ANALYSIS OF FRINGE PATTERNS WITH VARIABLE DENSITY USING MODIFIED VARIATIONAL IMAGE DECOMPOSITION AIDED BY HILBERT TRANSFORM

Cywińska M., Trusiak M., Patorski K.

Warsaw University of Technology, Institute of Micromechanics and Photonics, Warsaw, Poland

Analysis of fringe patterns with greatly variable density is a huge challenge for the single-frame fringe pattern analysis algorithms. The wide range of spatial frequencies contained in the single image widens the Fourier spectrum and makes the separation of the information difficult or even impossible. The background and information differentiation is also a challenging task in the case of Hilbert transform data preprocessing. On the other hand single-frame fringe pattern analysis algorithms need to be taken into the consideration and developed because of their ability of analyzing transient events.

One of the newest phase demodulation method is the Hilbert spiral transform (HST). At the output of the HST we are getting the fringe-signal which is in quadrature with the input fringe pattern. Both fringe-signals form the 2D analytic signal with phase and amplitude clearly defined by angle and modulus of this complex valued analytic fringe pattern. Nevertheless, HST input signal have to fulfill a few requirements: zero mean value (which can be obtained by successful background removal), low-pass amplitude modulation function (according to Bedrosian's theorem) and successful noise removal.

In this work the new approach to the preprocessing of images containing wide range of spatial frequencies will be introduced using modified variational image decomposition. By modifications we mean acceleration and better background and fringes differentiation. It will be also proven that quality of the preprocessing plays a key role in the phase demodulation process.

Received results will be compared with the ones given by the already well-established and versatile 2D Hilbert-Huang Transform technique.