USC Viterbi
School of Engineering
Ming Hsieh Department of Electrical and Computer Engineering

Ming Hsieh Institute **Seminar Series**

Integrated Systems

Analog at the Extremes: Circuits from the Edge

Dr. Alyosha Molnar
Professor, Cornell University

Date: Friday, December 6th, 2024, Time: 2:00pm, Location: EEB 248

Zoom Meeting Link: https://usc.zoom.us/j/93310952640

Refreshments will be served

Abstract: For at least 3 decades techno-polemicists have been predicting the end of analog circuits, even as the field has exploded both commercially and academically. What is true, however, is that analog circuits have changed, as digital computation and analog-to-digital converters have improved by leaps and bounds, pushing many traditionally analog problems into the digital, and even software domain. Some problems, however, remain beyond the reach of purely digital solutions. These problems are characterized by either extremely constrained power and size, or by very high frequency, very high dynamic range requirements. At the same time, such circuits must be designed with a much more algorithm-aware mindset, as they rarely exist in a computation-free environment. I will discuss two examples of such circuits. The first example is a tiny (60µm x 300µm) neural implant, able to measure and transduce electrophysiological signals from neurons and transmit them wirelessly. These microscale optoelectronically transduced electrodes (MOTEs) can be entirely powered by light (from a 2-photon imaging setup, for example), at levels safe for the brain, while reporting both spiking and synaptic activity in-vivo. The second problem is high dynamic-range RF and mm-Wave receivers. I will discuss our work in N-path mixers and filters which have been shown to enable flexible, interference tolerant receivers, and discuss our recent work mapping N-path designs to mmWave frequencies, while maintaining the mixers' linearity and noise without burning excessive power. I will finish up by discussing of a new style of flexible receiver, which leverages circuit and algorithm co-design to generate diverse combinations of signal and interference artifact. These diverse channels then allow simple algorithms to identification and remove interference artifacts without prior knowledge of the interference itself.

Biography:

Dr. Alyosha Molnar received his B.S. in Engineering from Swarthmore College and his Ph.D. in Electrical Engineering from UC Berkeley. At Conexant Systems (1998-2002), he co-led the development of the first commercially successful cellular direct conversion receiver and fully integrated quad-band GSM transceiver. Currently the Ilda and Charles Lee Professor of Engineering at Cornell University, his research encompasses RF and mmWave integrated circuits, novel image sensors and processing, neural interface systems, and microscale autonomous systems. His graduate work included pioneering sub-milliwatt radios for "smart dust" and studying biological circuits in the mammalian retina. Since joining Cornell in 2007, his contributions have been recognized with several prestigious honors including the NSF CAREER Award, DARPA Young Faculty Award, ISSCC Lewis Winner Award, and the Darlington Best Paper Award.

Hosted by Profs. Hossein Hashemi, Mike Chen and Constantine Sideris
Organized by Soumya Mahapatra (smahapat@usc.edu)
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