Kramers-Kronig digital holographic microscopy

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The Space-bandwidth product (SBP) [1] of an imaging system corresponds to the quantity of information transmitted through the system. The SBP of light through a microscope reaches up to tens of megapixels. To detect whole information without a loss, the SBP of a detector, or a number of pixels, must be greater than the SBP of a signal to detect. However current commercialized imaging sensors have few megapixels, which inevitably loses the information. This becomes a greater issue for digital holographic microscopy where the SBP of the interferogram reaches up to a hundred megapixels.

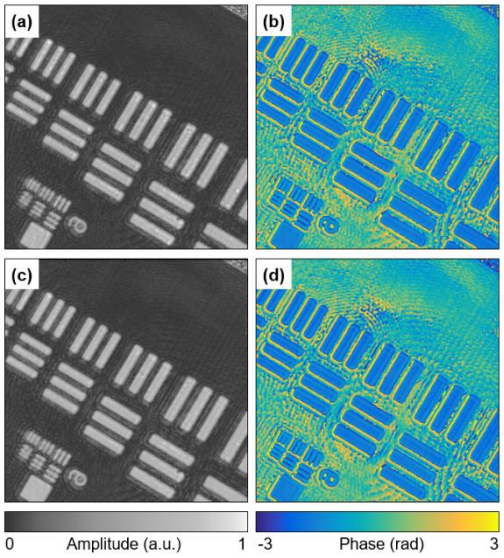

Figure 1: Comparison between off-axis digital holographic microscopy (a-b) and the proposed method (c-d)

Here we present a novel digital holographic microscopy that provides a four-fold increase in the SBP of a holographic image detected by the off-axis digital holographic microscopy. By exploiting the Kramers-Kronig relations, the proposed method retrieves a complex amplitude at the sample plane. The validity of the proposed method is demonstrated by comparing the performance of the proposed method with that of the off-axis digital holographic microscopy [2] using various microscopic samples.

Reference

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[2] Takeda, M., H. Ina, and S. Kobayashi, *Fourier-Transform Method of Fringe-Pattern Analysis for Computer-Based Topography and Interferometry.* Journal of the Optical Society of America, 1982. **72**(1): p. 156-160.