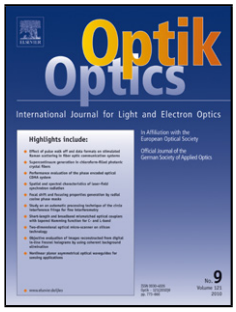

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PII: S0030-4026(17)31286-X
DOI: https://doi.org/10.1016/j.ijleo.2017.10.073
Reference: IJLEO 59809

To appear in:

Received date: 22-3-2016
Revised date: 15-10-2017
Accepted date: 15-10-2017

Please cite this article as: P.P.Padghan, K.M.Alti, Impact of multiple usages of digital filters on speckle contrast and phase maps, Optik - International Journal for Light and Electron Optics https://doi.org/10.1016/j.ijleo.2017.10.073

Impact of multiple usages of digital filters on speckle contrast and phase maps

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Abstract

Various digital filters have been use to remove unwanted noise in speckle pattern used in the field of Electronic speckle pattern interferometer (ESPI). However, multiple usages of these digital filters can contribute to significant drop in speckle contrast leading to loss of phase information. This paper reports effect of multiple usages of various digital filters namely, Median, Gaussian and Average on the speckle contrast and ultimately on the phase maps. This study also compares effectiveness of these three digital filters in removing noise from speckle patterns.

Keyword: Electronic speckle pattern interferometer; Digital filtering; Speckle contrast; Wrapped and Unwrapped Phase Map.

Introduction

Electronic speckle pattern interferometer (ESPI) is a widely used technique to quantify roughness/deformation of the object. It was first developed by J. Butters, J. Leendertz in 1970 [1]. Nowadays, ESPI technique is used widely to remotely quantify the roughness/deformation of an object. Wide varieties of objects, from soft condensed matter to metallic disk to thin films are probed using the ESPI technique [2-4]. By knowing the phase of the correlation fringe pattern, amplitude of deformation can be calculated. There are various ways developed over the years to determine the phase of the correlation fringe pattern. Among all the ways, temporal phase shifting techniques are popularly used by many researchers [5]. For determining the phase information, high quality speckle patterns are required. Quality of a speckle pattern is generally measured in terms of speckle contrast which is defined as following [6],