In Search of a Better MEMS-Switch:
An Elementary theory of how nanostructured dielectrics may soften landing, increase travel range, and decrease energy dissipation

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Abstract: As the future of Moore's law of transistor scaling appears uncertain, Electronics is trying to reinvent itself by integrating non-CMOS devices such as electronic-nose, biosensors, MEMS/NEMS onto the traditional CMOS platform. Such technologies (e.g. Mote technology for environment sensing for Intel, Marisol technology for display from Qualcomm, DNA sensors from Ion Torrent, etc.) have the potential to transform classical electronics by making it relevant to broader range of applications than classical CMOS-platform itself could address.

Among these various enabling devices, the Micro-electromechanical (MEMS) switches have potential applications in communication (e.g., RF-MEMS switches), in computation for sub 60 mV/dec switching (e.g., NEM-relay), in adaptive optics for mirrors, passive color displays (e.g., Marisol technology), and active cantilever based biosensors with sensitivity beyond the thermodynamic limit. This class of 'phase-change' switches is fundamentally different and offers many functionalities inaccessible to classical transistors. And yet, this exciting technology remains stymied by reliability concerns (e.g., stiction, dielectric charging, and salt penetration), high actuation voltage and power-dissipation related to intrinsic hysteresis and pull-in characteristics, and inability to tailor travel-range arbitrarily for various applications. In this talk, I will discuss an elementary theory of the role of nanostructured electrodes in addressing some of the challenges from a fundamentally different perspective. The goal is to start a conversation regarding the viability of the approaches suggested and see if the perspective offered is realistic and relevant.

About the Speaker: Professor Alam teaches Electrical Engineering at Purdue University, where his research focuses on the physics, simulation, characterization and technology of classical and novel semiconductor devices. From 1995 to 2001, he was with Bell Laboratories, Murray Hill, NJ, as a Member of Technical Staff in the Silicon ULSI Research Department. From 2001 to 2003, he was a Distinguished Member of Technical Staff at Agere Systems, Murray Hill, NJ. He joined Purdue University in 2004. Dr. Alam has published over 100 papers in international journals and has presented many invited and contributed talks at international conferences. He is a fellow of IEEE, APS, and AAAS, and recipient of 2006 IEEE Kiyo Tomiyasu Award for contributions to device technology for communication systems.