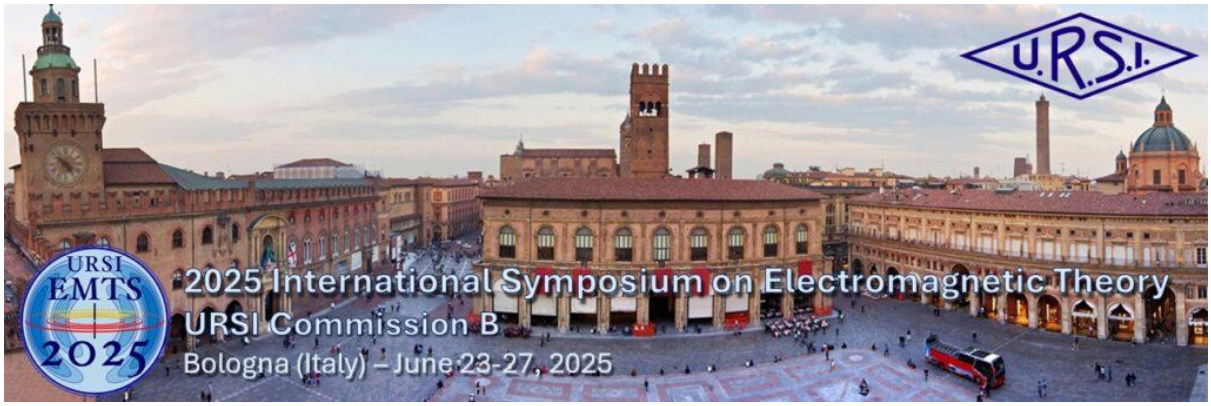
Drywall Panel Coated with Biochar for Electromagnetic Shielding Applications



Technical Programme

International Symposium on Electromagnetic Theory

URSI EMTS 2025

23-27 June 2025

Bologna, Italy

Version 15/06/2025

Tuesday, 24 June 2025

Tuesday, 24 June 2025 09:30 - 11:00 Room B

PLE-1 Opening Session & Plenary Talk 1

Session Chairs: *Ludger Klinkenbusch (Germany)*

Tu-PLE-AM0-1 **Opening Session**

Tu-PLE-AM0-2 **Evolution of Computational Electromagnetics, Review of the State of the Art and Future Prospects (Invited)**
Ulrich Jacobus (1)
(1) Altair Engineering (Germany)
DOI: https://doi.org/10.46620/URSIEMTS25/UMXN6337

Tuesday, 24 June 2025 14:30 - 16:30 Room C

S13-1 Metamaterials and metasurfaces: space, time, and spacetime control of wave propagation - Part 1

Session Chairs: *Victor Pacheco-Peña (United Kingdom), Carlo Rizza (Italy), J. Enrique Vázquez-Lozano (Spain)*
Session Conveners: *Victor Pacheco-Peña, Iñigo Liberal, Carlo Rizza*

Tu-S13-PM0-1 **Wave Scattering from Time-Varying Dispersive Interfaces (Invited)**
Carlo Rizza (1), Maria Antonietta Vincenti (2), Giuseppe Castaldi (3), Alessandra Contestabile (1), Vincenzo Galdi (3), Michael Scalora (4)
(1) University of L'Aquila (Italy); (2) University of Brescia (Italy); (3) University of Sannio (Italy); (4) U.S. Army CCDC (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/DCTE2694

Tu-S13-PM0-2 **Electrodynamics of Temporal Interfaces: Analysis and design of Time-switched metamaterial devices (Invited)**
Davide Ramaccia (1), Luca Stefanini (1), Andrea Alù (2), Alessandro Toscano (1), Filiberto Bilotti (1)
(1) Roma Tre University (Italy); (2) Advanced Science Research Center (ASRC), City University of New York (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/TJQL5386

Tu-S13-PM0-3 **Photon-Pair Annihilation at Time Interfaces: Consequent Quantum Optical Effects (Invited)**
Mohammad Sajjad Mirmoosa (1)
(1) University of Eastern Finland (Finland)
DOI: https://doi.org/10.46620/URSIEMTS25/JVZR4653

Tu-S13-PM0-5 **From Photonic Time Interfaces to Smooth Temporal Modulations**
Mariya Antyufeyeva (1, 2), Victor Pacheco-Peña (1)
(1) Newcastle University (United Kingdom); (2) V. N. Karazin Kharkiv National University (Ukraine)
DOI: https://doi.org/10.46620/URSIEMTS25/XSBB5994

Tu-S13-PM0-6 **The impact of multipath scenarios on electromagnetic wave propagation in curved tunnels**
Yehuda Taragin (1), Gad A. Pinhasi (2), Yosef Pinhasi (1)
(1) Faculty of Engineering, Dept. of Electrical and Electronic Engineering, Ariel University (Israel); (2) Dept. of Chemical Engineering, Ariel University (Israel)
DOI: https://doi.org/10.46620/URSIEMTS25/DRCT7299

Tuesday, 24 June 2025 14:30 - 16:30 Room H

S11-1 Electromagnetic methods for direct and inverse scattering involving stratified media - Part 1

Session Chairs: *Cristina Ponti (Italy), Andrea Randazzo (Italy)*
Session Conveners: *Giuseppe Schettini, Andrea Randazzo, Cristina Ponti*

Tu-S11-PM0-1 **On the interaction of a Bessel-shaped beam with planar multilayer structures for maximum power transfer (Invited)**
Santi Concetto Pavone (1), Gino Sorbello (1)
(1) Dept. of Electrical, Electronics, and Computer Engineering (DIEEI), University of Catania (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/IMYQ3401

Tu-S11-PM0-2 **A Study on Numerical Approach to Transient Electromagnetic Scattering Based on Fast Inverse Laplace Transform (Invited)**
Koki Watanabe (1)
(1) Fukuoka Institute of Technology (Japan)
DOI: https://doi.org/10.46620/URSIEMTS25/JNZB3842

Tu-S11-PM0-3 **A scattering matrix based approach to design anomalous reflection from a PEC plane (Invited)**
Roberta Palmeri (1, 2), Renat Abdullin (1), Giada Maria Battaglia (1), Andrea Francesco Morabito (1), Lorenzo Crocco (2), Tommaso Isernia (1, 2)
(1) University Mediterranea of Reggio Calabria (Italy); (2) IREA - CNR (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/PLMG8032

Tu-S11-PM0-4 **Electromagnetic Scattering by a Sphere of Magnetic Vortices (Invited)**
Vakhtang Jandieri (1), Nicolas Tsagareli (2), Ramaz Khomeriki (3), Pingjuan Werner (4), Douglas H. Werner (4), Daniel Erni (1), Jamal Berakdar (5)
(1) University of Duisburg– Essen (Germany); (2) Free University of Tbilisi (Georgia); (3) Tbilisi State University (Georgia); (4) The Pennsylvania State University (United States); (5) Martin-Luther-Universität (Germany)
DOI: https://doi.org/10.46620/URSIEMTS25/ICKP2891

Tu-S11-PM0-5 **Performance Analysis of an Improved Chebyshev Spectral Solver for Vector Radiative Transfer in a Molecular Atmosphere**
Emanuele Tavanti (1), Andrea Randazzo (2)
(1) University of Pisa (Italy); (2) University of Genoa (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/ZTTB6115

Tu-S11-PM0-6 **Extension of the diffraction hyperbola method to the case of layered media**
Raffaele Persico (1), Ding Yang (2), Gianfranco Morelli (3), Ilaria Catapano (4), Giuseppe Esposito (4), Gregory De Martino (5), Luigi Capozzoli (5)
(1) University of Calabria (Italy); (2) University of Electronic Science and Technology of China (China); (3) Geostudi Astier s.r.l. (Italy); (4) IREA-CNR (Italy); (5) IMAA-CNR (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/GYNX1421

Tuesday, 24 June 2025 14:30 - 16:30 Room I

S07-1 On the development of effective models for electromagnetic applications - Part 1

Session Chairs: *Lars Jonsson (Sweden), Valentin De la Rubia (Spain)*
Session Conveners: *Lars Jonsson, Valentin de la Rubia*

Tu-S07-PM0-1 **Analytic Optimal Inverse Design for Maximal Scattering and Absorption (Invited)**
Mats Gustafsson (1)
(1) Lund University (Sweden)
DOI: https://doi.org/10.46620/URSIEMTS25/IPIW8716

Tu-S07-PM0-2 **A Mixed Tree-Cotree Gauge for Reduced Order Models for the Time-Harmonic Maxwell's Equations (Invited)**
Anna Ziegler (1), Sebastian Schöps (1)
(1) Technische Universität Darmstadt (Germany)
DOI: https://doi.org/10.46620/URSIEMTS25/TRTF8398

Tu-S07-PM0-3 **A Model order reduction method for smoothly varying propagation problems (Invited)**
Gian Guido Gentili (1), Matteo Oldoni (1)
(1) Politecnico di Milano (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/SCYN9128

Tu-S07-PM0-4 **Addressing Spurious Modes in Reduced Order Models for Efficient Electromagnetic Scattering and Metasurface Design**
Monica Ortega (1), Ruth Medeiros (1), Valentin de la Rubia (1)
(1) Universidad Politécnica de Madrid (Spain)
DOI: https://doi.org/10.46620/URSIEMTS25/OJAY7586

Tu-S07-PM0-5 **POD-Based Parametric Model Order Reduction for Dielectric Materials in Electromagnetic Devices**
Clara Iglesias-Tesouro (1), Lihong Feng (2), Valentín De la Rubia (1)
(1) Universidad Politécnica de Madrid (Spain); (2) Max Planck Institute for Dynamics of Complex Technical Systems (Germany)
DOI: https://doi.org/10.46620/URSIEMTS25/DHPJ6722

Tu-S07-PM0-6 **A Scalable open source electromagnetics model for Wireless power transfer and Space-Based Solar Power**
Timothy Pelham (1), Fearon Thomas (1)
(1) University of Bristol (United Kingdom)
DOI: https://doi.org/10.46620/URSIEMTS25/NKLW8291

Tuesday, 24 June 2025 14:30 - 16:30 Poster room

YSP Young Scientist Poster Session

Tu-YSP-PM0-1 **Semi-Analytical Method for Electromagnetic Propagation in Biaxially Anisotropic Cylindrical Waveguides**
Raul O. Ribeiro (1), Guilherme S. Rosa (1), Rafael A. Penchel (1), Fernando L. Teixeira (2)
(1) São Paulo State University (Brazil); (2) The Ohio State University (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/PWUU8066

Tu-YSP-PM0-2 **On Number of Active and Passive Elements in Reactively Loaded Antennas**
Albert Salmi (1), Anu Lehtovuori (1), Ville Viikari (1)
(1) Aalto University (Finland)
DOI: https://doi.org/10.46620/URSIEMTS25/QUZO8393

Tu-YSP-PM0-3 **Ansatz for longitudinal solution for TEM-wave propagation through a metamaterial composite in a hollow waveguide**
Balwan Rana (1), Mariana Dalarsson (1)
(1) KTH Royal Institute of Technology (Sweden)
DOI: https://doi.org/10.46620/URSIEMTS25/TZAR8953

Tu-YSP-PM0-4 **Spectral Analysis of Boundary Integral Operators Discretized Over the Sphere: a High-Frequency Perspective**
Viviana Giunzioni (1), Adrien Merlini (2), Francesco P. Andriulli (1)
(1) Politecnico di Torino (Italy); (2) IMT Atlantique (France)
DOI: https://doi.org/10.46620/URSIEMTS25/FNNN4703

Tu-YSP-PM0-5 **Advances in Human Health Monitoring Empowered by Reconfigurable Intelligent Surfaces (Invited)**
Xin Yu Li (1), Jian Wei You (1), Tie Jun Cui (1)
(1) Southeast University (China)
DOI: https://doi.org/10.46620/URSIEMTS25/FMID5473

Tu-YSP-PM0-6 **Polarization-Aware Ray-Tracing Enhanced Back-Projection Algorithm for Microwave Imaging in Complex Multipath Environments (Invited)**
Han Na (1), Quanfeng Wang (1), Matthias Saurer (1), Meisong Tong (2), Thomas F. Eibert (1)
(1) Department of Electrical Engineering, School of Computation, Information and Technology, Technical University of Munich (Germany); (2) Department of Electronic Science and Technology, Tongji University (China)
DOI: https://doi.org/10.46620/URSIEMTS25/RKHF8213

Tu-YSP-PM0-7 **Theoretical Characterization of Scattered Floquet Modes in the Canonical Problem of Anomalous Reflection**
Federico Giusti (1), Enrica Martini (1), Stefano Maci (1), Matteo Albani (1)
(1) Department of Information Engineering and Mathematics, University of Siena (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/JSXV1892

Tu-YSP-PM0-8 **Numerical Solution of the GO Equations for GRIN Lens Antennas by Using the Lax-Friedrichs Sweeping Method (Invited)**
Ilir Gashi (1), Stefano Maci (1), Matteo Albani (1)
(1) Department of Information Engineering and Mathematics, University of Siena (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/SEFT2603

Tu-YSP-PM0-9 **High-Gain mm-Wave Leaky-Wave/Fabry-Perot Antenna Using Substrate-Integrated Partially Reflective Surfaces**
Rana Muhammad Hasan Bilal (1), Stefano Moscato (2), Simone Genovesi (1), Giuliano Manara (1), Filippo Costa (1)
(1) University of Pisa (Italy); (2) Research and Development Department of SIAE MICROELETTRONICA (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/FQGU7083

Tu-YSP-PM0-10 **Semi-Analytical Formulation of Diffraction from a Cone with an Arbitrary Cross-Section Using FEM (Invited)**
Iraklis Sarigiannidis (1, 2), Massimiliano Casaletti (1), Matteo Albani (2)
(1) Sorbonne University (France); (2) University of Siena (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/VPAD9880

Tu-YSP-PM0-11 **Laplacian Surrogate of the EFIE based on Differential Forms: Application to Preconditioning**
Clément Henry (1), Adrien Merlini (1), Francesco P. Andriulli (2)
(1) IMT Atlantique (France); (2) Politecnico di Torino (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/FETQ8846

Tu-YSP-PM0-12 **Preconditioning Strategies and Conformal Discretizations Empowered by High-Order Projectors (Invited)**
Johann Bourhis (1), Adrien Merlini (1), Francesco P. Andriulli (2)
(1) IMT Atlantique (France); (2) Politecnico di Torino (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/KZIS4265

Tu-YSP-PM0-13 **Generalized Richmond-Mie Theory for the Scattering of Metallic and Dielectric Cylinders Wrapped by Surface Impedance Multilayers**
Giuseppe Labate (1), Andrea Alù (2), Giampiero Gerini (3)
(1) TNO - Radar Department (Netherlands); (2) Advanced Science Research Center (ASRC), City University of New York (United States); (3) TNO - Optics Department (Netherlands)
DOI: https://doi.org/10.46620/URSIEMTS25/TUYS5870

Tu-YSP-PM0-14 **Unit Cell Design for space-fed Surfaces via Kernel-based Machine Learning Regression**
Michele Beccaria (1), Nazanin Soleimani (1), Riccardo Trinchero (1), Paola Pirinoli (1)
(1) Politecnico di Torino (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/JDLD6926

Tu-YSP-PM0-15 **Electromagnetic Channel Statistics for Continuous-Aperture Array (CAPA) Systems**
Chongjun Ouyang (1), Boqun Zhao (2), Xingqi Zhang (2), Yuanwei Liu (3)
(1) Queen Mary University of London (United Kingdom); (2) University of Alberta (Canada); (3) The University of Hong Kong (Hong Kong)
DOI: https://doi.org/10.46620/URSIEMTS25/OCQP8005

Tu-YSP-PM0-16 **Highly selective notch filter based on a cylindrical dielectric resonator for 5.8 GHz dedicated short-range communications**
Giacomo Giannetti (1), Stefano Maddio (1), Stefano Selleri (1)
(1) Università di Firenze (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/LZZU8857

Tu-YSP-PM0-17 **Electromagnetic wave-based solutions to partial differential equations using networks of waveguide-based metatronic T-circuits (Invited)**
Ross Glyn Macdonald (1), Alex Yakovlev (1), Christian Johnson-Richards (1), Victor Pacheco-Peña (1)
(1) Newcastle University (United Kingdom)
DOI: https://doi.org/10.46620/URSIEMTS25/JFPD3675

Tu-YSP-PM0-18 **Reconfigurable Plasma Frequency Selective Surface (Invited)**
Krushna Kanth Varikuntla (1), Muhammad Ali Babar Abbasi (1), Okan Yurduseven (1)
(1) Queens University Belfast (United Kingdom)
DOI: https://doi.org/10.46620/URSIEMTS25/WHRT9994

Tu-YSP-PM0-19 **PTD Symmetric Double Edge Line Using the Bed of Nails Metasurface (Invited)**
Nelson Castro (1), Enrica Martini (2), Stefano Maci (2), Eva Rajo-Iglesias (1)
(1) University Carlos III of Madrid (Spain); (2) University of Siena (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/TAMC7458

Tu-YSP-PM0-20 **Metamaterial wireless pressure sensor based on deformable substrate**
Sandra Rodini (1), Simone Genovesi (1), Giuliano Manara (1), Filippo Costa (1)
(1) Dipartimento di Ingegneria dell'Informazione, Università di Pisa (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/WNHT3828

Tuesday, 24 June 2025 17:00 - 18:00 Room C

S14-1 Reconfigurable intelligent surfaces (RIS) and their applications- Part 1

Session Chairs: *Filippo Costa (Italy), Shuo Liu (China)*
Session Conveners: *Filippo Costa, Shuo Liu*

Tu-S14-PM3-1 **Green's Function of Metasurface-Assisted Cavities (Invited)**
Abdorreza Torabi (1), Gabriele Gradoni (1)
(1) University of Surrey (United Kingdom)
DOI: https://doi.org/10.46620/URSIEMTS25/OEMX5832

Tu-S14-PM3-2 **Advances in the Design of Reconfigurable Intelligent Surfaces using the Composite Vortex Theory (Invited)**
Mirko Barbuto (1), Alessio Monti (1), Stefano Vellucci (2), Andrea Alù (3), Filiberto Bilotti (1), Alessandro Toscano (1)
(1) Roma Tre University (Italy); (2) Niccolò Cusano University (Italy); (3) Advanced Science Research Center (ASRC), City University of New York (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/YUDO2709

Tu-S14-PM3-3 **Polarization Deflector in PTD - Symmetric Geometry – Part II: Experiment and Reconfigurability**
Roee Geva (1), Mário Silveirinha (2), Raphael Kastner (1)
(1) Tel Aviv University (Israel); (2) University of Lisbon (Portugal)
DOI: https://doi.org/10.46620/URSIEMTS25/HCKH7915

Tuesday, 24 June 2025 17:00 - 18:00 Room D

S08-1 Mathematical modelling of EM problems - Part 1

Session Chairs: *Paul Smith (Australia), George Uslenghi (United States)*
Session Conveners: *Paul Smith, George Uslenghi*

Tu-S08-PM3-1 **Helicoidal Plane-Wave Modes in a Rectangular Coaxial cable Containing DNG Deflectors**
Piergiorgio Uslenghi (1)
(1) University of Illinois (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/CQAS5918

Tu-S08-PM3-2 **Semi-Analytical Method for Electromagnetic Propagation in Biaxially Anisotropic Cylindrical Waveguides**
Raul O. Ribeiro (1), Guilherme S. Rosa (1), Rafael A. Penchel (1), Fernando L. Teixeira (2)
(1) São Paulo State University (Brazil); (2) The Ohio State University (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/PWUU8066

Tu-S08-PM3-3 **On the Existence of TE Waves in a Circular Dielectric Rod**
Diana A. Volobueva (1), Yury V. Shestopalov (1)
(1) Russian Technological University MIREA (Russia)
DOI: https://doi.org/10.46620/URSIEMTS25/JMYY4554

Tuesday, 24 June 2025 17:00 - 18:00 Room H

S12-1 Scattering of waves by particles: new applications from radio waves to optics - Part 1

Session Chairs: *Samel Arslanagic (Denmark), Mariana Dalarsson (Sweden)*
Session Conveners: *Mariana Dalarsson, Samel Arslanagic*

Tu-S12-PM3-1 **Exceptional Points from Huygens' Dipole Nanoscatterers (Invited)**
Christos Argyropoulos (1)
(1) The Pennsylvania State University (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/YKUV5639

Tu-S12-PM3-2 **Polarizability of Biased Ferroelectric Particles of Different Shapes (Invited)**
Daniel Sjöberg (1)
(1) Lund University (Sweden)
DOI: https://doi.org/10.46620/URSIEMTS25/EAKF2166

Tu-S12-PM3-3 **Effective permittivity of functionally graded gold nanoparticles for biomedical applications**
Mika Söderström (1), Mariana Dalarsson (1)
(1) KTH Royal Institute of Technology (Sweden)
DOI: https://doi.org/10.46620/URSIEMTS25/EJBD4333

Tuesday, 24 June 2025 17:00 - 18:00 Room I

S06-1 Advanced algorithms in computational electromagnetics - Part 1

Session Chairs: *Vladimir Okhmatovski (Canada)*
Session Conveners: *Shinichiro Ohnuki, Vladimir Okhmatovski, Qing Huo Liu*

Tu-S06-PM3-1 **An h-p Refinement Strategy for Locally Corrected Nystrom Discretization of CFIE on 3D Objects with Sharp Corners**
Omid Babazadeh (1), Jin Hu (2), Emrah Sever (3), Ian Jeffrey (1), Constantine Sideris (2), Vladimir Okhmatovski (1)
(1) University of Manitoba (Canada); (2) University of Southern California (United States); (3) Aselsan (Turkey); (2) University of Southern California (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/QVMI3622

Tu-S06-PM3-2 **Compression and Fast Solution of Multipole-based Generalized Integral Equations**
Richard Kalhöfer (1), Yaniv Brick (2), Arkadi Sharshevsky (3), Amir Boag (3), Ludger Klinkenbusch (1)
(1) Kiel University (Germany); (2) Ben-Gurion University of the Negev (Israel); (3) Tel Aviv University (Israel)
DOI: https://doi.org/10.46620/URSIEMTS25/ABEI8652

Tu-S06-PM3-3 **Spectral Analysis of Boundary Integral Operators Discretized Over the Sphere: a High-Frequency Perspective**
Viviana Giunzioni (1), Adrien Merlini (2), Francesco P. Andriulli (1)
(1) Politecnico di Torino (Italy); (2) IMT Atlantique (France)
DOI: https://doi.org/10.46620/URSIEMTS25/FNNN4703

Wednesday, 25 June 2025

Wednesday, 25 June 2025 09:00 - 11:00 Room C

S02-1 Antenna theory for design, analysis, and measurements - Part 1

Session Chairs: *Andrea Michel (Italy), Somak Bhattacharyya (India)*
Session Conveners: *Debatosh Guha, Andrea Michel*

We-S02-AM1-1 **Corrugated Sectorial Leaky-Wave Antenna for DoA applications (Invited)**
Matteo Perrone (1), Julien Sarrazin (2), Guido Valerio (2), Guido Lombardi (1)
(1) Politecnico di Torino (Italy); (2) Sorbonne Université (France)
DOI: https://doi.org/10.46620/URSIEMTS25/GANP7276

We-S02-AM1-2 **Circularly Polarized Dielectric Resonator Antenna with Wide Axial Ratio Bandwidth Using Parasitic Metallic Plates**
Partha Pratim Shome (1), Debanjali Sarkar (2), Sembiam R. Rengarajan (3)
(1) SR University (India); (2) VIT-AP University (India); (3) California State University (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/DCWI2503

We-S02-AM1-3 **A Wideband Vivaldi Antenna**
Jessica L. Mundell (1), Johann W. Odendaal (1), Johan Joubert (1), Bennie Jacobs (1)
(1) University of Pretoria (South Africa)
DOI: https://doi.org/10.46620/URSIEMTS25/GRIB6008

We-S02-AM1-4 **Dual-Band Beam-Scanning Risley Prism Antenna by using Fully Dielectric Transmitarray**
Francesco Alessio Dicandia (1), Simone Genovesi (2)
(1) CNR Pisa (Italy); (2) University of Pisa (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/PHLR8584

We-S02-AM1-5 **A Simplified and Cost-Effective Fiber Laser Fabrication Method for Designing Wideband Multi-Layer Fabry-Perot/Leaky-Wave Antenna with Complementary PRS**
Rana Muhammad Hasan Bilal (1), Etienne Perret (2, 3), Simone Genovesi (1), Giuliano Manara (1), Filippo Costa (1)
(1) University of Pisa (Italy); (2) Univ. Grenoble Alpes, Grenoble INP, LCIS (France); (3) Institut Universitaire de France (France)
DOI: https://doi.org/10.46620/URSIEMTS25/KHLB6810

We-S02-AM1-6 **A Gain Enhanced Dual Band Wearable Microstrip Antenna for IoT Band**
Nurhak Mondal (1), Aritra Biswas (1), Deepak Ram (2), Ardhendu Kundu (1), Sayan Sarkar (1), Gobinda Sen (1), Somak Bhattacharyya (2)
(1) Institute of Engineering & Management, Salt Lake, Kolkata (India); (2) Indian Institute of Technology (BHU) Varanasi (India); (2) Indian Institute of Technology (BHU) Varanasi (India)
DOI: https://doi.org/10.46620/URSIEMTS25/DJUR8376

Wednesday, 25 June 2025 09:00 - 11:00 Room D

S09-1 Novel mathematical methods in electromagnetics - Part 1

Session Chairs: *Kazuya Kobayashi (Japan), Yury Shestopalov (Russia), Guido Lombardi (Italy)*
Session Conveners: *Kazuya Kobayashi, Guido Lombardi, Yury Shestopalov*

We-S09-AM1-1 **Analytic and Numerical Techniques for Computing the Fourier Spectrum of Bandlimited Periodic Signals Using Signal and Signal Derivative Sampling (Invited)**
Olav Breinbjerg (1)
(1) ElMaReCo (Denmark)
DOI: https://doi.org/10.46620/URSIEMTS25/ATYV1547

We-S09-AM1-2 **A rigorous solution to the problem of an open resonator consisting of a coaxial section of a pipe located inside the infinite waveguide: the Wiener - Hopf method (Invited)**
Gulnar Bairova (1), Gulnar Alkina (1), Seil Sautbekov (1)
(1) Al-Farabi Kazakh National University (Kazakhstan)
DOI: https://doi.org/10.46620/URSIEMTS25/MCYP3994

We-S09-AM1-3 **Rigorous RCS Analysis of the Plane Wave Diffraction by a Perfectly Conducting Rectangular Cylinder (Invited)**
Kewen He (1), Kazuya Kobayashi (1)
(1) Chuo University (Japan)
DOI: https://doi.org/10.46620/URSIEMTS25/WYME3457

We-S09-AM1-4 **Exact Solution and Its Simplified Form for Edge-Line PTD Waveguides (Invited)**
Xenofon M. Mitsalas (1), Stefano Maci (1)
(1) Department of Information Engineering and Mathematics, University of Siena (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/PJYF3642

We-S09-AM1-5 **Metasurface Reflectors based on Bianisotropic Susceptibilities (Invited)**
Oscar Céspedes Vicente (1), Christophe Caloz (1)
(1) KU Leuven (Belgium)
DOI: https://doi.org/10.46620/URSIEMTS25/IMZD2311

Wednesday, 25 June 2025 09:00 - 11:00 Room H

S12-2 Scattering of waves by particles: new applications from radio waves to optics - Part 2

Session Chairs: *Samel Arslanagic (Denmark), Mariana Dalarsson (Sweden)*
Session Conveners: *Mariana Dalarsson, Samel Arslanagic*

We-S12-AM1-1 **All-dielectric Cylindrical Homogenized Metasurface for Enhanced Directional Scattering (Invited)**
Rasmus Elkjær Jacobsen (1), Samel Arslanagic (1)
(1) Technical University of Denmark (Denmark)
DOI: https://doi.org/10.46620/URSIEMTS25/FDTO2201

We-S12-AM1-2 **Maximizing Bandwidth-to-Thickness Ratio of Electrically Thin Absorbers through Dispersion Engineering (Invited)**
Pardha Sourya Nayani (1), Morteza Moradi (1), Pooria Salami (1), Younes Ra'di (1)
(1) Syracuse University (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/RRRZ9768

We-S12-AM1-3 **1-Bit Transmissive Huygens Metasurfaces for Antenna Beam-Steering (Invited)**
Stefano Vellucci (1), Monti Alessio (2), Mirko Barbuto (2), Alessandro Toscano (2), Filiberto Bilotti (2)
(1) Niccolò Cusano University (Italy); (2) Roma Tre University (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/UZOQ4783

We-S12-AM1-4 **Electromagnetic wave-based solutions to partial differential equations using networks of waveguide-based metatronic T-circuits (Invited)**
Ross Glyn Macdonald (1), Alex Yakovlev (1), Christian Johnson-Richards (1), Victor Pacheco-Peña (1)
(1) Newcastle University (United Kingdom)
DOI: https://doi.org/10.46620/URSIEMTS25/JFPD3675

We-S12-AM1-5 **First-principles nanocircuit model of open electromagnetic resonators**
Carlo Forestiere (1), Giovanni Miano (1), Andrea Alù (2)
(1) University of Naples "Federico II" (Italy); (2) Advanced Science Research Center (ASRC), City University of New York (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/IZXC7046

We-S12-AM1-6 **Ray-Optic Solutions for Fields Radiated by Arbitrarily Oriented Point Current Sources in Presence of Smooth, Convex, Impedance Surfaces (Invited)**
Kittisak Phaebua (1), Prabhakar Pathak (2), Deb Chatterjee (3), Chuwong Phongcharoenpanich (4)
(1) King Mongkut's University of Technology North Bangkok (Thailand); (2) The Ohio State University (United States); (3) University of Missouri at Kansas City (UMKC) (United States); (4) King Mongkut's University of Technology Ladkrabang (Thailand)
DOI: https://doi.org/10.46620/URSIEMTS25/ATWX2150

Wednesday, 25 June 2025 09:00 - 11:00 Room I

S07-2 On the development of effective models for electromagnetic applications - Part 2

Session Chairs: *Lars Jonsson (Sweden), Valentin De la Rubia (Spain)*
Session Conveners: *Lars Jonsson, Valentin de la Rubia*

We-S07-AM1-1 **Efficient Method of Moments Analysis of Periodic Metasurfaces Combining Spectral and Spatial Domain Approaches (Invited)**
Jonathan Dessy (1), Laurent Paucot (1), Denis Tihon (1), Modeste Bodehou (2), Christophe Craeye (1)
(1) Université catholique de Louvain (Belgium); (2) Université d'Abomey-Calavi (Benin)
DOI: https://doi.org/10.46620/URSIEMTS25/BHHQ9781

We-S07-AM1-2 **Analytical Modelling of Electromagnetic Scattering from Multilayered Meta-Grating Consisting of Core-Shell Cylinders (Invited)**
Mohammed G.H. Alijani (1), Alessio Monti (1), Stefano Vellucci (2, 3), Mirko Barbuto (1, 3), Alessandro Toscano (1), Filiberto Bilotti (1, 3)
(1) Roma Tre University (Italy); (2) Niccolò Cusano University (Italy); (3) Virtual Institute for Artificial Electromagnetic Materials and Metamaterials (Belgium)
DOI: https://doi.org/10.46620/URSIEMTS25/PZKU4626

We-S07-AM1-4 **Degrees of Freedom and the Bounds on Information Density in Chip-Less RFID (Invited)**
Miloslav Capek (1), Stepan Bosak (1), Lukas Jelinek (1)
(1) Czech Technical University in Prague (Czech Republic)
DOI: https://doi.org/10.46620/URSIEMTS25/XLSK1552

We-S07-AM1-5 **On Peak Sidelobe Level Reduction Using Octomino-Based Subarrays**
Lars Jonsson (1), Harald Hultin (1), Lucas Åkerstedt (1)
(1) KTH Royal Institute of Technology (Sweden)
DOI: https://doi.org/10.46620/URSIEMTS25/VZJP3906

We-S07-AM1-6 **On Number of Active and Passive Elements in Reactively Loaded Antennas**
Albert Salmi (1), Anu Lehtovuori (1), Ville Viikari (1)
(1) Aalto University (Finland)
DOI: https://doi.org/10.46620/URSIEMTS25/QUZO8393

Wednesday, 25 June 2025 11:30 - 12:50 Room C

S11-2 Electromagnetic methods for direct and inverse scattering involving stratified media - Part 2

Session Chairs: *Cristina Ponti (Italy), Andrea Randazzo (Italy)*
Session Conveners: *Giuseppe Schettini, Andrea Randazzo, Cristina Ponti*

We-S11-AM2-1 **Contactless Multiview and Multistatic Microwave Subsurface Imaging (Invited)**
Carlo Noviello (1), Gianluca Gennarelli (1), Medhi Masoodi (1), Francesco Soldovieri (1), Ilaria Catapano (1)
(1) Institute for Electromagnetic Sensing of the Environment – National Research Council of Italy (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/JRAH9898

We-S11-AM2-2 **Advanced modelling of the electromagnetic scattering by buried targets with the Cylindrical-Wave Approach**
Cristina Ponti (1), Giuseppe Schettini (1)
(1) Roma Tre University (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/JECE9968

We-S11-AM2-3 **Buried target localization using MUSIC algorithm and contactless measurement platforms**
Angela Dell' Aversano (1), Antonio Cuccaro (2), Maria Antonia Maisto (1), Rosa Scapaticcl (3), Raffaele Solimene (1)
(1) Dept. of Engineering, University of Campania (Italy); (2) Dept. of Informa., Modeling, Electron.Syst. Engineering, University of Calabria (Italy); (3) Institute for the Electromagnetic Sensing of the Environment, CNR (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/SXFN1428

We-S11-AM2-4 **Preliminary results on the number of communication channels within in-homogenous medium**
Mario Del Prete (1), Maria Antonia Maisto (1), Raffaele Solimene (1)
(1) Università degli Studi della Campania (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/BYKB5228

Wednesday, 25 June 2025 11:30 - 12:50 Room D

S01-1 Electromagnetic theory - Part 1

Session Chairs: *Henrik Wallén (Finland), Daniel Sjöberg (Sweden), Mariana Dalarsson (Sweden)*
Session Conveners: *Daniel Sjöberg, Henrik Wallén, Mariana Dalarsson*

We-S01-AM2-1 **Time-Domain Physical Bounds on the Causal Response of Electromagnetic Systems: A Brief Summary of Recent Developments (Invited)**
Martin Stumpf (1, 3), Sven Nordebo (2), Jonas Ekman (3), Giulio Antonini (4)
(1) Brno University of Technology (Czech Republic); (2) Linnæus University (Sweden); (3) Luleå University of Technology (Sweden); (4) University of L'Aquila (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/BIFC6469

We-S01-AM2-2 **Identifying Optimization Degrees Of Freedom In Electromagnetic Dipole Forces (Invited)**
Lukas Jelinek (1), Jakub Liska (1), Martin Zlabek (1), Miloslav Capek (1)
(1) Czech Technical University in Prague (Czech Republic)
DOI: https://doi.org/10.46620/URSIEMTS25/JVYG4290

We-S01-AM2-3 **Reusing Submatrix Calculations in Array Decomposition Method for Finite Arrays with Electrically Connected Elements (Invited)**
Lucas Åkerstedt (1), Harald Hultin (1, 2), Lars Jonsson (1)
(1) KTH Royal Institute of Technology (Sweden); (2) Saab Surveillance (Sweden)
DOI: https://doi.org/10.46620/URSIEMTS25/HSKB3856

We-S01-AM2-4 **Classical Photons and the Transition from Classical to Quantum Wave Theory (Invited)**
Arthur D. Yaghjian (1)
(1) Electromagnetics Research (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/FLNH2337

Wednesday, 25 June 2025 11:30 - 12:50 Room H

S05-1 Propagation and scattering from low frequency to the THz frequency band: advances, trends and new applications - Part 1

Session Chairs: *Thomas Kürner (Germany), Guido Lombardi (Italy)*
Session Conveners: *Danilo Erricolo, Thomas Kuerner, Guido Lombardi*

We-S05-AM2-1 **Statistical Modelling and Analysis of Conditioned Clutter Loss in Earth-to-Space links for U6G Interference Evaluation (Invited)**
Francesco Capelletti (1), Carlo Riva (1), Laura Resteghini (2)
(1) Politecnico di Milano (Italy); (2) Huawei Technologies s.r.l (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/HQBJ3189

We-S05-AM2-2 **Towards a Heuristic Path Loss Model for RIS Links (Invited)**
Lorenz H. W. Loeser (1), Thomas Kürner (1)
(1) Technische Universität Braunschweig (Germany)
DOI: https://doi.org/10.46620/URSIEMTS25/SKHF6427

We-S05-AM2-3 **Enhancing Propagation Model Accuracy for Frequency Coordination with High-Resolution Terrain Data**
Ahmad Hamada (1), Thomas Kürner (1)
(1) TU Braunschweig / Institut für Nachrichtentechnik (Germany)
DOI: https://doi.org/10.46620/URSIEMTS25/ZLUE7771

We-S05-AM2-4 **Analytical evaluation of the effects on the electromagnetic field induced by a moving dielectric slab**
Riccardo Onesti (1), Mirco Raffetto (1), Kirill Zeyde (1)
(1) University of Genoa (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/YLOS1726

Wednesday, 25 June 2025 11:30 - 12:50 Poster room

POS Poster Session

We-POS-AM2-1 **Compact Low-Profile Ultra-Wideband Unidirectional Dipole Antenna**
Heesu Wang (1); Ikmo Park (1)
(1) Ajou University (South Korea)
DOI: https://doi.org/10.46620/URSIEMTS25/SNRW3625

We-POS-AM2-2 **The progress of the development of the electronic nose based on microwave gas sensors (Invited)**
Stanislaw Karcz (1), Anna Palecezk (1), Dominik Grochala (1), Mateusz Kocoń (1), Lukasz Blajszczak (2), Kamil Staszek (3), Artur Rydosz (1)
(1) The Biomarkers Analysis LAB, AGH University of Krakow (Poland)
DOI: https://doi.org/10.46620/URSIEMTS25/LAFF5521

We-POS-AM2-3 **A Field-Based Surface Integral Formalism for the Nonlocal Hydrodynamic Response from Nanoparticles**
Hui-Wen Zhang (1), Xuezhi Zheng (2), Roberto D. Graglia (3), Xin-Qing Sheng (1)
(1) Beijing Institute of Technology (China); (2) KU Leuven (Belgium); (3) Politecnico di Torino (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/OJYK9152

We-POS-AM2-5 **Phase Space Imaging: A Preliminary Study of the Wigner Migration Technique**
Davide Santagata (1), Maria Antonia Maisto (1), Raffaele Solimene (1)
(1) University of Campania "L. Vanvitelli" (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/KEFO3328

We-POS-AM2-6 **Design of a Multifrequency and Multibeam Transmitarray Based on Dielectric Cells**
Andrea Dalle Piagge (1), Francesco Alessio Dicandia (2), Simone Genovesi (1)
(1) Dipartimento Ingegneria dell'informazione, Università di Pisa (Italy); (2) CNR-Istituto di Elettronica e di Ingegneria dell'Informazione e delle Telecomunicazioni (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/BYUA2688

We-POS-AM2-7 **Optimizing the Excitation Amplitudes in THz Photonic Integrated Phased Arrays Using a Genetic Algorithm**
Nabil Alchami (1), Kevin Kolpatzeck (1), Bashar Husain (1), Andreas Czylwik (1)
(1) University of Duisburg-Essen (Germany)
DOI: https://doi.org/10.46620/URSIEMTS25/LFKS2447

We-POS-AM2-9 **Low-Profile Fully Metallic Lens Using Higher Symmetries Structures**
Behnaz Bakhtiari (1), Anja K. Skrivervik (1)
(1) EPFL (Switzerland)
DOI: https://doi.org/10.46620/URSIEMTS25/MOAZ5954

We-POS-AM2-10 **Smart Skins in SREs: Improving Communication and Localization Performance**
Michele Beccaria (1), Davide Scazzoli (2), Maurizio Magarini (2), Paola Pirinoli (1)
(1) Politecnico di Torino (Italy); (2) Politecnico di Milano (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/UHCK2934

We-POS-AM2-11 **Dual-Band Microwave Sensor With Stable Resonance Response for Medical Applications**
Antonio Cuccaro (1), Raffaele Solimene (2), Sandra Costanzo (1)
(1) DIMES, University of Calabria (Italy); (2) Dept. of Engineering, University of Campania (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/ITQC7342

Wednesday, 25 June 2025 14:30 - 15:30 Room B

PLE-2 Plenary Talk 2

Session Chairs: *Giuliano Manara (Italy)*

We-PLE-PM1-1 **Deriving Quantum EM Solutions Using Classical Knowledge—An Overview (Invited)**
Weng Chew (1)
(1) Purdue University (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/CFQD6882

Wednesday, 25 June 2025 15:30 - 16:30 Room C

S14-2 Reconfigurable intelligent surfaces (RIS) and their applications- Part 2

Session Chairs: *Filippo Costa (Italy), Shuo Liu (China)*
Session Conveners: *Filippo Costa, Shuo Liu*

We-S14-PM2-1 **Advances in Human Health Monitoring Empowered by Reconfigurable Intelligent Surfaces (Invited)**
Xin Yu Li (1), Jian Wei You (1), Tie Jun Cui (1)
(1) Southeast University (China)
DOI: https://doi.org/10.46620/URSIEMTS25/FMID5473

We-S14-PM2-2 **Reconfigurable Plasma Frequency Selective Surface (Invited)**
Krushna Kanth Varikuntla (1), Muhammad Ali Babar Abbasi (1), Okan Yurduseven (1)
(1) Queens University Belfast (United Kingdom)
DOI: https://doi.org/10.46620/URSIEMTS25/WHRT9994

We-S14-PM2-3 **Beam-Scanning Curved Smart Electromagnetic Skins for Outdoor Scenarios**
Michele Beccaria (1), Agnese Mazzinghi (2), Angelo Freni (2), Paola Pirinoli (1)
(1) Politecnico di Torino (Italy); (2) Università di Firenze (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/SFFO3454

Wednesday, 25 June 2025 15:30 - 16:30 Room D

S08-2 Mathematical modelling of EM problems - Part 2

Session Chairs: *Paul Smith (Australia), George Uslenghi (United States)*
Session Conveners: *Paul Smith, George Uslenghi*

We-S08-PM2-1 **Rigorous RCS Analysis of a Finite Parallel-Plate Waveguide Cavity with Perfect Electric Conductor Loading (Invited)**
Tong Zhang (1), Kazuya Kobayashi (1)
(1) Chuo University (Japan)
DOI: https://doi.org/10.46620/URSIEMTS25/TXYY8330

We-S08-PM2-2 **Accurate Calculations of Complex Eigenvalues in Open Prolate Spheroidal Cavities (Invited)**
Elena D. Vinogradova (1), Galyna Prytula (2)
(1) Macquarie University (Australia); (2) O. Y. Usikov Institute for Radiophysics and Electronics NASU (Ukraine)
DOI: https://doi.org/10.46620/URSIEMTS25/GAIR7456

We-S08-PM2-3 **Some properties of perfect boundaries in electromagnetics (Invited)**
Ari Sihvola (1)
(1) Aalto University (Finland)
DOI: https://doi.org/10.46620/URSIEMTS25/DQFA1669

Wednesday, 25 June 2025 15:30 - 16:30 Room H

S05-2 Propagation and scattering from low frequency to the THz frequency band: advances, trends and new applications - Part 2

Session Chairs: *Thomas Kürner (Germany), Guido Lombardi (Italy)*
Session Conveners: *Danilo Erricolo, Thomas Kuerner, Guido Lombardi*

We-S05-PM2-1 **Long-distance tunable MMW wireless communication channel based on p-i-n InGaAs Photomixer and free space amplifier**
Daniel Rozban (1), Nadav Pinhasi (1), Yossef Pinhasi (1), Amir Abramovich (1)
(1) Ariel University (Israel)
DOI: https://doi.org/10.46620/URSIEMTS25/GXKI3976

We-S05-PM2-2 **The Effects of the Atmospheric Medium on Wireless link Operating in the Millimeter Wavelengths and Terahertz Frequencies**
Theodor Fedor Yudachev (1), Yosef Golovachev (2), Ya'akov Greenberg (3), Aviel Glam (3), Gad A. Pinhasi (4), Yosef Pinhasi (1)
(1) Ariel University (Israel); (2) Jerusalem College of Technology (Israel); (3) RAFAEL Advanced Defense Systems (Israel)
DOI: https://doi.org/10.46620/URSIEMTS25/NWUE8445

We-S05-PM2-3 **Impact of Sharp Corner Geometries in Tunnels on the Performance of wireless digital Links: A Study Using a Scaled-Down Model**
Yehuda Taragin (1), Gad A. Pinhasi (2), Yosef Pinhasi (1)
(1) Faculty of Engineering, Dept. of Electrical and Electronic Engineering, Ariel University (Israel); (2) Dept. of Chemical Engineering, Ariel University (Israel)
DOI: https://doi.org/10.46620/URSIEMTS25/XSMR9449

Wednesday, 25 June 2025 15:30 - 16:30 Room I

S07-3 On the development of effective models for electromagnetic applications - Part 3

Session Chairs: *Lars Jonsson (Sweden), Valentin De la Rubia (Spain)*
Session Conveners: *Lars Jonsson, Valentin de la Rubia*

We-S07-PM2-1 **On Incorporation of Adaptive Frequency Sampling into Herglotz-function-based Approximation Framework (Invited)**
Yevhen Ivanenko (1), Lucas Åkerstedt (2), B. L. G. Jonsson (2)
(1) Blekinge Institute of Technology (Sweden); (2) KTH Royal Institute of Technology (Sweden)
DOI: https://doi.org/10.46620/URSIEMTS25/IOZY1869

We-S07-PM2-2 **Quantifying Nonlinear Particle Dipole Moment Using Phase Field Simulations (Invited)**
Daniel Sjöberg (1)
(1) Lund University (Sweden)
DOI: https://doi.org/10.46620/URSIEMTS25/FBRB8279

We-S07-PM2-3 **Characteristic Modes of PEMC Objects (Invited)**
Henrik Wallén (1), Pasi Ylä-Oijala (1)
(1) Aalto University (Finland)
DOI: https://doi.org/10.46620/URSIEMTS25/BQJJ2889

Thursday, 26 June 2025

Thursday, 26 June 2025 09:00 - 11:00 Room C

S02-2 Antenna theory for design, analysis, and measurements - Part 2

Session Chairs: *Andrea Michel (Italy)*
Session Conveners: *Debatosh Guha, Andrea Michel*

Th-S02-AM1-1 **A Partially Grounded Wideband Metasurface-based Circularly Polarized Patch Antenna with Enhanced Gain**
Deepak Ram (1), Amit Kumar Singh (1), Somak Bhattacharyya (1)
(1) Indian Institute of Technology (BHU) Varanasi (India)
DOI: https://doi.org/10.46620/URSIEMTS25/KSUE4595

Th-S02-AM1-2 **The Effects of Amplitude and Phase Deviations in a Uniform Circular Array on Orbital Angular Momentum Beam**
Abdulkadir Uzun (1), Ibrahim Tekin (1)
(1) Sabanci University (Turkey)
DOI: https://doi.org/10.46620/URSIEMTS25/NLOQ5931

Th-S02-AM1-3 **Design and Analysis of Compact Self-Multiplexing Antenna Based on Half-Mode Substrate-Integrated Circular and Rectangular Cavities**
Rusan Kumar Barik (1), Rajender Rathod (2), Xiaoguang Liu (1), Daniele Rossi (2)
(1) Southern University of Science and Technology (China); (2) University of Pisa (Italy); (2) University of Pisa (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/EKKQ3052

Th-S02-AM1-4 **Optimal Patch Antenna Placement for an Efficient Aperture Sharing with a Reflector Antenna**
Martin Petek (1), Francesca Vipiana (1), Eva Rajo-Iglesias (2)
(1) Politecnico di Torino (Italy); (2) University Carlos III of Madrid (Spain)
DOI: https://doi.org/10.46620/URSIEMTS25/IUNG7378

Th-S02-AM1-5 **Design of a Waveguide Filtering Antenna for Energy Harvesting Application**
Mohsen Karamirad (1), Alessio Monti (1), Mirko Barbuto (1), Stefano Vellucci (2), Alessandro Toscano (1), Filiberto Bilotti (1)
(1) Roma Tre University (Italy); (2) Niccolò Cusano University (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/JACH9316

Th-S02-AM1-6 **Fresnel Analysis of Pulsed Modal Radiation from Closed Metallic Waveguides in Half-Space**
Niharika Kaja (1), Deb Chatterjee (1)
(1) University of Missouri at Kansas City (UMKC) (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/KIBD7470

Thursday, 26 June 2025 09:00 - 11:00 Room D

S01-2 Electromagnetic theory - Part 2

Session Chairs: *Henrik Wallén (Finland), Daniel Sjöberg (Sweden), Mariana Dalarsson (Sweden)*
Session Conveners: *Daniel Sjöberg, Henrik Wallén, Mariana Dalarsson*

Th-S01-AM1-1 **Ansatz for longitudinal solution for TEM-wave propagation through a metamaterial composite in a hollow waveguide**
Balwan Rana (1), Mariana Dalarsson (1)
(1) KTH Royal Institute of Technology (Sweden)
DOI: https://doi.org/10.46620/URSIEMTS25/TZAR8953

Th-S01-AM1-2 **Well-posedness of the time-dependent, bi-anisotropic Maxwell system on anisotropic fractals**
Eric Stachura (1)
(1) Kennesaw State University (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/KKAP2306

Th-S01-AM1-3 **High-Q Metasurface-Enabled Cavities with Effective Electric and Magnetic Surface Impedances (Invited)**
Pietro Brugnolo (1), Samel Arslanagic (1), Rasmus Elkjær Jacobsen (1)
(1) Technical University of Denmark (Denmark)
DOI: https://doi.org/10.46620/URSIEMTS25/DODP2656

Th-S01-AM1-4 **Homogenization of Cylindrical Wire Structures (Invited)**
Or Tayar (1), Yarden Mazor (1)
(1) Tel Aviv University (Israel)
DOI: https://doi.org/10.46620/URSIEMTS25/WSWC9378

Th-S01-AM1-5 **Resonant Coupling of a Deep-Subwavelength Particle in a Rectangular Conducting Cavity: Beyond the Jaynes-Cummings Model (Invited)**
Koffi-Emmanuel Sadzi (1), Yakir Hadad (1)
(1) Tel Aviv University (Israel)
DOI: https://doi.org/10.46620/URSIEMTS25/ODYO4807

Th-S01-AM1-6 **PTD Symmetric Double Edge Line Using the Bed of Nails Metasurface (Invited)**
Nelson Castro (1), Enrica Martini (2), Stefano Maci (2), Eva Rajo-Iglesias (1)
(1) University Carlos III of Madrid (Spain); (2) University of Siena (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/TAMC7458

Thursday, 26 June 2025 09:00 - 11:00 Room H

S03-1 Scattering and diffraction - Part 1

Session Chairs: *Giuliano Manara (Italy), Ludger Klinkenbusch (Germany)*
Session Conveners: *Giuliano Manara, Ludger Klinkenbusch*

Th-S03-AM1-1 **Multiplicity of optical theorems**
Edwin Marengo (1), Mohammadrasoul Taghavi (1)
(1) Northeastern University (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/BSUQ3314

Th-S03-AM1-2 **Degrees of freedom in direct and inverse scattering problems (Invited)**
Mats Gustafsson (1)
(1) Lund University (Sweden)
DOI: https://doi.org/10.46620/URSIEMTS25/IVKE7692

Th-S03-AM1-3 **Polarization Deflector in P•T•D - Symmetric Geometry – Part I: Theory (Invited)**
Roee Geva (1), Mário G. Silveirinha (2), Raphael Kastner (1)
(1) Tel Aviv University (Israel); (2) University of Lisbon (Portugal)
DOI: https://doi.org/10.46620/URSIEMTS25/JJEA2914

Th-S03-AM1-4 **A Novel Approach to the Veselago-Pendry Lens (Invited)**
Danilo Erricolo (1), Piergiorgio L.E. Uslenghi (1)
(1) University of Illinois (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/PUQW8193

Th-S03-AM1-5 **Anomalous refraction from infinite and finite all-dielectric binary metagratings (Invited)**
Cristina Ponti (1), Nikolaos L. Tsitsas (2)
(1) Roma Tre University (Italy); (2) Aristotle University of Thessaloniki (Greece)
DOI: https://doi.org/10.46620/URSIEMTS25/YVNG6747

Thursday, 26 June 2025 09:00 - 11:00 Room I

S19 Electromagnetics in various sensing applications

Session Chairs: *Artur Rydosz (Poland), Emanuele Tavanti (Italy)*
Session Conveners: *Artur Rydosz, Kamil Staszek, Ilona Piekarz*

Th-S19-AM1-1 **Fast Localization and Sensing with Passive Backscattering IoT Devices**
Andrea Motroni (1), Glauco Cecchi (1), Emanuele Tavanti (1), Andrea Ria (1), Paolo Nepa (1)
(1) University of Pisa (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/GNAS5773

Th-S19-AM1-2 **Position and Attitude/Orientation sensing with UHF RFID systems and array antennas**
Emanuele Tavanti (1), Andrea Motroni (1), Paolo Nepa (1), Roberto Gabbrielli (2), Marco Pirozzi (3)
(1) Department of Information Engineering, University of Pisa (Italy); (2) Department of Civil and Industrial Engineering, University of Pisa (Italy); (3) Department of Technological Innovations and Safety of Plants, Products and Human Settlements, INAIL (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/GTCM1895

Th-S19-AM1-3 **Metamaterial wireless pressure sensor based on deformable substrate**
Sandra Rodini (1), Simone Genovesi (1), Giuliano Manara (1), Filippo Costa (1)
(1) Dipartimento di Ingegneria dell'Informazione, Università di Pisa (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/WNHT3828

Th-S19-AM1-4 **Impact of Subarray Position Errors in mm-Wave MIMO Automotive Radar Polarimetric Phase Calibration**
Changxu Zhao (1), Yanki Aslan (1), Alejandro Garcia-Tejero (2), Alexander Yarovoy (1)
(1) Delft University of Technology (Netherlands); (2) HUBER+SUHNER AG (Switzerland)
DOI: https://doi.org/10.46620/URSIEMTS25/PXOM1912

Th-S19-AM1-5 **High-Power Microwave Switch for a Waveguide System Using Plasma**
Krushna Kanth Varikuntla (1), Muhammad Ali Babar Abbasi (1), Okan Yurduseven (1)
(1) Queens University Belfast (United Kingdom)
DOI: https://doi.org/10.46620/URSIEMTS25/JGVX8019

Thursday, 26 June 2025 11:30 - 12:50 Room C

S18-1 Advanced array antennas: smart, reconfigurable, adaptive and much more - Part 1

Session Chairs: *Paolo Nepa (Italy), Diego Masotti (Italy)*
Session Conveners: *Paolo Nepa, Diego Masotti*

Th-S18-AM2-1 **Diversity Techniques Combined to Collaborative Beamforming for Distributed Phased-Arrays with Enhanced Capabilities (Invited)**
Sandra Costanzo (1, 2), Giovanni Buonanno (1)
(1) University of Calabria (Italy); (2) Consorzio Nazionale Interuniversitario per le Telecommunicazioni (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/FGWV8921

Th-S18-AM2-2 **Synthesis of Spatially Distributed Caustics for Curved Wave Beam Radiation in the Near Field. (Invited)**
Federica Anfuso (1), Ahsan Ullah Khan (1), Gino Sorbello (1), Santi Concetto Pavone (1)
(1) Dept. of Electrical, Electronics, and Computer Engineering (DIEEI), University of Catania (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/HAZU6081

Th-S18-AM2-3 **Frequency-selective Dynamic Scattering Arrays for Over-the-air EM Processing (Invited)**
Davide Dardari (1, 2)
(1) Univesity of Bologna (Italy); (2) WiLAB-CNIT (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/YIAT8244

Th-S18-AM2-4 **Development of Simple Phased Array with Waveguide Phase Shifter for Wireless Power Transfer at 28GHz (Invited)**
Naoki Shinohara (1), Shunta Kameo (1), Bo Yang (1)
(1) Kyoto University (Japan)
DOI: https://doi.org/10.46620/URSIEMTS25/TRGA4304

Thursday, 26 June 2025 11:30 - 12:50 Room D

S08-3 Mathematical modelling of EM problems - Part 3

Session Chairs: *Paul Smith (Australia), George Uslenghi (United States)*
Session Conveners: *Paul Smith, George Uslenghi*

Th-S08-AM2-1 **The Abel Integral Transform and the Solution of Mixed Boundary Value Problems in Electromagnetic Wave Scattering (Invited)**
Elena D. Vinogradova (1), Paul D. Smith (1)
(1) Macquarie University (Australia)
DOI: https://doi.org/10.46620/URSIEMTS25/DFDG9734

Th-S08-AM2-2 **Rays and Gaussian beams related with the Feynman-Kac solutions of the Helmholtz equation (Invited)**
Bair Budaev (1)
(1) University of California at Berkeley (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/WNIR6684

Th-S08-AM2-3 **Benchmark of several stochastic finite element approach for the Poisson equation**
Titouan Marquaille (1), Arnaud Coatanhay (1), Thomas Bonnafont (2)
(1) ENSTA (France); (2) Lab-STICC, UMR CNRS 6285, ENSTA, Institut Polytechnique de Paris (France)
DOI: https://doi.org/10.46620/URSIEMTS25/KRBH5386

Thursday, 26 June 2025 11:30 - 12:50 Room H

S03-2 Scattering and diffraction - Part 2

Session Chairs: *Giuliano Manara (Italy), Ludger Klinkenbusch (Germany)*
Session Conveners: *Giuliano Manara, Ludger Klinkenbusch*

Th-S03-AM2-1 **Wiener-Hopf Technique for Electromagnetic Scattering Problems Containing Cylindrical Finite Domain Regions (Invited)**
Vito Daniele (1), Guido Lombardi (1)
(1) Politecnico di Torino (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/AAWD6178

Th-S03-AM2-2 **Semi-Analytical Formulation of Diffraction from a Cone with an Arbitrary Cross-Section Using FEM (Invited)**
Iraklis Sarigiannidis (1, 2), Massimiliano Casaletti (1), Matteo Albani (2)
(1) Sorbonne University (France); (2) University of Siena (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/VPAD9880

Th-S03-AM2-3 **Physical Optics Approximation for Dielectric Wedge Diffraction (Invited)**
Hiroshi Shirai (1), Duc M. Nguyen (1)
(1) Chuo University (Japan)
DOI: https://doi.org/10.46620/URSIEMTS25/KKZL3165

Th-S03-AM2-4 **UAPO Solution for Plane Wave Diffraction by a Resistive Half-Plane Between Isorefractive Media**
Giovanni Riccio (1), Gianluca Gennarelli (2), Flaminio Ferrara (3), Claudio Gennarelli (3), Rocco Guerriero (3)
(1) D.I.E.M. – University of Salerno (Italy); (2) IREA -CNR (Italy); (3) D.I.In. – University of Salerno (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/WNYL7864

Thursday, 26 June 2025 11:30 - 12:50 Room I

S10-1 Machine learning and optimization techniques in electromagnetics: new trends and novel applications - Part 1

Session Chairs: *Sembiam Rengarajan (United States), Ahmad Hoorfar (United States)*
Session Conveners: *Sembiam R. Rengarajan, Christos G. Christodoulou, Ahmad Hoorfar*

Th-S10-AM2-1 **Advances in Inverse-Profiling of Subsurface Targets Using Machine-Learning Techniques (Invited)**
Maryam Hajebi (1), Ahmad Hoorfar (2)
(1) University of Hormozgan (Iran); (2) Villanova University (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/HNZG2974

Th-S10-AM2-2 **Global Optimization of Design Parameters of Analog Pre-Distortion Linearizers for RF Power Amplifiers (Invited)**
Tommaso Cappello (1), Md. Samiul Islam Borno (1, 2), Ahmad Hoorfar (2)
(1) High-Performance RF Lab (HPRF) (United States); (2) Villanova University (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/FACJ5387

Th-S10-AM2-3 **Preliminary Insights into ANN-based Analysis of Electrically Large Reflective Quasi Periodic Surfaces (Invited)**
Álvaro F. Vaquero (1), Sergio Luis Suárez Gómez (1), Manuel Arrebola (2)
(1) University of Oviedo (Spain); (2) Universidad Politécnica de Madrid (Spain)
DOI: https://doi.org/10.46620/URSIEMTS25/ESQN5763

Th-S10-AM2-4 **Multi-Fidelity Bayesian Optimization of Metasurface Designs**
Ayoub Bellouch (1), Mahmoud Elsawy (1), Guillaume Leroy (1), Mickaël Binois (1), Régis Duvigneau (1), Stéphane Lanteri (1)
(1) Université Côte d'Azur, Inria, CNRS, LJAD (France)
DOI: https://doi.org/10.46620/URSIEMTS25/NGOF2231

Thursday, 26 June 2025 14:30 - 15:30 Room B

PLE-3 Plenary Talk 3

Session Chairs: *Henrik Wallén (Finland)*

Th-PLE-PM1-1 **High-Accuracy Satellite Antenna Testing employing the Spherical Near-Field Measurement Technique (Invited)**
Olav Breinbjerg (1)
(1) ElMaReCo (Denmark)
DOI: https://doi.org/10.46620/URSIEMTS25/FKKU4081

Thursday, 26 June 2025 15:30 - 16:30 Room C

S18-2 Advanced array antennas: smart, reconfigurable, adaptive and much more - Part 2

Session Chairs: *Paolo Nepa (Italy), Diego Masotti (Italy)*
Session Conveners: *Paolo Nepa, Diego Masotti*

Th-S18-PM2-1 **Impact of Real Antenna Elements on Frequency Diverse Array Propagation: A Ray Tracing Approach**
Simone Del Prete (1), Lorenzo Bastia (1), Tommaso Tiberi (1), Franco Fuschini (1), Diego Masotti (1), Enrico Maria Vitucci (1)
(1) University of Bologna (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/QDEN1640

Th-S18-PM2-2 **A Novel Low Sidelobe Level Uniform Transmit/Receive Antenna Arrays for RFID Applications**
Rathod Rajender (1), Gabriele Ciapri (2), Simone Genovesi (1), Daniele Rossi (1)
(1) University of Pisa (Italy); (2) CERN-European Centre for Nuclear Research (Swaziland)
DOI: https://doi.org/10.46620/URSIEMTS25/IDKZ3837

Th-S18-PM2-3 **Electromagnetic Channel Statistics for Continuous-Aperture Array (CAPA) Systems**
Chongjun Ouyang (1), Boqun Zhao (2), Xingqi Zhang (2), Yuanwei Liu (3)
(1) Queen Mary University of London (United Kingdom); (2) University of Alberta (Canada); (3) The University of Hong Kong (Hong Kong)
DOI: https://doi.org/10.46620/URSIEMTS25/OCQP8005

Thursday, 26 June 2025 15:30 - 16:30 Room D

S01-3 Electromagnetic theory - Part 3

Session Chairs: *Henrik Wallén (Finland), Daniel Sjöberg (Sweden), Mariana Dalarsson (Sweden)*
Session Conveners: *Daniel Sjöberg, Henrik Wallén, Mariana Dalarsson*

Th-S01-PM2-1 **Plane Wave Scattering from a Monoclinic Slab (Invited)**
Michael J. Havrilla (1)
(1) Air Force Institute of Technology, Wright-Patterson Air Force Base (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/PQUJ7140

Th-S01-PM2-2 **Generalized Richmond-Mie Theory for the Scattering of Metallic and Dielectric Cylinders Wrapped by Surface Impedance Multilayers**
Giuseppe Labate (1), Andrea Alù (2), Giampiero Gerini (3)
(1) TNO - Radar Department (Netherlands); (2) Advanced Science Research Center (ASRC), City University of New York (United States); (3) TNO - Optics Department (Netherlands)
DOI: https://doi.org/10.46620/URSIEMTS25/TUYS5870

Th-S01-PM2-3 **Theoretical Characterization of Scattered Floquet Modes in the Canonical Problem of Anomalous Reflection**
Federico Giusti (1), Enrica Martini (1), Stefano Maci (1), Matteo Albani (1)
(1) Department of Information Engineering and Mathematics, University of Siena (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/JSXV1892

Thursday, 26 June 2025 15:30 - 16:30 Room H

S04-1 Inverse scattering and imaging - Part 1

Session Chairs: *Raffaele Solimene (Italy), Andrea Randazzo (Italy)*
Session Conveners: *Andrea Randazzo, Raffaele Solimene, Shouhei Kidera*

Th-S04-PM2-1 **Design and Synthesis of Dual-Reconfigurable Cylindrical Reflectarrays for Millimeter-Wave Imaging (Invited)**
Chunyang Teng (1), Shiyong Li (1, 2), Ahmad Hoorfar (3), Rike Jie (1), Bailing Ren (4), Bin Zhang (4)
(1) Beijing Key Laboratory of Millimeter Wave and Terahertz Technology, Beijing Institute of Technology (China); (2) Tangshan Research Institute, Beijing Institute of Technology (BIT) (China); (3) Antenna Research Laboratory, Villanova University (United States); (4) Beijing Research Institute of Telemetry (China)
DOI: https://doi.org/10.46620/URSIEMTS25/IKWK1191

Th-S04-PM2-2 **Antenna Arrays Diagnosis Through Inverse-Based Approaches (Invited)**
Sandra Costanzo (1), Giuseppe Di Massa (1), Alessandro Fedeli (2), Andrea Randazzo (2)
(1) University of Calabria (Italy); (2) University of Genoa (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/LPZI8405

Th-S04-PM2-3 **UWB Horn Antenna for Food Inspection via Microwave Imaging**
Juan Felipe González Pardo (1), Calin Ion Maraloiu (1), Jorge Alberto Tobón Vasquez (2), Marco Ricci (2), Francesca Vipiana (1)
(1) Politecnico di Torino (Italy); (2) Wavision s.r.l. (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/XHAO9880

Thursday, 26 June 2025 15:30 - 16:30 Room I

S10-2 Machine learning and optimization techniques in electromagnetics: new trends and novel applications - Part 2

Session Chairs: *Sembiam Rengarajan (United States), Ahmad Hoorfar (United States)*
Session Conveners: *Sembiam R. Rengarajan, Christos G. Christodoulou, Ahmad Hoorfar*

Th-S10-PM2-1 **Microstrip Antenna Classification using Random Forest and K-Nearest Neighbor Based Machine Learning Classifier**
Anjani Kumar (1), Taimoor Khan (1), Mamoni Saha (1), Sembiam R. Rengarajan (2)
(1) National Institute of Technology Silchar (India); (2) California State University (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/WSPA7451

Th-S10-PM2-2 **Performances Evaluation of Machine Learning Optimization in the Electromagnetic Design of a Metamaterial-Inspired Patch Antenna**
Michela Longhi (1), Stefano Vellucci (1), Mirko Barbuto (2), Alessio Monti (2), Filiberto Bilotti (2), Alessandro Toscano (2)
(1) Niccolò Cusano University (Italy); (2) Roma Tre University (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/RXQW8084

Th-S10-PM2-3 **Unit Cell Design for space-fed Surfaces via Kernel-based Machine Learning Regression**
Michele Beccaria (1), Nazanin Soleimani (1), Riccardo Trinchero (1), Paola Pirinoli (1)
(1) Politecnico di Torino (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/JDLD6926

Thursday, 26 June 2025 17:00 - 18:00 Room C

S16 Millimeter wave and Terahertz antennas

Session Chairs: *Elias A. Alwan (United States)*
Session Conveners: *Elias Alwan, Satheesh Bojja Venkatakrishnan*

Th-S16-PM3-1 **Design of a Long Grating-Loaded Waveguide Slot Array Antenna with Irises Integrated in the Corporate-Feed Network**
Yaxiang Wu (1), Jiro Hirokawa (1), Takashi Tomura (1)
(1) Institute of Science Tokyo (Japan)
DOI: https://doi.org/10.46620/URSIEMTS25/UBTN4168

Th-S16-PM3-2 **A Low profile Low-Cost Tri-band Shared Aperture Antenna for Backhaul Application**
Md Nur Alam (1), Md Khadimul Islam (1), Elias A. Alwan (1)
(1) Florida International University (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/JPRM4628

Th-S16-PM3-3 **High-Gain mm-Wave Leaky-Wave/Fabry-Perot Antenna Using Substrate-Integrated Partially Reflective Surfaces**
Rana Muhammad Hasan Bilal (1), Stefano Moscato (2), Simone Genovesi (1), Giuliano Manara (1), Filippo Costa (1)
(1) University of Pisa (Italy); (2) Research and Development Department of SIAE MICROELETTRONICA (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/FQGU7083

Thursday, 26 June 2025 17:00 - 18:00 Room D

S08-4 Mathematical modelling of EM problems - Part 4

Session Chairs: *Paul Smith (Australia), George Uslenghi (United States)*
Session Conveners: *Paul Smith, George Uslenghi*

Th-S08-PM3-2 **The problem of radio wave propagation through plasma density irregularities in the ionosphere: a discussion on recent modelling challenges**
Biagio Forte (1), Mario M. Bisi (2), John Morgan (3), Tianchu Lu (1), Paul Kinsler (1)
(1) University of Bath (United Kingdom); (2) RAL Space UKRI STFC (United Kingdom); (3) Commonwealth Scientific and Industrial Research Organisation (CSIRO) (Australia)
DOI: https://doi.org/10.46620/URSIEMTS25/JMJX4983

Th-S08-PM3-3 **Split-step framelet: leveraging wavelet frames for tropospheric long-range propagation**
Thomas Bonnafont (1)
(1) Lab-STICC, UMR CNRS 6285, ENSTA, Institut Polytechnique de Paris (France)
DOI: https://doi.org/10.46620/URSIEMTS25/LPIM7565

Thursday, 26 June 2025 17:00 - 18:00 Room H

S04-2 Inverse scattering and imaging - Part 2

Session Chairs: *Raffaele Solimene (Italy), Andrea Randazzo (Italy)*
Session Conveners: *Andrea Randazzo, Raffaele Solimene, Shouhei Kidera*

Th-S04-PM3-1 **3D Simulation Code Using Parallel Processing for Microwave Reconstruction of Defects in Known Objects From Scattering Parameters**
Alexandros Pallaris (1), Daniel Sjöberg (1)
(1) Lund University (Sweden)
DOI: https://doi.org/10.46620/URSIEMTS25/RXOJ6945

Th-S04-PM3-2 **Detection and Monitoring of Brain Stroke Onsets by an Ad-hoc Double Stage Delay-Multiply-And-Sum (DS-DMAS) Algorithm**
Alex Ramiro Masaquiza Caiza (1), David Orlando Rodriguez Duarte (1), Francesca Vipiana (1)
(1) Politecnico di Torino (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/BYST7983

Th-S04-PM3-3 **Enhanced resolution imaging in strongly scattering media**
Alexander Christie (1), Matan Leibovich (2), Miguel Moscoso (3), Alexei Novikov (4), George Papanicolaou (1), Chrysoula Tsogka (5),
(1) Stanford University (United States); (2) Courant Institute of Mathematical Science, New York University (United States); (3) Universidad Carlos III de Madrid (Spain); (4) Pennsylvania State University (United States); (5) University of California Merced (United States);
DOI: https://doi.org/10.46620/URSIEMTS25/YYLO4878

Thursday, 26 June 2025 17:00 - 18:00 Room I

S21-1 Open session - Part 1

Session Chairs: *Henrik Wallén (Finland), Ludger Klinkenbusch (Germany)*
Session Conveners: *Henrik Wallén, Ludger Klinkenbusch*

Th-S21-PM3-1 **EMF Exposure Measurements in the Vicinity of VSATs**
Amina Fellan (1), Hans. D. Schotten (1)
(1) RPTU Kaiserslautern-Landau (Germany)
DOI: https://doi.org/10.46620/URSIEMTS25/BPCV2841

Th-S21-PM3-2 **Narrowband and Broadband Liquid Phantoms of Gastrointestinal Tissues**
Adrián Fernández Carnicero (1), Sujith Raman (2), Anja K. Skrivervik (1)
(1) Microwave and Antenna Group (MAG), École Polytechnique Fédérale de Lausanne (EPFL) (Switzerland); (2) Radio Systems Group, University of Twente (Netherlands)
DOI: https://doi.org/10.46620/URSIEMTS25/UYJT7525

Th-S21-PM3-3 **Drywall Panel Coated with Biochar for Electromagnetic Shielding Applications**
Giuseppe Ruscica (1), Zahra Alinaghi (1), Isabella Natali Sora (1), Patrizia Savi (2)
(1) University of Bergamo (Italy); (2) Politecnico di Torino (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/UYUS2075

Friday, 27 June 2025

Friday, 27 June 2025 09:00 - 11:00 Room C

S17 Vehicular and automotive RF links

Session Chairs: *Daniel Aloi (United States), Andrea Michel (Italy)*
Session Conveners: *Daniel Aloi, Andrea Michel*

Fr-S17-AM1-1 **An Efficient GNSS-Simulator for Noisy Multipath Scenario (Invited)**
Stefan Lindenmeier (1), Wilfrid Pascher (1), Ben Kampen (1)
(1) Universität der Bundeswehr München (Germany)
DOI: https://doi.org/10.46620/URSIEMTS25/SDRZ7606

Fr-S17-AM1-2 **Highly selective notch filter based on a cylindrical dielectric resonator for 5.8 GHz dedicated short-range communications**
Giacomo Giannetti (1), Stefano Maddio (1), Stefano Selleri (1)
(1) Università di Firenze (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/LZZU8857

Fr-S17-AM1-3 **Characterization of Plug-in Antennas for Telematic Control Unit**
Enrico Toniolo (1), Andrea Michel (2), Paolo Nepa (2)
(1) MTA Antenne s.r.l. (Italy); (2) Università di Pisa (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/FACM4490

Fr-S17-AM1-4 **Automotive Simulation and Far Field Antenna Measurement Analysis**
Ahmad Yacoub (1), Ahmed Harb (1), Daniel Aloi (1)
(1) Oakland University (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/GWCZ4799

Fr-S17-AM1-5 **D-Band Antenna for Sub-THz 6G-V2X Vehicular Applications**
Ettore Noccetti (1), Riccardo Urbani (1), Francesco Filice (2), Andrea Michel (1), Sergio Saponara (1)
(1) Università di Pisa (Italy); (2) IMEC (Belgium)
DOI: https://doi.org/10.46620/URSIEMTS25/JVDA5311

Friday, 27 June 2025 09:00 - 11:00 Room D

S09-2 Novel mathematical methods in electromagnetics - Part 2

Session Chairs: *Kazuya Kobayashi (Japan), Yury Shestopalov (Russia), Guido Lombardi (Italy)*
Session Conveners: *Kazuya Kobayashi, Guido Lombardi, Yury Shestopalov*

Fr-S09-AM1-1 **Study of the Dense-Discretization Breakdown and its Cures for Generalized Source Integral Equations (Invited)**
Yossi Dahan (1), Simon B. Adrian (2), Yaniv Brick (1)
(1) Ben-Gurion University of the Negev (Israel); (2) Universität Rostock (Germany)
DOI: https://doi.org/10.46620/URSIEMTS25/VEQN8056

Fr-S09-AM1-2 **Pyramid Elements for Finite Methods (Invited)**
Roberto D. Graglia (1), Damiano Franzò (1), Paolo Petrini (1)
(1) Politecnico di Torino (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/UVYK9087

Fr-S09-AM1-3 **An adaptive generalized RWG basis functions for the h-refinement of multiscale problems with curvature information (Invited)**
Victor F. Martin (1), Jose M. Taboada (2), Francesca Vipiana (3)
(1) Universidad Rey Juan Carlos (Spain); (2) Universidad de Extremadura (Spain); (3) Politecnico di Torino (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/NNMF7044

Fr-S09-AM1-4 **Dimensional Normalization of Maxwell's Equations for Efficient PML-FDTD Applications (Invited) (Invited)**
Ahmet Arda Çoşan (1), Fatih Erden (1)
(1) National Defence University, Turkish Naval Academy (Turkey)
DOI: https://doi.org/10.46620/URSIEMTS25/NWGH8285

Fr-S09-AM1-5 **Preconditioning Strategies and Conformal Discretizations Empowered by High-Order Projectors (Invited)**
Johann Bourhis (1), Adrien Merlini (1), Francesco P. Andriulli (2)
(1) IMT Atlantique (France); (2) Politecnico di Torino (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/KZIS4265

Fr-S09-AM1-6 **Laplacian Surrogate of the EFIE based on Differential Forms: Application to Preconditioning**
Clément Henry (1), Adrien Merlini (1), Francesco P. Andriulli (2)
(1) IMT Atlantique (France); (2) Politecnico di Torino (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/FETQ8846

Friday, 27 June 2025 09:00 - 11:00 Room H

S04-3 Inverse scattering and imaging - Part 3

Session Chairs: *Raffaele Solimene (Italy), Andrea Randazzo (Italy)*
Session Conveners: *Andrea Randazzo, Raffaele Solimene, Shouhei Kidera*

Fr-S04-AM1-1 **Key Points in Electromagnetic Inverse Scattering Problems: Scattered Field Dimension**
Rocco Pierri (1), Raffaele Solimene (1), Maria Antonia Maisto (1)
(1) Università della Campania "Luigi vanvitelli" (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/CRML2101

Fr-S04-AM1-2 **Towards Source Localization in a Complex Environment With a Low Number of Sensors**
Rosa Scapaticci (1), Ehsan Akbari Sekehravani (1), Lorenzo Crocco (1), Angela Dell'Aversano (2), Raffaele Solimene (2)
(1) CNR Naples (Italy); (2) Università della Campania "Luigi vanvitelli" (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/GULM5909

Fr-S04-AM1-3 **Ad-hoc-network-based target detection and tracking in complex media (Invited)**
Edwin A. Marengo (1), Daniel P. Chu (1)
(1) Northeastern University (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/WDDE1448

Fr-S04-AM1-4 **Quantitative subsurface imaging via linear microwave tomography and U-NET (Invited)**
G. Esposito (1), F. Soldovieri 1), I. Catapano (1), G. Gennarelli (1)
(1) Institute for Electromagnetic Sensing of the Environment – National Research Council of Italy (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/BHLT5761

Fr-S04-AM1-5 **Imaging of targets of interest in GPR prospecting on layered media**
Raffaele Persico (1), Ding Yang (2), Gianfranco Morelli (3), Ilaria Catapano (4), Giuseppe Esposito (4), Gregory De Martino (5), Luigi Capozzoli (5)
(1) University of Calabria (Italy); (2) University of Electronic Science and Technology of China (China); (3) Geostudi Astier s.r.l. (Italy); (4) IREA-CNR (Italy); (5) IMAA-CNR (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/PCDN7706

Fr-S04-AM1-6 **1D Inverse Scattering with Backing Reflecting Plane**
Maria Antonia Maisto (1), Roberto Dima (1), Loreto Di Donato (2), Angela Dell'Aversano (1), Raffaele Solimene (1)
(1) Dipartimento di Ingegneria, University of Campania "L. Vanvitelli" (Italy); (2) Dipartimento di Ingegneria Elettrica, Elettronica ed Informatica, University of Catania (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/WJRD6133

Friday, 27 June 2025 09:00 - 11:00 Room I

S22 Quantum Electronics

Session Chairs: *Gabriele Gradoni (United Kingdom), Michael Haider (Germany)*
Session Conveners: *Henrik Wallén, Ludger Klinkenbusch*

Fr-S22-AM1-1 **Modelling the Spill-out Effect from a Metallic Nanosphere: A Boundary-based Approach (Invited)**
Xuezhi Zheng (1), Guy A. E. Vandenbosch (1)
(1) KU Leuven (Belgium)
DOI: https://doi.org/10.46620/URSIEMTS25/TZAB2335

Fr-S22-AM1-2 **Quantum emitter interacting with a dispersive dielectric object: a model based on the modified Langevin noise formalism (Invited)**
Giovanni Miano (1), Loris Maria Cangemi (1), Carlo Forestiere (1)
(1) University of Naples "Federico II" (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/PVWN7444

Fr-S22-AM1-3 **Symbolic-Numeric Modeling of Resonant Phase Matching for Dispersion Engineering in Josephson Traveling-Wave Parametric Amplifiers (Invited)**
Michael Haider (1), Yongjie Yuan (1), Johannes Stowasser (1), Lukas Seitner (1), Samuel T. Elkin(2), Thomas E. Roth(2), Christian Jirauschek (1)
(1) Technical University of Munich (Germany); (2) Purdue University (United States)
DOI: https://doi.org/10.46620/URSIEMTS25/ZPRE7896

Fr-S22-AM1-5 **Quantum-based optimization of Reconfigurable Intelligent Surfaces: Barren Plateaus Analysis**
Emanuel Colella (1), Luca Bastianelli (1), Valter Mariani Primiani (1), Franco Moglie (1), Zhen Peng (2), Gabriele Gradoni (3)
(1) Università Politecnica delle Marche (Italy); (2) University of Illinois (United States); (3) University of Surrey (United Kingdom)
DOI: https://doi.org/10.46620/URSIEMTS25/ATYP3190

Friday, 27 June 2025 11:30 - 12:50 Room C

S15-1 Deterministic propagation models for 6G and RIS-aided wireless systems - Part 1

Session Chairs: *Matteo Albani (Italy), Enrico Maria Vitucci (Italy)*
Session Conveners: *Matteo Albani, Enrico M. Vitucci*

Fr-S15-AM2-1 **Semianalytic Analysis of a RIS Based on an Infinite 2D Array of Minimum Scattering Planar Antennas with Variable Reactance (Invited)**
Matteo Albani (1), Ilir Gashi (1), Enrica Martini (1), Alberto Toccafondi (1)
(1) Department of Information Engineering and Mathematics, University of Siena (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/AUES4801

Fr-S15-AM2-2 **Uniform Ray Description for PO Scattering from Reconfigurable Intelligent Surfaces**
Enrico Maria Vitucci (1), Nicolò Cenni (1), Vittorio Degli-Esposti (1), Matteo Albani (2)
(1) University of Bologna (Italy); (2) University of Siena (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/ASXN5816

Fr-S15-AM2-3 **Iterative Physical Optics Method for Evaluation of Near Field Dielectric Target Scattering in mmWave Sensing Applications (Invited)**
Tom Malherbre (1), Christophe Delaveaud (1), Philippe Pouliguen (2), Raffaele D'Errico (1)
(1) CEA Leti (France); (2) DGA-AID (France)
DOI: https://doi.org/10.46620/URSIEMTS25/XDHX8112

Fr-S15-AM2-4 **Empirical Study of Scattering from Construction Materials at 10 GHz**
Pekka Kyösti (1, 2), Usman Virk (1), Bernardi Elena (3), Enrico Maria Vitucci (3)
(1) Keysight Technologies (Finland); (2) University of Oulu (Finland); (3) University of Bologna (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/HOBU6023

Friday, 27 June 2025 11:30 - 12:50 Room D

S09-3 Novel mathematical methods in electromagnetics - Part 3

Session Chairs: *Kazuya Kobayashi (Japan), Yury Shestopalov (Russia), Guido Lombardi (Italy)*
Session Conveners: *Kazuya Kobayashi, Guido Lombardi, Yury Shestopalov*

Fr-S09-AM2-2 **Numerical Solution of the GO Equations for GRIN Lens Antennas by Using the Lax-Friedrichs Sweeping Method (Invited)**
Ilir Gashi (1), Stefano Maci (1), Matteo Albani (1)
(1) Department of Information Engineering and Mathematics, University of Siena (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/SEFT2603

Fr-S09-AM2-3 **A Semi-Analytical Method for the Study and Characterization of 3-D Periodic Woodpile Lattices (Invited)**
Alessandro Romano (1), Vakhtang Jandieri (2), Guido Valerio (3), Ludovica Tognolatti (1), Paolo Baccarelli (1)
(1) "Roma Tre" University (Italy); (2) University of Duisburg– Essen (Germany); (3) Sorbonne Université (France)
DOI: https://doi.org/10.46620/URSIEMTS25/JSOZ2771

Friday, 27 June 2025 11:30 - 12:50 Room H

S20-1 Rays and beams in electromagnetics - Part 1

Session Chairs: *Giuliano Manara (Italy), Ludger Klinkenbusch (Germany)*
Session Conveners: *Prabhakar Pathak, Giuliano Manara, Ludger Klinkenbusch*

Fr-S20-AM2-1 **Polarization-Aware Ray-Tracing Enhanced Back-Projection Algorithm for Microwave Imaging in Complex Multipath Environments (Invited)**
Han Na (1), Quanfeng Wang (1), Matthias Saurer (1), Meisong Tong (2), Thomas F. Eibert (1)
(1) Department of Electrical Engineering, School of Computation, Information and Technology, Technical University of Munich (Germany); (2) Department of Electronic Science and Technology, Tongji University (China)
DOI: https://doi.org/10.46620/URSIEMTS25/RKHF8213

Fr-S20-AM2-3 **Enhanced Modeling of an H-Polarized Surface Wave Diffraction Over a Corner (Invited)**
Xenofon M. Mitsalas (1), Talha Arshed (1), Enrica Martini (1), Stefano Maci (1)
(1) Department of Information Engineering and Mathematics, University of Siena (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/OGIB5963

Fr-S20-AM2-4 **Uniform Complex-Source Beam Diffraction by a PEC Wedge Surrounded by a Lossy Medium**
Ludger Klinkenbusch (1), Giuliano Manara (2), Andrea Michel (2)
(1) Kiel University (Germany); (2) Università di Pisa (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/VRNI8503

Friday, 27 June 2025 11:30 - 12:50 Room I

S13-2 Metamaterials and metasurfaces: space, time, and spacetime control of wave propagation - Part 2

Session Chairs: *Victor Pacheco-Peña (United Kingdom), Carlo Rizza (Italy), J. Enrique Vázquez-Lozano (Spain)*
Session Conveners: *Victor Pacheco-Peña, Iñigo Liberal, Carlo Rizza*

Fr-S13-AM2-1 **Thermal Emission from Time-Modulated Dispersive Media (Invited)**
J. Enrique Vázquez-Lozano (1), Iñigo Liberal (1)
(1) Universidad Pública de Navarra (Spain)
DOI: https://doi.org/10.46620/URSIEMTS25/SIUK9046

Fr-S13-AM2-2 **FDTD Analysis of EM Wave Propagation in a Space-time-modulated Lossy Transmission Line**
Anand Kumar (1), Debdeep Sarkar (1)
(1) Indian Institute of Science (India)
DOI: https://doi.org/10.46620/URSIEMTS25/HULZ1192

Fr-S13-AM2-3 **6-Port Topological Valley Junction for Signal Routing**
Christian Johnson-Richards (1), Ross Glyn MacDonald (1), Alex Yakovlev (1), Victor Pacheco-Peña (1)
(1) Newcastle University (United Kingdom)
DOI: https://doi.org/10.46620/URSIEMTS25/QEKB6335

Friday, 27 June 2025 14:30 - 15:30 Room B

PLE-4 Plenary Talk 4

Session Chairs: *Marina Barbiroli (Italy)*

Fr-PLE-PM1-1 **Frontiers in Bioelectromagnetic Research: Simulations, Experimental activity and Applications (Invited)**
Micaela Liberti (1)
(1) DIET, Sapienza, University of Rome (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/AGVF4094

Friday, 27 June 2025 15:30 - 16:30 Room C

S15-2 Deterministic propagation models for 6G and RIS-aided wireless systems - Part 2

Session Chairs: *Matteo Albani (Italy), Enrico Maria Vitucci (Italy)*
Session Conveners: *Matteo Albani, Enrico M. Vitucci*

Fr-S15-PM2-1 **Ray Interpolation Technique for Moving Receiver in Urban Environment (Invited)**
Conor Brennan (1), Allan Wainaina Mbugua (2), Yun Chen (2), Sajjad Hussain (3)
(1) Dublin City University (Ireland); (2) Huawei Technologies Duesseldorf GmbH (Germany); (3) National University of Sciences and Technology (Pakistan)
DOI: https://doi.org/10.46620/URSIEMTS25/IPRM6913

Fr-S15-PM2-2 **Modeling Radio-Wave Propagation in Complex Geometry Tunnels using 3-D Ray Tracing**
Ori Glikstein (1), Yehuda Taragin (1), Gad A. Pinhasi (2), Yosef Pinhasi (1)
(1) Department of Electrical and Electronic Engineering, Ariel University (Israel); (2) Department of Chemical Engineering, Ariel University (Israel)
DOI: https://doi.org/10.46620/URSIEMTS25/ARPR7759

Friday, 27 June 2025 15:30 - 16:30 Room D

S06-2 Advanced algorithms in computational electromagnetics - Part 2

Session Chairs: *Vladimir Okhmatovski (Canada)*
Session Conveners: *Shinichiro Ohnuki, Vladimir Okhmatovski, Qing Huo Liu*

Fr-S06-PM2-1 **Innovative Application of the Born-Approximation for Analyzing Medium Motion Effects in COMSOL Time Explicit EMW Module**
Kirill Zeyde (1), Mirco Raffetto (1)
(1) University of Genoa (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/CLNI3022

Fr-S06-PM2-2 **Iterated Crank-Nicolson-Based FDTD Method for Three-Dimensional Problems**
Jun Shibayama (1), Akira Kawahara (1), Koshin Miwatashi (1)
(1) Hosei University (Japan)
DOI: https://doi.org/10.46620/URSIEMTS25/TQFT2965

Fr-S06-PM2-3 **Study on Structural Optimization of Axisymmetric Meta-lenses by Function Expansion Method**
Mio Taniguchi (1), Taiki Matsuzaki (1), Akito Iguchi (1), Yasuhide Tsuji (1), Keita Morimoto (2)
(1) Muroran Institute of Technology (Japan); (2) University of Hyogo (Japan)
DOI: https://doi.org/10.46620/URSIEMTS25/WSDQ1308

Friday, 27 June 2025 15:30 - 16:30 Room H

S20-2 Rays and beams in electromagnetics - Part 2

Session Chairs: *Giuliano Manara (Italy), Ludger Klinkenbusch (Germany)*
Session Conveners: *Prabhakar Pathak, Giuliano Manara, Ludger Klinkenbusch*

Fr-S20-PM2-1 **A Novel Geometrical Optics Approach for Curved Reflectors with Variable Reflection Phase (Invited)**
Serena Assefa Asfaw (1), Enrica Martini (1), Dayan Pérez-Quintana (1), Giovanni Toso (2), Matteo Albani (1)
(1) Department of Information Engineering and Mathematics, University of Siena (Italy); (2) European Space Agency (Netherlands)
DOI: https://doi.org/10.46620/URSIEMTS25/SRSF8813

Fr-S20-PM2-2 **Generative Path Selection Technique for Efficient Ray Tracing Prediction (Invited)**
Jérome Eertmans (1), Nicola Di Cicco (2), Enrico Maria Vitucci (2), Claude Oestges (1), Vittorio Degli-Esposti (2)
(1) Université catholique de Louvain (Belgium); (2) CNIT, University of Bologna (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/AQFK2004

Friday, 27 June 2025 15:30 - 16:30 Room I

S21-2 Open session - Part 2

Session Chairs: *Henrik Wallén (Finland), Ludger Klinkenbusch (Germany)*
Session Conveners: *Henrik Wallén, Ludger Klinkenbusch*

Fr-S21-PM2-1 **Three-Dimensional Chipless RFID Technology: A New Frontier in Counterfeit Deterrence**
Suvadeep Choudhury (1, 2), Filippo Costa (1), Giuliano Manara (1), Simone Genovesi (1)
(1) University of Pisa (Italy); (2) The LNM Institute of Information Technology (India)
DOI: https://doi.org/10.46620/URSIEMTS25/ZAAA7114

Fr-S21-PM2-2 **Performance Analysis of Physical Layer Security Secrecy Key Generation in Indoor Environment**
Alessandro Santorsola (1, 2), Giovanni Magno (1), Vincenzo Petruzzelli (1), Sabino Roberto Caporusso (2), Giovanna Calò (1)
(1) Politecnico di Bari (Italy); (2) BV TECH spa (Italy)
DOI: https://doi.org/10.46620/URSIEMTS25/MGXR5100

Fr-S21-PM2-3 **Rapid Virtual Prototyping for Cubesat Scale Deployable Reflector Antennas**
Timothy Pelham (1), Andrew Austin (1)
(1) University of Bristol (United Kingdom)
DOI: https://doi.org/10.46620/URSIEMTS25/YXDS2743

URSI-B EMTS 2025, Bologna, 23–27 June

Drywall Panel Coated with Biochar for Electromagnetic Shielding Applications

Giuseppe Ruscica[(1)], Zahra Alinaghi[(1)], Isabella Natali Sora[(1)] and Patrizia Savi[(2)]
(1) Department of Engineering and Applied Sciences, Università di Bergamo, Dalmine, 24044 Bergamo, Italy, https://www.unibg.it/
(2) Electronic and Telecom Dept., Politecnico di Torino, Italy, http://www.polito.it

Abstract

Biochar, a material derived from biomass with a high carbon content, is a sustainable, renewable, eco-friendly, and cost-effective option in many applications. Recently, biochar has been added to construction materials in order to increase their electromagnetic shielding properties. In this work, commercially produced biochar, thermally treated at 750 °C, is applied in multiple layers on drywall panels aiming to develop a building component with increased shielding effectiveness for the construction sector. The transmission properties of drywall panels with several biochar layers are measured in the frequency band 1-12 GHz.

1 Introduction

Electromagnetic interferences (EMI) not only affect the performance of electronic equipment but also pose potential risks to human health, raising concerns about their impacts for safety and well-being [1]. Traditionally, metals with high electrical conductivity have been the primary choice for EMI shielding due to their excellent shielding properties [2]. Drawbacks of using metal shields are weight and density, high cost, corrosion susceptibility, and lack of flexibility [3]. Carbon-based materials can be a good substitute for metal shields. They provide several benefits, such as exceptional strength, high modulus, resistance to corrosion and fatigue, low density, and minimal thermal expansion [4]. However, the elevated cost of conductive fillers like carbon nanotubes, and carbon fibers, may hinder their application as EMI shielding materials in the construction sector. Current strategies focus on integrating EMI shielding into non-structural building components by emphasizing more cost-effective and sustainable alternatives, such as biochar [5, 6].

Biochar is a carbon-rich material produced by the thermochemical processing of biomass. Unlike metals and other synthetic carbon-based materials, biochar ehnanced exhibits the electromagnetic shielding properties of construction materials [7]. Incorporating biochar into innovative construction materials can provide economic advantages through carbon trading, encouraging the construction and building sector to significantly reduce overall carbon emissions [8]. In this work, the shielding effectiveness of drywall panels coated with several layers of biochar is measured and compared with a reference drywall panel.

2 Shielding effectiveness and sample preparation

Consider a dielectric slab of thickness d in air and a plane wave incident from the left. The shielding effectiveness (SE) is defined as:

$$SE = 20\log_{10}\frac{E_t}{E_i} \tag{1}$$

where E_i is the electric field of the plane wave incident on the left, E_t is the transmitted electric field. In case of drywall panel with and without biochar coating, the SE can be obtained from the measurements of the transmitted field. The SE measurement environment was prepared by cutting a 300x300 mm^2 square hole in a holder placed inside an anechoic chamber where the sample is inserted. The scattering parameter S_{21} is measured as a function of frequency without the sample (S_{21}, ref) and with the sample made of drywall coated with biochar coating present (S_{21}, sample) and the SE evaluated.

In this work, commercial drywall panels of 10 mm thickness are covered on one side with a coating based on commercial biochar (Carlo Erba). The wood biomass biochar supplied by Carlo Erba is treated at 750 °C for four hours. The coating is prepared by mixing biochar, water, methyl hydroxyethyl cellulose (MHEC), and ammonia (NH_3) in different proportions. The mixture is manually applied on the drywall panel. Then, the panel is cured in ambient conditions (T=25°C and relative humidity 50%) for 24 hours. This process is repeated multiple times until panels with the desired number of layers are obtained. A reference specimen consisting of a drywall panel itself is also considered for the experimental tests (see Figure 1).

3 Results

Transmission measurements were made in an anechoic chamber using double-ridged, linearly polarized broad-

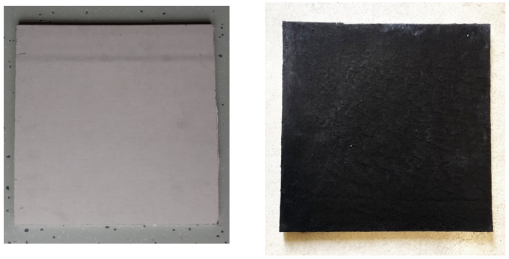


Figure 1. Drywall reference sample without coating (left) and drywall with multiple layers of biochar (right).

band horn antennas (1 GHz–12 GHz) mounted on a 3-axis positioner and connected to a vector network analyzer (Keysight, N5227A). The anechoic chamber (dimensions of 2 m × 4 m × 2 m) has the walls, ceiling, and floor covered with pyramidal microwave absorbers designed from 1200 MHz up to 90 GHz. The transmitting and receiving antennas, as well as the sample under test, are positioned inside the chamber, while the signal generator and receiver are placed outside to eliminate interference. The samples are mounted on a holder positioned between the two horn antennas. The antennas are spaced 2.5 meters apart. The wooden holder is covered with a metal sheet and has a window of 30 cm x 30 cm where the sample under test can be fixed. The Shielding effectiveness is determined by comparing the signal levels measured with and without the sample.

The SE of drywall panel of 10 mm thickness covered on one side with 2, 3, and 5 layers of biochar is measured. Results are shown in Figure 2 and compared with a drywall panel without any coating. Increasing the number of biochar layers on the drywall leads to an increase in the SE value. Considering f = 10 GHz, the drywall panel alone is almost transparent (SE = 0.5 dB) while the SE increases to 9.5 dB, 11 dB and 12 dB for the case of 2, 3, and 5 layers, respectively.

4 Conclusions

Commercial biochar has been used as a coating on standard drywall panels and the SE measured in the frequency band 1-12 GHz. Results show Drywall panels without coating have a very low SE, which can be considered approximately equal to 0 dB. By adding two or more layers of biochar to the drywall, the SE value increases. Panels with two and three layers of biochar perform almost similarly, but increasing the number of layers to five results in a improvement in SE, rising from approximately 7 dB for two layers to around 10 dB for five layers.

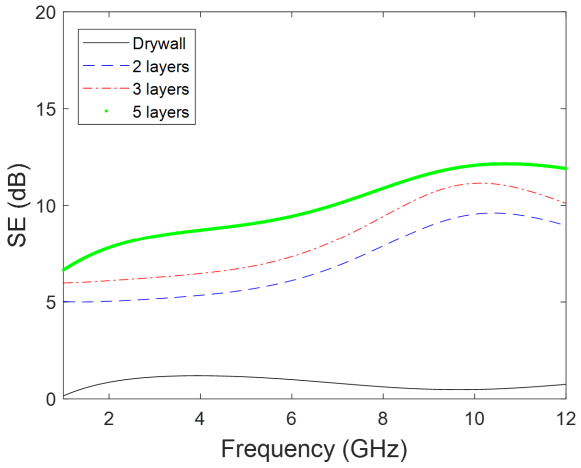


Figure 2. Shielding effectiveness of samples with 2, 3 and 5 layers of biochar

References

[1] R. S. Kasevich, "Cellphones, radars, and health," *IEEE Spectrum*, vol. 39, no. 8, pp. 15–16, 2002.

[2] D. Wanasinghe, F. Aslani, G. Ma, and D. Habibi, "Advancements in electromagnetic interference shielding cementitious composites," *Construction and Building Materials*, vol. 231, p. 117116, January 2020.

[3] E. Mikinka and M. Siwak, "Recent advances in electromagnetic interference shielding properties of carbon-fibre-reinforced polymer composites—a topical review," *Journal of Materials Science: Materials in Electronics*, vol. 32, no. 20, pp. 24 585–24 643, Oct 2021.

[4] D. Tan, C. Jiang, Q. Li, S. Bi, X. Wang, and J. Song, "Development and current situation of flexible and transparent em shielding materials," *Journal of Materials Science: Materials in Electronics*, vol. 32, no. 21, pp. 25 603–25 630, November 2021.

[5] D. Torsello, M. Bartoli, M. Giorcelli, M. Rovere, R. Arrigo, G. Malucelli, A. Tagliaferro, and G. Ghigo, "High frequency electromagnetic shielding by biochar-based composites," *Nanomaterials*, vol. 11, no. 9, p. 2383, Sep 2021.

[6] M. Bartoli, R. Arrigo, G. Malucelli, A. Tagliaferro, and D. Duraccio, "Recent advances in biochar polymer composites," *Polymers*, vol. 14, no. 12, p. 2506, Jun 2022.

[7] P. Savi, G. Ruscica, D. di Summa, and I. Natali Sora, "Shielding effectiveness measurements of drywall panel coated with biochar layers," *Electronics*, vol. 11, no. 15, p. 2312, Jan 2022.

[8] L. Wang, L. Chen, C. S. Poon, C. H. Wang, Y. S. Ok, V. Mechtcherine *et al.*, "Roles of biochar and CO_2 curing in sustainable magnesia cement-based composites," *ACS Sustainable Chemistry Engineering*, vol. 9, no. 25, pp. 8603–8610, June 2021.