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

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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-Zernikebased polynomials in the ENZ theory in imaging systems with circular Gaussian pupils. The resulting semianalytical 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<br> considered for a student <br> &nbsp; award (Yes / No)?

No

Level for award<br>&nbsp;(Hons, MSc, <br> &nbsp; PhD, N/A)?

N/A

#### Main supervisor (name and email)<br>and his / her institution

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

No

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