Principles and applications of a speckle-based wavefront sensor

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Principles and applications of a speckle-based wavefront sensor

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The motivation for this study is to carry-out interferometric applications using phase retrieval which affords a simple setup. The wavefront sensor has 3 components: 1) diffuser, 2) speckle patterns, and a 3) phase retrieval algorithm. A coherent test wavefront incident on a diffuser facilitates the formation of a speckle field. The sampled speckle patterns are input in a phase retrieval algorithm to reconstruct and compare test wavefronts. In this presentation, basic principles of the algorithm and applications of the technique in deformation analysis and angular displacement measurements are presented.

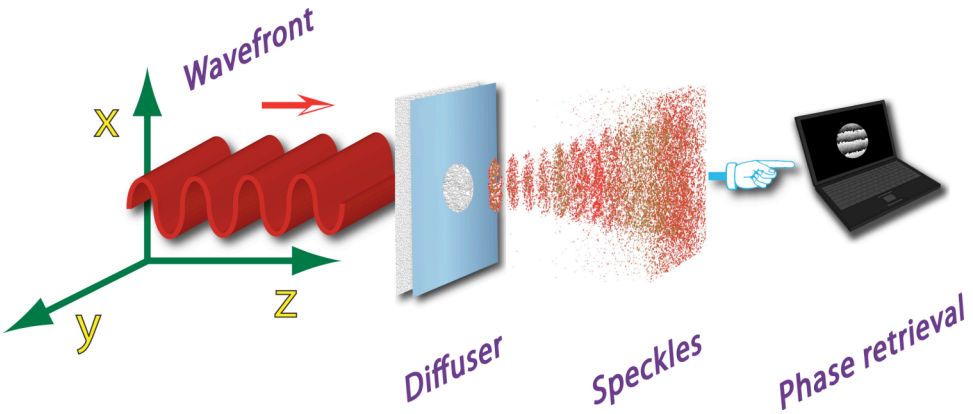

Fig. 1. Setup. A test wavefront incident on a phase diffuser generates a volume speckle field. Axially-displaced speckle intensity measurements are input in an algorithm based on the wave propagation equation.

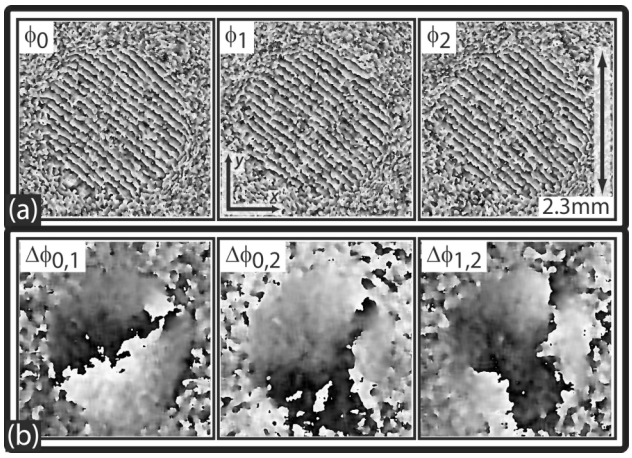

Fig. 2. Surface deformation analysis. (a) Retrieved phases for various deformation states. (b) Phase differences.

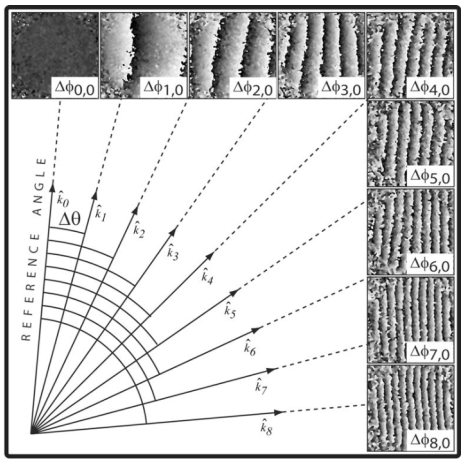

Fig. 3. Angular displacement measurement. Differences of retrieved phases for planar wavefronts with increasing angular displacements.