SCANNING OPTICAL MICROSCOPE WITH PROGRAMMABLE ILLUMINATION BEAM INTENSITY

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KEY WORDS: Confocal microscope, computer generated holography, signal to noise ratio, liquid crystal spatial light modulator.

1. INTRODUCTION
Conventional scanning optical microscopes such as the confocal microscopes [1] use an illumination beam for imaging the sample whose intensity is constant for the entire image frame. However light emitted or scattered by the sample may vary from region to region. As the number of photons, reaching the image plane from a certain sample point, determine the signal to noise ratio (SNR), hence, in practice the SNR over the entire image plane is not constant. For instance, in the case of reflected light microscopy, the region in the sample plane having high reflectivity will have high SNR relative to regions having low reflectivity. In this paper we propose a point scanning optical microscope using the principle of computer generated holography in which the intensity of the illumination beam can be modulated programmably so that the variation in SNR over a single image frame is minimized.

2. METHODOLOGY AND RESULTS
We implement binary diffraction hologram using a computer controlled liquid crystal spatial light modulator (LCSLM) to generate a diffracted beam whose amplitude and phase can be programmably described [2]. A scanning optical microscope in the reflection mode is constructed [3] which uses the diffracted beam as the illumination beam that can be scanned over the sample plane without the use any galvo based scanner. Knowing the reflectivity profile of the sample plane a computer program can generate a sequence of appropriate binary holograms to write on the LCSLM so that the intensity of the illumination beam is modulated to enhance the SNR in the region of sample plane having poor reflectivity. Thus the final image, which requires two scanning over the sample plane, will have more uniform SNR for the entire image frame. Figure 1(a) and (b) show the diffraction patterns corresponding to two diffracted beams. In this paper we will present computer simulation results and proof of concept experimental results to demonstrate the advantages of the proposed technique.

3. REFERENCES