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Pushing the Boundaries of Computational Electromagnetics – Application to Antenna Designs, Placement, Co-site Interference Simulations and Digital Twins

Simulation-driven design changed product development forever, enabling engineers to reduce design, iterations, and prototype testing. Increasing scientific computing power expanded the opportunity to apply analysis, making large design studies possible within the timing constraints of a program. This talk will focus on advanced CEM simulation tools that incorporate numerical methods, such as Method of Moments (MoM), Multilevel Fast Multipole Method (MLFMM), Finite Element Method (FEM), Finite Difference Time Domain (FDTD), Physical Optics (PO), Ray Lancing Geometrical Optics (RL-GO), and Uniform Theory of Diffraction (UTD). As the complexity of connected devices increases each day, designers are taking advantage of AI/ML to generate trained models for their physical antenna designs and perform fast and intelligent optimization on these trained models. Using the trained models, different optimization algorithms and goals can be run quickly, in seconds, that can be utilized for comparison studies, stochastic analysis for tolerance studies etc. Use of cloud computing combined with AI/ML, many design iterations can be performed in a short period and reducing the time to market. This talk will also focus on future trends in cloud computing for physics-based simulations and the emerging topics such as Digital Twins.

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 and 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.*"



Mahmoud Wagih

Reader, University of
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What Makes Green RF Electronics: Advanced Materials, Packaging, and Emerging Applications

The electronics industry produces non-negligible emissions and e-waste, and is a major consumer of critical raw materials (CRMs), which could hinder its growth to deliver our digital aspirations. I will introduce a life cycle assessment (LCA)-driven approach to electronics design, showing how to quantify the true environmental footprint as well as methods to design electronics for environmental sustainability and supply chain resilience. Looking at the impact of semiconductor devices and specifically RFICs, methods for circularity through recycling and re-use will be introduced, identifying trade-offs in reliability, performance, and ease of recycling. Fully biodegradable RF package assemblies with high-performance transmission beyond 120 GHz will be showcased, along with their ability to enable a circular economy for RFICs, without the use of traditional bonding approaches. Finally, emerging applications in RF-based sensing will be introduced, showing how microwave electronics could reduce the complexity of sensing interfaces.

Mahmoud Wagih is a Reader at the University of Glasgow, UK, leading the Green RF-Enabled Electronics Lab, and co-director for the UKRI Centre for Responsible Electronics “REACT”; he is also the Founder of RX Watt Ltd., a start-up dedicated to RF-powered sensors. His research covers materials, manufacturing, and applications of sustainable microwave to THz systems including advanced packaging, RF sensing, and RFID/wireless power, with 130+ papers and 4 patents on these topics. He has been principal or co-investigator on £17M projects and has received 20+ Awards including a Royal Academy of Engineering Medal, being listed in Forbes 30Under30, and multiple Best Paper prizes. He is an IEEE Distinguished Microwave Lecturer, a Topic Editor for the IEEE Journal of Microwaves, and a member/vice-chair of several IEEE microwave committees.



Goutam Chattopadhyay
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MHz to THz Technologies (MTT) and Our Place in the Universe

Space exploration has long served as a powerful catalyst for inspiring the imagination of the next generation. The sight of rovers on Mars, images from distant galaxies, and the dream of humans returning to the Moon or reaching Mars ignite curiosity and a spirit of discovery in young minds. These missions are not just feats of engineering – they are stories that capture the human desire to explore the unknown and push beyond boundaries. By engaging students, educators, and the public in the wonders of space, exploration fosters STEM education, fuels innovation, and builds a generation that dreams bigger and reaches further.

Beyond its inspirational value, space exploration offers a unique lens through which we can better understand ourselves and our place in the cosmos. As we study other planets and moons, we gain valuable insight into planetary evolution, atmospheric behavior, and the potential for life beyond Earth. Observing Earth from space also provides critical data on climate change, environmental degradation, and the fragile systems that sustain life. In this way, space science not only fuels our search for extraterrestrial life but also deepens our understanding of Earth's past, present, and future. Ultimately, exploring the universe is a journey inward as much as outward – it challenges us to think about our shared humanity, our responsibility to protect our planet, and our collective future among the stars.

In this lecture, we will explore the technological innovations in the MHz to THz frequency domain driving the next generation of space instruments and highlight specific instrument developments along with the fundamental science questions they aim to address.

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Goutam Chattopadhyay is a Senior Scientist at NASA's Jet Propulsion Laboratory (JPL), California Institute of Technology (Caltech), and a Visiting Professor at Caltech in Pasadena, USA. He previously served as the BEL Distinguished Visiting Chair Professor at the Indian Institute of Science, Bangalore, and as an Adjunct Professor at the Indian Institute of Technology, Kharagpur. Dr. Chattopadhyay received his Ph.D. in Electrical Engineering from Caltech in 2000. He is a Fellow of the IEEE (USA), National Academy of Inventors (NAI), and the IETE (India); an Associate Fellow of the AIAA, the 2025 President of the IEEE Microwave Theory and Technology Society (MTT-S), a Track Editor for the IEEE Transactions on Antennas and Propagation, and an IEEE Distinguished Lecturer. His research focuses on microwave, millimeter-wave, and terahertz receiver systems and radars, as well as space instrumentation for the search for life beyond Earth.

Dr. Chattopadhyay has authored over 450 publications in international journals and conferences and holds more than 25 patents. He has received over 35 NASA Technical Achievement and New Technology Invention Awards. In 2026, he received NASA's Group Achievement Medal. In 2025, he received the NASA-JPL North Star Award, the highest honor bestowed upon a NASA-JPL scientist. In 2024, he was awarded the prestigious Armstrong Medal by the Radio Club of America (RCA) in recognition of his outstanding contributions to radio science. He also received the NASA-JPL People Leadership Award in 2023. Among other honors, he was named IEEE Region 6 Engineer of the Year in 2018 and received the Distinguished Alumni Award from the Indian Institute of Engineering Science and Technology (IIST), India, in 2017. He is a two-time recipient of the Best Journal Paper Award from IEEE Transactions on Terahertz Science and Technology (2020 and 2013) and also received the Best Paper Award for Antenna Design and Applications at EuCAP in 2017. Additional accolades include the IETE Biman Bihari Sen Memorial Award (2022) and the IETE Prof. S. N. Mitra Memorial Award (2014).