

Two dimensional shape retrieval from interferometric out-of-focus images of non-spherical particles

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Interferometric out-of-focus images of non-spherical particles are commonly speckle-like patterns. We will present a treatment that is able to retrieve the two dimensional shape of the particle from its simulated interferometric out-of-focus image [1]. Firstly, the information retrieval issue from the interferometric out-of-focus image will be demonstrated identical to the phase retrieval under certain condition. Then the hybrid–input–output algorithm will be employed to conduct the reconstruction [2]. For a successful reconstruction, a tighter support is required. Thus, the method to get a tighter support will be explained. The reconstructed object has the same global two-dimensional shape of the real particle, though an ambiguity of the shape orientation exists. The size of the reconstructed image is scaled by the parameters for the reconstruction. After that, the superposed interferometric out-of-focus image of two single particles which are close enough to each other will be treated. We will show that the proposed treatment is capable to reconstruct the two particles at the same time. Finally, we will analysis the noise in the out-of-focus pattern that would hobble the reconstruction and thus advises will be given for optical system design. Moreover, preliminary experimental results will be presented.

References

- [1] Shen, H., L. Wu, Y. Li, and W. Wang, 2018: Two-dimensional shape retrieval from the interferometric out-of-focus image of a nonspherical particle.—Part I: Theory. *Appl. Opt.* **57**, 4968–4976.
- [2] Fienup, J. R., 1978: Reconstruction of an object from the modulus of its Fourier transform. *Opt. Lett.* **3**, 27–29.

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