SAIP 2017 South African Institute of Physics Conference
3-7 JULY 2017 • STELLENBOSCH UNIVERSITY • STELLENBOSCH • SOUTH AFRICA

Contribution ID: **236** Type: **Oral Presentation**

Implementation of the orthonormal Zernike-based polynomials in the Extended Nijboer-Zernike diffraction theory

Tuesday, 4 July 2017 14:00 (20 minutes)

The Nijboer-Zernike diffraction theory was devised to solve imaging problems in which the phase is represented as a linear combination of Zernike circle polynomials. The extension of the theory to create the Extended Zernike-Nijboer (ENZ) theory gives an allowance for the analysis of imaging systems with high numerical aperture and strong defocus. We investigate the implementation of circular Gaussian-Zernike-based polynomials in the ENZ theory in imaging systems with circular Gaussian pupils. The resulting semi-analytical model gives reasonably accurate results in the case of a diffraction-limited imaging system. The results show that the model allows for the simulation of weakly aberrated imaging systems, specifically phase and intensity profiles, axial intensity, point spread functions and analysis of the focal volume through comparison with numerical calculations. The model has potential use in simulating adaptive optics protocols in which the source of light is nonuniform, such as a laser. The model can also be used to characterize a laser source by decomposing its beam's point spread function to reveal the beam's aberration composition.

Apply to be
 considered for a student
   award (Yes / No)?

No

Level for award
 (Hons, MSc,
   PhD, N/A)?

N/A

Main supervisor (name and email)
and his / her institution

Tjaart P. J. Krüger
tjaart.kruger@up.ac.za
Department of Physics, Faculty of Natural and Agricultural Sciences, University of Pretoria,

Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?

No

Primary author: Dr MAFUSIRE, Cosmas (University of Pretoria)

Co-author: Dr KRÜGER, Tjaart (University of Pretoria)

Presenter: Dr MAFUSIRE, Cosmas (University of Pretoria)

Session Classification: Photonics

Track Classification: Track C - Photonics