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Directional Moiré Boosting Using Spatial Filtering

Joydeep Chatterjee
Department of Applied Optics and Photonics, University of Calcutta, Kolkata, West Bengal, India

Abstract: Overlapping of two or more grating structures of small frequency differences gives rise to the Moiré patterns. While the overall moiré patterns are widely studied, in many cases – specially in case of a zonal fringe analysis – zone or direction based highlighting or suppression of moiré patterns are very helpful. This paper presents a simple method for directional boosting of moiré patterns, generated using Spatial Light Modulator (SLM) based interferometric setup, using the spatial filtering technique.

Keywords: Moiré, Spatial Filter, Directional Boosting, Interferometry, Spatial Light Modulator, Optics

I. INTRODUCTION

Moiré patterns are the results of two or more grating structures with very small differences in their frequencies. Besides wide presence in the domain of electronic imaging, the optical setup based (using LASER etc.) moiré have proven their usefulness over the years. But, in most of the cases one has to work with the entire moiré fringes. Availability of a technique to zonally or directionally boost or suppress the moiré fringes can be more convenient to work with in many focussed and directionally varying sample analysis and computational load reduction. This paper presents a simple method for directional moiré boosting using spatial filters.

II. LITERATURE SURVEY

Lord Rayleigh [1] did some early research on the moiré patterns. Amidror et al. [2,3] and Patorski et al. [4] did some intense theoretical research on moire patterns. Caldero´n-Hermosillo et al. [5] used the moiré technique on complex amplitude of the Spatial Light Modulator. The moiré technique has also been applied to the structural illumination microscopy [6,7]. Yu et al. [8,9] worked on the visible moiré patterns and the influence of different grating frequencies on the resulting moiré patterns. Joydeep [10] has shown a method for experimental variation of shape of the moiré patterns generated using interferometry and a Spatial Light Modulator. Directional edge boosting has been used in imaging previously [11-14].

III.PROPOSED METHOD

The moiré generation part of the experimental setup is similar to that in one of my previous papers [10]. First, the LASER beam from a 632.8 nm He-Ne LASER source is expanded with the help of a beam-expander and split by a beam-splitter with one beam falling on the Spatial Light Modulator (SLM) and the another part falls on a mirror. The resulting interferometric fringe and the circular grating pattern generated on the SLM overlap to form the moiré pattern.

This moiré pattern is Fourier transformed. Then spatial filter comes into play. The used spatial filter is shown in Fig. 1. In this filter, the white part has the value 1 while the dark portion corresponds to the value 0. The spatial filter is placed at the plane of the Fourier transform of the moiré pattern and then it is inverse Fourier transformed. Now, changing the orientation of the spatial filter, different segments of the moiré pattern can be boosted up compared to other portions of the moiré pattern as shown in Fig. 2.

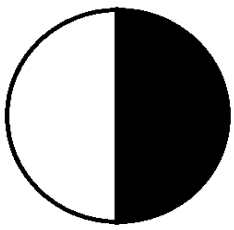

Fig. 1 The spatial filter used.

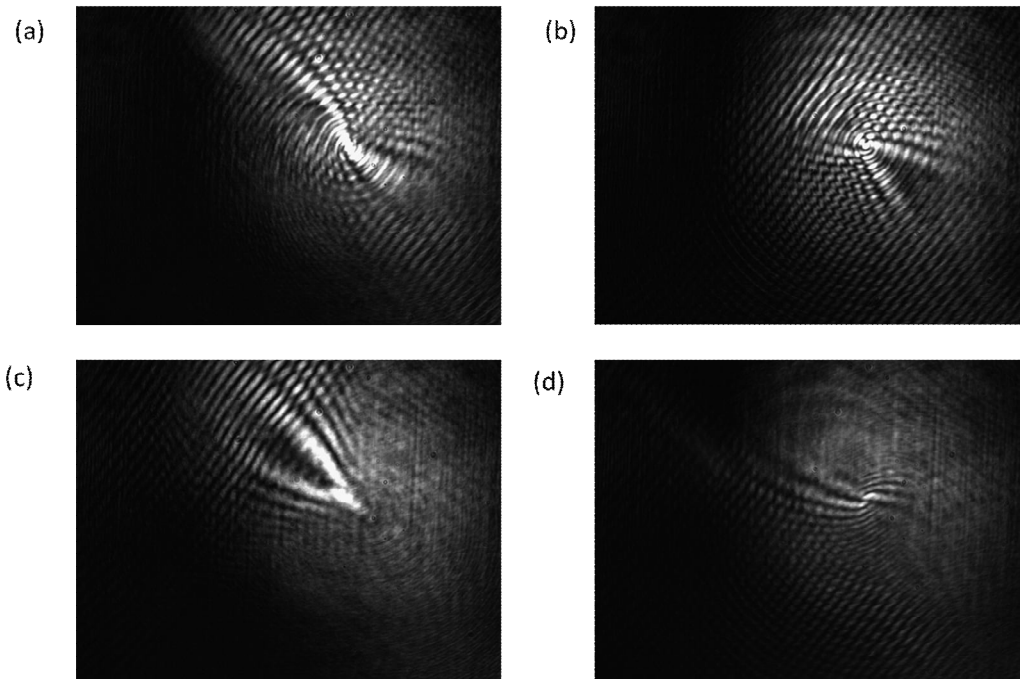

Fig. 2 Different directionally boosted moiré patterns.

IV. CONCLUSIONS

From the results, it is clear that for different orientations of the spatial filter, different portions of the moiré pattern have been boosted up successfully. The results have been obtained in the real time. This setup is highly customizable and quite simple.

V. ACKNOWLEDGMENT

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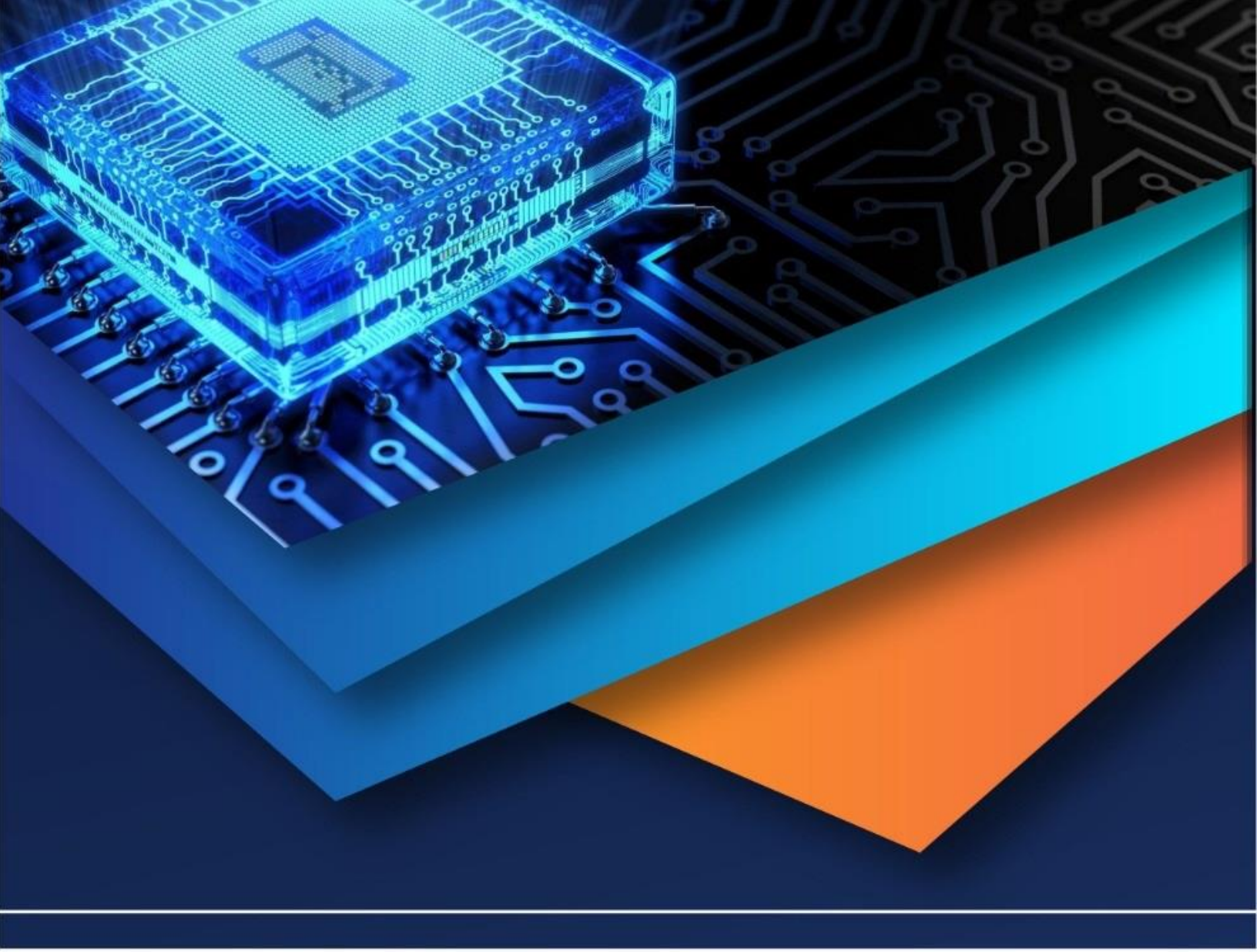

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