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

Ming Hsieh Institute **Seminar Series**

Semiconductors and Microelectronics Technology

Unleashing the Power of Nano-Mechanics on Chip using CMOS-based Ferroelectric Hafnia

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Date: Monday, May 20, 2024
Time: 2:00pm – 3:30pm
Location: EEB 248

Abstract: The incorporation of nanoscale piezoelectric transducers into advanced semiconductor nodes enables the direct implementation of high-frequency nanomechanical resonators onto CMOS chips. The discovery of metastable ferroelectric phase in hafnia heralds the long-awaited arrival of this integrated piezoelectric transducer. Hafnia films, already utilized in amorphous form as high-k dielectrics in standard semiconductor processes, can be further engineered to stabilize in the ferroelectric phase with significant piezoelectric coupling. Hafnia piezoelectric transducers pave the way for the development of on-chip nanomechanical resonators with quality factors several orders of magnitude higher than solid-state counterparts. This exceptional performance, combined with seamless integration with electronic circuitry, enables the creation of on-chip clocks, local oscillators, and microwave filters, meeting the escalating frequency-control requirements in computing and communication applications. This presentation will provide an overview of Tabrizian Lab's work focusing on the development of nanoscale hafnia transducers and resonators, and their application in creating on-chip distributed clocks for massive computing and monolithic microwave spectral processors for adaptive wireless communication.

Bio: Roozbeh Tabrizian is an Associate Professor and the NELMS Rising Star Endowed Professor at the Department of Electrical and Computer Engineering, University of Florida. He received his B.S. (2007) degree in EE from Sharif University of Technology, Iran, and the Ph.D. (2013) degree in ECE from Georgia Tech. He was a Post-Doctoral Scholar (2014) at the University of Michigan. His research interests include semiconductor micro- and nano-electro-mechanical systems for frequency control applications; microwave acoustics; and novel ferroic materials and devices. Tabrizian has received the DARPA Director's Fellowship Award, a DARPA Young Faculty Award, and an NSF CAREER Award. He is an associate editor of the IEEE Journal of Microelectromechanical Systems (JMEMS) and Sensors and Actuators A: Physical. Tabrizian and his students are recipients of multiple outstanding paper awards at top-tier conferences such as IEEE MEMS, IEEE IFCS, IEEE IEDM, IEEE NEMS, and Transducers.

Hosted by Prof. J. Joshua Yang, Prof. Han Wang, Prof. Chongwu Zhou, Prof. Stephen Cronin, and Prof. Wei Wu.
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