

Quantitative Phase Imaging by All-Fiber Polarized Digital Holographic Microscopy

Veronica Cazac^{1,*}, Constantin Losmanschii¹, Vladislav Botnari¹, Vladimir Abashkin¹, Elena Achimova¹

¹Moldova State University, Institute of Applied Physics, Academiei, str.5, Chisinau, MD-2002, Moldova

***Email:** veronikakazak21@gmail.com

Abstract: In this work, we present an optical fiber-based polarized digital holographic microscopy system designed to improve interferometric stability and measurement precision. The proposed architecture integrates monomode optical fibers into the interferometric setup, forming a compact and robust “all-in-fiber” configuration. This approach minimizes alignment complexity and significantly reduces sensitivity to external disturbances. The system enables non-destructive, label-free imaging of transparent samples, making it particularly suitable for biological and material science applications. Dedicated software tools are developed for data acquisition and numerical reconstruction, allowing accurate phase retrieval and three-dimensional visualization. Experimental results describe the polarization calibration procedure for the developed instrument for estimating the sensitivity for quantitative birefringence measurements. The proposed FO-PDHM system represents a promising platform for advanced interferometric imaging, offering flexibility, precision, and applicability across multidisciplinary research fields.

Keywords: Optical fiber, birefringence imaging, digital holographic microscopy, polarization

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