IEEE SF Bay Area MEMS and Sensors Chapter

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Low Power MEMS-Enabled Wireless Transceivers

Speaker: Prof. Clark T.-C. Nguyen, University of California at Berkeley.
Date/Time: Wednesday, Sept. 23rd, 2015, 7:00 pm
Location: Texas Instruments Building E Conference Center, 2900 Semiconductor Dr., Santa Clara, CA 95052
Food: Pizza and beverages will be available starting at 6:00 pm for a donation at the door.
Sponsorship: Contact sfba-mems-officers@listserv.ieee.org if you are interested in sponsorship this meeting.

There are many mobile wireless capabilities quietly enabled by Microelectromechanical Systems (MEMS) technology, from inertial sensors that decide whether a phone should be in portrait or landscape mode, to FBAR duplexer filters that enable wireless communications in interference rich environments, to low-end timing oscillators needed by virtually all synchronous electronics. Recent research on higher end versions of the last of these (the oscillators) suitable for cell phone or other communication applications has shown that the extremely high Q's and low shunt capacitance offered by MEMS permits unprecedented low power performance, even achieving marks that meet the challenging GSM phase noise specification while consuming less than 10μW of power. The wake of results like this has now yielded a fully functional transceiver employing a single multi-port high-Q MEMS resonator as the operative element in a super-regenerative topology to both transmit and receive wireless FSK, with an initial demonstrated power consumption less than 490□W, and ultimate projections to less than 10□W. Another receiver using a similar topology, but employing instead a MEMS-based optomechanical oscillator, enables low power optical reception without the need for compound semiconductors. The most recent receiver harnesses resonant mechanical impact switching to enable continuous listening with zero power consumption, only consuming power when a valid input within its passband appears. This talk uses these and other examples to show how MEMS approaches to wireless communication can be very compelling for sensor network environments, e.g., the Internet of Things (IoT), where low power consumption is paramount.

Bio: Prof. Clark T.-C. Nguyen received the B. S., M. S., and Ph.D. degrees from the University of California at Berkeley in 1989, 1991, and 1994, respectively, all in Electrical Engineering and Computer Sci¬ences. In 1995, he joined the faculty of the University of Michigan, Ann Arbor, where he was a Professor in the Department of Electrical Engineering and Computer Science up until mid-2006. In 2006, he joined the Department of Electrical Engineering and Computer Sciences at the University of California at Berkeley, where he is presently a Professor and a Co-Director of the Berkeley Sensor & Actuator Center. His research interests focus upon micro electromechanical systems (MEMS) and include integrated micromechanical signal processors and sensors, merged circuit/microme¬chanical technologies, RF communication architectures, and integrated circuit design and technology. In 2001, Prof. Nguyen founded Discera, Inc., the first com¬pany aimed at commercializing communication products based upon MEMS technology, with an initial focus on the very vibrating micromechanical resonators pioneered by his research in past years. He served as Vice President and Chief Technology Officer (CTO) of Discera until mid-2002, at which point he joined the Defense Advanced Research Projects Agency (DARPA) on an IPA, where he served for nearly four years as the Program Manager for 10 different MEMS-centric programs in the Microsystems Technology Office of DARPA. Prof. Nguyen was the Technical Program Chair of the 2010 IEEE Int. Frequency Control Symposium and a Co-General Chair of the 2011 Combined IEEE Int. Frequency Control Symposium and European Frequency and Time Forum. He is an IEEE Fellow and served as a Distinguished Lecturer for the IEEE Solid-State Circuits Society from 2007 to 2009. From 2008 to 2013, Prof. Nguyen served as the Vice President of Frequency Control for the IEEE Ultrasonics, Ferroelectrics, and Frequency Control Society and is presently the President-Elect of the society.