…….
  – Commercial art uses techniques for generating logos, page layout, TV advertising spots…….
Fig a. Electronic painting “Sphere of Influence”

Fig b. Creation based on visualization of “Fermat’s Last Theorem”
Fig a. Three-dimension rendering logo

Fig b. Synthesize form and color with musical composition
Entertainment

• Application areas
  – Television productions
  – Motion pictures
  – Music videos
  – Human actors simulations
  – Combine with the live action or graphics
Animated characters from the film
“Final Fantasy – The Spirits Within”
Examples of morphing from the David Byrne video
Image Processing

• Image processing
  – The modification or interpretation of existing pictures, such as photographs and TV scans
  – Application areas
    • Improve picture quality
    • Analyze image
    • Recognize visual patterns for robotics
Fig a. Computer animation visualizing cardiac activation level

Fig b. One image from a stereoscopic pair, showing the bones of human hand
Graphical User Interface

• Graphical user interface (GUI)
  – Major components: display windows, screen cursor, selection menus and icons
  – Example
    • GUI showing multiple display windows