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信息科学

基于实时波前信息的图像复原

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摘要： 提出了一种基于PIX总线的千单元可扩展波前探测图像恢复技术。采用波前探测与图像恢复相结合的方式来克服大气扰动和系统像差对图像分辨率的影响,满足大型地基望远镜高分辨率成像的需求。首先利用波前探测的方法得到波前相位畸变量,再由此恢复退化图像。其核心部件-波前处理器则采用波前处理主板和可扩展的波前处理子板相结合的方式来满足不同光学系统对波前处理规模的需求,波前空间采样数可扩展至千单元数量级。系统在室内进行了激光光源图像恢复实验,使激光光源的能量集中度提高50%左右;在室外对恒星和0.6″的双星图像进行了恢复,其半高全宽下降了约80%。系统采用大规模现场可编程门阵列(FPGA)作为波前处理的核心器件,实现了波前探测的实时处理和透过大气成像的退化图像的高分辨率图像恢复。

关键词： 地基望远镜 波前测量 实时处理 图像恢复

Image restoration based on real time wave-front information

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Abstract: A thousand-unit scalable wave-front detector based image restoration technology was proposed. The wave-front detection and image restoration were combined to eliminate the effect of atmospheric disturbance and system aberration on the image resolution and to meet the requirements of large ground-based telescopes for high-resolution imaging. First, the wave-front detection was used to obtain the wave-front aberration and then degenerated images were restored based on obtained aberration amounts. The core component, a wave-front processor, used a wave-front host Printed Circuit Board(PCB) combined with a wave-front sub PCB to implement wave-front processing for optical systems with different sizes and it could reach thousand magnitude unit outputs. An image restoration experiment for a laser source was performed in an experimental laboratory, which shows the laser energy concentration has increased by 50%. And the binary source of 0.6 arc-second experiments was carried out in a telescope, and its Full Width at Half Maximum (FWHM) has decreased by 80%. By using a large-scale Field Programming Gate Array(FPGA) as the core processing device, the system achieves the high resolution image restoration for a degenerated image from the ground-based telescope.

Keywords: ground-based telescope wave-front measurement real time processing image restoration

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