CGH and 3D Display

Yaping Zhang, Jianqiang Zhang

(Kunming University of Science and Technology)

Because 2D images give only limited information about an object which lack of parallax and depth, people seek 3D enjoyment unceasingly. There are a lot of ways to achieve a 3D display.

Current approaches to display three-dimensional (3D) images can be classified into several main types: stereoscopic display, volumetric system, integral photography (also known as integral imaging), and holography. Each of these technologies has particular advantages and disadvantages. Holographic three-dimensional (3D) displays provide realistic images without the need for special eyewear, making them valuable tools for applications that require situational awareness. However, recording holograms of 3D real objects demands wave interference between two intense laser beams with a high degree of coherence between them. The optical system must be very stable, since a very slight movement can destroy the interference fringes, which contain both intensity and phase information. These requirements have prevented conventional hologram recorders from becoming widely used for outdoor recording. A partial solution for these limitations might be using computer-generated holograms (CGH).

CGHs have the advantages that the objects which one wants to show do not have to possess any physical reality at all. However, computing hologram's objects data are generally obtained from the computer programming presently, so applications of computing hologram is restricted.

The objects to be constructed by the CGH can be represented in the computer by mathematical or graphical descriptions, or by their spatial samples. Many algorithms for synthesizing CGH have been proposed in the past three decades. The choice among the various algorithms depends on different factors such as computation time, the hologram applications, and image characteristics.

For the past decade, many methods to reduce the computation time have been attempted. Unfortunately, the researchers realized that the computational speed and image quality is limited. Even with modern mathematical techniques and high computing equipment, real-time computation is tricky.

To solve these questions, a technique to obtain the real object 3D information by GI 3D camera in computing holography was proposed. And the relationship of the scanner data with the object light distribution for

holograms is analyzed, and how to remove hiddensurface in computing hologram is a question to resolve.
At the same time, it is based on propagation using the angular spectrum of plane waves. To compute a CGH from a polygon representation of a 3D model is the key work. To achieve this, our method assumes that the 3D object is made up of triangles, each one defined by three coplanar vertices spanning a plane. This plane will be called the triangle plane.
At the same time, conformal geometry is the fundamental tool for imaging and computer graphics on surfaces. Conformal maps are corresponding relationship between planar and curved surface and widely used in computer graphic. Comparing with simply coordinates transferring, conformal maps have many advantages, such as they make the invariability of geometric form between origin images and reconstructed one. We combined conformal maps with the generation of CGH, realized the generation of CGH of real complex curve surface 3D object, and realized the computer simulation of holographic record and reconstruct process.
To simplify the system, to make real-time dynamic 3D display be true, and get high quality 3D display, at the same time write hologram fast enough so we will have a video rate dynamic holographic display is our goal.