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High resolution imaging of *in vivo* cardiac dynamics using color Doppler optical coherence tomography

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Abstract

Color Doppler optical coherence tomography (CDOCT) is a noninvasive technique for simultaneous high spatial resolution (~20 μm) imaging and high velocity resolution (~500 μm/s) imaging flowmetry in living tissues. In this paper, we demonstrate a reconstruction method which overcomes fundamental limitations on Doppler flow mapping associated with both high- and low-speed imaging. This algorithm is successful in retaining the high velocity resolution of CDOCT while eliminating motion artifact caused by slow image acquisition in samples which exhibit repetitive motion. We demonstrate reconstruction of blood flow throughout a beating *Xenopus laevis* heart and surrounding vasculature using gated CDOCT reconstruction.

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Adrian Mariampillai, Beau A. Standish, Nigel R. Munce, Cristina Randall, George Liu, James Y. Jiang, Alex E. Cable, I. Alex Vitkin, and Victor X.D. Yang
Opt. Express **15**(4) 1627-1638 (2007)

In vivo bidirectional color Doppler flow imaging of picoliter blood volumes using optical coherence tomography
Joseph A. Izatt, Manish D. Kulkarni, Siavash Yazdanfar, Jennifer K. Barton, and Ashley J. Welch
Opt. Lett. **22**(18) 1439-1441 (1997)

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About

We previously reported a Doppler optical coherence tomography (DOCT) system design [1] for high-speed imaging with wide velocity dynamic range (up to 28.5 dB when acquiring 8 frames per second), operating at 1.3 m with a coherence length of 13.5 m. Using a developmental biology model (Xenopus laevis), here we test the DOCT system's. ability to image cardiac dynamics in an embryo in vivo, with a simple hand-held scanner at 4 ~ 16 frames per second. In particular, we show that high fidelity DOCT movies can be obtained by increasing the reference arm scanning rate (~8 kHz). PDF | Color Doppler optical coherence tomography (CDOCT) is a functional extension of optical coherence tomography (OCT) that can image flow in turbid | Find, read and cite all the research you need on ResearchGate. This Doppler processing method is compatible with a high speed OCT system capable of imaging in real time. Using this system, we demonstrate cross-sectional imaging of bidirectional flow with CDOCT at four frames per second in a tissue-simulating phantom consisting of intralipid solution flowing in glass capillaries. As a demonstration of real-time imaging of blood flow in vivo we imaged pulsatible blood flow in a rat femoral artery at eight frames per second. aging of in vivo cardiac dynamics using color Doppler optical coher-. Real-time. In Vivo. Optical coherence tomography is a widely used high-resolution optical imaging technique, which is typically applied to transparent or semi-transparent objects of limited depth – in particular, to biological tissues. It is suitable for various applications in medical imaging such as ophthalmology (e.g. retinal imaging for diagnosing conditions like glaucoma or macular degeneration), dermatology, oncology (cancer detection) and cardiology; the capability of high-resolution (possibly sub-micrometer) real-time in-vivo imaging makes OCT a valuable tool for the diagnosis of many different medical co… J. A. Izatt et al., “In vivo bidirectional color Doppler flow imaging of picoliter blood volumes using optical coherence tomography”, Opt. Lett. The use of color flow Doppler (CFD) or color Doppler imaging (CDI) (or simply color Doppler) sonography allows the visualization of flow direction and velocity within a user defined area. A region of interest is defined by the sonographer, and th… The use of color flow Doppler (CFD) or color Doppler imaging (CDI) (or simply color Doppler) sonography allows the visualization of flow direction and velocity within a user defined area. A region of interest is defined by the sonographer, and the Doppler shifts of returning ultrasound waves within are color-coded based on average velocity and direction.