

Wide Area Quantitative Phase Microscopy by Spatial Phase Scanning Digital Holography

Researchers at the University of South Florida have developed a new technique of Digital Holographic Microscopy (DHM) which is suitable for large area quantitative phase microscopy. The newly developed technique can be useful in diverse applications such as fast scans of blood smear, cell and tissue cultures, and microelectronic surface profiles.

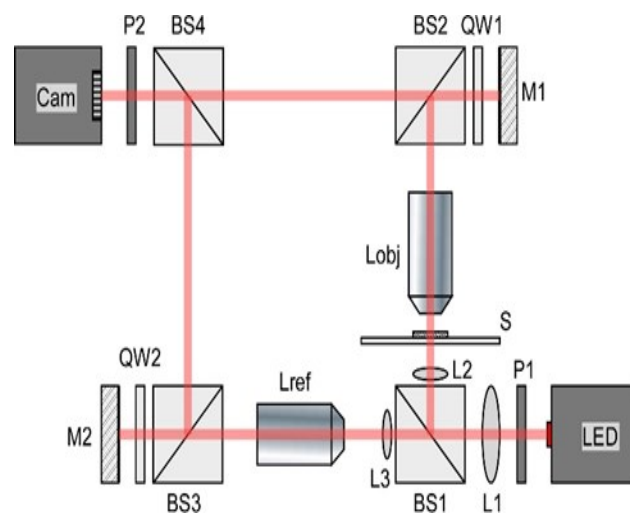
In DHM, the complex optical field of the light transmitted through or reflected from the object is reconstructed where the phase profile conveys subtle variations in both physical height and material refractive index. In certain types of applications, acquisition of high resolution image over a large area requires special consideration in order to optimize acquisition and processing speed, size of data set, and complexity of the system. When applied to phase shifting digital holography (PSDH) the multiple exposures of each field-of-view FOV requires stop-and-go motion that can cause problems in terms of speed, stability, and complexity of the system.

With this in mind, the USF inventors have developed a new technique dubbed spatial phase scanning (SPS) digital holography, where the object is scanned across 2- π phase variation of the reference field, instead of shifting the reference phase itself. This obviates phase shifting significantly reduces optomechanical complexity, as well as allowing continuous scanning of large area of the object. The preliminary experiments validated the principles of spatial phase scanning DHM for wide area quantitative phase microscopy. Processing of acquired data is straightforward as well and indefinitely long strip of holographic image can be acquired from a single scan.

ADVANTAGES:

- Good quality images are obtained
- Significantly reduces optomechanical complexity
- Allows continuous scanning of large area of the object

The System Consists of a Mach-Zehnder Interferometer for Linear Scan of the Object



Schematic Representation of the SPS DHM Apparatus