ALTERNATIVE IMPLEMENTATIONS OF THE PYRAMID PHASE MICROSCOPE

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The Pyramid Phase Microscopy (PPM)[1], is a non-diffractive and non-interferometric quantitative phase microscopy modality, that has several advantages over others, the most significant being its low instrumentation complexity, its robustness against noise and mechanical stability and the capability of real time imaging. The technique is based on splitting the light to form, on an array sensor, four modified sub-images of the sample. This division can be attained using a glass pyramid[1] or other refractive element[2]. The combination of these sub-images produces a normal microscope image and a bidimensional map of point-by-point sample-induced phase gradients.

The technique was demonstrated on an experimental optical bench prototype[1] which provided limited image quality. In the path to fulfill the PPM potential, a new refined optical system has been developed adapting the system to the camera port of a commercial inverted microscope that uses an improved illumination. In this presentation we will show the details of this new system and images obtained using a high NA objective.

Finally, we will also address the problem of a restricted image field caused by the necessary accommodation of the sub-images in the sensor area. The use of a liquid crystal[3], operating as an intensity modulator (see Fig. 1), will be presented as a simple alternative to the glass pyramid and as a method of implementing the PPM without field limitation.

Fig 1. (a) Set of the images of microspheres corresponding to the binary patterns shown in the upper row; (b) the gradients in orthogonal directions

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