

Phase-shift estimation from interferograms by histogram of phase difference

Jiancheng Xu and Yong Li

Summary

We propose a non-iterative approach to extract the unknown phase shift in phase shifting interferometry without the assumption of equal distribution of measured phase in $[0, 2\pi]$. According to the histogram of the phase difference between two adjacent frames, the phase shift can be accurately extracted by finding the bin of histogram with the highest frequency. The main factors that influence the accuracy of the proposed method are analyzed and discussed, such as the random noise, the quantization bit of CCD, the number of fringe patterns used and the bin width of histogram. It shows that the

average phase-shift extraction error is less than 0.01 rad when the number of fringe patterns used is 50, the signal-to-noise is 60dB and the bit of CCD is 8. Numerical simulations and optical experiments are also implemented to verify the effectiveness of this method. This method is well implemented in existing interferometers simply by incorporating a high-speed camera and choosing a proper preset phase shift. It has potential application for test and measurement of large-aperture optical elements.

