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论文

相位光栅分离双波长宽角度光线的理论分析

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摘要:

使用衍射光栅的分色分光方式一般以平行光入射情况为讨论基础,对于非平行光入射的情况讨论较少.本文基于菲涅尔衍射理论和角谱理论,将球面波与平面波的衍射波场联系起来,从而在传播函数中引入角度参量,结合分数泰伯效应的理论基础,推导出双波长宽角度入射光线经相位光栅衍射后的波场分布函数,并对推导出的函数进行数值模拟,得到像面不同位置衍射波场分布.与平行光入射时的标准波场分布相比较,得到宽角度入射时的衍射波场的横向展宽量和偏移量.通过调节光栅台阶的宽度,改变衍射场的展宽和偏移,使各个单一波长的衍射波场宽度小于光栅周期的一半,从而减少双波长光衍射波场的混叠.同时本文给出波场宽度与光栅台阶宽度的变化关系,选取光栅面上多个位置作为台阶宽度的计算点,并对整个光栅的台阶宽度进行曲线拟合,得到可以使双波长宽角度入射光实现良好空间分离的光栅参量.该结果可用于各类宽角度入射光线的光谱分离场合,如双波长成像、液晶显示和液晶投影等.

关键词: 衍射分光 宽角度入射 相位光栅 双波长 泰伯效应

Theoretical Analysis of dual Wavelength and Wide-angle Light Spatial Separation by Phase Grating

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Abstract:

Existing color separation diffraction grating spectroscopic methods are generally discussed on parallel incident light,and there is little discussion of the case of non-parallel incident light.Based on the Fresnel diffraction theory and the angular spectrum theory,the spherical wave propagation field and plane wave diffraction wave field are linked together,and angle function parameters are imported.Combined with fractional Talbot effect theory,the dual-wavelength wide-angle incident wave field function is derived.The numerical simulation of the function is presented to calculate the diffraction distribution in different locations,which are compared to standard parallel incident wavefield distribution and calculated horizontal broadening and offsets.By adjusting the width of grating steps,the diffraction field broadening and offset is compensated.Each single-wavelength diffraction width is less than half of the grating period,thereby reducing the dual-wavelength optical diffraction aliasing.In this paper,the relation between the wave field width and grating step width is presented.The step width curve is fitted based on multi calculate points on the phase grating and the grating parameter can be used to achieve well spatial separation of dual-wavelength wide angle incident light.The result is available for a variety of wide angle incident situation,such as dual-wavelength imaging,LCD display,LCD projection,etc.

Keywords: Diffraction light split Wide-angle incidence Phase grating Dual wavelength Talbot effect

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