

Use of optical fiber bundle in digital image plane holography

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Abstract Use of optical fiber bundles (OFBs) in digital image plane holography systems is limited due to, first, poor quality of transmitted images through the OFB and, second, further image degradation caused by overlappings in the image (also hologram) plane. Existing systems are aimed at near-distant (order of a centimeter) objects and use demanding procedures to achieving acceptable quality of holographic reconstructions. This paper presents an OFB based holographic system capable of achieving fast and good-quality holographic and interferometric reconstructions of far-distant (order of a meter) objects. The proposed system is based on performing subtraction operations through the image acquisition interface buffers directly accessed to process the holograms and instantly display the output. The system is analyzed theoretically and its effectiveness is validated by experimental results.

Keywords Digital holography · Digital holographic interferometry · Optical fiber bundle

1 Introduction

Optical fiber bundles (OFBs) enable transmission of optical images from one end to the other without alteration. Major benefits of their use in optical imaging are their ability to reach otherwise inaccessible places as well as to transmit light over longer distances. Application areas of the OFBs tend to increase in recent years, from improving the imaging systems (Hossain et al. 2012; Fernandez et al. 2012) to analyzing biological tissues (Kothapalli et al. 2012; Xi et al. 2012). Furthermore, by changing the shape of the core, the OFBs with square-core optical fibers find new applications in spectroscopy and laser machining (Schuberts et al. 2011).

While OFBs are proven useful in various holographic- and interferometric-based systems such as endoscopy, hologram multiplexing and shearography, there is a lack of their use in more general digital holography setups that are also suited for larger and far-distant objects.

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