SMART BioSyM Seminar

Deep Tissue imaging using Focal Modulation Microscopy

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SMART Enterprise Wing Level 5,
Perseverance Rooms 1 & 2

Abstract

Line-scan focal modulation microscopy is a high-speed, high-resolution imaging technique capable of imaging deep in biological tissues. Focal modulation microscopy (FMM) is an emerging microscopy technique that uses a phase modulator in the excitation path to achieve modulated illumination confined to the focal plane. The resulting emissions from the focal plane are also therefore modulated. By filtering out the non-modulated emissions from the total signal, the contribution of scattered photons in the excitation path can be removed, thereby improving the SBR and allowing deeper imaging in optically thick tissues. We describe the development of a line-scanning FMM system which uses a cylindrical lens to condense the light beam in one dimension to from a line focus. A 1D fast galvanometer scanner scans the line across the sample. Phase modulation at the focal plane is achieved by using a tilting glass-plate modulator. The image of the line emission is scanned across a 2D camera using a second synchronized galvanometer scanner. The performance of the microscope is validated by imaging fluorescent beads embedded in a scattering gel. We demonstrate the improved signal-to-background ratio for the line-scan FMM system compared to line-scanning confocal systems even at depths >100 µm. Thus this system retains its sectioning capability even at great depths. The line-scan FMM system has been used to image the blood flow in various zebrafish models. Comparison of the line-scan FMM image with different commercial confocal systems shows that the FMM system has improved spatial and temporal resolution, thus making it a powerful tool for *in vivo* imaging.

Biography

Shilpa Pant is pursuing her PhD at the National University of Singapore under the supervision of Dr Nanguang Chen. She is working on the development of a high-speed, high resolution line-scan focal modulation microscope for deep imaging in optically thick tissues. Shilpa did her Masters in Biomedical Engineering from the University of Florida and her Bachelor of Engineering degree from the University of Pune. She worked as a research officer at the Singapore Bioimaging Consortium, A*STAR before starting her PhD. There she worked on translational MRI imaging studies on small animal models, NMR profiling of biological samples and stem cell targeted imaging using dual mode magnetic and fluorescent quantum dots.