Microscopic measurement of Red Blood Cells using parallel phase shifting interferometry

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Abstract.

In this research, an interferometric technique is presented for the calculation of the optical path difference (OPD) induced by a red blood cell (RBC) to measure its 3D phase profile, allowing the examination of its morphology which is very important in the biomedical field to diagnose diseases. The developed system is based on a polarized cyclic path interferometer with a nonpolarizing beam splitter in the output, which generates two interferograms with relative phase shifts of $\pi/2$. From these two interferograms, which are captured in single-shot of the camera, it is possible to measure the optical phase map using a regularized optical flow algorithm developed by Vargas-Quiroga. The presented measurement system is immune to vibrations caused by environmental disturbances, so it can be implemented outside the laboratory; additionally, the use of two interferograms simplify the number of phase steps required to find the optical phase, and it can be adapted to obtain the optical phase with four interferograms obtained in two shots. Using the proposed technique, the experimental results showing the 3D morphology of RBC are presented.