


Four New Distinguished Lecturers for 2021-2022

Vignesh Rajamani, EMC Society Vice-President for Member Services and Ramachandra Achar, Chair, EMC Society Distinguished Lecturer Program

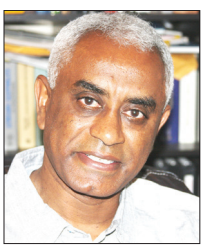
The EMC Society Board of Directors has approved four new Distinguished Lecturers (DLs) for the term 2021-2022. They are Dr. Wendem Beyene, Prof. Alexandre Piantini, Prof. Akimasa Hirata, and Mr. Stephen Scearce. Our other current four DLs, Dr. Bhyrav Mutnury, Dr. Alpesh U. Bhobe, Dr. D. V. Giri, and Mr. Michael K. McInerney will continue their terms through December of 2021.

Before introducing the newest DLs, we want to acknowledge the contributions made by our retiring DLs, Dr. Xiaoxiong (Kevin) Gu, Prof. Marcos Rubinstein, Prof. Seungyoung Ahn, and Prof. Liang Zhou over the past two years. During their terms, they volunteered to spend many days away from home, family, familiar food, and familiar people. They traveled by airplane, by car, and bus in order to give presentations in the Unites States, Americas, Asia, and Europe. In addition, facing up to the challenge posed by the pandemic, they delivered their talks via webinars to a global audience. Our Society's local Chapter meetings have benefited from the contributions of these bright and learned volunteers. For those of you who have attended one of their presentations, I am sure you know what a very fun and educational experience these folks provide. Please join me in thanking our retiring DLs, and welcoming our new expert speakers.

If you have not seen a DL at your Chapter meeting or their online webinar, you are really missing one of the most popular benefits that our Society offers. I am certain that this year's new speakers will continue the DL tradition of offering excellent technical education, advice, and entertainment. Chapter Chairs can request any of the Distinguished Lecturers to come to their local Chapter meeting. Once the schedule details are agreed upon by both parties, the EMC Society pays for the travel costs, so the local Chapter gets expert speakers, on a wide range of topics, at no cost to the local Chapter! Travel may be a reality in mid to late 2021 so it is not too early to plan ahead.

Following are our new Distinguished Lecturers for 2021-2022. Please feel free to contact them directly by phone or email to discuss hosting them at your next Chapter meeting, university class, or other special event. You can find contact information under the Distinguished Lecturer section of the EMC Society web site (www. emcs.org).

Dr. Wendem Beyene (Email: wendem@gmail.com)



Dr. Wendemagegnehu (Wendem) T. Beyene (M'88–SM'05) was born in Addis Ababa, Ethiopia. He received the B.S. and M.S. degrees in electrical engineering from Columbia University, New York, NY, USA, in 1988 and 1991, respectively, and the Ph.D. degree in electrical and computer engineering from the University of Illinois at Urbana-Champaign, USA, in 1997. In the past, he was employed by IBM, Hewlett-Packard, and Agilent Technologies. In 2000, he joined Rambus Inc., Los Altos, CA, USA, and served as a senior principal engineer responsible for signal integrity of multi-gigabit parallel and serial interfaces. During 2017-2020, he served as principal engineer responsible for signal and power integrity analysis of high-performance FPGA including fabric and high-speed I/O subsystems as well as I/O modeling. In 2020, he joined Facebook as an Analog & Mixed-Signal Architect focusing on low-power and high-performance SoC design.

Dr. Beyene has authored or co-authored numerous refereed papers in various leading IEEE Transactions and conference publications. His papers covered various disciplines including package and interconnect modeling, analysis, and optimization. He is currently an Associate Editor of the IEEE Transactions on Components, Packaging and Manufacturing Technologies (CPMT) and is a Senior Member of the IEEE. He also serves on several leading technical program committees, including for the Electrical Performance of Electronic Packaging and Systems (EPEPS) and Signal and Power Integrity (SPI) conferences. Following is a summary of his presentation options:

Talk 1. Design and SI/PI Analysis of High-Performance Memory Systems

This presentation starts with an introduction to memory systems in computing devices such as computers, tablets, or smartphones. Then, an in-depth analysis of standard memory systems for low-power and high-performance applications is provided. The interactions between the signaling, clocking architecture, and packaging technology of a memory interface as well as how these interactions determine the achievable data rates and power efficiency are discussed. Signaling and clocking schemes for standard memories, including DDR3 and DDR4 (DDR5?), and mobile memories, such as LPDDR3 and LPPDR4 (LPDDR5?) are detailed and compared against each other. The emerging 2.5D/3D memory systems such as HBM1/2/2E, and HMC1/2 and beyond are also presented. Packaging options such as BGA, PoP, and the emerging 2.5D/3D are also discussed. To analyze and compare different state-of-the-art memory interfaces, the following metrics are used in the analysis: cost, power efficiency, bandwidth, design complexity, signal and power integrity, thermal solution, and form factor. Attendees will gain an in-depth understanding of high-speed memory interfaces; learn about the interactions between the signaling, clocking architecture, and packaging technology of a memory interface, and find out how those interactions determine the achievable data rates and power efficiency. The presentation will conclude by demonstrating how this knowledge can be used

to analyze and compare different state-of-the-art memory interfaces to help attendees implement or select a solution that best fits their specific application.

2. Statistical Link Modeling and Simulation

Since the method's introduction in early 2000, statistical link modeling/analysis has widely been used in the design and analysis of wireline high-speed links. Currently, all major commercial circuit simulation software tools are providing fast channel analysis engine based on this method since it offers a very fast means of computing performance. In addition, the statistical link analysis are often used for efficient investigation of link equalization architecture and channel variations. The analysis computes link performance to unconceivably low BER in a matter of seconds. However, statistical link analysis should not be considered an alternative to existing techniques but a complement, as the linearity assumptions made must be carefully understood. Newer approaches have been investigated to include encoded bit streams, transceiver nonlinearity, and colored jitter. The presentation concludes by reviewing the theory of statistical link analysis, explaining some of the limitations of the method and discussing some of the latest developments.

3. Package Requirements for Data Rates of 112 Gbps and Beyond

As the data rates increase rapidly in high-speed systems – such as SerDes and memory systems – to meet the bandwidth growth intensified by various applications, the electrical performance of packages has become critical. The bump and BGA or pin assignments, the layer stack up, and package material selection are very important to meet the signal and power integrity requirements. In addition, the role of new emerging 2.5D and 3D IC packaging platforms with ever increasing system integration requirements have made the role of packaging even more important. The sources of signal loss, noise coupling, and discontinuities in packages must be fully understood and minimized when designing packages. At the same time, the design and development of packages have to meet cost, performance, form factor, and reliability goals. In this presentation, we will examine the key electrical characteristics: signal loss, signal crosstalk, return loss, mode conversion, power integrity, and other important factors necessary to meet the performance requirements of high-speed systems with data rates of 112 Gbps and beyond.

Prof. Alexandre Piantini (Email: piantini@iee.usp.br)

Prof. Piantini (SM'04) received the M.Sc. and Ph.D. degrees from the Polytechnic School of the University of São Paulo, São Paulo, Brazil, in 1991 and 1997, respectively. He joined the University of São Paulo in 1986 and served, from 1998–2011, as Director of Technological Development of the Institute of Energy and Environment, where he is Associate Professor and the Head of the Lightning and High Voltage Research Centre. He was the Convener of the CIGRE WG C4.408 "Lightning Protection of Low-Voltage Networks" and member of various IEEE and CIGRE working groups. He is an Associate Editor of the IEEE Transactions on Electromagnetic Compatibility, Electrical Engineering, High Voltage, and member of the Editorial Advisory Panel of the Electric Power Systems Research. He has participated in 26 research projects related mainly to lightning and EMC. He coordinated 21 of these projects, of which 15 were funded mainly by power companies and national agencies for research support. Prof. Piantini is the Chairman of the International Symposium on Lightning Protection (SIPDA) and member of scientific committees of various conferences such as the International Conference on Lightning Protection (ICLP). He is a Guest Professor of the Chongqing University, China, and a member of the IEEE Committee for the Sun & Grzybowski Award. In 2018, he was the recipient of the ICLP R. H. Golde Award. He is the author or co-author of four book chapters and over 150 scientific papers published in prestigious reviewed journals or presented at international conferences with a review board. Following is a summary of his presentation options:

1. Scale Models and their Application to the Study of Lightning Transients in Power Systems

Investigations on lightning transients on power systems can be carried out through the use of the following methods: measurements on real, full-scale power lines; rocket-triggered lightning; digital simulations; and scale models. Scale models have been an important tool to predict power system transients after different types of perturbations. This technique enables tests to be performed under controlled conditions and allows for the simulation of a wide variety of situations. In this lecture, after presenting the various techniques and their main advantages and drawbacks, emphasis is given to scale models. The theory is described, the scale factors for the various quantities are derived, and methods for simulating the stroke current and the lightning channel, as well as the most important power system components, namely transmission towers, overhead lines, transformers, and surge arresters, are presented. Then the technique is applied to the evaluation of lightning transients in transmission lines and typical rural and urban overhead power distribution networks. The versatility of the scale model technique is demonstrated and examples are presented that illustrate its usefulness in the analysis of complex phenomena, either for enabling the evaluation of situations which are not worthwhile to be treated theoretically or for giving adequate support for the validation of theoretical models and relevant computer codes.

2. Lightning Protection of Overhead Power Networks

The reliability of a power system bears on its ability to supply continuous and uninterrupted energy without significant momentary disturbances. However, power lines are often located in areas of high ground flash densities, being therefore prone to lightning-caused power interruptions. Different protective measures can be adopted to mitigate these effects, each with its own cost and effectiveness. In this presentation, a procedure for the estimation of the mean annual number of direct lightning strikes to a given power line is presented and the main protective measures that

can be applied to improve the lightning performance of transmission and distribution (MV and LV) lines against direct and indirect strokes are addressed. The effectiveness of each measure as a function of various parameters such as, e.g., the soil resistivity, ground impedance, and grounding spacing, is also discussed.

3. Lightning Interaction with Transmission and Distribution Power Systems

The growing use of sensitive electronic devices and the increasing demand of utility customers for stability of the power supply in recent years has emphasized the importance of improving the reliability and power quality levels of electric systems. Although various phenomena and situations can cause disturbances on power transmission and distribution networks, lightning is usually responsible for a significant amount of unscheduled supply interruptions and permanent damage to equipment such as distribution transformers, as well as damage to or malfunction of sensitive electronic equipment. It is therefore essential to evaluate the lightning electromagnetic environment in order to mitigate its effects and improve the power system quality. In this lecture, the major mechanisms by which lightning overvoltages can be produced on power transmission and distribution (medium and low-voltage) systems are explained, the general characteristics of the overvoltages are evaluated, and their dependence upon the network configuration and some of the most important ground and stroke parameters are discussed, with examples provided of measured and calculated voltage wave shapes.

Prof. Akimasa Hirata (Email: ahirata@nitech.ac.jp)

Prof. Hirata (S'98–M'01–SM'10–F'17) received the B.E., M.E., and Ph.D. degree in communications engineering from Osaka University, Suita, Japan, in 1996, 1998, and 2000, respectively. From 1999 to 2001, he was a Research Fellow of the Japan Society for the Promotion of Science, and a Visiting Research Scientist at the University of Victoria, BC, Canada, in 2000. In 2001, he joined the Department of Communications Engineering, Osaka University, as an Assistant Professor. In 2004, he moved to Nagoya Institute of Technology where he is currently a Full Professor and Director of Research Center. His research interests include electromagnetic safety, EMC, antennas, filters, risk management system for heat-related illness, methods in neuroscience, and related computational techniques. Prof. Hirata is an Associate Editor of the IEEE Transactions on EMC and an editorial board member of Physics in Medicine and Biology. He is a member of the main commission and a chair of the project group of the International Commission on Non-Ionizing Radiation Protection (ICNIRP, from 2015), and a member of the administrative committee and a Subcommittee (EMF Dosimetry Modeling) Chair of the IEEE International Committee on Electromagnetic Safety (ICES, from 2014), and an expert of the World Health Organization. From 2006 to 2012, he was also an Associate Editor of the IEEE Transactions on Biomedical Engineering. He received several awards including the Young Scientists' Prize (2006) and Prizes for Science and Technology (Research Category 2011, Public Understanding Promotion Category 2014, 2020) by the Commendation for Science and Technology by the Minister of Education, Culture, Sports, Science, and Technology, Japan. He is the recipient of the IEEE EMC Society Technical Achievement Award (2015), and the Japan Academy Medal and JSPS Prize (2018). He is a Fellow of Institute of Physics and IEICE. Following is a summary of his presentation options:

1. Introduction to Bioelectromagnetics - Fundamentals and EMC Applications

The human body whose electrical behavior depends on frequency should be considered in the modern design of wireless devices that are used in proximity of the human body. However, the complexity of the modeling may depend not only on the frequency but also on the individual variables, environmental factors, size of the devices, and use scenarios. In this lecture, first, a discussion on modeling of the human body in electromagnetics for different cases is provided. Then, the effect of the human presence on the wireless devices including wireless communication terminals and wireless power transfer systems is explained considering typical exposure scenarios. The electromagnetic field emitted from electrostatic discharge is also discussed.

2. Human Safety from Electromagnetic Fields

Safety concerns exist for exposure to electromagnetic fields. The adverse health effect due to electromagnetic fields has been summarized in documents of the World Health Organization. To protect the human body from electromagnetic fields, a two-tier approach has then been applied in our daily life. First, the exposure standards are developed based on the threshold of adverse health effect. The limit of induced physical quantities in the human body, such as induced electric field and specific absorption rate (SAR), are derived considering the reduction (safety) factor. The safety of the products should be assessed following the method of product standards. In this lecture, the relationship between these two types of standards is discussed including the rationale from an engineering viewpoint from extremely low frequencies to millimeter waves. Recent standardization related to 5G wireless communications system is also summarized. In addition, the research necessary in this area is mentioned.

3. Computational Methods in Biomedical EMC

The human body is comprised of different biological tissues and organs, and thus its interaction with electromagnetic fields is not straightforward to evaluate. Different computational methods are thus used in different applications. However, the applicability of computational methods and accuracy depends on the frequency as well as source size, etc. In the low- and radio-frequency ranges, multi-scale and multi-physics techniques are used to model the nerve stimulation and tissue heating caused by exposure to electromagnetic fields. In addition, post-processing is needed to derive the quantity, which is related to the biological effect pre-

scribed in the international guidelines/standard. In this presentation, the effectiveness and limitations of different computational methods are summarized, providing guidelines for researchers selecting appropriate methods.

Mr. Stephen Scearce (Email: sscearce@cisco.com)

Mr. Stephen Scearce serves as a Principal Engineer/Engineering Manager of Cisco's Electronics Packaging and Diagnostics team. Stephen provides the technical direction/leadership for Signal Integrity, Power Integrity, Mechanical/Thermal Design, and Software Diagnostics design in the US/China. He has global responsibility for Cisco's Enterprise Routing, Wireless, Core Switching, and Security product lines. Stephen has worked for Cisco for 19 years focused in ASIC/System PI, SI, Package Design, and EMC design. Prior to working at Cisco, Stephen worked for NASA LaRC in the Electromagnetic Research Branch HIRF team. Stephen holds seven U.S. issued patents and co-authored 15 papers. He has served on the IEEE EMC+SIPI symposium committee for six years and is a member of the 2021 IEEE International Virtual Symposium on EMC+SIPI organizing committee. Following is a summary of his presentation options:

1. Leveraging Genetic Algorithms for Capacitors

There are thousands of high frequency decoupling capacitors on a Cisco design. While SI engineers will typically check that most of the PCB power nets have the required decoupling, they may not have the time to find the best scheme for every net. We will discuss a tool and methodology leveraged by Cisco to optimize our designs for cost and performance. Our algorithm works with internal Cisco databases that store component information, including cost, parasitic resistances and inductances, tolerances, voltages, etc. The algorithm automatically identifies power planes on the design and determines the mounting impedance of every component on the board. For each power net in the design, it will automatically determine a subset of Cisco capacitors on which to optimize. The program can then optimize the PDN response to one of several targets: a flat target impedance, better than current impedance profile, and minimal integrated impedance across frequency band. It will show a range of Pareto optimal capacitor sets (a set of capacitors such that there is not another that both performs better and costs less) and displays their Z11 impedance profiles colored by cost to easily select desired impedance profiles. An engineer can either have the tool determine the least expensive solutions that meet their criteria or select based on the visual results given by the tool.

2. A Practical Look at PCB Skew Issues and Mitigation

The glass weave effect on 56Gbps PAM-4 systems have shown bit error rate issues in the lab. Our lab results show that our PAM-4 systems are more sensitive for PN skew than previous generations of NRZ with the same UI. For the current generation of designs we must consider glass direction, glass type, and weave density. The stackup decisions are based on the measured network parameters, TDR, silicon BER, and eye diagram measurement results. Techniques used to mitigate the unbalance effect of the glass weave with differential pairs are discussed in this presentation and statistical measurement results will be shared. **EMC**

The Distinguished Lecturer Program – How it Works

The EMC Society's Distinguished Lecturer Program provides speakers for Society Chapter meetings and similar functions. Each Distinguished Lecturer (DL) can offer one of several pre-prepared presentations on various EMC and SI/PI topics. DLs are appointed by the EMC Society Board of Directors for a two-year term. In 2021, the EMC Society will have eight Distinguished Lecturers serving on alternating terms.

Distinguished Lecturers may give up to six talks per year under the program, which reimburses the DL for their approved travel expenses up to a recommended limit of $1,500 USD per US engagement, or $2,000 USD for international engagements. To provide as many opportunities to as many members as possible, the Society encourages hosting Chapters whenever possible to absorb some part of the speaker's costs, such as by providing or paying for local transportation, meals, and lodging. Due to the pandemic, the DLs have not been able to travel. Instead, they offered their lectures via WebEx; many chapters were able to organize their meetings around these presentations. We plan to continue these virtual meetings for at least the first part of 2021 as we expect travel restrictions will still be in effect.

For more information about the EMC Society's Distinguished Lecturer Program, visit our web site at http://www.emcs.org/dl-main.html. You can also contact Vignesh Rajamani via email at vignesh@ieee.org.

Please also note the Respected Speaker Bureau which is comprised of past DLs and other notable speakers. Information on the Respected Speaker Bureau can be found on the DL web site at https://www.emcs.org/distinguished-lecturers.html.

Also, remember to take a look at the Video DL program information. These DVDs can also be used at Chapter meetings.