Electrostatic Nano Electromechanical Switches (NEMS) for Energy-Efficient Digital Systems

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Micro and nano-fabricated sensors and actuators have become commonplace in recent years and have transformed the interfaces between the physical world and the Internet. Nano electro-mechanical switches (NEMS), by contrast, are intended for augmenting the performance of digital systems at the core of information technology. This talk will summarize recent research in NEMS, with a focus on designs using electrostatic actuation. The performance characteristics of NEMS are well-suited for a promising system application – implementing the programmable routing in field-programmable gate arrays (FPGAs). At Stanford, we have developed processes for fabricating lateral (in-plane) electrostatically actuated, multi-terminal switches on top of CMOS. I will review the fabrication challenges, contact phenomena, and scaling of lateral NEMS, as well as their micro-encapsulation and potential applications in charge-biased resonators and sensors.

Roger T. Howe is the William E. Ayer Professor in Engineering at Stanford University. He received the B.S. degree in physics from Harvey Mudd College and the M.S. and Ph.D. in electrical engineering from the University of California, Berkeley in 1981 and 1984. After faculty positions at CMU and MIT from 1984-1987 and Berkeley from 1987-2005, he joined Stanford's Electrical Engineering Department. His research interests include nano/micro electromechanical system design and fabrication technologies. Prof. Howe was Director of the U.S. National Nanotechnology Infrastructure Network (NNIN) from 2011-2015 and has been the Faculty Director of the Stanford Nanofabrication Facility since 2010. He was elected an IEEE Fellow in 1996, was co-recipient of the IEEE Cledo Brunetti Award in 1998, and the IEEE EDS Robert Bosch Award and the IEEE EDS Education Award in 2015. He was elected a member of the U.S. National Academy of Engineering in 2005.