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光电系统与工程

不同Zernike多项式求取环孔径波面像差的研究

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摘要：

由于Zernike环多项式各项在环域上正交，以此为基准可以得到Zernike圆多项式拟合环孔径波面求解Seidel像差系数的误差。为了对Zernike圆多项式与环多项式求解的Seidel系数进行准确的比较，根据波像差理论推导并建立对比实验模型，进行量化比较。比较对于具有较大遮拦比的环孔径波面采用Zernike环多项式拟合与采用Zernike圆多项式拟合求取Seidel系数的差别。实验结果表明，采用Zernike圆多项式进行拟合求取Seidel系数时，主要的相对误差存在于离焦、球差和慧差。9项Zernike圆多项式拟合求取的Seidel系数比36项Zernike圆多项式更接近Zernike环多项式求取的系数。同时，如果参与拟合的项数继续减少，求取的Seidel误差反而增大。

关键词： Zernike多项式 Seidel系数 最小二乘法 中心遮拦

Aberration analysis for annular pupils by different Zernike polynomials

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Abstract:

Due to the orthogonality of every Zernike annular polynomial in the annular field, the error in Seidel coefficients solved by wave front fitting with circular polynomial for annular pupils could be obtained. To accurately compare Seidel coefficients solved by circular polynomial with Zernike annular polynomial, an experiment model was built according to the theory of wave front aberration. The Seidel coefficients solved by wave front fitting for large obscuration pupils with Zernike annular polynomial and Zernike circular polynomial were compared. The result showed that the main relative errors remained in defocus, sphere and coma aberrations, when the Seidel coefficients were solved by Zernike circular polynomials. The Seidel coefficients solved by the 9 circular polynomial terms are more close to the results solved by the annular polynomial rather than the 36 circular polynomial terms. However, when the number of circular polynomial terms decreases to fewer than 9, the error in Seidel coefficients obtained by circular polynomial will increase.

Keywords: Zernike polynomials Seidel coefficient least square method central obscuration

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