

## 论文

### 利用相位模板实现数字全息超分辨成像

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#### 摘要:

为了简化数字全息超分辨记录系统, 分别在其物光和参考光部分引入一块相位模板, 以获得垂直和倾斜方向照明物体的光束和具有不同载波频率的参考光束. 当这些具有不同照射方向的光透过物体后, 可以使CCD在位置固定的情况下记录到携带低频和高频信息的物体衍射场, 不同载波频率的参考光则保证了高频和低频信息在复合全息图的频谱面上能够相互分离. 实验结果证明, 通过将记录到的物体高频和低频信息合成, 可以获得超出系统衍射极限分辨率的再现像.

关键词: 相位模板 数字全息术 合成孔径技术 超分辨成像技术

## Digital Holographic Super-resolution Imaging with Phase Mask

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#### Abstract:

In order to simplify the super-resolution imaging system, a phase mask is proposed and introduced into the object and reference beams part of the digital holographic recording system, respectively, to produce the on-axis and off-axis illumination beams and the sub-reference beams with different carrier frequency. The diffraction fields containing the low and high frequency information can be recorded by the CCD sensor whose position is fixed during the recording process with different illumination beams produced by phase mask. The low and high frequency information can be separated by reference beams with different carrier frequency in the spectrum plane of the composite hologram. After the frequency filtering followed by an inverse Fourier transform, the low and high frequency information can be obtained, and the object wavefront containing the low and high frequency information at the object plane can be obtained by calculating the Fresnel diffraction and removing the additional phases introduced by the object illuminations. The reconstructed image can be obtained by synthesizing the wavefront containing low and high frequency information of the recorded object. It can be known from the experiment that the resolution of the synthesized image is over that determined by the numerical aperture of the recording system.

Keywords: Phase mask Digital holography Synthetic aperture Super-resolution imaging

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