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论文

基于主动光学技术的任意视场变分辨率空间望远镜

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摘要:

介绍了一种新型的空间望远镜,通过改变光学系统焦距,可以提高任意感兴趣视场的成像分辨率。光学系统有四个反射镜组成,包括两个静态非球面反射镜和两个面形动态可调非球面反射镜.通过改变两个可变形反射镜的面形,系统焦距可以在399 mm到558 mm范围内进行动态调整.和机械式变焦系统相比,此主动变焦系统避免了光学元件的精密移动,有效减少反应时间。分析了此系统的成像质量,给出了0°、0.51°、0.7°不同视场的弥散斑:1.6 μm、1.0 μm、1.7 μm,及传递函数:在68 lp/mm 时,MTF曲线值大于0.7.此新型成像技术还可以有效减少数据传输链带宽需求,在遥感领域具有广阔的应用前景.

关键词: 主动变焦系统 光学系统设计 可变形镜 任意视场角

Space-based Telescope with Variable Resolution at Any Field Angle by Active Optical Zoom

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Abstract:

A new kind of space-based telescope with variable resolution at any field angle by active optical zoom is proposed theoretically. It can change the magnification of imaging system at any field angle that means the effective focal length can be changed at a limited region of interest and simultaneously maintain high resolution. It comprises two static aspheric mirrors and two deformable mirrors and the focal length can be adjusted from 399 to 558.6 mm by changing the curvature of the two deformable mirrors. Comparing with the mechanical zoom systems, they are active optical zoom systems, in addition, they avoid the precisely moving of elements and reduce the response time. The imaging quality of this optical zoom system is examined by analyzing the Spot Diagrams and the Modulation Transfer Function (MTF) curves at different field of view especially about the outside of the specific FOV. The Root Mean Square (RMS) radius of field angle at 0, 0.51 and 0.7 degrees are about 1.6 μm, 1.0 μm, and 1.7 μm, respectively, and the MTF values in the Spatial Frequency (SF) of 68 lp/mm is almost unchanged at 0.7. The novel system reduces the bandwidth of data transmission and may find potential applications in remote sensing.

Keywords: Any field angle Deformable mirror Active zoom system Optical systems design

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