

ASICON 2017 Tutorial Session

Date : Oct. 25 , 2017

Location : 3rd Floor , Hotel Pullman Guiyang

9:00-10:30

**T-1 Electrostatic discharge protection of consumer electronics:
challenges and solutions**

Speaker: Prof. J.J.Liou, University of Central Florida, USA



Abstract: Electrostatic discharge (ESD) is one of the most prevalent threats to the reliability of electronic components. It is an event in which a finite amount of charge is transferred from one object (i.e., human body) to the other (i.e., microchip). This process can result in a very high current passing through the microchip within a very short period of time, and more than 35% of chip damages can be attributed to such an event. As such, designing robust on-chip ESD structures to protect microchips against ESD stress is a high priority in the semiconductor industry. The continuing scaling of CMOS technology makes the ESD-induced failures even more prominent, and one can predict with certainty that the availability of effective and robust ESD protection solutions will be a critical factor to the success of the deep sub-micron technology advancement. In fact, many semiconductor companies worldwide are having difficulties in meeting the increasingly stringent ESD protection requirements for various electronics applications.

There has been a wide spread use of integrated circuits in consumer applications. An example is the automotive electronics which are typically operated in a voltage range of 40-60 V. This relatively high-voltage operation imposes certain challenges to the design of ESD protection solutions embedded in the modern vehicles. On the other hand, due to the huge market of civil wireless communications, low-voltage integrated circuits are also in high demands. Effective ESD protection solutions for these high-speed circuits are typically required to operate within a very narrow ESD design window and with a minimal loading effect (i.e., high transparency), hence introducing a different set of challenges.

This talk gives a comprehensive coverage on challenges and solutions pertinent to ESD protection of high- and low-voltage IC's utilized in various consumer electronics.

Bio: Jun J. Liou received the B.S. (honors), M.S., and Ph.D. degrees in electrical engineering from the University of Florida, Gainesville, in 1982, 1983, and 1987, respectively. In 1987, he joined the Department of Electrical and Computer Engineering at the University of Central Florida (UCF), Orlando, Florida, where he held the positions of UCF Pegasus Professor and Lockheed Martin Chair Professor of Engineering. His current research interests are Micro/nanoelectronics computer-aided design, RF device modeling and simulation, and electrostatic discharge (ESD) protection design and simulation. Currently, he is the president of Emoat, LLC, a consulting firm which provides know-how and expertise on the design and characterization of ESD solutions. He also serves as a chair professor of Zhengzhou University, China.

Dr. Liou holds 12 U.S. patents (1 more filed and pending), and has published 13 books, more than 290 journal papers (including 21 invited review articles), and more than 230 papers (including more than 100 keynote and invited papers) in international and national conference proceedings. He has been awarded more than \$14.0 million of research contracts and grants from federal agencies (i.e., NSF, DARPA, Navy, Air Force, NASA, NIST), state government, and industry (i.e., Semiconductor Research Corp., Intel Corp., Intersil Corp., Lucent Technologies, Alcatel Space, Conexant Systems, Texas Instruments, Fairchild Semiconductor, National Semiconductor, Analog Devices, Maxim Integrated Systems, Allegro Microsystems, RF Micro Device, Lockheed Martin), and has held consulting positions with research laboratories and companies in the United States, China, Japan, Taiwan, and Singapore. In addition, Dr. Liou has served as a technical reviewer for various journals and publishers, general chair or technical program chair for a large number of international conferences, regional editor (in USA, Canada and South America) of the *Microelectronics Reliability* journal, and guest editor of 7 special issues in the *IEEE Journal of Emerging and Selected Topics in Circuits and Systems*, *Microelectronics Reliability*, *Solid-State Electronics*, *World Scientific Journal*, and *International Journal of Antennas and Propagation*.

Dr. Liou received ten different awards on excellence in teaching and research from the University of Central Florida (UCF) and six different awards from the IEEE. Among them, he was awarded the UCF Pegasus Distinguished Professor (2009) – the highest honor bestowed to a faculty member at UCF, UCF Distinguished Researcher Award (four times: 1992, 1998, 2002, 2009) – the most of any faculty in the history of UCF, UCF Research Incentive Award (four times: 2000, 2005, 2010, 2015), IEEE Joseph M. Biedebach Outstanding Engineering Educator Award in 2004 for exemplary engineering teaching, research, and international collaboration, and IEEE Electron Devices Society Education Award in 2014 for promoting and inspiring global education and learning in the field of electron devices. His other honors are Fellow of IEEE, Fellow of IET, Fellow of Singapore Institute of Manufacturing Technology, Fellow of UCF-Analog Devices, Distinguished Lecturer of IEEE Electron Device Society (EDS), and Distinguished Lecturer of National Science Council. He holds several honorary professorships, including the Chang Jiang Scholar Endowed Professor of Ministry of Education, China – the highest honorary professorship in China, NSVL Distinguished Professor of National Semiconductor Corp., USA, International Honorary Chair Professor of National Taipei University of Technology, Taiwan, Honorary Endowed Professor of National Taiwan University of Science and Technology, Taiwan, Chang Gung Endowed Professor of Chang Gung University, Taiwan, Feng Chia Chair Professor of Feng Chia University, Taiwan, Chunhui Eminent Scholar of Peking University, China, Cao Guang-Biao Endowed Professor of Zhejiang University, China,

Honorary Professor of Xidian University, China, Consultant Professor of Huazhong University of Science and Technology, China, and Courtesy Professor of Shanghai Jiao Tong University, China. Dr. Liou was a recipient of U.S. Air Force Fellowship Award and National University Singapore Fellowship Award.

Dr. Liou has served as the IEEE EDS Vice-President of Regions/Chapters, IEEE EDS Treasurer, IEEE EDS Finance Committee Chair, Member of IEEE EDS Board of Governors, and Member of IEEE EDS Educational Activities Committee.

10:45-12:15

T-2 Circuit Simulation Technique: From Device Data to Circuit Performance

Speaker: Prof. Mansun Chan, Hong Kong University of Science & Technology



Abstract: Circuit Simulation is a key step in developing circuit applications and CAD tools cannot be avoided in the process. While there are a lot of tools available to help circuit designers, the circuit simulation methodology is in general not well understood and it is difficult for designers to handle problems related to the simulator, such as non-convergence or inconsistency. Furthermore, circuit designers have may not fully understand the limitation of circuit simulators and the reliability of the simulation results. In this tutorial, the basic concepts of circuit simulation will be introduced, including transfer function simulation, transient simulation, frequency domain simulation and reliability simulation. With the recent development of the “more-than-Moore” technology development focus, circuit simulators also need to adapt to the accelerated development of new type of devices to allow designers to perform simulation for circuit evaluation before these technologies mature. Methodology to accelerate the process to bring emerging device data to circuit simulation platform for early circuit evaluation will also be discussed.

Bio: Prof. Mansun Chan received his Ph.D degree from the University of California at Berkeley. During his undergraduate study, he has been working with Rockwell International Laboratory on Heterojunction Bipolar Transistor (HBT) modeling, where he developed the self-heating SPICE

model for HBT. His research at Berkeley covered a broad area in silicon devices ranging from process development to device design, characterization, and modeling. A major part of his work was on the development of record-breaking Silicon-On-Insulator (SOI) technologies. Dr. Chan has also maintained a strong interest in device modeling and circuit simulation. He is one of the major contributors to the unified BSIM model for SPICE, which has been accepted by most US companies and the Compact Model Council (CMC) as the first industrial standard MOSFET model. He joined the ECE faculty at Hong Kong University of Science and Technology after graduation. His research interests include nano-device technologies, 2-D material and technology, 3-D stacked circuit, Circuit simulation methodology, Device Modeling and Bioelectronic technology. Between July 2001 and December 2002, he was a Visiting Professor at University of California at Berkeley and the Co-director of the BSIM program. He is currently a Distinguished Lecturer and a Fellow of IEEE.

14:00-15:30

T-3 Protecting cryptographic integrated circuits with side-channel information

Speaker: Prof. Makoto Nagata, Kobe University



Abstract: Side-channel attacks have emerged as the nondestructive threats of security vulnerability in cryptographic hardware. This tutorial provides an overview of side-channel leakage problems at IC chip and assembly levels. It will also cover the protection techniques with counter ways of utilizing side-channel information leakage for combatting side-channel attacks, and their potential extensions toward the authenticity of devices against counterfeits or even falsification.

Bio: Makoto Nagata received the B.S. and M.S. degrees in physics from Gakushuin University, Tokyo, Japan, in 1991 and 1993, respectively, and the Ph.D in electronics engineering from Hiroshima University, Japan, in 2001. He is currently a professor of the graduate school of science, technology and innovation, Kobe University, Japan. His research interests include design techniques toward high performance mixed analog, RF, and digital VLSI systems with particular emphasis on power/signal/substrate integrity and electromagnetic compatibility, testing and diagnosis, three dimensional system integration, as well as connectivity and security

applications.

He was a technical program chair (2010-2011) and a symposium chair (2012-2013) for Symposium on VLSI circuits. He is currently a program committee member for IEEE International Solid-State Circuits Conference (2014-), an associate editor for IEEE Transactions on VLSI Systems (2015-) and also a chair for IEEE SSCS Kansai Chapter (2017-). He also served as an associate editor of the IEICE Transactions on Electronics (2002-2005).

15:45-17:15

T-4 Smart Image Sensors and applications to 3D range-finding

Speaker: Prof. Makoto Ikeda, University of Tokyo



Abstract: This lecture will highlight several 3-D range-finding techniques, including, high-speed 3-D range-finding techniques based on light-section method(1D projection), time-encoded pattern projection method(2D projection), lockin-pixel and SPAD techniques based on ToF. Followed by asics of each techniques, this lecture will cover both device structure optimized for each techniques, and circuits optimization to maximize their performance.

Bio: Makoto Ikeda received the BE, ME, and Ph.D. degrees in electricalengineering from the University of Tokyo, Tokyo, Japan, in 1991, 1993and 1996, respectively. He joined the University of Tokyo as a researchassociate, in 1996, and now professor at the department of electricalengineering and information systems. At the same time he has beeninvolving the activities of VDEC(VLSI Design and Education Center,the University of Tokyo), to promote VLSI design educations and researches in Japanese academia. He worked for asynchronous circuits design, smart image sensor for 3-D range finding, and time-domain circuits for associate memories. He has published more than 230 technical publications, including 10 invited papers, and 7 books/chapters. He has been serving various positions of various international conferences, including ISSCC IMMD sub-committee chair (ISSCC 2015 -), A-SSCC 2015 TPC Chair, VLSI Circuits Symposium PC Chair (for 2016/2017). He served IEEE SSCS Distinguished Lecturer in 2015 and 2016. He is a member of IEEE, IEICE Japan, IPSJ and ACM.