Ptychographical Phase Retrieval

Andrew. M. Maiden[1] and John. M. Rodenburg[1]

1. Dept. of Electrical and Electronic Engineering, University of Sheffield, S1 3JD, UK

a.maiden@sheffield.ac.uk

Keywords: phase retrieval, diffractive imaging, ptychography

The Field of Coherent Diffractive Imaging (CDI), where an image of an object is reconstructed from measurements of its diffractive properties, is currently enjoying a burst of interest amongst researchers thanks to its immediate applicability to important areas, such as X-ray and Electron Microscopy, and the availability of increasingly powerful computing resources. Recently, several particularly robust iterative algorithms have been developed that combine multiple far-field diffraction patterns to form an image of a sample and which exhibit improved robustness and convergence speed over single diffraction pattern methods.

For these methods to work, diversity must be introduced into the diffraction pattern measurements by varying the conditions under which each recording is made. The Ptychographical Iterative Engine (PIE) [1] introduces diffraction pattern diversity by scanning a localised probe waveform across a transmissive sample, recording diffraction patterns at a set of overlapping probe positions- an approach that has been shown to work well at optical and X-ray wavelengths [2,3]. Here, we report on improvements to the PIE method that have enabled us to improve the quality and resolution of the images obtained using this technique.

M.A. Pabst, G. Zellnig (Eds.): MC2009, Vol. 2: Life Sciences,
DOI: 10.3217/978-3-85125-062-6-162, © Verlag der TU Graz 2009

1. J M Rodenburg and H M L Faulkner, Appl. Phys. Letts. 85(20) (2004), p4795.
2. J R Rodenburg et al. Ultramicroscopy, 107 (2007), p227.
3. J R Rodenburg et al. Phys. Rev. Lett. 98 (2007).
4. The author(s) wish to gratefully acknowledge the support of EPSRC for funding this work which was part of the - Basic Technology Grant (EP/E034055/1) and also the support of Phase Focus ltd.

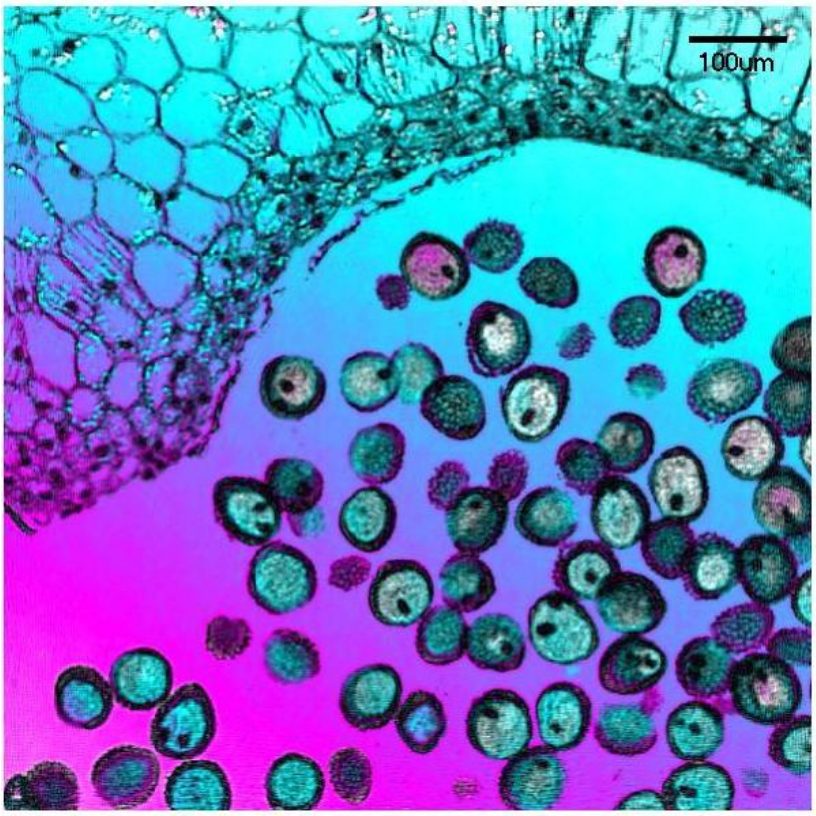

Figure 1. A Phase Contrast image of Lilly Anthers. The phase part of the complex-valued Ptychographic reconstruction has been used to adjust the hue of the image, whilst its brightness is governed by the amplitude part of the reconstruction.

DOI: 10.3217/978-3-85125-062-6-162,