

Technical Seminar Series 2010

GUEST SPEAKERS

Prof Gianluca Piazza (University of Pennsylvania)
Prof Gary K. Fedder (Carnegie Mellon University)

When: **4th May 2010, 9.00 a.m. to 12.00 noon**
Where: **Institute of Microelectronics, Singapore**
11 Science Park Road Singapore Science Park II Singapore 117685

Prof Gianluca Piazza
University of Pennsylvania

Title: Aluminium Nitride Piezoelectric NanoElectroMechanical Resonators and Switches

Abstract

Thanks to their nano-scaled dimensions, NanoElectroMechanical Systems (NEMS) resonators and switches will yield significant advancements over state-of-the-art semiconductor-based products with respect to reduced power consumption, increased frequency of operation and sensing resolution and find application in the areas of communications, computing and chem/bio sensing.

A major challenge associated with the demonstration of NEMS is the ability to efficiently transduce the mechanical device without the need of external and bulky setups. This work presents noteworthy opportunities associated with the scaling of piezoelectric AlN films to the nano realm and their application to the making of efficient NEMS resonators and switches that are directly interfaced with conventional electronics. Experimental data showing NEMS AlN resonators (250 nm thick with lateral features as small as 300 nm) vibrating at record-high frequencies approaching 10 GHz with Qs in excess of 500 will be presented. The extreme compact form factor of these devices permits to envision large scale integration (LSI) of NEMS to develop disruptive microwave architectures. Similarly, these NEMS resonators yield unprecedented sensitivities and are employed to tag analyte concentrations that reach the part per trillion levels.

The use of nano-piezoelectric films (100 nm thick) in NEMS actuators for switching applications will be shown and experimental data confirming that bimorph nano-piezo-actuators have the same piezoelectric properties of microscale counterparts will be presented. These actuators set a realistic pathway towards the demonstration of nanomechanical computing elements.

Biography



Prof Gianluca Piazza is a Wilf Family Term Assistant Professor in the department of Electrical and Systems Engineering (ESE) at the University of Pennsylvania. His research interests focus on piezoelectric micro and nano systems (MEMS/NEMS) for RF wireless communications, biological detection, wireless sensor platforms and all mechanical computing. He also has general interest in the areas of micro/nano fabrication techniques and integration of micro/nano devices with state-of-the-art electronics. Prof Piazza received his Ph.D. degree from the University of California, Berkeley where he developed a new class of AlN contour-mode vibrating microstructures for RF communications. He has more than 10 years of experience working with piezoelectric materials. He holds two patents in the field of micromechanical resonators and has recently co-founded a start-up (Harmonic Devices, Inc.) aiming at the commercialisation of single-chip and multi-band RF filters. He received the IBM Young Faculty Award in 2006 and has won, with his students, the Best Paper Award in Group 1 and 2 at the IEEE Frequency Control Symposium in 2008 and 2009, respectively.

Prof Gary K. Fedder
Carnegie Mellon University

Title: Opportunities and Challenges of CMOS MEMS Platform

Abstract

Prof Gary K. Fedder's research for the past 20 years has revolved around monolithic integration of MEMS with CMOS and development of the requisite design and modelling paradigm to create complex on-chip microsystems. The "More than Moore" trend in the microelectronics industry is driving a renewed interest in MEMS integration. Integration becomes a necessity for multi-component microsystems, where interconnect issues scale with MEMS component count. Integration also drives down parasitic capacitances and thus provides opportunities for ultra-low-power and/or ultra-compact microsystems. As examples of the opportunities and challenges in such systems, Prof Fedder will give an overview of the various MEMS design and fabrication efforts in his group.

Biography



Prof Gary K. Fedder is Director of the Institute of Complex Engineered Systems, Howard M. Wilkoff Professor of Electrical and Computer Engineering and Professor in The Robotics Institute at Carnegie Mellon University. Prof Fedder received his B.S. and M.S. degrees in electrical engineering from MIT in 1982 and 1984, respectively, and his Ph.D. degree from U. C. Berkeley in 1994. From 1984 to 1989, he worked at Hewlett-Packard on circuit design and printed-circuit modelling. He is an IEEE Fellow and received the 1994 AIME Electronic Materials Society Ross Tucker Award, the 1996 Carnegie Institute of Technology G.T. Ladd Award, and the 1996 NSF CAREER Award. He currently serves as a subject editor for the IEEE/ASME Journal of Microelectromechanical Systems, on the editorial boards of the IOP Journal of Micromechanics and Microengineering and IET

Micro & Nano Letters and as co-editor of the Wiley-VCH Advanced Micro- and Nanosystems book series. He has contributed to over 160 research publications and holds several patents in the MEMS area. His research interests include microsensor and microactuator design and modelling, integrated MEMS manufactured in CMOS processes and structured design methodologies for MEMS. As the general chair of the IEEE Sensors Conference in 2010, he cordially invites you to participate in the conference on the Kona coast of Hawaii this November!

Registration

Pre-registration is required.
Closing date is 3rd May 2010.

To register, please log on:

http://eastar.eventshub.sg/ems_wb_Details.aspx?CallID=28&EventID=124280

Location Map

