



**IEEE Solid-State Circuits Society SSCS Distinguished Lecture  
IEEE SSCS/CASS Atlanta Joint Chapter Seminar**

**Title: CMOS Flow Cytometry using Multi-GHz Dielectric Spectroscopy**

**Speaker:** Dr. Jun-Chau Chien

**Affiliation:** Department of Electrical Engineering and Computer Sciences (EECS) at UC Berkeley

**Abstract:** Rapid cell identification in blood analysis for leukemia and HIV diseases using microfluidics and CMOS technology has the potential to reduce the costs and the testing time for point-of-care diagnostics. In the past, such an analysis requires labeling the cells with fluorophores and measurements using optical-based instruments, which limits the total assay time. In the pursuit of label-free techniques, I will discuss using dielectric spectroscopy as an analytic tool to analyze the cells based on the differences in their intracellular permittivity at microwave frequencies. In particular, I will focus on a sensor-on-CMOS approach, which reduces the post-fabrication complexity. From the electronic perspective, I will present the design of sensors that embeds injection-locked oscillators in an interferometric system architecture for high-resolution capacitance measurements at high speed. Various chopper stabilization techniques employing phase-, frequency-, and near-field modulations are studied for flicker noise reduction. The prototype sensor, implemented in 65-nm CMOS technology, consists of a distribution of four sensing channels that cover the frequency range from 6.5 to 30 GHz. After the integration of CMOS with microfluidics that performs hydrodynamic focusing, the experiments on polystyrene beads and insect cells are performed, demonstrating the sensor capability for high-throughput analysis (> 10 kcells/sec). I will also present other interesting molecular sensing applications including the measurements of glucose concentration and protein conformation changes using the proposed sensing platform.

**Speaker Biography:** Jun-Chau Chien received the B.S. and M.S. degrees in electronics engineering from National Taiwan University, Taipei, Taiwan, in 2004 and 2006, respectively, and Ph.D. degree in electrical engineering from University of California, Berkeley, in 2015. He is currently a postdoctoral research associate at University of California, Berkeley, and a circuit design consultant at HMicro Inc. He held positions at Xilinx and InvenSense in 2012 and 2015, respectively. His research topics include CMOS bio-sensor designs for single cell analysis, VNA calibration techniques at sub-THz frequency, and mixed-signal clock generation. Dr. Chien is the recipient of the 2014 Microwave Theory and Techniques Society (MTT-S) Graduate Fellowship for Medical Applications, the 2014 Solid-State Circuit Society (SSCS) Predoctoral Achievement Award, the 2013–2014 Outstanding Graduate Student Instructor Award, University of California at Berkeley, the 2007 International Solid-State Circuits Conference (ISSCC) Silkroad Award, and the 2006 Outstanding Research Award and Annual Best Thesis Award of the Graduate Institute of Electronics Engineering, National Taiwan University, Taipei, Taiwan. He is also the co-recipient of the 2010 Jack Kilby Award for Outstanding Student Paper for his work on a 90 GHz pulser with 30 GHz of bandwidth for medical imaging.



**Seminar Time:** 2:00PM-3:30PM on Dec 1<sup>st</sup> 2015

**Seminar Location:** Klaus Advanced Computing Building 1116 West, Georgia Tech

**Organizer:** Dr. Hua Wang, IEEE SSCS/CASS Atlanta Joint Chapter Chair, Assistant Professor, School of Electrical and Computer Engineering, Georgia Institute of Technology. Email: [hua.wang@ece.gatech.edu](mailto:hua.wang@ece.gatech.edu). Phone: (404) 385-6003