

液晶与显示 2011, 26(6) 818-822 ISSN: CN:

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基于小波变换的ESPI图像去噪及边缘提取

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摘要： 电子散斑干涉条纹的强噪声特性使其信噪比过低,常用的图像滤波方法对于散斑干涉条纹都存在一定的不足。针对散斑条纹的特点,建立了自适应滤波与小波变换相结合的组合迭代滤波方法。在对散斑条纹预处理基础上,通过选择不同的小波函数以及更改分解层次和函数中的阈值达到不同的滤波效果。经反复试验,对于不同的小波基,采用4层分解,阈值为0.15~0.3时与自适应滤波的迭代效果最好。在滤波的基础上对图像进行了二值化,并采用Sobel算子对其进行边缘提取,最终得到电子散斑干涉条纹的边缘分布图。结果表明,该方法可以有效消除条纹图中的散斑噪声,并且条纹的边缘得以较好的保留。

关键词： 电子散斑干涉 小波滤波 迭代滤波 边缘提取

ESPI Image Denoising and Edge Extraction Based on Wavelet Transform

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Abstract: The high noise of ESPI(Electronic Speckle Pattern Interferometry) fringe pattern leads to the low ratio of signal-to-noise, there are some drawbacks of common image filtering method used in the speckle interferometry fringe pattern. According to the characteristics of speckle fringe pattern, the iterative filtering method based on adaptive filter and wavelet transform was established. On the basis of speckle fringe image pretreatment, the different wavelet functions, decomposition levels and threshold were chosen to achieve the different filtering effect. The repeated experiments proved that the iterative filter effect is the best when the threshold is 0.15~0.3 and wavelet function with the 4 layer decomposition, and then the image binarization and edge detection was carried out using Sobel operator, finally the marginal distribution of ESPI fringe pattern was obtained. The experiment results indicate that the method is able to achieve a good effect in the respect of speckle noise removal and edge preservation during the process.

Keywords: ESPI pattern wavelet filter iterative filter edge extraction

收稿日期 2011-04-12 修回日期 2011-05-14 网络版发布日期 2011-12-20

基金项目:

国家自然科学基金(No.60538020)

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