

REAL-TIME THREE DIMENSIONAL MEMS BASED BIO-PHOTONIC IMAGING FOR CLINICAL ENVIRONMENTS

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Optical coherence tomography (OCT) is an emerging imaging modality capable of achieving high resolution cross-sectional images in tissue and other materials. Due to the non-destructive nature of low-power optical imaging technologies, bio-photonics has become a major area of research focus in both academia and industry. In particular, OCT has received a great deal of attention in the fields of biology and medicine. This is due, in part, to the fact that in addition to providing high resolution non-destructive tomographic imaging capabilities, OCT provides the opportunity to simultaneously realize real-time visualization of tissue structure and blood flow in a non-invasive, or minimally invasive, manner.

Currently imaging technologies such as ultrasound and Doppler ultrasound are employed to obtain minimally invasive, *in-vivo*, real-time images of tissue structure and blood flow profiles. However, the spatial resolution of these techniques is limited to approximately 100 μ m due to the relatively long wavelength of acoustic waves. OCT takes advantage of the short coherence length of broadband light sources in order to achieve cross-sectional images with micrometer (2-10 μ m) scale resolution. Due to the limited penetration depth of OCT systems in most biological tissue (approximately 2-3mm) miniaturized endoscopic probes are required for imaging of internal organs and tissue. Advances in silicon micromachining and micro-electromechanical systems (MEMS) technologies provide an enabling technology, allowing a new approach to be taken in order to achieve high-speed, high resolution OCT imaging. The small physical size of MEMS optical components is highly advantageous when building miniaturized, portable scanning heads, hand-held scanners and minimally invasive endoscopic probes. In addition, MEMS technologies allow the realization of miniature optical systems exhibiting high speed, high resolution and low power operation.