SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

MEDICAL APPLICATION AND TECHNOLOGY DEVELOPMENT OF PHOTOACOUSTIC MICROSCOPY

PhD Preliminary Research Examination

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Abstract: In current clinical imaging, tools such as magnetic resonance imaging, computed tomography, positron emission tomography, and ultrasound imaging have been adopted for vascular imaging. However, these techniques often lack either sufficient spatial resolution or satisfactory contrast to be effective for microvascular imaging. To bridge this gap, optical resolution photoacoustic microscopy (OR-PAM) has been widely used to reveal the physiologically specific absorption signature of endogenous chromophores, such as hemoglobin and melanin *in vivo*. More importantly, with spectroscopic measurements, OR-PAM can quantify hemoglobin oxygenation and blood flow velocity within single vessels. Here, we demonstrated the first *in vivo* photoacoustic measurement of the pulse wave velocity (PWV) in the mouse peripheral vasculature. Moreover, the depth of focus (or focal zone) of conventional OR-PAM is often insufficient to encompass the depth variations of features of interest, particularly the vasculature in the brain and bumpy tumors. As a result, the image quality of out-of-focus blood vessels is compromised due to poor spatial resolution and a low signal-to-noise ratio (SNR). We developed a continuous 3-D motorized contour-scanning OR-PAM for *in vivo* imaging through uneven tissue surfaces. Furthermore, the monitoring of rapid hemodynamic processes on the second-to-minute timescale has been limited by the inability to simultaneously achieve a high scanning speed and a wide FOV; therefore, we present three-dimensional arbitrary trajectory (3-DAT) OR-PAM to address the aforementioned challenges. In 3-DAT OR-PAM, the scanning path follows selected vessels. Such a technical innovation significantly improves the scanning speed by excluding extraneous regions. To further demonstrate OR-PAM's potential for medical applications, we will monitor the metabolic rate of oxygen in a renal tumor model. To further improve PWV measurement accuracy, we propose a simultaneous dual-PWV measurement method based on a digital micromirror device (DMD).

DATE:	Friday, May 9, 2014
TIME:	9:10 a.m.
PLACE:	Green Hall, Room 0120

Thesis advisor:
Dr. Lihong Wang

This seminar is in partial fulfillment of the Doctor of Philosophy degree

Washington University in St. Louis
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