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Orthonormal polynomials for centred non-uniform rotationally symmetric pupils

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Abstract content
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We derive a formulation for the orthonormal polynomials for rotationally symmetric non-uniform light beams going through a centred rotationally symmetric pupil by presenting a formulation derived using the QR decomposition form of the Gram-Schmidt orthogonalization procedure. We expand this model to derive an algorithm for performing the Cholesky decomposition in a way that makes it possible perform such calculations in a simpler and much faster way. We also investigate a method for calculating normalized coefficients when measuring phase in the pupil using Zernike circle polynomials from which we obtained a relationship between the two sets of coefficients. We verify the efficacy of the model by fitting both Zernike circle and orthonormal polynomials to experimental results of Gaussian beams going through circular apertures. This model may be used for imaging applications, such as super resolution microscopy, in communications, astronomy and in the general analysis of the propagation of aberrated light beams.

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