

Drywall Panel Coated with Biochar for Electromagnetic Shielding Applications

Original

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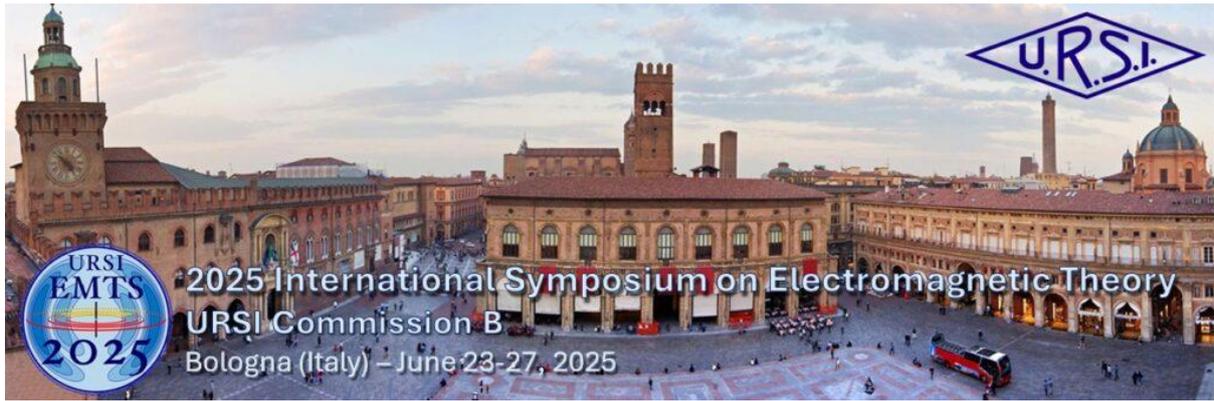
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Technical Programme

**International Symposium on
Electromagnetic Theory**

URSI EMTS 2025

23-27 June 2025

Bologna, Italy

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), Valentin 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 Trincherò (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)**
Abdorrezza 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/JMY4554>

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. Mitsalás (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 Scapatricci (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 Paleczek (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 Czulwik (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 Klippenbusch (Germany)*

Session Conveners: *Giuliano Manara, Ludger Klippenbusch*

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 $\mathbf{P} \bullet \mathbf{T} \bullet \mathbf{D}$ - Symmetric Geometry – Part I: Theory (Invited)

Roe 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 Piekarcz

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 Telecomunicazioni (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) University 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 Elsayw (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) EIMaReCo (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 Barbutto (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 Trincherio (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 Aloï (United States), Andrea Michel (Italy)

Session Conveners: Daniel Aloï, 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 Aloï (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 Nocchetti (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 Coşan (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)

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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 Klickenbusch*

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/HOBUB6023>

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. Mitsalás (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)

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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)

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(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)

Jérôme 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)

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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>

Drywall Panel Coated with Biochar for Electromagnetic Shielding Applications

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(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 enhanced 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:

$$SE = 20 \log_{10} \frac{E_i}{E_t} \quad (1)$$

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 mm² 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 ($S_{21, \text{ref}}$) and with the sample made of drywall coated with biochar coating present ($S_{21, \text{sample}}$) 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 (NH₃) in different proportions. The mixture is manually applied on the drywall panel. Then, the panel is cured in ambient conditions ($T=25^\circ\text{C}$ 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-

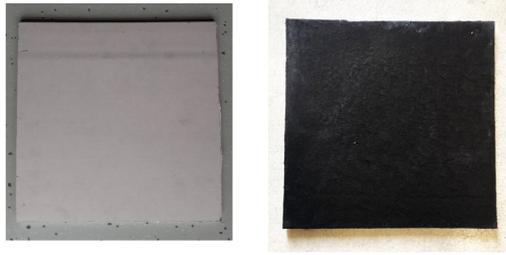


Figure 1. Drywall reference sample without coating (left) and drywall with multiple layers of biochar (right).

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 × 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 an improvement in SE, rising from approximately 7 dB for two layers to around 10 dB for five layers.

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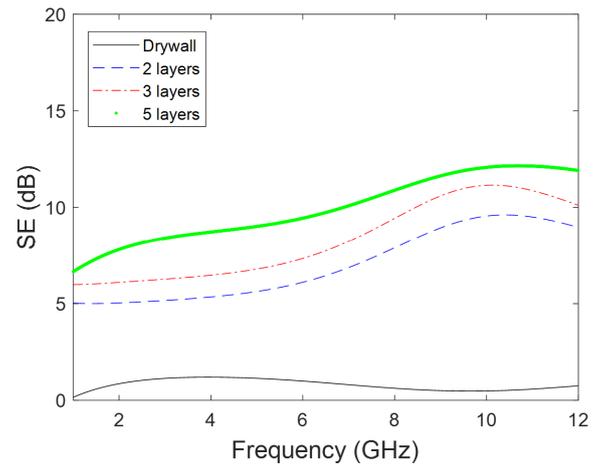


Figure 2. Shielding effectiveness of samples with 2, 3 and 5 layers of biochar

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