2026 3rd IEEE Antennas and Propagation Society (AP-S)

Member and Geographic Activity (MGA) Lecture Event in Japan

Recent Trends and Challenges in Antennas and Propagation Technologies by IEEE AP-S Representatives

Book of Abstract

September 11th, 2026

Organizers：IEEE AP-S Tokyo, Nagoya, Kansai-joint and Fukuoka Chapters

IEEE AP-S Technical Directional Committees: TC1, TC2 and TC3

Co-organizers： IEICE Technical Committee on Antennas and Propagation

Venue : Ishikawa Prefectural Library, Kanazawa, Japan

2-43-1, Kodatsuno, Kanazawa, 920-0942, Japan

Program (September 11th Friday)

Start	End	Speakers and Titles
13:20	13:30	Opening
13:30	13:45	C. J. Reddy, AP-S President's Talk
13:45	14:15	C. J. Reddy (Siemens), "Role of Electromagnetic Simulations in Commercial Product Design"
14:15	14:45	Francesco P. Andriulli (Politecnico di Torino), "New Frontiers in Computational Electromagnetics for Brain Imaging and Diagnostics"
14:45	15:15	Filippo Capolino (University of California Irvine), "Active oscillating arrays"
15:15	15:30	Break
15:30	15:35	[Short Talk] Koichi Ito (Chiba University), AP-S Technical Directions Committee Chair's Talk
15:35	15:40	[Short Talk] Jawad Siddiqui (Royal Military College of Canada), AP-S SIGHT Committee Chair's Talk
15:40	16:00	Debatosh Guha (University of Calcutta), "Fields Vs. Currents in Microstrip Radiators: Advanced Design Strategies"
16:00	16:30	Christophe Fumeaux (University of Queensland), "Transforming Antenna Design Through Inhomogeneous Dielectric 3D Printing"
16:30	17:00	Naoki Kita (Tokyo Denki University), "A Fresnel-Zone-Aware Line-of-Sight Probability Model Based on the Statistical Properties of Obstructions"
17:00	17:15	Break
17:15	17:45	Lei Guo (Dalian University of Technology, YP speaker), "RF Energy Harvesting for Batteryless Wireless Sensing and Long-Range Communication"
17:45	18:15	Makoto Sano (Yokohama National University, YP speaker), "Circularly Polarized Beam-Steering Folded Reflectarray Antennas for SATCOM Applications"

Role of Electromagnetic Simulations in Commercial Product Design

C. J. Reddy

Siemens Fellow, Siemens Digital Industries Software, USA

Abstract- Wireless devices such as mobile phones, tablets etc. have become part of our daily life. Emerging Technologies, 5G/6G, Autonomous Driving, automated delivery systems, smart homes, smart cities will revolutionize the way we live, work, and communicate soon. A key component in all these technologies is an antenna or multiple antennas that are used for transmitting and receiving signals. As a result, many products we use today and will be using soon, will need to incorporate antennas that are efficient and can fit within the space available in the device. Advances in simulation technology using computational electromagnetic tools have made possible antenna design and integration of antennas into various devices. In this talk, we will review advances in EM computational methods in the context of product design process in various industries.

Dr. C.J. Reddy is Siemens Fellow at Siemens Digital Industries Software. He served as Vice President, Business Development-Electromagnetics for Americas at Altair from 2014 to 2025 and transitioned to Siemens, with the acquisition of Altair by Siemens. Dr. Reddy was awarded the Natural Sciences and Engineering Research Council (NSERC) of Canada Visiting Fellowship to work at Communications Research Center in Ottawa during 1991-1993 and was awarded the US National Research Council (NRC) Resident Research Associateship in 1993 to work at NASA Langley Research Center in Hampton, Virginia. He also worked as Research Professor at Hampton University from 1995 to 2000. Dr. Reddy was the President of Applied EM, Inc (2000-2017) where he led several Phase I and Phase II SBIR projects for the DoD and NASA. He was also the President of EM Software & Systems (USA) Inc (2002-2014) and led the marketing of the EM Simulation tool, Feko in North America. EM Software & Systems (USA) Inc was acquired by Altair in 2014.

Dr. Reddy is a Fellow of IEEE, Fellow of ACES (Applied Computational Electromagnetics Society) and a Fellow of AMTA (Antenna Measurement Techniques Association). Dr. Reddy is a co-author of the book, “Antenna Analysis and Design Using FEKO Electromagnetic Simulation Software,” published in June 2014 by SciTech Publishing (now part of IET). Dr. Reddy served as an Associate Editor for IEEE Open Journal of Antennas of Propagation and IEEE Transactions on Antennas and Propagation. He served as the Chair of IEEE Antennas and Propagation Society (AP-S) Young Professionals Committee during 2021-2024 and served on the AP-S AdCom during 2023-2024. Dr. Reddy is appointed to IEEE Fellows Committee by IEEE Board of Directors for the terms 2020-2021 and 2022-2023. Currently, Dr. Reddy is serving as the 2026 IEEE AP-S President. Dr. Reddy is inducted into IEEE Heritage Circle by the IEEE Foundation for establishing the "IEEE AP-S CJ Reddy Travel Grant for Graduate Students."

New Frontiers in Computational Electromagnetics for Brain Imaging and Diagnostics

Francesco P. Andriulli

Politecnico di Torino, Italy

Abstract – Electroencephalography (EEG) from scalp potentials is one of the primary non-invasive strategies for functional imaging of the human brain. By recording external potentials, it provides crucial insights into neural activity and remains a cornerstone of clinical neuroimaging. Its importance is particularly evident in epilepsy diagnostics: in focal epilepsy, accurate source characterization and localization are essential steps prior to surgical intervention. At the same time, EEG is a foundational technology for Brain–Computer Interfaces (BCIs), enabling direct communication between the brain and external devices. High-resolution EEG systems, however, are computationally intensive technologies, where a significant part of the imaging process relies on advanced electromagnetic modeling of brain propagation. Innovations in computational methods, modeling strategies, and algorithmic approaches are currently at the heart of major cross-disciplinary research efforts, originating from Computational Electromagnetics (CEM) and advanced electromagnetic engineering.

This talk will present some of the most recent strategies and advances in the field of CEM-empowered neuroimaging: technologies for brain diagnostics, therapy, and interaction where computational power, advanced algorithms, and ad hoc platforms have enabled exciting discoveries, therapeutic progress, and impactful applications. Current trends and open Grand Challenges will be outlined, alongside past achievements and ongoing research efforts, including those within the EIC Pathfinder project "CEREBRO." Without over-indulging in technicalities, the talk will showcase recent theoretical and experimental breakthroughs, always in connection with their promising applications in diagnostics, mind–machine interfaces, and immersive neurofeedback.

Francesco P. Andriulli received the Laurea in electrical engineering from the Politecnico di Torino, Italy, in 2004, the MSc in electrical engineering and computer science from the University of Illinois at Chicago in 2004, and the PhD in electrical engineering from the University of Michigan at Ann Arbor in 2008. From 2008 to 2010 he was a Research Associate with the Politecnico di Torino. From 2010 to 2017 he was an Associate Professor (2010-2014) and then Full Professor with the Ecole Nationale Supérieure Mines-Télécom Atlantique (IMT Atlantique), Brest, France. Since 2017 he has been a Full Professor with the Politecnico di Torino, Turin, Italy. His research interests are in computational electromagnetics including frequency- and time-domain integral equation solvers, well-conditioned formulations, fast solvers, low-frequency electromagnetic analyses, and modeling techniques for antennas, wireless components, microwave circuits, and biomedical applications with a special focus on brain imaging.

Prof. Andriulli received several best paper awards at conferences and symposia (URSI NA 2007, IEEE AP-S 2008, ICEAA IEEE-APWC 2015) also in co-authorship with his students and collaborators (EMTS 2025, ICEAA IEEE-APWC 2021, EMTS 2016, URSI-DE Meeting 2014, ICEAA 2009) with whom received also a second prize conference paper (URSI GASS 2014), a third prize conference paper (IEEE–APS 2018), seven honorable mention conference papers (ICEAA 2011, URSI/IEEE–APS 2013, 4 in URSI/IEEE–APS 2022, URSI/IEEE–APS 2023) and other three finalist conference papers (URSI/IEEE-APS 2012, URSI/IEEE-APS 2007, URSI/IEEE-APS 2006, URSI/IEEE–APS 2022)). Moreover, he received the 2014 IEEE AP-S Donald G. Dudley Jr. Undergraduate Teaching Award, the triennium 2014-2016 URSI Issac Koga Gold Medal, and the 2015 L. B. Felsen Award for Excellence in Electrodynamics.

Prof. Andriulli is a Fellow of the IEEE and of the International Union of Radio Science (URSI), and a member of Eta Kappa Nu, Tau Beta Pi, and Phi Kappa Phi. He serves as the 2026 President-Elect of the IEEE Antennas and Propagation Society and served as IEEE AP-S Vice-President of Publications 2025, as Editor-in-Chief of the IEEE Antennas and Propagation Magazine, Track Editor for the IEEE Transactions on Antennas and Propagation and as an Associate Editor for the IEEE Antennas and Wireless Propagation Letters, IEEE Access, URSI Radio Science Letters, and IET-MAP.

Active Oscillating Arrays

Filippo Capolino

University of California, Irvine, USA

Abstract- We present theory and possible applications of exceptional point degeneracies (EPD) in waveguides with periodic antenna arrays including periodic active gain elements. EPDs are special degeneracies where two or more eigenstates of a system fully coalesce. Such exceptional degeneracies can be designed in circuits, resonators, and multimode waveguides and involve also the degeneracy of polarization states and can be designed in a surprisingly large number of systems, like fully passive systems or in systems that include gain elements. We provide new concepts, theory and various experimental verifications of the occurrence of EPDs in circuits and waveguides, and we discuss applications in antenna arrays, for high power synchronized arrays of radiators where the radiation from every part of a large array is coherent with low phase noise, forming a very directive high-power beam. Attention is devoted to the study of the saturated regime in systems with nonlinear gain leading to tightly synchronized arrays of oscillators, like grid arrays. EPD can be applied also to leaky wave antennas (LWA) by periodically coupling a LWA with another "associated" parallel waveguide forming various kinds of EPDs. We will show simple strategies to make a LWA+EPD system and how this system can be used for ultra-sensitive sensing.

Filippo Capolino received the Ph.D. degree in electrical engineering from the University of Florence, Italy, in 1997. He is currently a Professor with the Department of Electrical Engineering and Computer Science at the University of California, Irvine, CA, USA. Previously he has been an Assistant Professor at the Department of Information Engineering at the University of Siena, Italy from 2002 to 2008. From 1997 to 1999, he was a Fulbright Scholar and Postdoctoral Fellow with the Department of Aerospace and Mechanical Engineering, Boston University, MA, USA. From 2000 to 2001, part of 2005 and in 2006, he was a Research Assistant Visiting Professor with the Department of Electrical and Computer Engineering, University of Houston, TX, USA. He has been a short-term Visiting Professor at the Fresnel Institute, Marseille, France (2003) and at the Centre de Recherche Paul Pascal, Bordeaux, France (2010). In 2022 he has been the recipient of the Cathedra of Excellence from the University of Carlos III, Madrid, Spain. His research interests include applied electromagnetics, sensors in both microwave and optical ranges, photonics, metamaterials and their applications, traveling wave tubes, antennas, propagation, wireless systems, chip-integrated systems, etc. He is an IEEE Fellow, an Optica Fellow, and he is the editor of the two volume "Metamaterials Handbook", and he has published 230 journal articles in IEEE, Optica, Physics journals, etc.

Modal Fields Vs. Conduction Currents: New Design Strategies for Microstrip Antennas

Debatosh Guha
University of Calcutta, India

Abstract- Microstrip-based resonant antennas have remained a cornerstone of modern communication, radar, and sensing technologies. Decades of development have brought to light several fundamental challenges. Drawing upon recent personal research experiences, this talk demonstrates how strategic engineering with the modal fields, or more broadly, the conduction current distribution can offer elegant solutions to many of these longstanding challenges.

Debatosh Guha is the INAE Chair Professor at the Institute of Radio Physics and Electronics, University of Calcutta. He is a Fellow of IEEE and a Fellow of all four Indian National Academies of Science and Engineering. He was awarded the Abdul Kalam Technology Innovation National Fellowship by the Government of India (2020–2025) and the prestigious ANRF J. C. Bose Grant, Govt. of India in 2025. He has served the IEEE Antennas and Propagation Society as a Distinguished Lecturer, an Associate Editor of the *AP Transactions* along with the other journals, and currently serves as the Chair of the Member and Geographic Activities (MGA) Standing Committee.

Transforming Antenna Design Through Inhomogeneous Dielectric 3D Printing

Christophe Fumeaux

The University of Queensland, Australia

Abstract- Recent advances in additive manufacturing are opening unprecedented new possibilities for antenna engineering. In particular, three-dimensional printing of inhomogeneous dielectric materials enables spatial control of electromagnetic properties that was previously difficult, costly, or impractical to achieve. This presentation explores how dielectric 3D printing is transforming antenna design, shifting the focus from purely geometric shaping to full volumetric engineering of materials and fields. The talk begins with an overview of the principles and practical implementation of inhomogeneous dielectric structures enabled by modern additive manufacturing technologies. Key benefits and limitations are discussed, including material characterization, achievable resolution, dielectric losses, and fabrication constraints.

Building on this foundation, several recent antenna concepts are presented to illustrate how spatially varied dielectric distributions can be exploited to improve performance, functionality, and integration. Examples include planar and conformal antennas with inhomogeneous substrates, dielectric resonator antennas, dielectric rod and leaky wave antennas, as well as 3D printed flexible wearable antennas and sub terahertz antennas for direction of arrival estimation and spectral sensing.

By combining electromagnetic theory, material engineering, and manufacturing technology, this presentation highlights how controlled inhomogeneity enabled by dielectric 3D printing provides new design freedom and fresh perspectives for antenna engineering, offering promising pathways to address emerging challenges in future wireless and sensing systems.

Christophe Fumeaux received his Ph.D. degree from ETH Zurich, Switzerland, in 1997. From 1998 to 2008, he held various positions at the University of Central Florida, the Swiss Federal Office of Metrology, and ETH Zurich. From 2008 to 2023, he was a Professor with The University of Adelaide. In 2023, he joined the School of Electrical Engineering and Computer Science at The University of Queensland, as Chair Professor in Optical and Microwave Engineering. His main research interests concern applied electromagnetics, antenna engineering, and the application of RF design principles across the electromagnetic spectrum.

Prof. Fumeaux was the recipient of the ETH Medal for his doctoral dissertation. He was the recipient of the 2018 Edward E. Altshuler Prize, the 2014 IEEE Sensors Journal and the 2004 ACES Journal best paper awards. He was the recipient of the University of Adelaide 2018 Stephen Cole the Elder Award for Excellence in PhD Supervision. From 2017 to early 2023, he served as the Editor-in-Chief for the IEEE Antennas and Wireless Propagation Letters. He was 2025 President of the IEEE Antennas and Propagation Society and he is currently serving as IEEE AP-S Vice-President of Publications. He is a Fellow of the IEEE.

A Fresnel-Zone-Aware Line-of-Sight Probability Model Based on the Statistical Properties of Obstructions

Naoki Kita

Tokyo Denki University, Japan

Abstract - This talk presents a method for calculating line-of-sight (LOS) probability in higher-frequency wireless access and relay environments, taking into account the first Fresnel zone, based on building statistics from urban environments.

With a view toward the advancement of 5G and the realization of 6G, research is underway on Integrated Access and Backhaul (IAB), which uses the same frequency band for access and backhaul links, as well as Non-Terrestrial Networks (NTN) that utilize satellites, UAVs, and other technologies. In the link-revel simulations and link design for these systems, it is crucial to accurately assess the line-of-sight probability between the transmitter and receiver. In particular, in the 7–24 GHz frequency band—known as FR3 in addition to FR2—it is necessary to consider not only the line-of-sight path but also building obstruction within the first Fresnel zone formed around it.

Therefore, this presentation describes a method for simply calculating line-of-sight probability by probabilistically evaluating building obstruction within the first Fresnel zone based on statistical information—such as building density, building height distribution, and the relationship between building height and width—without the need for detailed 3D building data.

Naoki Kita received the B.E. degree from Tokyo Metropolitan Institute of Technology, Tokyo, Japan, in 1994, and the M.E. and Ph.D. degrees from Tokyo Institute of Technology, Tokyo, in 1996 and 2007, respectively. Since joining NTT Corporation, in 1996, he has been engaged in the research of propagation characteristics for wireless access systems, the development of future satellite communication systems, the research of future mobile communication systems, and international standardization on radio wave propagation. From 2009 to 2010, he was a Visiting Scholar with Stanford University, Stanford, CA, USA. From 2013 to 2014, he was a Visiting Research Scholar with Waseda University, Tokyo, Japan. He is currently a Professor at Tokyo Denki University (TDU), Tokyo, where he is engaged in studies on radio wave propagation for wireless systems. He is a Senior Member of IEICE and Member of IEEE.

He received the IEICE Young Researcher's Award, the IEICE Communications Society Best Paper Award, the IEICE Best Paper Award, and the Best Paper Award in ISAP2016, in 2002, 2010, 2014, and 2016, respectively. He also received the Telecommunication Advancement Foundation Telecom System Technology Award, in 2024.

RF Energy Harvesting for Batteryless Wireless Sensing and Long-Range Communication

Lei Guo

Dalian University of Technology, China

Abstract- The realization of the Internet of Things depends on a large number of geographically distributed wireless sensor nodes, whose deployment is often constrained by conventional power supplies and batteries due to wiring limitations, finite lifetime, maintenance costs, and environmental concerns. RF power harvesting offers a promising solution by enabling batteryless wireless sensing through ambient and dedicated wireless energy sources. This talk will present the rigorous analysis and development of RF power harvesters under practical ambient energy conditions. Building on this approach, the talk will demonstrate how the proposed harvesting techniques enable long-range wireless communication for batteryless devices. It will be then followed by the realization of long-range communication and sensing without the use of a microcontroller, thereby reducing system power consumption and complexity. Experimental demonstrations in representative IoT sensing scenarios will further illustrate the potential of RF energy harvesting for next-generation batteryless wireless sensing systems.

Lei Guo received the B.Eng. degree in communication engineering from the Harbin Institute of Technology, Harbin, China, in 2011, and the Ph.D. degree in electronic engineering from the City University of Hong Kong, Hong Kong, China, in 2016. From 2016 to 2019, she was a postdoctoral research fellow with City University of Hong Kong, China and Poly-Grames Research Center, Polytechnique Montreal, Canada. She is currently an Associate Professor with the School of Information and Communication Engineering, Dalian University of Technology, Dalian, China.

She has authored/ co-authored more than 80 articles, and holds 20 patents including US patents and Chinese patents. She received the IEEE Antennas and Propagation Society Young Professional of the Year Award, Young Professional Scientist at IEEE UCMMT-2025 and the Student Best Paper Award at iWEM-2015.She served as the organizing committee member in multiple international conference, e.g. 2018 IEEE MTT-S WPTC, 2022 ICMMT, 2023 MTT-S IWS, 2025 MTT-S IWS, and etc. She has continuously contributed to organizing women special sessions and activities for the IEEE Open Journal of Antennas and Propagation (OJAP) and the IEEE Transactions on Antennas and Propagation (TAP).

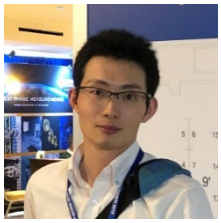
She served as a Guest Editor for special issues in IEEE OJAP (2021), IEEE MTT (2023), and IEEE AWPL (2025). She also takes lead in the launch of a WeChat Channels, for the promotion of IEEE TAP in China. Dr. Guo is now serving as an Associate Editor for both IEEE TAP and IEEE OJAP. She was recognized as the Outstanding Associate Editor for OJAP in 2024, Outstanding Guest Editor for AWPL in 2026, and was selected as AP-S Young Professional Ambassador in 2024. She also served as the committee member of IEEE AP-S TC-10, History Committee, and IEEE MTT-S TC-25. Her current research interests include wireless energy harvesting techniques, wireless sensing technologies, dielectric resonator antennas, and millimeter-wave antenna arrays.

Circularly Polarized Beam-Steering Folded Reflectarray Antennas for SATCOM Applications

Makoto Sano

Yokohama National University, Japan

Abstract- In recent years, internet access via satellites has emerged. In order to use satellite internet, ground terminals capable of tracking satellites are required. Recently, the author developed a beam-steerable circularly polarized folded reflectarray antenna for Ka-band satellite communication (SATCOM) applications. The antenna is based on the Risley prism principle and enables beam steering by rotating two surfaces mechanically, eliminating the need for expensive active circuit components. This talk presents the simulation and experimental results of the antenna designed for Ka-band downlink. This talk also covers an ongoing project on dual-band dual circularly polarized folded reflectarray antennas that cover both Ka-band downlink and uplink.



Makoto Sano received the B.S., M.S., and D.E. degrees in electrical and electronic engineering from Tokyo Institute of Technology, Tokyo, Japan, in 2010, 2012, and 2015, respectively. Part of his doctoral work was conducted in Technical University of Madrid, Madrid, Spain, where he studied antenna-diagnosis techniques as a visiting student. He worked for Toshiba Corporation, Kanagawa, Japan from 2015 to 2023. He was an Assistant Professor at Kumamoto University, Kumamoto, Japan from 2023 to 2025. He is currently an Associate Professor at Yokohama National University, Kanagawa, Japan. His research interests include reflectarray and transmitarray antennas. He was an Associate Editor of IEICE Electronics Express from 2018 to 2024. He holds 8 US Patents. He received IEEE AP-S Tokyo Chapter Young Engineer Award in 2020. He is a recipient of Best Paper Award at 2025 International Symposium on Antennas and Propagation (ISAP2025).