

# FUTURE OF HOLOGRAM

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The concept of the hologram is considered. The principles of work of the technology are observed. Future perspectives of the hologram are analyzed.

Any recording of information begins with two components: light (information carrier) and recording medium. The process of creating a hologram also consists of two stages. The first is to record information, the second is to restore it. The process of creating a hologram is based on the laws of optics and on the properties of light waves – diffraction and interference. Diffraction is the deviation of light from the rectilinear direction of propagation when passing near obstacles (the circumference of obstacles by light waves). Interference is the phenomenon of overlapping coherent waves (having the same frequencies, a constant phase difference, whose oscillations occur in the same plane). A hologram is a three-dimensional image of an object [1]. It is an optical clone of the object, which can be obtained by two main methods: Denis Gabor and George String; Yuri Denisyuk.

The Gabor method consists of two stages: recording a hologram and restoring it. The process of recording a hologram (Figure 1): we have an object that we want to get in the form of a hologram; beamsplitter, which helps to divide a coherent light beam into two beams: a reference beam (carries information about the light source, the phase recorded by the signal is counted from it); a lighting beam (illuminates the object, subsequently from which the information beam (object) is reflected – records the interference pattern, carries information about the object itself). We record all this on a photographic plate (a small glass plate, on one side covered with a photosensitive layer on which the image is fixed), where the intensity is high, blackening will occur, where the intensity is less, there will be no blackening. The photosensitive layer is a special emulsion that is applied to the surface of the plate, changes its properties under the influence of certain radiation. Thereby, we received information about the object, which is stored on a photographic plate. The process of restoring the hologram (Figure 2): to do this, we need a photographic plate that stores information about the object and reconstruction beam (another monochromatic wave, a light wave similar to the reference one), after the interaction of the plate and our wave, divergent waves (object beam) are obtained, which are reflected

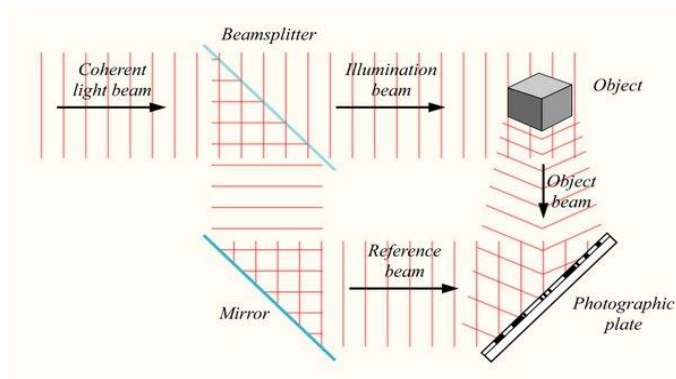


Figure 1 – Recording

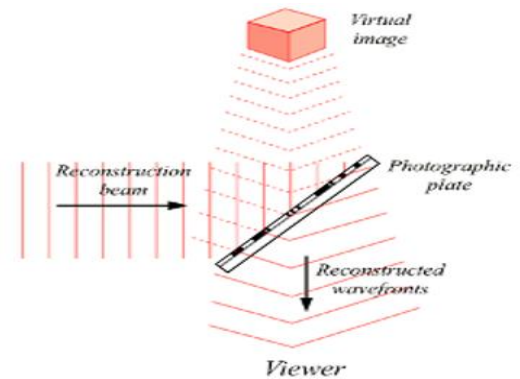


Figure 2 – Recovery

with the same accuracy (with the same diffraction angles as when recording the hologram), as well as from the object itself, and as a result we see a three-dimensional image of the object [2].

Denisyuk's method (Figure 2) also consists of two stages: making and viewing. We illuminate the beam-expanding lens with coherent light (an optical holographic plate, transparent), there is an object behind it: the first ray passes through the beam-expanding lens without being distorted; and the second, the object ray, is reflected from the object and they also meet and are also recorded. The properties of such holograms are "more interesting", since they themselves are filters for light. Denisyuk's method displays not only the amplitude and phase (information about a three-dimensional scene), but also the frequency of the wave – the color encoded in diffraction structures in the volume of the emulsion. Photoemulsion is a suspension (suspension) of photosensitive microcrystals of silver in a solid solution, forming a photosensitive layer of modern photographic materials. Thereby, the possibility of using white light sources and the possibility of recording color holograms opened up before us.

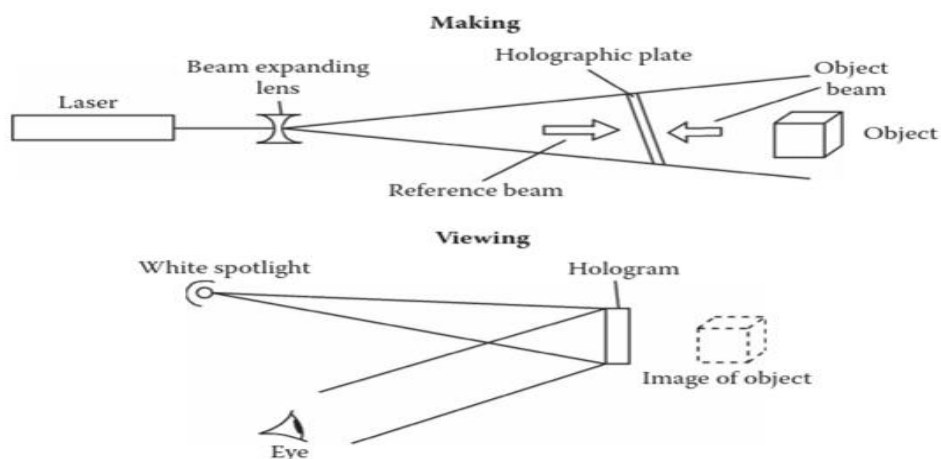


Figure 3 – Denisyuk's method

The future of the hologram is limitless, because it is able to bring any branch of humanity to a new level. It is a well-known fact that the most important industry for all humankind is medicine, since it is responsible for the duration and quality of life. The hologram can be used in operations of any complexity (visualizing all its stages), when crossing species. Visualization of "non-real objects" will definitely reduce costs (for medicines) and give an impetus to all medicine. A "holographic interaction" will open up before us (for example, we will be able to observe the reaction of a "holographic organism" to a "holographic medicine", which will help to avoid risks when using this medicine in life). Security will reach a new level, as it will be possible to use "fake" holograms to protect real objects. Nowadays, holographic stickers (signs) are already used, which help to avoid fakes. Special conditions are needed for their manufacture, so it is very easy to avoid "fakes", which definitely simplifies a person's life. Holography in the construction industry is able to help engineers, designers in recreating various drawings in real life, which will reveal flaws in the design before its implementation (manufacture). For example, it will be possible to visualize any dislocation with only an empty area (visualization of obstacles in a driving school). Education will reach a new stage, as it will be possible to hold conferences, meetings, presentations, while observing the object and all processes from all sides, which will contribute to understanding the topic. All this will make the demonstration and learning process more interactive, deep and interesting. Holographic displays will finally come into fashion, thanks to which communication will become even more convenient (thanks to the visibility of the object as a whole); films, movies, TV series will gain even more popularity, which will definitely bring cinematography to a new peak; people whose work depends on the computer will have new perspectives. In the universe of cinema, holograms have been used for a long time (for example, the creation of a hologram with the help of editing was shown in "Star Wars"), but these are not those holograms, since this is only their "copy". The hologram is able to attract buyers with its 3-d visualization (volume) of the product being sold, which will help advertisers and manufacturers of goods to improve their sales [3]. I cannot but mention the entertainment industry: games, quizzes, quests will change beyond recognition, thanks to new entertainment, humanity will always forget what boredom is, since with the help of a hologram it will be possible to recreate any universe at home; games, quests, and quizzes will become more dynamic and interesting. Culture should be mentioned separately: thanks to the hologram, it will be possible to hold exhibitions (for example, the "Holozoopark", for which materials for the manufacture of exhibits are not needed), concerts, displays of exhibits anywhere in the world. Nowadays, holographic displays, fans that are capable of creating holograms have already been invented, but these are not yet the holograms that can be used in everyday life because of their high cost and the principle of operation, which is still far from perfect.

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Thereby, we have analyzed the concept of a hologram, the principle of its operation and its application in real life. We have observed the prospects that it will be able to open for us in the future.

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