Computer-generated hologram of three-dimensional objects from perspective images using GPU parallel processing

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  In this technique, 3D images are synthesized from two-dimensional (2D) multiple perspective view images and then discretely recorded as a hologram using computer-aided algorithm. View image generation at arbitrary position is important in the field of 3D optical information processing. Since the set of the elemental images represents the ray space of the 3D object. We captured view images of 3D object using one camera and generated hologram using computer. 3D scene is imaged through the lens array, forming the elemental images on the CCD plane. After capturing three-dimensional object using a lens array, disparity estimation is performed for the central pixels. According to the estimated disparity, appropriate parts of elemental images are mapped to synthesize view images in perspective geometry. Disparity is defined as a position of corresponding points between view images. A computer-generated hologram is computed from a set of angular projections of the observed 3D object. According to perspective geometry, the light-rays travelling to all directions are recorded. Since the system requires only one camera, a lens array and display device such as a LCD as shown in Fig 1. Here, the multiple perspective images of the object and computer-generated hologram of these perspective view images are generated through GPU parallel processing. Finally, we verified this technique optically. With an appropriate illumination, real 3D image of the object is reconstructed.
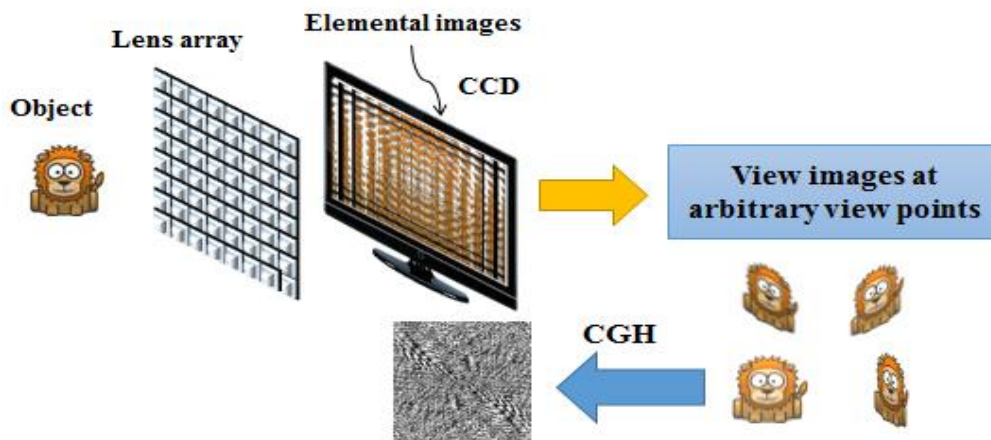

Fig. 1. Schematic configuration of the CGH of perspective view images

References
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