应用光学 2007 28 (1): 38-42 ISSN: 1002-2082 CN: 61-1171/O4

光电工程

用Zernike多项式实现光机分析的技术方法

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收稿日期 修回日期 网络版发布日期 2007-1-15 接受日期

摘要 由于光学软件不能直接利用有限元分析的结果，而Zernike多项式的各项与光学像差有对应关系，因此常用Zernike多项式作为光机接口。针对目前常用轴向位移作为拟合量描述拟合面形的不足，给出了几种常用的表面位移校正方法并说明了其优缺点。用具体实例比较各校正位移，并对其进行Zernike多项式拟合，从拟合系数的差异可以看出，曲率比较大的表面必须采用校正位移进行拟合。最后指出：在不知道初始表面方程的情况下，轴向和法向校正位移均采用从初始表面出发的方法，如果已知初始表面方程，则轴向校正位移采用从变形表面出发的方法，法向校正位移仍采用从初始表面点出发进行计算。

关键词 光机分析 表面位移校正 有限元分析 Zernike多项式
分类号 0439 TH744

Methods of opto-mechanical analysis with Zernike polynomials

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Abstract Zernike polynomials are used as interface for opto-mechanical analysis because the items of Zernike polynomials have corresponding meanings to Seidel aberrations, because the result of finite element analysis can not be directly used by optical software. At present, optical-axis component of nodal surface displacement to the original surface is fitted by Zernike polynomials, which is not accurate. Some algorithms of surface corrected displacement are described and compared. Each corrected displacement is compared with specific examples, and they are fitted by Zernike polynomials. From the difference of fitting coefficient, it is discovered that the corrected displacement must be adopted if the surface curvature is large. It is concluded that both axial and normal corrected displacements adopt the method from original nodes if the original surface equation is unknown, the axial corrected displacement uses the method from the deformed nodes and the normal corrected displacement makes use of the methods from original nodes if the original surface equation is known.

Key words optomechanical analysis corrected surface displacement finite element analysis Zernike polynomials

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