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Department of Electrical and Computer Engineering

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Title: *« Novel Techniques for Resolution Improvement in Optical Coherence Tomography»*

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Abstract: Optical Coherence Tomography (OCT), a method for cross sectional tissue imaging, is gaining significant ground as diagnostic tool in various fields. However many early disease changes remain below the resolution of the technique. In OCT the resolution is fundamentally limited by the spectrum of the laser source and the optics used. Enhancements can only be marginal since the spectral increase required for further axial resolution improvement cannot be supported even by the highest end lasers. The lateral resolution of OCT can be improved by use of high numerical aperture (NA) objectives. However, use of a high NA objective restricts the depth of focus. In this presentation we propose some novel methods for axial and lateral resolution improvement which are independent from the above limitations, providing the opportunity for cellular and subcellular resolution imaging, without increasing the cost and complexity of the system. A method for axial resolution improvement was developed, which was based on the modulation of the axial PSF of the system. With this method the axial resolution could be improved by a factor of 7. The application of this method in Time Domain OCT differs significantly from that in Frequency Domain OCT systems. However different formulations have been developed for both. Their mechanical basis and experimental validation will be presented. Also a method for lateral resolution improvement based on the oversampling of the OCT images was developed. The information in the oversampled OCT images was used to estimate the locations of multiple scatterers, assuming each contributes a weighted portion to the detected signal. This method was applied to laterally oversampled OCT images, and a resolution improvement of a factor of 3.7 was experimentally demonstrated. The development of the above methods can significantly improve the resolution of OCT images allowing imaging of diagnostically crucial cellular level characteristics. Such technological improvement can increase the effectiveness of OCT as a tool for diagnosis of very early cancer and other diseases

Biography: Evgenia Bousi received the Diploma degree (BSc/MSc) in Electrical and Computer Engineering from the National Technical University of Athens, Greece in 2004, and the PhD degree in Electrical Engineering from the University of Cyprus in 2012. From 2004 to 2005 she was a software engineer at the software centre of Siemens, Greece. From 2005 to 2007 she was a research assistant at the Biomedical Imaging and Applied Optics Laboratory, University of Cyprus. She is currently a Research Fellow at KIOS Research Center for Intelligent Systems and Networks of the University of Cyprus. Her research interests include Optical Coherence Tomography, Biomedical Optics, Optical Imaging, Signal and Image processing and new technologies in clinical applications for the improvement of the diagnosis and treatment. She is involved in various projects funded by the University of Cyprus and the Research Promotion Foundation of Cyprus She is a member of the IEEE, and the Technical Chamber of Cyprus (ETEK) and Greece (TEE).