Reflective digital holographic microscopy using a single-element

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Abstract

Digital holographic microscopy (DHM) is currently a well-established optical microscopy technique. DHM employs a single-shot, non-invasive and non-scanning operating principle to provide quantitative phase imaging (QPI), using an interferometric architecture. When DHM is implemented in a reflection mode, it provides the quantitative phase delays of the light reflected or scattered by the sample, which are directly related to its surface topography. The inspection of the topography of technical microscopic objects is of great interest in fields as science, technology, and industry. Reflective DHM is commonly implemented using a Michelson interferometer. However, Michelson layouts are complex in design and their double-path configuration make them more sensitive to external perturbations than common-path interferometers (CPI). Inside CPIs, single-element CPIs (SE-CPIs) only employ one optical component to create the interferograms. Hence, SE-CPIs are particularly relevant due to simpleness, cost-effectiveness, and robustness. Nevertheless, SE-CPIs were only found in the literature working in transmission modality, thus restricting their applicability to transmissive/transparent objects. In this contribution, we report on the implementation of a single-element CPI layout under reflective mode. The proposed technique, named as single-element reflective DHM (SER-DHM), utilizes a single diffraction grating for simultaneously illuminating the sample in reflection and providing holographic recording for QPI. SER-DHM is experimentally validated using different reflective objects.

Biography

Dr. José Ángel Picazo-Bueno is a postdoctoral physicist researcher from University of Valencia (UV), Spain. He received his BSc, MSc, and PhD in Physics from the UV in 2013, 2014, and 2020, respectively. His area of expertise is Optics, specially focused on interferometric microscopy, quantitative phase imaging, digital (and lensfree) holographic microscopy, super-resolved imaging, and biomedical optics. He is co-author of more than 20 papers on peer-reviewed journals and contributed with around 15 presentations in international conferences. Currently, he is a postdoctoral fellow at the Biomedical Technology Center in Münster, Germany.