Augmented line-scan focal modulation microscopy for in vivo imaging of zebrafish heart

Shilpa Pant, Yubo Duan, Fei Xiong, and Nanguang Chen
Department of Biomedical Engineering, National University of Singapore, S117583, Singapore
biecng@nus.edu.sg

ABSTRACT

Zebrafish has become a popular small animal model for biological and pharmaceutical researches. The relative small size of Zebrafish and its weak scattering/absorption properties allow three-dimensional imaging of the whole body with high spatial resolution. Wide-field optical microscopy and confocal microscopy are not ideal solutions for in-vivo visualization due to limited optical sectioning or imaging speed, respectively. Line scan focal modulated microscopy (LSFMM), a proprietary technique highly suitable for Zebrafish imaging, has been developed in the Optical Bioimaging Lab at NUS[1]. It features parallel light sheet illumination and parallel detection, leading to much improved imaging speed (over 100 frames per second) without compromising the optical sectioning capability.

Augmented line-scan focal modulation microscope (aLSFMM) provides further image quality enhancement by merging the information from both LSFMM and line-scan confocal microscopy (LSCM). Such a hybrid imaging scheme features very low excitation light power, and therefore much reduced photobleaching that is desirable for three-dimensional (3D) and four-dimensional (4D) image acquisition.

[1] S. Pant et al., "Line-scan focal modulation microscopy," Journal of Biomedical Optics **22**(5), 050502-050502 (2017).