

DSN-I Seminar Series

*Professor Gianluca Piazza*

Information Processing with Piezoelectric Micro and NanoElectroMechanical Systems

WHEN: September 19, 2014**WHERE:** Scaife Hall 125**TIME:** 3:30 p.m. - 5:00 p.m.**► Abstract**

MicroElectroMechanical Systems (MEMS) have become a commercial reality and are readily found in many electronic systems enabling unique signal processing and sensing functionalities in a small form factor. MEMS and their nano version, known as NanoElectroMechanical Systems (NEMS), would have greater transformative impact on the electronic industry if used in large arrays and directly or heterogeneously integrated with CMOS electronics. Large scale integration (LSI) of mechanical components could play a revolutionary role in information processing by providing efficient and alternative ways of performing computations.

This talk presents ongoing efforts in: 1) the development of piezoelectric NEMS relays for the synthesis of ultra-low-energy digital components and 2) the use of ovenized mechanical resonators for the implementation of energy efficient associative memories. Progress in material synthesis, and innovation in device design will be presented as the main factors that lead to the demonstration of highly scalable prototypes. Piezoelectric NEMS relays capable of very low leakage and milliVolt switching will be shown to enable new levels of energy efficiency for digital applications. Ovenized piezoelectric M/NEMS resonators capable of tuning their impedance when heated will be described as key building blocks for the implementation of novel and efficient ways to perform neuromorphic computations.

► Speaker Bio

Gianluca Piazza is the Sathaye Family Foundation Career Development Associate Professor in Electrical and Computer Engineering at Carnegie Mellon University. He also holds a courtesy appointment in Mechanical Engineering. Prior to joining CMU in 2012, he was the Wilf Family Term Assistant Professor in the department of Electrical and Systems Engineering at the University of Pennsylvania. His research interests focus on piezoelectric micro and nano electromechanical systems (M/NEMS) for RF wireless communication, chemical/biological detection, and all mechanical computing. He also has a general interest in the areas of micro/nano fabrication techniques and integration of micro/nano devices with state-of-the-art electronics. He received his Ph.D. degree from the University of California, Berkeley in 2005. He has more than 10 years of experience working with piezoelectric materials and devices. He holds several patents in the field of micromechanical resonators some of which have been acquired by industry. He received the IBM Young Faculty Award in 2006 and has won, with his students, the Best Paper Award at the IEEE Frequency Control Symposium in 2008, 2009, 2011 and 2013, and at the IEEE Ultrasonic Symposium in 2012. He serves as an associate editor for the IEEE Journal of MicroElectroMechanical Systems (JMEMS).