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Next generation EUV optical systems are moving to higher resolution optics to accommodate the smaller length scales targeted by the semiconductor industry. As the numerical apertures of the optics become larger, it becomes increasingly difficult to characterize aberrations, which broaden the point-spread function and thus limit the resolution of an optical system. Conventional interferometric techniques such as point-diffraction interferometry (PDI) are difficult to realize experimentally because of the small spatial filters which are nearly impossible to fabricate and have poor photon throughput[1].

Lateral shearing interferometry (LSI) provides an attractive alternative to PDI because of its experimental simplicity, stability, relaxed coherence requirements, and ability to theoretically scale to high numerical apertures[2]. LSI is a type of common-path interferometry whereby the test wavefront is incident on a low spatial frequency grating which causes the resulting diffracted orders to interfere on the CCD. LSI eliminates the need for a high quality spatially coherent reference wave by interfering the test wavefront with a shifted (sheared) copy of itself. The reconstructed phase approximates the derivative of the wavefront in the direction of the shear.

LSI has been used at lower numerical apertures with great success. However, moving to higher numerical apertures presents new challenges. Wavefront distortion from the diffraction grating creates systematic aberrations that have no simple analytic model. The large spectrum of angles makes carrier-frequency based interferogram analysis extremely difficult which may force a phase-shifting approach to the analysis. High numerical apertures create stricter tolerances for the alignment of the optical elements.

In this paper, a new analytic method is presented based on a holographic construction of the LSI setup. Historically difficult to perform in simulation, numerical computations of high numerical aperture propagation are made feasible by an 80-core supercomputer that verify the validity of the analysis. A visible light mockup is created to confirm the results of the simulation.

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[1] Patrick P. Naulleau, Kenneth A. Goldberg, Sang H. Lee, Chang Chang, David Attwood, and Jeffrey Bokor, Appl. Opt. **38**, 7252-7263 (1999)

[2] JJ. E. Bjorkholm, A. A. MacDowell, O. R. Wood, Z. Tan, B. LaFontaine, and D. M. Tennant. Vac. Sci. Technol. B 13, 2919 (1995);

DISCLAIMER

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