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Three-dimensional holographic projection of tumors

Rania M. Abdelazeem[1], Doaa Youssed[1], Jala El-Azab[1], Salah Hassab-Elnaby[1] and Mostafa Agour[2]

[1] Engineering Applications of Laser Department, National Institute of Laser Enhanced Sciences "NILES", Cairo University, 12613, Giza, Egypt
[2] Physics Department, Faculty of Science, Aswan University, 81528 Aswan, Egypt

Abstract

Holographic projection is regarded as one of the most encouraging and powerful tools for providing three-dimensional (3D) information of the object without special eyewear. Recently, the progress in holographic recording and reconstruction techniques and the availability of the tools for the interpretation of holographic interferograms exhibit a strong promise for emerging the holographic projection as a powerful tool for medical applications. Consequently, medical holographic projection systems can be used as a valuable technique for displaying an accurate 3D representation of different body organs that further provide for better understanding, interpretation and diagnosis of different diseases. In this study, a real-time 3D holographic projection system for the abnormal structures (tumors) of magnetic resonance (MR) and computed tomography (CT) plane images is proposed. For a sequence of plane images, the tumor is detected from each layer to provide a 3D scene of the tumor. The level set evolution is utilized to precisely extract the tumor from the slice images. Phase-only computer-generated holograms (CGHs) for the detected tumors are calculated by applying a modified Gerchberg-Saxton (GS) iterative algorithm where the projection is based on plane wave decomposition. Then, a single two-dimensional (2D) phase hologram is calculated by the coherent superposition of all calculated complex-amplitudes holograms. The optical experiments are realized using a reflective phase-only spatial light modulator (SLM) to reconstruct a dynamic 3D image of the detected tumors. The achieved results revealed that the proposed 3D holographic visualization system can aid in better interpretation of tumors and in the achievement of well diagnostic results.

Biography:

Hassab Elnaby, Salah has completed his PhD at the age of 30 years from Orsay University (Paris) and postdoctoral studies from Ecole Polytechnique. He is the ex-director of laser technology center at Cairo University. He has published more than 25 papers in reputed journals. He was chairman of Engineering Applications of Lasers.

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