Innovative Process of Computer Graphics

Kulnazarova Zamira Bakhromovna
Lecturer at the Samarkand state architectural and civil engineering university, (Republic of Uzbekistan), Zamirakulnazarova@gmail.com

A B S T R A C T
The article discusses the types of computer graphics, such as vector graphics, graphic bitmaps and fractal graphics, 3-D modeling tools, highlights the differences between them, as well as methods, methods and applications. Also considered are software products designed for processing graphic images and 3-D modeling, Adobe Photoshop, Corel Draw.

A R T I C L E I N F O
Article history:
Received 11 Feb 2023
Received in revised form 12 Mar 2023
Accepted 14 Apr 2023

Keywords: Computer graphics, 3D graphics, vector, raster, fractal, graphics, image, 3D modeling, visualization.

Introduction. Computer graphics is a gigantic field of modern computer knowledge. In a general sense, it is understood as the generation of images and videos by means of a computer. As a rule, this refers to data created by means of specialized graphics programs. The term "computer graphics" was coined by designers William Vetter and Vern Hudson in 1960 while they were working for Boeing.

Today, the term "computer graphics" refers to:

- representation of image data by a computer and management;
- different methods of formation and processing of images;
- a branch of computer science that studies the methods of digital synthesis of visual content and its management.

Application of computer graphics:

- computational biology - the use of mathematical and statistical models to solve biological problems;
- computational physics - the use of numerical algorithms to solve problems in physics;
- simplified presentation of complex information;
- scientific visualization — 3D visualization of architectural, meteorological, medical and biological models;
- graphic design - the combination of symbols, images and / or words to visually reproduce ideas and messages;
- computer-aided design - the formation of geometric models of objects;
- web design - creation of content indication systems using an Internet browser;
- digital art - the creation of works of art in digital form;
- virtual reality and video games - the use of methods of user interaction with a computer-simulated

environment;

- machine simulation.
- Many tools are used to visualize data. Visual information generated by a computer is divided into:
- two-dimensional;
- three-dimensional;
- animated.

Classification of computer graphics according to the method of displaying the image:

- raster;
- vector;
- fractal.

Results. A raster graphics image is a dot-matrix structure, usually represented as a rectangular grid of pixels.

A pixel is the smallest element of the display surface, which can be defined by various image characteristics: color, brightness, transparency. All pixels have the same shape and size and differ only in color. The color of a pixel is determined by the combination of bits.

A bitmap image is characterized by a certain number of rows and columns. Resizing this type of image inevitably results in loss. They are slightly less noticeable when the image size is reduced - individual details simply disappear from the picture. They appear more clearly when it is increased - the pixels are simply converted into squares of the same color, consisting of several pixels.

Advantages:

- high accuracy of tints and halftones, as a result of which raster editors are the best means of editing photos;
- the raster method of representing graphic information is used in most monitors, printers, scanners, cameras;
- the ability to generate a picture of any complexity;
- compatibility with most graphics programs;
- prevalence of use - from small icons to huge posters.

Flaws:

- large file size (even for simple images);
- Difficulty scaling images.

Raster images are usually stored in a compressed form. Compression (compression) can be lossy (exact image restoration is not feasible) or lossless. Raster image formats that provide lossless compression:

- bmp – for storing single-layer rasters;
- gif — for line-by-line storage of an image in a palette of 256 colors;
- pcx is analogous to bmp, providing for combining pixels of the same color following one after another;
- png is a format designed to replace the gif format and has a number of improvements.

Lossy compression formats:

- jpeg is a popular format for storing photographic images.

In vector graphics, the representation of an image is based on vectors connecting points on a plane, called control points or nodes. Each of the nodes has its own coordinates along the x and y axes, and each vector

is characterized by a certain direction of the route. A route can be assigned various attributes such as color, shape, curvature, thickness, and padding.

For a circle, for example, it is enough to set such parameters as: location of the center of the circle, radius and color. When scaling, you just need to change these parameters.

Since most displays and printers are raster devices, the vector image format for them must be converted to raster.

Advantages:

- the ability to resize images while maintaining quality;
- smaller size of vector image files;
- high quality of the picture when it is printed;
- the possibility of saving and subsequent modification of the parameters of objects;
- ease of conversion to raster form.

Flaws:

- low realism.

The main formats of vector graphics:

- cdr - files created by the graphics editor Corel Draw;
- ai - files created by Adobe Illustrator;
- – wmf — media container.

Discussion. Fractal graphics provides for the automatic creation of images by performing mathematical calculations. In this case, images are created by programming, not by drawing. The use of fractal graphics in electronic or printed documents is minimal.

The concept of fractal appeared in the beginning. 70s of the last century. The very word "fractal" (from the Latin "fractus") indicates that the object consists of fragments. The main property of fractals is self-similarity. It lies in the fact that the enlarged parts of the fragments of the object are similar to each other and are similar to the object itself.

Image processing in a computer is performed by graphic editors.

Of the simplest raster editors, the most widely used is Paint, which is installed in all versions of Windows. The editor allows you to open and edit bmp, gif (without animation), jpeg files. The application can run in black and white (two color) or color mode, but it does not have the ability to display grayscale. Due to its simplicity, Paint quickly gained popularity among users. Many people use it to get the first skills in drawing on a computer and perform simple image manipulation operations.

The most famous professional raster graphics editor is Adobe Photoshop with powerful image processing tools. Developed in 1988 by brothers Thomas and John Knoll, Photoshop has become the de facto industry standard for bitmap graphics editing. In everyday life, the verb form from the name of this editor has long been used: “photoshop” (image).

Photoshop allows you to create and modify bitmap images with a layered structure, and also supports the use of masks, merging an object with a background to create a transparent effect (full or partial). This editor allows you to work with all major color models. It supports the main image formats, but also has its own - psd. In addition to its basic functions, Photoshop has limited options for editing text, vector images, 3D graphics and video.

To expand the capabilities of the main program, a lot of special software modules have been developed - Photoshop plug-ins, supplied separately and launched in the main program window.

Vector editors are more commonly used for web page design, typography, logo design, as illustrative inserts for artwork, diagramming, and complex geometric patterns.

Popular vector editors of graphic material:

- Corel Draw;
- Adobe Illustrator;
- Microsoft Visio;
- Xara Xtreme.

Some of the vector editors support animation, but among them there are special software packages for working with animated graphics:

- Synfig Studio;
- Animatron;
- Adobe Flash.

In any case, vector graphics are more suitable for working with animation than the animation tools of raster editors. Vector editors, in particular Scribus and Adobe InDesign, are close in their characteristics to desktop publishing systems. Modern vector graphics tools have the ability to create original brochures, advertising posters, consisting of one or more pages (to create large documents, page layout programs are used).

Special vector editors are used as computer-aided design systems. They are not suitable for artistic or decorative graphics, but they have many tools and object libraries that allow you to use drawing tools to create complex drawings.

In addition, 3D graphics programs can also be used in addition to traditional 2D vector editors. These are programs such as:

- 3D Studio Max;
- Blender;
- Maya.

Conclusion. Software complexes for generating fractals have the following capabilities: selection of an algorithm; saving files in png, tiff or jpeg formats; creating a parameter file, thanks to which the user can easily return to previously created images for their subsequent modification.

The following programs generating fractals are available for commercial and free use:

- Electric Sheep is an open source distributed computing system;
- Chaotica is a commercial program for MS Windows, Mac OS and Linux;
- Apophysis is an open source program for the operating system (OS) MS Windows;
- Sterling is free software for MS Windows;
- Kalles Fraktaler - image scaling program for MS Windows;
- Fractint is free and open source software;
- XaoS is an open source cross-platform fractal scaling program.

Many software packages allow the user to enter their own formulas to manipulate fractals, select rendering intents, filters, and other image manipulation tools. Some programs allow you to create images from a sequence of fractal images.

In addition, some standard graphics packages (such as GIMP) contain filters or plugins that can be used to generate fractals. In turn, software systems that specialize in creating fractals can be used together with other graphic editors to create more complex images.

– Ultra Fractal — fractal generator for Mac OS and MS Windows; – Terragen is a fractal generator.

References:

1. Кулназаров Б.Б. Чизма геометрия. – Тошкент: “Ўзбекистон”. 2006.
2. Raximov Z.O., Berdimurodov A.Sh., Kulnazarova Z.B. Mehmonxona interyeri va landshafti. Darslik – Samarqand: “STEP-SEL”, 2022. 270 bet
3. Kulnazarov B.B., Kulnazarova Z.B. 3DsMAXda Arxitektura & Dizayn. O‘quv qo‘llanma – Samarqand: SamDAQI, 2021.
4. Kulnazarov B.B., Kulnazarova Z.B. Kompyuter grafikasi AutoCAD 2013-2014. O‘quv qo‘llanma – Samarqand: SamDAQI, 2021.
5. Kulnazarova Z.B. Ta’lim jarayonlariga vebinar texnologiyalarini joriy etishning pedagogik imkoniyatlari. Uslubiy qo‘llanma – Samarqand: SamDAQI, 2021.
6. Kulnazarov B.B, Bekmurodov U.B., Kulnazarova Z.B. Kompyuter grafikasining arxitektura va dizayn sohasidagi talabalar o’quv jarayonidagi tutgan o’rn. ME′MORCHILIK va QURILISH MUAMMOLARI (ilmiy-texnik jurnal) 2022, №1 (2-қисм). – Samarqand: SamDAQI, 2022.
7. Kulnazarova Z.B. (2021). Samarqand shahri arxitekturasining istiqboldagi rivojlanish yo‘llari. Monografiya. – Samarqand: SamDAQI, 124.
8. Odilovich, R. Z., & Baxromovna, K. Z. (2021). The importance of hotel building architecture for the development of tourism in Uzbekistan. Emergent: Journal of Educational Discoveries and Lifelong Learning (EJEDL), 2(04), 118-121.
9. Odilovich, R. Z., & Baxromovna, K. Z. (2021). Architecture of Samarkand in the development of tourism. Innovative Technologica: Methodical Research Journal, 2(04), 78-81.
10. Raximov Z.O. Tueizm rivojlanishida mehmonxonalar interyer-dizayni. Monografiya. – Samarqand: “STEP-SEL”, 2022.
11. Raximov, Z. O. (2021). Socio-economic problems of hotel industry development in the field of tourism. Monograph.-Samarkand: SamISI.-2021.
12. Bakhromovna, K. Z., & Ibraimovna, M. F. (2022). Use of Modern Industrial Technologies in Architecture.
13. Bakhromovna, K. Z., & Abdurafikovna, G. R. (2022). The Impact of Changing Public Attitudes on the Development of Urban Architecture. CENTRAL ASIAN JOURNAL OF ARTS AND DESIGN, 3(4), 5-9.