Wrapping-free phase retrieval with applications to interferometry, 3D-shape profiling, and deflectometry

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Abstract

Phase unwrapping is probably the most challenging step in the phase retrieval process in phase-shifting and spatial-carrier interferometry. Likewise, phase unwrapping is required in 3D-shape profiling and deflectometry. In this paper, we present a novel phase retrieval method that completely sidesteps the phase unwrapping process, significantly eliminating the guessing in phase reconstruction and thus decreasing the time data processing. The proposed wrapping-free method is based on the direct integration of the spatial derivatives of the interference patterns under the single assumption that the phase is continuous. This assumption is valid in most physical applications. Validation experiments are presented confirming the robustness of the proposed method.