

利用相位差异法检测镜面面形

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Surface testing with phase diversity method

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摘要

图/表

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摘要 为了验证相位差异波前检测器演示系统利用自带光源独立完成波前检测任务的能力,搭建了基于相位差异法检测镜面面形的实验平台。测试时在焦面和离焦面上同时采集短曝光图像,在已知离焦量的前提下解算出波前相位分布并恢复出目标,从而实现大镜面像差的估计。为了进一步验证相位差异测量方法的准确性,对相位差异法与高精度的ZYGO干涉仪得到的测量结果进行了比较分析。实验结果表明:两种方法获得的面形误差分布及误差的峰谷值(PV)和均方根值(RMS)一致性很好,而波前RMS的测量精度达到了 $2.83/1\ 000\lambda$ 。得到的结果表明提出的相位差异法能有效地检测出镜面的像差,且准确性很好。

关键词 : 镜面面形, 面形检测, 相位差异法, 泽尔尼克多项式, 像差

Abstract : To verify the demonstration system of a phase difference wavefront detector by using its own light source to complete the wavefront detection independently, an experiment platform to detect the mirror surface shape with the phase diversity method is set up. The phase diversity method collects shorter exposure images in the focal plane and away from the focal plane at the same time, then it calculates the distribution of wavefront solutions and recovers the target based on known defocus, so as to realize the estimation of large mirror aberration. In order to further validate the phase diversity method, the measurement results from phase diversity method are compared with that from a high accuracy ZYGO interferometer. Experimental results demonstrate that the error distribution, PV values and RMS values of the two methods are well in agreement, and their wavefront RMS accuracy is $2.83/1\ 000\lambda$. These results mean that the phase diversity method effectively detects the mirror aberration and has good feasibility and accuracy.

Key words : mirror surface surface test phase diversity method Zernike polynomial aberration

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