

Computer-Generated Holographic Stereograms

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Abstract: We examine one type of holographic stereogram and its implementation on two widely different media. The first medium is photoresist for a conventional computer-generated hologram. The second medium is photo-refractive polymer for re-writable holograms.

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1. The image-plane hologram

The image-plane CGH records the wavefield at the object or image plane in the propagation path. A strictly image-plane CGH is of course two-dimensional. The interesting variation should be called a near-image-plane CGH. The object may be two-dimensional and slightly removed from the image plane, or it may be three-dimensional but with its entire extent located near, or embedded in, the image plane. The output of the propagation is the wavefield just after exiting the object. It is this wavefield that is encoded into the CGH. The CGH itself looks like a coherently defocused picture. When illuminated, the diffraction pattern separates into viewing ports. The proper port is then selected for viewing. This selection is commonly done by correctly locating the pupil of the eye in preparation for viewing. Any one of many types of CGH [1, 2] types can be used to record wavefront. There are two main ways of calculating the wavefront that the CGH should encode: lumped-model beam propagation method, and holographic stereogram. We focus here on the holographic stereogram.

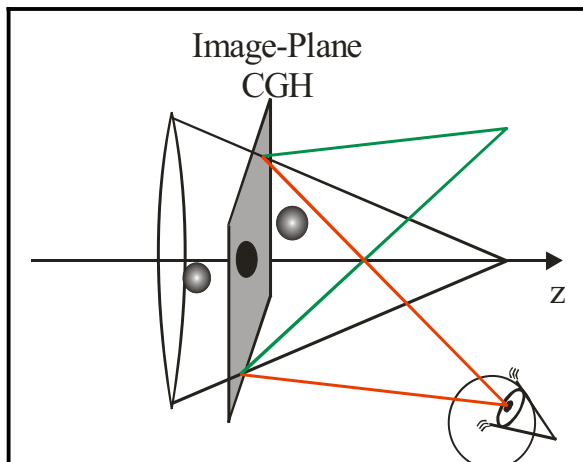


Figure 1: Reconstructing an Image-Plane CGH

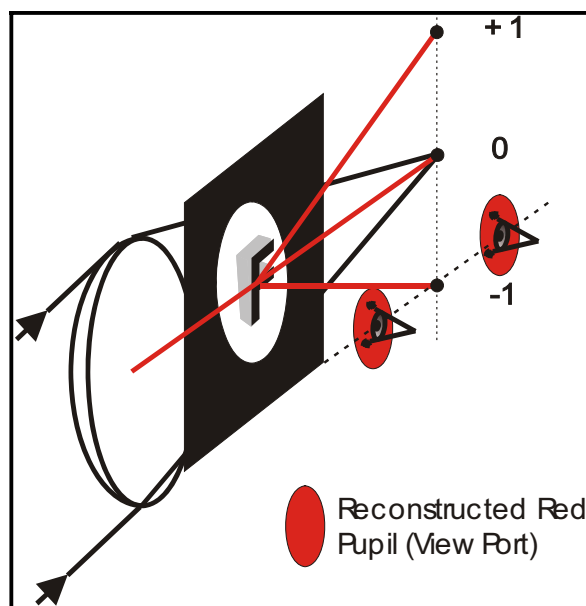


Figure 2: Holographic Stereogram

2. Holographic stereogram

The holographic stereogram [3] can actually record multiple perspectives; it is not restricted to the two that the term “stereo” would suggest. The basic setup is shown in Figs 1&2. You might consider the image-plane CGH to be reconstructing the viewing portals. Fig 3a shows one image from a set of twenty-three spine perspectives that were extracted from a pediatric computer tomogram (CT). Fig 3b is the corresponding viewing portal. We have used this data set to record two very different hologram realizations. The first is a static CGH written on photoresist using the