Field of view enhancement of dynamic holographic displays using algorithms, devices, and systems: A review

Monika Rani, Narmada Joshi, Bhargab Das, Raj Kumar*

CSIR-Central Scientific Instruments Organization, Sector 30C, Chandigarh, 160030, India

Email: raj.optics@csio.res.in

Abstract

Holography is a prominent 3D display approach as it offers a realistic 3D display without the need for special glasses. The core of dynamic holographic displays is spatial light modulator (SLM) technology. However, owing to the limited resolution and large pixel size of SLMs, holographic displays suffer from certain bottlenecks such as limited field of view (FOV) and narrow viewing angle. To develop a holographic display at the commercial level, it is crucial to solve these problems. A variety of probable solutions to these challenges may be found in the literature. In this review, we discuss the essence of these approaches.

Holographic Displays: Technical challenges and solutions

Holographic Display

In holographic displays, the computer generated holograms are calculated from 3D objects and they are reconstructed using spatial light modulators

Technical challenges

➤ Field of View (FOV)
➤ Space Bandwidth Product (SBP) of the hologram
➤ The display quality

are all constrained by the size and pixel pitch of commercially available SLMs. From the literature survey, computer generated hologram (CGH) algorithms, number/configuration of display systems, and the optical devices are identified as the three most promising candidates for the above purpose.

Section I: Algorithms

One of the most important aspects of holographic displays is CGH generation.

The main objective of these algorithms is:-

➤ The real-time computation of complex holographic patterns with huge information capacities for multi-color, wide-angle.
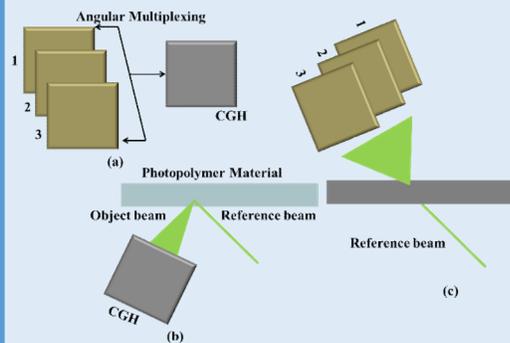
➤ large-image Systems.

Figure. 1. (a) Angular multiplexing of the different objects in single CGH; (b) Recording, (C) Reconstruction.

However, the spatial frequency and physical size of the CGH affect its information capacity

Section II: Systems

➤ SLMs are used in holographic displays to replicate wave fronts of an object.FOV reconstructed images is relatively constrained because small size of available SLM.To display the calculated digital holograms, spatial light
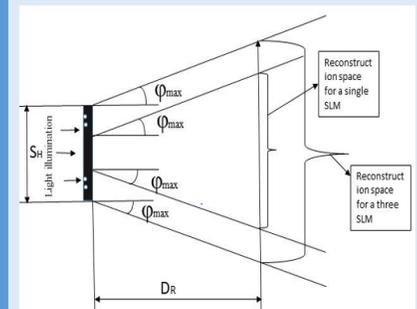
➤ modulators (SLM) are one of the widely used.

Figure2: Reconstruction space increased when multiple SLMs are used

Section III: Devices

➤ The optical devices used in the optical configurations also have a significant contribution in enhancement of FOV
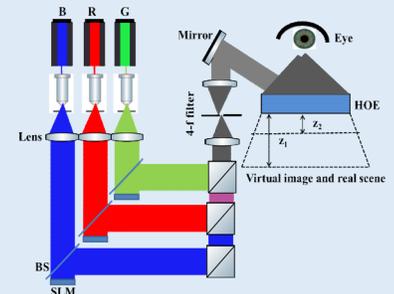

Figure. 3. Schematic view of the wide field see-through holographic display

The development of such devices are helpful in realization of holographic displays with wide FOV.

Conclusions

This paper reviews the current state-of-the-art of the FOV expansion for the holographic displays. CGH generation algorithms, configuration of display systems, and the optical devices are identified as the three most promising candidates for the above purpose. The combination of different primitive methods into an optimized algorithm is a good solution to enhance the FOV.

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