

Reduction of the ringing effect in off-axis digital holography reconstruction from two reconstruction distances based on Talbot effect

Miguel León-Rodríguez; Raúl R. Cordero; Juan A. Rayas; Amalia Martínez-García; Adrián Martínez-Gonzalez; Fernando Labbe; Alejandro Téllez-Quiñones; Victor Flores-Muñoz

Opt. Eng. 54(10) 104110 doi: 10.1117/1.OE.54.10.104110

Published in: Optical Engineering Volume 54, Issue 10

Abstract.

A simple strategy based on wavefront propagation in the Fresnel regime to reduce a ringing effect by using an ideal filter in off-axis digital holography (DH) is presented. In addition, we demonstrate a better focusing capacity by using this ideal filter than Butterworth and Gaussian methods. It also provides a way to increase the visibility of the refocused plane by reducing the influence of the out-of-focus planes. We also use the unique feature of the refocusing capability of DH in the reconstructed and enhanced image, which is obtained from the averaging operation between the image at the focused image plane ($z=z_{hd0}$) and the first Talbot distance order ($z=z_{hd1}$). This distance is determined by the periodic ringing. Reductions of 50% of these anomalies are computed in simulation and 30% is obtained experimentally (nearly 2 nm). Also a numerical simulation shows that the focusing resolution is directly related to the filter size and shows a 0.8 mm focus zone with an ideal filter. Numerical simulations and experimental results are carried out to validate the proposal.