Electrical & Computer ENGINEERING

SEMINAR

THURSDAY
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Scaife Hall Auditorium
Room 125

4:30 p.m.
Refreshments—4:00 p.m.

Dielectric Charging Effects in MEMS Capacitive Switches

JAMES C. M. HWANG

PROFESSOR
Lehigh University

James C. M. Hwang is a Professor of Electrical Engineering and Director of the Compound Semiconductor Technology Laboratory at Lehigh University. He graduated from National Taiwan University with a B.S. degree in Physics in 1970, and subsequently earned his M.S. (1973) and Ph.D. (1976) degrees in Materials Science and Engineering at Cornell University. After twelve years of industrial experience working at IBM, AT&T, GE, and GAIN, he joined the Lehigh University faculty in 1988. In 2002, Professor Hwang helped establish a $60-million, five-year Center for Optical Technologies between Lehigh University and Pennsylvania State University and served as its interim director for six months. In 2006, he helped establish a $10-million, six-year IMPACT Center for N/MEMS VLSI between Lehigh University, University of Illinois, Purdue University, and Georgia Institute of Technology. To date he continues to lead major research thrusts in both centers. He has been a visiting professor at Nanyang Technological University in Singapore and at Shanghai Jiaotong University in China. He has been a consultant for the U. S. Government and many electronic companies in the areas of RF/microwave devices and integrated circuits. Prof. Hwang co-founded GAIN and QED; the latter became a public company (IQEP). He has published approximately 200 technical papers and has been granted four U. S. patents. He is a Fellow of the Institute of Electrical and Electronic Engineers.

MEMS capacitive switches are enabling component technologies for future-generation radar and communication systems that are based on electronically steered phased-array antennas and reconfigurable RF front ends. However, in spite of excellent performance of MEMS capacitive switches, their deployment has been hindered by packaging and reliability problems. Using an innovative micro-encapsulation approach, packages with low loss, volume, weight and cost have been achieved. By carefully trading off electrical, mechanical, and material design parameters, more than 260 billion cycles of switch operation has also been demonstrated. This talk will concentrate on the modeling and characterization of dielectric charging effects in MEMS capacitive switches. The resulted model can be used to design control-voltage waveforms that can be used either to prolong switch lifetime or to accelerate switch failure. Accelerated life testing of MEMS switches is important because they are relatively slow and it takes about a month to test them for more than 100 billion cycles.

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