Gabor fusion master slave optical coherence tomography

This paper describes the application of the Gabor filtering protocol to a Master/Slave (MS) swept source optical coherence tomography (SS)-OCT system at 1300 nm. The MS-OCT system delivers information from selected depths, a property that allows operation similar to that of a time domain OCT system, where dynamic focusing is possible. The Gabor filtering processing following collection of multiple data from different focus positions is different from that utilized by a conventional swept source OCT system using a Fast Fourier transform (FFT) to produce an A-scan. Instead of selecting the bright parts of A-scans for each focus position, to be placed in a final B-scan image (or in a final volume), and discarding the rest, the MS principle can be employed to advantageously deliver signal from the depths within each focus range only. The MS procedure is illustrated on creating volumes of data of constant transversal resolution from a cucumber and from an insect by repeating data acquisition for 4 different focus positions. In addition, advantage is taken from the tolerance to dispersion of the MS principle that allows automatic compensation for dispersion created by layers above the object of interest. By combining the two techniques, Gabor filtering and Master/Slave, a powerful imaging instrument is demonstrated. The master/slave technique allows simultaneous display of three categories of images in one frame: multiple depth en-face OCT images, two cross-sectional OCT images and a confocal like image obtained by averaging the en-face ones. We also demonstrate the superiority of MS-OCT over its FFT based counterpart when used with a Gabor filtering OCT instrument in terms of the speed of assembling the fused volume. For our case, we show that when more than 4 focus positions are required to produce the final volume, MS is faster than the conventional FFT based procedure.

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