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ELECTRICAL & COMPUTER ENGINEERING
TEXAS A&M UNIVERSITY

S E M I N A R

Room 1003 ETB

December 2, 2014 3:55-5:10 P.M.

MEMS Acoustic Delay Lines and Multiplexers for Photoacoustic Imaging

by

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Abstract: In current photoacoustic tomography (PAT), the photoacoustic (PA) signals generated from the imaging target were usually received by using an ultrasonic transducer array followed by multi-channel data acquisition (DAQ) electronics. The imaging capability (e.g., resolution and frame rate) of the PAT system is largely determined by the size of the transducer array and the number of DAQ channels. However, as the number of transducer elements and DAQ channels increases, the PAT system will become more complex and costly. Electronic multiplexing has been used to reduce the number of DAQ channels by selecting and serially receiving PA signals from multiple transducers. However, the transducer array and its sophisticated electrical interface still remain. As an elastic material, single-crystalline silicon (SCS) provides both outstanding mechanical and acoustic properties, such as low acoustic attenuation even at high frequencies. With recent development of deep etching processes, it is possible to use SCS as the structural material for making high-performance micro acoustic delay line circuits to enable direct acoustic signal processing.

In this talk, a new MEMS acoustic delay line (ADL) array and a new MEMS acoustic multiplexer will be presented. By using the ADL array to transmit the PA signals emitting from an imaging target, the time-delayed PA signals can be combined into one acoustic signal channel and received unambiguously even with one ultrasound transducer. In addition, by employing an acoustic multiplexer, multiple channels of acoustic signals can be selectively relayed onto one transducer and received in a time series by using only one DAQ channel. Both the ADL array and the acoustic multiplexer could open new venues for ultrasound transceiver designs for photoacoustic imaging without the need of complex transducer arrays and data acquisition electronics.

Dr. Jun Zou is currently an associate professor in the Department of Electrical and Computer Engineering, Texas A&M University, where he directs the Micro Imaging and Sensing Devices and Systems Lab. His research interests lie in the development of novel micro sensors, actuators and systems for bio-sensing and bio-imaging applications.