

论文

大气环境下用于瞄准的激光波束传播特性研究

吕宏;高明

西安工业大学光电工程学院, 陕西西安710032

摘要:

针对激光瞄准过程中的光斑偏移现象, 结合修正的Von Karman谱的折射指数起伏和Hufnagel Vally湍流模型上的近似积分, 研究了高斯脉冲光束在湍流大气中远场水平以及斜程传播时的脉冲展宽和闪烁指数, 分析了强湍流条件下1.06μm准单色光斜程大气传输光强分布与脉冲展宽的关系, 对数值结果进行比较, 发现远距离传输中波长和距离对波束瞄准偏差影响较大. 从理论和实验上对大气环境下激光光斑瞄准偏差进行了分析研究, 研究结果表明: 将激光光斑全场数据及分析结果应用到现有偏差补偿算法中, 可以实现激光瞄准偏差的有效补偿, 在大气能见度1km~3km范围内, 激光瞄准偏差测量误差σA≤0.1mrad.

关键词: 大气环境; 高斯波束; 瞄准误差; 脉冲展宽

Propagation characteristics of laser pointing in atmosphere environment

LU Hong;GAO Ming

School of Optoelectronic Engineering, Xi'an Technological University, Xi'an 710032, China

Abstract:

Aiming at the problem of pointing error of laser spot in atmosphere environment, in combination with the approximate integration on the refractive index fluctuations of the modified Von Karman spectrum model and the Hufngel-Valley turbulence profile model, the pulse broadening and scintillation index of Gaussian pulsed beam in the far-field horizontal and slant path propagation in the turbulent atmosphere are studied. The relation between the light intensity distribution and pulse broadening of 1.06 quasi-monochromatic laser beam propagating in the far-field strong atmospheric turbulence are analyzed. The comparison and validation of the numerical results are presented, which show that the critical parameters affecting the pointing error are the optical wavelength and propagation distance. Theoretical analysis and experiment results show that application of the laser spot whole-field data and analysis result in the available error compensation method can make effective compensation to the pointing error. The laser pointing error is σA≤0.1mrad when the visibility of air in the range of 1km~3km.

Keywords: atmospheric environment; Gaussian-beam; pointing error; pulse broadening

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通讯作者: 吕宏(1975-), 男, 山西河津人, 博士, 主要从事激光大气传输理论及光通信技术研究。

作者简介:

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