International Applied Computational Electromagnetics Society Symposium in Denver (ACES-Denver 2018)

Denver, Colorado, USA
25 - 29 March 2018

ISBN: 978-1-5108-6303-3

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571

Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2018) by The Applied Computational Electromagnetics Society (ACES)
All rights reserved.

Printed by Curran Associates, Inc. (2018)

For permission requests, please contact The Applied Computational Electromagnetics Society (ACES) at the address below.

The Applied Computational Electromagnetics Society (ACES)
www.aces-society.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

2018 International Applied Computational Electromagnetics Society Symposium in Denver (ACES-Denver 2018)

Conference Proceedings
Table of Contents

Session 3: Computational Electromagnetics, Advanced Algorithms and Emerging Applications

03-01 "A Nystrom Discretization of an Augmented Muller Surface Integral Equation"
Nastaran Hendijani and Stephen D. Gedney 1

03-02 "An Adaptive Factorization Method for Inverse Scattering Problems"
Koung Hee Leem, Jun Liu, and George Pelekanos 3

03-03 "First Principles Model of Electric and Magnetic Cable Braid Penetrations"
Salvatore Campione, Larry K. Warne, and William L. Langston 5

03-04 "Flammer's Exact Solution for the Circular Conducting Disk: A Benchmark Problem for EM Software Validation" 7
Andrew F. Peterson and Malcolm M. Bibby

Session 4: Antenna Optimization for RFID Applications

04-01 "On Compact Wideband Antenna Design Using Topology Modifications"
Muhammad Aziz ul Haq and Slawomir Koziel 9

04-02 "Design Optimization of Novel Compact Circular Polarization Antenna"
Slawomir Koziel and Adrian Bekasiewicz 11

04-03 "PEEC-Based Multi-Objective Synthesis of NFC Antennas in the Presence of Conductive Structures"
Thomas Bauernfeind, Paul Baumgartner, Oszkar Biro, Christian Magele, Werner Renhart, and Riccardo Torchio 13

04-04 "Synthesis of NFC Antenna Structure under Multi Card Condition"
Paul Baumgartner, Thomas Bauernfeind, Oszkar Biro, Christian Magele, Werner Renhart, and Riccardo Torchio 15

04-05 "The Adaptive Wind Driven Optimization and its Application in Electromagnetics"
Jogender Nagar, Sawyer D. Campbell, Douglas H. Werner, Zikri Bayraktar, and Muge Komurcu 17

Session 5: Microwave/Millimeter Wave and Terahertz Devices and Applications – 1

05-01 "Dual-Band Microstrip Antenna for the Fifth Generation Indoor/Outdoor Wireless Applications"
Mourad S. Ibrahim 19

05-02 "Co-Simulations of DC Magnetic Bias Fields and RF Performance for Microwave Ferrite Circulators"
Laila Fighera Marzall, Mauricio Pinto, Andrea Ashley, Dimitra Psychogiou, and Zoya Popovic 21

05-03 "A Design Approach for Monolithically Integrated Broadband Circulators"
Mauricio Pinto, Laila Fighera Marzall, Andrea Ashley, Dimitra Psychogiou, and Zoya Popovic 23

05-04 "Terahertz Evanescent Wave Tunneling in Bianisotropic Thin Films"
Faroq Razzaz and Majeed A. S. Alkanhal 25

05-05 "Tuning the Resonant Frequency of Microstrip Patch Antenna in LWIR"
Shenjie Miao and Brian A. Lail 27

Session 6: Student Paper Competition – 1

06-01 "On the Conforming Combination of the Electric and Magnetic Field Integral Equations"
Ahmet F. Yilmaz and H. Arda Ulku 29

06-02 "A Volume Integral Equation Solver for Quantum-Corrected Transient Analysis of Scattering from Plasmonic Nanostructures"
Sadeed B. Sayed, Ismail Enes Uysal, H. Arda Ulku, and Hakan Bagci 31

06-03 "A Space-Time Domain Decomposition Method for High-fidelity Electromagnetic Simulation"
Shu Wang and Zhen Peng 33

06-04 "Analysis of Nonlinear Graphene Plasmonics Using Surface Integral Equations"
Ling Ling Meng, Xiaoyan Y. Z. Xiong, Tian Xia, Li Jun Jiang, and Weng Cho Chew 35
06-05 "Design of Ungrounded CPW GaN-on-Si MMICs"
Philip Zurek, Myles Foreman, Ryan Johnson, Christopher Galbraith, Jose Estrada, and Zoya Popovic 37

Session 7: Challenges of Antenna Designs for Integration in Extreme Environments
07-01 "Even-Arm Modulated Arm Width Spiral Properties"
W. Neill Kefauver and Dejan S. Filipovic 39
07-02 "High Temperature Electronics for Demanding Aircraft Applications"
Roger A. Brewer 41
07-03 "Radiation Modes of an Outside Fed 4-arm Conical Spiral"
Thomas P. Cencich, Jeannette C. McDonnell, and Timothy W. Samson 43
07-04 "On Matching Lossy Antennas for Maximum Power Absorption"
Ofer Markish, Daniel Silverstein, and Yehuda Leviatan 45
07-05 "Fast Computation of Back Scattered Fields for Large Scanned Array Antennas"
Arun K. Bhattacharyya and Nicholas D. Saiz 47

Session 8: Design, Analysis and Applications of EM Metasurfaces – 1
08-01 "Triple Fano Resonances in Plasmonic Heptamer Nanohole Arrays: Symmetric and Asymmetric Structures"
Akram Hajebifard and Pierre Berini 49
08-02 "Metagratings: A Novel Paradigm for Efficient Wavefront Control"
Dimitrios L. Sounas, Younes Ra'di, and Andrea Alu 51
08-03 "Metamaterial Enhanced Antenna Systems: A Review"
Daniel Binion, Pingjuan L. Werner, Douglas H. Werner, Erik Lier, and Thomas H. Hand 53
08-04 "A Dual Band-Reject FSS for WI-FI Application"
Mehdi Bahadorzadeh and Charles F. Bunting 55
08-05 "The Time-Bandwidth Limit in Optical Nanostructures and Its Relation to Nonreciprocity"
Dimitrios L. Sounas, Sander Mann, and Andrea Alu 57

Session 9: Microwave/Millimeter Wave and Terahertz Devices and Applications – 2
09-01 "Design of Ungrounded CPW GaN-on-Si MMICs"
Philip Zurek, Myles Foreman, Ryan Johnson, Christopher Galbraith, Jose Estrada, and Zoya Popovic 59
09-02 "Bandwidth Design of Ferrite-Based Circulators"
Andrea Ashley, Laila Fighera Marzall, Mauricio Pinto, Zoya Popovic, and Dimitra Psychogiou 61
09-03 "Amplitude-Equalized Microwave Phasers"
Mohamed K. Emara, Kimi Maheshwari, Jim S. Wight, and Shulabh Gupta 63

Session 10: Student Paper Competition – 2
10-01 "A Novel Stochastic Integral Equation Method for Wireless Communication in Diffuse Multipath Environments"
Shen Lin and Zhen Peng 65
10-02 "Surface Integral Computation for the Higher Order Surface Integral Equation Method of Moments"
Sanja B. Manic and Branislav M. Notaros 67
10-03 "Vector Parabolic Equation Modeling of Wireless Propagation in Tunnels with Statistically Rough Surface Walls"
Xingqi Zhang and Costas D. Sarris 69
10-04 "A DC to HF Volume PEEC Formulation Based on Hertz Potentials and the Cell Method"
Riccardo Torchio, Piergiorgio Alotto, Paolo Bettini, Dimitri Voltolina, and Federico Moro 71
10-05 "Recent Developments in the Application of Contactless Inductive Flow Tomography"
Matthias Ratajczak, Thomas Wondrak, and Frank Stefani 73

Session 11: Fast Methods for Radar Signature Prediction and Direction Finding Algorithms

11-01 "Parametric Models for Signature Prediction and Feature Extraction"
Julie Ann Jackson 75

11-02 "Sparse Recovery Method for Order-of-Magnitude Reduction in RCS Measurements"
Tayfun Özdemir, Kevin Bi, Santos Campos, and Robert J. Burkholder 77

11-03 "Analytic Solutions for the Bistatic Radar Signature of a Dihedral Target of Arbitrary Angle"
Robert J. Burkholder 79

11-04 "GNSS AoA Estimation Based on Dual-frequency Joint Processing"
Boyi Wang, Yafeng Li, Nagaraj Channarayapatna Shivaramaiah, and Dennis M. Akos 81

11-05 "Design of Platform-Based HF Direction Finding Antennas Using the Characteristic Mode Theory"
Ruyu Ma and Nader Behdad 84

11-06 "Impact of Flat Radomes on Amplitude-Only Direction Finding Performance"
Muhannad A. Al-Tarifi and Dejan S. Filipovic 86

11-07 "Directional of Arrival Tag Response for Reverse RFID Localization"
Allee D. Zarrini, Atef Elsherbeni, and Jurgen F. Brune 88

Session 12: Design, Analysis and Applications of EM Metasurfaces – 2

12-01 "Modal Analysis of Stacked Gratings using B-splines Basis"
Gerard Granet 90

12-02 "Resonant Nanoantennas for Enhancing the Interaction of Terahertz Radiation with Nanomaterials"
L. Razzari 92

12-03 "Bi-Anisotropic Homogenization for Efficient Metasurface Design"
Zhaxylyk A. Kudyshev, Ludmila J. Prokopeva, Maowen Song, Sajid Choudhury, and Alexander V. Kildishev 94

12-04 "The Constitutive Effective Parameters of Two-Dimensional Multilayered Dielectric Grating Slab"
Quang Nguyen, Amir I. Zaghloul, Mario J. Mencagli, and Nader Engheta 96

12-05 "Optimization of Plasmonic Metasurfaces for Subtractive Color Filtering"
Walied Sabra, Maowen Song, Shaimaa I. Azzam, Arafa H. Aly, and Alexander V. Kildishev 98

12-06 "Millimeter-Wave Electromagnetic Metasurfaces based on Perforated Dielectrics"
NaquashA. Sheikh, Khaled Madhoun, Sonya Stuhec-Leonard, and Shulabh Gupta 100

12-07 "Implicit and Explicit FDTD Methods for Modelling EM Metasurfaces"
Tom J. Smy, Scott A. Stewart, and Shulabh Gupta 103

Session 13: Radio Propagation Modeling and Channel Estimation

13-01 "28 GHz Propagation Channel Measurements for 5G Microcellular Environments"
C. Umit Bas, Rui Wang, Seun Sangodoyin, Sooyoung Hur, Kuyeon Whang, Jeongho Park, Jianzhong Zhang, and Andreas F. Molisch 105

13-02 "Improving Millimeter-Wave Channel Models for Suburban Environments with Site-Specific Geometric Features"
Yaguang Zhang, David J. Love, Nicolo Michelusi, James V. Krogmeier, Soumya Jyoti, Alex Sprintson, and Christopher R. Anderson 107

13-03 "Analysis of Radar Altimeter Interference due to Wireless Avionics Intra-Communication Systems by Using Large-Scale FDTD Method"
Shunichi Futatsumori, Kazuyuki Morioka, Akiko Kohmura, Naruto Yonemoto, Takashi Hikage, Tetsuya Sekiguchi, Manabu Yamamoto, and Toshio Nojima 109

13-04 "Recent Advances in Spatiotemporally-Modulated (STM) Magnetless Circulators"
Dimitrios L. Sounas, Ahmed Kord, and Andrea Alu 111

13-05 "Millimeter-wave Frequency FDTD Simulation for Error Vector Magnitude of Modulated Signals"
Joseph Elliott Diener, Jeanne Quimby, Kate A. Remley, and Atef Z. Elsherbeni 113

Session 14: Numerical Methods for Analysis, Design and Measurement of Antennas – 1

14-01 "Near-Field Far-Field Transformations for Automobile Antenna Measurements"
Thomas F. Eibert and Raimud A.M. Mauermayer 115

14-02 "Hierarchical Universal Matrices for Sensitivity Analysis by Curvilinear Finite Elements"
Laszlo Levente Toth and Romanus Dyczij-Edlinger 117

14-03 "Embedding the Shooting and Bouncing Rays Method in a Hybrid Solver Framework"
Benjamin Motz and Thomas Weiland 119

14-04 "Mode Tracking for Parametrized Eigenvalue Problems in Computational Electromagnetics"
Philipp Jorkowski and Rolf Schuhmann 121

14-05 "Estimation of Mutual Coupling in Irregular Planar Arrays"
Andrej Konforta, Thomas Bertuch, and Peter Knott 123

14-06 "Effects of Internal Reflections on the Performance of Lens-Integrated mmW and THz Antenna"
Burak Ozbey and Kubilay Sertel 125

14-07 "Ray Tracing Using Shooting-Bouncing Technique to Model Mine Tunnels: Theory and Verification for a PEC Waveguide"
Blake Troksa, Cam Key, Forest Kunkel, Slobodan V. Savic, Milan M. Ilic, and Branislav M. Notaros 127

Session 17: Time Domain Methods – 1

17-01 "Integral Accuracy and Experimental Evidence for the Stability of Time Domain Integral Equations"
Jielin Li, Daniel S. Weile, and David A. Hopkins 129

17-02 "A Novel Port Extraction Technique for Coupling Circuits with Full Wave Time Domain Integral Equation Solvers"
S. O'Connor, S. Hughey, and B. Shanker 131

17-03 "A Modified Streamline Upwind/Petrov-Galerkin Stabilization Matrix for Time-Domain FEM"
Srijith Rajamohan and William Kyle Anderson 133

17-04 "Using an Approximate Streamline Upwind/Petrov-Galerkin Stabilization Matrix for the Solution of Maxwell's Equations in Dispersive Materials"
Srijith Rajamohan and William Kyle Anderson 135

17-05 "Analysis of Transient Scattering from Impedance Surfaces using Physical Optics Approximation"
Huseyin A. Serim and H. Arda Ulku 137

Session 18: Advances in Electrical Impedance Tomography

18-01 "Physiologically Inspired Model of the Skin for Use in Electrical Impedance Tomography"
Michelle M. Mellenthin and Jennifer L. Mueller 139

18-02 "Reconstruction of Complex Conductivities by Calderón's Method on Subject-Specific Domains"
Peter Muller and Jennifer L. Mueller 141

18-03 "Spatial Priors in the D-bar Method for Human Thoracic Electrical Impedance Tomography Data"3
Melody Alsaker and Jennifer L. Mueller 143

18-04 "An Experimental Study of the Human Scapula Movement for the Development of an Anatomical Atlas for Electrical Impedance Tomography"
Tayran M. M. Olegário, Erick L. B. de Camargo, Marcelo B. P. Amato, and Raul Gonzalez Lima 145

18-05 "Introduction of Statistical Priors into the D-bar Method for Electrical Impedance Tomography"
Talles B. R. Santos, Erick L. B. de Camargo, Jennifer L. Mueller, and Raul Gonzalez Lima 147

Session 19: Broadband Antennas and Applications

19-01 "Wideband GCPW-Fed Dielectric Resonator Antenna for WLAN Applications"
Wei-Chung Weng, Min-Chi Chang, and Min-Sian Chen 149

19-02 "Design of Broadband Luneburg Lens Feed Manifold"
Maxim Ignatenko, Carlos A. Mulero Hernandez, and Dejan Filipovic 151

19-03 "Multioctave Antenna Array for Simultaneous Transmit and Receive Applications"
Mohamed A. Elmansouri, Jaegeun Ha, and Dejan Filipovic 153
19-04 "Wideband, Scanning Array for Simultaneous Transmit and Receive"
Alexander Hovsepian, Satheesh Bojja Venkatakrishnan, Elias A. Alwan, and John L. Volakis 155
19-05 "Hexagonal Waveguides: New Class of Waveguides for mm-wave Circularly Polarized Horns"
Shubhendu Bhardwaj and John Volakis 157

Session 20: Wideband and Multiband Antennas
20-01 "Size-Reduced Patch-Antenna Feedpoint Parametric Study"
Randall L. Musselman and James L. Vedral 159
20-02 "Multiband Antenna for Wireless Applications Including GSM/UMTS/LTE and 5G Bands"
Amirreza Jalali Khalilabadi and Ata Zadehgol 161
20-03 "2 to 18 GHz Ultra-Wideband Dual-Linear Polarized Phased Array with 60° Scanning"
Jingni Zhong, Elias A. Alwan, and John L. Volakis 163

Session 21: Optimization and Inverse Problems in Low-Frequency Electromagnetic Fields
21-01 "Biomedical Magnetic Induction Tomography: An Inhomogeneous Green's Function Approach"
Philippe De Tillieux and Yves Goussard 165
21-02 "Approaches for Magnetic Sources Reconstruction in Controlled Thermo-Nuclear Fusion Technology"
A. G. Chiariello, A. Formisano, R. Martone, and JET Contributors 167
21-03 "Resolution Limits of Near-field Electromagnetic Imaging"
Vijay Harid 169
21-04 "Perturbation Approach to Shape Reconstruction in a Rectangular Waveguide using Experimental Data"
Martin Norgren, Irene Ortiz de Saracho, and Mariana Dalarsson 171

Session 22: Building Blocks for Fast FEM and MoM Computation in Electromagnetics
22-01 "High-Order Moment-Matching MOR with Impedance Boundaries for Signal Integrity Analysis"
Matthew B. Stephanson 173
22-02 "Circuit-Based Model Order Reduction for EM-CAD"
Valentin de la Rubia and Sofia Tinoco-Galafate 175
22-03 "Necessary Conditions for the Diagonalizability of Maxwell's Equations in Inhomogeneous and Fully Bi-anisotropic Media"
A. R. Baghai-Wadji 177
22-04 "Diagonalizability of Thermo Electromagnetic Equations in Inhomogeneous and Fully Tri-anisotropic Media"
A. R. Baghai-Wadji 179

Session 23: EM Modeling Using FEKO – 1
23-01 "A Study of SAR on Child Passengers and Driver Due to Cellphone Connectivity Within Vehicle"
M. Lyell and Daniel Aloi 181
23-02 "Reduction of Coupling between Flush-Mounted Antennas"
Prathap Valale Prasannakumar, Mohamed A. Elmansouri, Maxim Ignatenko, and Dejan Filipovic 183
23-03 "Review of Selected New Features in FEKO 2018"
Ulrich Jakobus, Andrés Aguilar, Elia Attardo, Marlize Schoeman, Johann van Tonder, and Kitty Longtin 185
23-04 "FEKO™ Modeling Study of Passive UHF RFID Tags Embedded in Pavement"
Sourabh R. Walvekar and Robert J. Burkholder 187
23-05 "The Application of Design of Experiments to RF Systems"
Scott Burnside 189

Session 24: Wideband and Multiband Antenna Modeling and Applications

24-01 "System Modeling of a Quad-band Antenna Using the Singularity Expansion Method"
Sajjad Ur Rehman and Majeed A. S. Alkanhal 191

24-02 "Inverted P-Shaped UWB Antenna with Dual/Tri-Band-Notch Characteristics"
Asim Quddus, Rashid Saleem, M. Farhan Shafique, and Sabih ur Rehman 193

24-03 "Printed Cross-Slot Wideband Conformal Antenna for GPS Application"
Ratikanta Sahoo, D. Vakula, and NVSN Sarma 195

Session 25: Time Domain Methods – 2

25-01 "A Volume Integral Equation Solver for Quantum-Corrected Transient Analysis of Scattering from Plasmonic Nanostructures"
Sadeed B. Sayed, Ismail Enes Uysal, Hakan Bagci, and H. Arda Ulku 197

25-02 "Mixed Finite Element Methods for the Maxwell's Equations with Matrix Parameters"
Asad Anees and Lutz Angermann 199

25-03 "Time-Domain Magnetic Shielding Effectiveness of Planar Stratified Shields"
R. Araneo, G. Lovat, S. Celozzi, and P. Burghignoli 201

25-04 "Modeling Time Domain Multiphysics of Reverse Saturable Absorption"
Shaimaa I. Azzam and Alexander V. Kildishev 203

25-05 "Time Domain Finite Element Methods for Maxwell's Equations in Three Dimensions"
Asad Anees and Lutz Angermann 205

25-06 "Numerical Simulation of EMP Environment Radiated by X-rays inside a High-Power Laser Facility"
Zhiqian Xu and Cui Meng 207

25-07 "A Multiphysics Time-Dependent Model of Dielectric Breakdown in Solids"
Raymond A. Wildman and George A. Gazonas 209

Session 27: EM Modeling Using FEKO – 2

27-01 "Massive MIMO – Beyond 4G and a Basis for 5G"
Gopinath Gampala and C. J. Reddy 211

27-02 "Ultra-Wideband Antenna Performance Comparison"
William Coburn and Seth McCormick 213

Session 28: Computational Methods for Complex EM Domains, Integral Equation Methods

28-01 "A DC to HF Volume PEEC Formulation Based on Hertz Potentials and the Cell Method"
Riccardo Torchio, Piergiorgio Alotto, Paolo Bettini, Dimitri Voltolina, and Federico Moro 215

28-02 "Decoupled Potential Integral Equations for Electromagnetic Scattering"
J. Li and B. Shanker 217

28-03 "A Lagrange Multiplier Approach to Constraining Electromagnetic Surface Integral Equations"
Daniel L. Dault and Andrew J. Pray 219

28-04 "Sparse Direct Matrix Solvers of Finite Element Discretizations in Electromagnetics"
Marinos N. Vouvakis and Javad Moshfegh 221

28-05 "Fast Integral Equation Solvers based on the Randomized Cross Approximation"
Constantinos L. Zekios and Marinos N. Vouvakis 223

28-06 "Adjoint Methods for Uncertainty Quantification in Applied Computational Electromagnetics: FEM Scattering Examples"
Cam Key, Aaron Smull, Branislav M. Notaros, Donald Estep, and Troy Butler 225

28-07 "Numerical Validation of a Boundary Element Method With E and $\partial E/\partial N$ as the Boundary Unknowns"
Johannes Markkanen, Alex J. Yuffa, and Joshua A. Gordon 227

Session 31: Low Frequency Computational Electromagnetics – 1

31-01 "Locally Corrected Nystrom Discretization for Impressed Current Cathodic Protection Systems"
John C. Young, Robert Pfeiffer, Robert J. Adams, and Stephen D. Gedney 229

31-02 "A Huygens Surface Source Model for Field Prediction Valid from sub-ELF to High Frequencies"
Nastaran Hendijani, Stephen D. Gedney, John C. Young, and Robert J. Adams 231
31-03 "Micromagnetic Model Simulation of Spin-Torque Oscillator and Write Head for Microwave-Assisted Magnetic Recording – Spin Injection Layer with In-Plane Anisotropy"
Yasushi Kanai, Ryo Itagaki, Simon Greaves, and Hiroaki Muraoka 233
31-04 "A Finite-Difference Frequency Domain Solver for Quasi-TEM Applications"
J. Patrick Donohoe 235

Session 32: Advanced FDTD Methods
32-01 "SAR and Temperature Rise Distributions in a Human Head Due to a Multi-Frequency Antenna Source"
Fatih Kaburcuk and Atef Z. Elsherbeni 237
32-02 "Provably Stable Local Application of Crank-Nicolson Time Integration to the FDTD Method with Nonuniform Gridding and Subgridding"
A. Van Londersele, D. De Zutter, and D. Vande Ginste 239
32-03 "Model Order Reduction for Finite Difference Modeling of Cardiac Propagation using DMD modes"
Riasat Khan and Kwong T. Ng 241
32-04 "Numerical Dispersion Analysis for Spherical FDTD"
Ravi C. Bollimuntha, Mohammed F. Hadi, Melinda J. Piket-May, and Atef Z. Elsherbeni 243
32-05 "Improved FDTD Method around Dielectric and PEC Interfaces using RBFFD Techniques"
Brad Martin, Atef Elsherbeni, Gregory E. Fasshauer, and Mohammed Hadi 245

Session 33: Electromagnetic Simulation for RF and Microwave Design Optimization
33-01 "GA-MoM Optimization of Slot Arrays"
Sembiam R. Rengarajan 247
33-02 "Uniform Sampling Procedure for Constrained Surrogate Modeling of Antenna Structures"
Slawomir Koziel and Ari T. Sigurdsson 249
33-03 "Novel Structure and EM-Driven Design of Miniaturized Microstrip Rat-Race Coupler"
Adrian Bekasiewicz and Slawomir Koziel 251
33-04 "Coplanar Waveguide-based Lowpass Filters with Non-uniform Signal Trace and Ground Planes"
Qizhen Li, Khair Al Shamaileh, and Vijay Devabhaktuni 253
33-05 "Nonlinear Neural Network Equalizer for Metro Optical Fiber Communication Systems"
Mahmoud M.T. Maghrabi, Shiva Kumar, and Mohamed H. Bakr 255

Session 34: Wireless Implants for Biomedical Telemetry – 1
34-01 "Towards Batteryless Wearables and Implants"
Wei-Chuan Chen, Brock DeLong, Ramandeep Vilkhu, and Asimina Kiourti 257
34-02 "Optimizing Scattering Coefficients of Disordered Metamaterials Using the Finite-Difference Time-Domain Method"
Adam Mock and Sheldon Hewlett 259
34-03 "Dual-Band (2.4/4.8 GHz) Implantable Antenna for Biomedical Telemetry Applications"
John Blauert and Asimina Kiourti 261
34-04 "An RF-Driven Lightweight Implantable Insulin Pump"
Bingxi Yan, Brock DeLong, Duo An, Asimina Kiourti, Kathleen Dungan, John Volakis, Minglin Ma, and Liang Guo 263
34-05 "Miniature Implantable Antenna Design for Blood Glucose Monitoring"
Ayesha Ahmed, Masood Ur-Rehman, and Qammer Hussain Abbasi 265

Session 35: Low Frequency Computational Electromagnetics – 2
35-01 "Field-Plate Length Variation on GaN Devices for BV and On-Resistance Characterization"
Christopher R. Lashway, Alberto Berzoy, and Osama Mohammed 267

35-02 "Numerical Analysis of Mutual Transient Voltages in Grounding Systems of Offshore Wind Farms"
R. Araneo, G. Lovat, S. Celozzi, and P. Burghignoli 269
35-03 "Shielding Effectiveness of Finite Width Shields Against Low-impedance Magnetic Near-field Sources"
R. Araneo, G. Lovat, S. Celozzi, and P. Burghignoli 271
35-04 "CT Eccentricity Error Evaluation Model Based on the Actual Magnetization Curve"
Hao Zhang, Zeyao Huang, Xiao Zhang, and Abd A. Arkadan 273
35-05 "Field Analysis of a Moving Current-carrying Coil in OMOP Kibble Balances"
S. Li, M. Stock, F. Biesla, A. Kiss, and H. Fang 275

Session 36: Celebrating 50th Anniversary of Field Computation by Moment Methods
36-01 "Roger Harrington and Shielded Planar Microwave Electromagnetic Analysis"
James C. Rautio 277
36-02 "HODLR Direct MOM Solver"
John Shaeffer 279
36-03 "History of Developments Leading to the Method of Moments"
Donald R. Wilton 281
36-04 "A Novel Stochastic Integral Equation Method for Wireless Communication in Diffuse Multipath Environments"
Shen Lin and Zhen Peng 283
36-05 "Spectral Element Boundary Integral Method for Rapid and Accurate Simulations of Inhomogeneous Objects in Layered Media in Nanophotonics"
Yiqian Mao, Jun Niu, and Qing Huo Liu 285

Session 37: Advances in Electromagnetic Modeling by WIPL-D – 1
37-01 "Robust Feed Modeling of the Asymmetric Planar Mesh Dipole-Type Antenna"
Jennifer Rayno and Derek S. Linden 287
37-02 "Modeling and Validation of a mm-Wave Shaped Dielectric Lens Antenna"
David C. Mooradd, Alan J. Fenn, and Peter T. Hurst 289
37-03 "Higher Order Mode Analysis in WIPL-D"
J. Lyn Alford and Milos S. Pavlovic 291
37-04 "Full-Wave Modeling of RF Exciters Using WIPL-D: Road to Real-Time Simulation and Optimization"
Pranav S. Athalye, Branislav M. Notaros, and Milan M. Ilic.....293
37-05 "Efficient Modeling of Towel Bar Antennas Using Model of Distributed Loading Along Wires"
Milos M. Jovicic, Saad N. Tabet, and Branko M. Kolundzija 295

Session 39: Modeling Electromagnetic Waves in Plasma Environments
39-01 "Whistler Mode Wave Numerical Raytracing in a Finite Temperature Anisotropic Plasma Medium"
Marek Golkowski and Ashanthi Maxworth 297
39-02 "Spatial Distributions of Magnetospheric Radio Energy due to Lightning"
Austin P. Sousa and Robert A. Marshall 299
39-03 "FD-PIC Simulation of Broadband Whistler Mode Wave Interactions with Energetic Electrons in the Earth's Radiation Belts"
Poorya Hosseini, Mark Golkowski, and Vijay Harid 301
39-04 "Particle-In-CellMethods for Modeling Electromagnetic Propagation in Plasmas"
John R. Cary 303
39-05 "Late-time Instability in Finite Difference Modeling of Very-Low-Frequency Propagation in the Earth-Ionosphere Waveguide"
Robert A. Marshall, Wei Xu, and Austin P. Sousa 307

39-06 "Simplified FDTD Model of Electromagnetic Wave Propagation in Magnetized Plasma"
Santosh Pokhrel, Varun Shankar, and Jamesina J. Simpson 309
39-07 "Nonlinear FDTD Modeling of Ionospheric Cross-Modulation Experiments"
Robert C. Moore and Anthony J. Erdman.....311

Session 41: Advances in Electromagnetic Modeling by WIPL-D – 2
41-01 "Monostatic RCS for General Aviation Aircraft"
Dennis W. Richardson, Ruben P. Ortega, and Saad N. Tabet 313
41-02 "Comparison of Commercial Simulation Performance for Efficient RCS Analysis"
Dongeun Lee, Sung-Hwan Chi, Do-Young Jang, and Han-Kil Jung 315
41-03 "Polarimetric Weather Radar Calibration by Computational Electromagnetics"
Djordje Mirkovic and Dusan S. Zrnic 317
41-04 "On Synthetic Aperture Radar Simulations using WIPL-D Pro"
Nimrod Teneh and Branko Lj. Mrdakovic 319

Session 42: Wireless Implants for Biomedical Telemetry – 2
42-01 "A Wideband Antenna for Biotelemetry Applications: Design and Transmission Link Evaluation"
Ala Alemaryeen and Sima Noghanian 321
42-02 "Hybrid Power Transfer and Wireless Antenna System Design for Biomedical Implanted Devices"
Reem Shadid and Sima Noghanian 323
42-03 "Circuitry Design and Magnetic Susceptibility Evaluation of 7T fMRI Implantable RF Coil"
Rong Wang, Celia M. Dong, Ed X. Wu, Robert C. Roberts, and Li Jun Jiang 325
42-04 "Power Transfer Efficiency for Distance-Adaptive Wireless Power Transfer System"
D.-G. Seo, S.-H. Ahn, J.-H. Kim, W.-S. Lee, S.-T. Khang, S.-C. Chae, and J.-W. Yu 327
42-05 "Novel Multiband Flamenco Fractal Antenna for Wearable WBAN Off-Body Communication Applications"
Omar Masood Khan, Qamar Ul Islam, Raed M. Shubair, and Asimina Kiourti 329
42-06 "Multi-Bandwidth CPW-Fed Open End Square Loop Monopole Antenna for Energy Harvesting"
Nermeen A. Eltresy, Dalia M. Elsheakh, and Esmat A. Abdallah 331

Session 43: Computational Nanophotonics: Advanced Numerical Methods and Applications – 1
43-01 "Quantum Electrodynamics of Optical Metasurfaces"
Igor V. Bondarev and Vladimir M. Shalaev 333
43-02 "Asymmetric Band Structure Calculations Using the Plane Wave Expansion Method with Time-Modulated Permittivity"
Adam Mock 335
43-03 "Ultra-thin, High-efficiency Mid-Infrared Huygens Metasurface Optics"
Hanyu Zheng, Jun Ding, Li Zhang, Hongtao Lin, Sensong An, Tian Gu, Hualiang Zhang, and Juejun Hu 337
43-04 "A High-Order Accurate FDTD Scheme for Maxwell's Equations on Overset Grids"
Jordan B. Angel, Jeffrey W. Banks, and William D. Henshaw 339
43-05 "Challenges and Opportunities in Modeling and Optimization of 3D Optical Metasurfaces"
D. Bruce Burckel, Aaron J. Pung, and Salvatore Campione 341
43-06 "Inverse Design of Engineered Materials for Extreme Optical Devices"
Sawyer D. Campbell, Danny Z. Zhu, Jogender Nagar, Ronald P. Jenkins, John A. Easum, Douglas H. Werner, and Pingjuan L. Werner 343

Session 45: Electromagnetic Methods for Devices and Applications – 1
45-01 "Suppression of Anisotropic Birefringence in a Rectangular Waveguide"
Gregory Mitchell 345

45-02 "Performance Analysis for Linear Minimum Variance Adaptive Beamforming"
Zhitao Yang and Guanglei Zhang 347
45-03 "The Novel Normalized Method for Interference Suppression at Subarray Level"
Zhitao Yang and Guanglei Zhang 349
45-04 "The Sidelobe Power Suppression for the Aircraft Circle Phase Array Radar"
Dan Wang 351
45-05 "Supercapacitor Implementation for PV Power Generation System and Integration"
Tunir Dey, Kowshik Dey, Greg Whelan, and Abdullah Eroglu 353
45-06 "Design of Dual Band Rectifiers for Energy Harvesting Applications"
Kowshik Dey, Tunir Dey, Rezwan Hussain, and Abdullah Eroglu 355

Session 46: Wireless Energy Harvesting and Power Transfer
46-01 "A Highly Efficient Miniaturized Microwave Collector for Wireless Power Transmission"
Safiullah Khan and Thomas F. Eibert 357
46-02 "Harvesting of Aircraft Radar Altimeter Sidelobes for Low-Power Sensors"
Jose Estrada, Philip Zurek, and Zoya Popovic 359
46-03 "Focused Antenna Arrays for Wireless Power Transfer Applications"
Payam Nayeri 361
46-04 "A Multi-Linear Polarization Reconfigurable Plus Shaped Dipole Antenna for Wireless Energy Harvesting Applications"
Ami Desai and Payam Nayeri 363
46-05 "Compact 24GHz Half-slot Antenna for Energy Combining"
M. Aboualalaa, Adel B. Abdel-Rahman, A. Allam, Ramesh K. Pokharel, Kuniaki Yoshitomi, and H. Elsadek 365
46-06 "Analysis of Two/Four Coils WPT Systems for Embedded PLC Communications"
Sami Barmada and Mauro Tucci 367

Session 47: Integral Equation Solvers for Real-Life Applications – 1
47-01 "On the Conforming Combination of the Electric and Magnetic Field Integral Equations"
Ahmet F. Yilmaz and H. Arda Ulku 369
47-02 "Coupled EM-Structural Analysis in Convected Coordinates"
Daniel S. Weile, David A. Hopkins, and Brian M. Powers 371
47-03 "A Study of Near-Field Imaging and Diagnostic Applications of Surface Equivalent Current Methods"
Arslan Azhar, Thomas F. Eibert, and Li Li 373
47-04 "Mode Analysis of Waveguides in Layered Media"
Aytac Alparslan 375
47-05 "Scattering Analysis of Silver Nanoparticles for Solar Cell Applications using Integral Equations"
Ismail Enes Uysal, Huseyin Arda Ulku, Oguz Gulseren, and Hakan Bagci 377
47-06 "An FFT-Accelerated Inductance Extractor for Voxelized Structures"
Abdulkadir C. Yucel, Ioannis P. Georgakis, Athanasios G. Polimeridis, Hakan Bagci, and Jacob K. White 379

Session 48: Computational Nanophotonics: Advanced Numerical Methods and Applications – 2
48-01 "Versatile Nanoparticle Manipulation with Designer Thermoplasmonic Metasurface"
Justus C. Ndukaife 381
48-02 "Time Domain Modeling of Active Materials"
Shaimaa I. Azzam, Ludmila J. Prokopeva, and Alexander V. Kildishev 383
48-03 "Coupling Electron Transport with Maxwell Equations for Modelling Optically Tunable Photonic Elements"
Michael Povolotskyi, Ludmila Prokopeva, and Alexander Kildishev 385

48-04 "Efficient Multiphysics and Multiscale FDTD Methods for Terahertz Plasmonic Devices"
Shubhendu Bhardwaj 387
48-05 "Frequency-Domain versus Time-Domain Analysis of Slow-light Mesophotonic Waveguides: Theoretical Insights for Practically Realizable Devices"
Stavroula Foteinopoulou 389

Session 49: RF/Microwave Electromagnetics
49-01 "Estimation of 1090 MHz Signal Environment on Airport Surface by using Multilateration System"
Junichi Honda, Yasuyuki Kakubari, and Takuya Otsuyama 391
49-02 "A Novel Compact Microstrip Bandstop Filter (BSF) Using Spurline & Stepped-Impedance Resonator (SIR)"
Hamad G. Alrwuili and T. S. Kalkur 393
49-03 "High-density Compact Chipless RFID Tag for Item-level Tagging"
Ayesha Habib, Hafsa Anam, Yasar Amin, and Hannu Tenhunen 395
49-04 "Design Method for Wide-Beam Waveguide Antenna"
Chong-Hwan Park, Seung-Real Ryu, Jae-Yoon Shin, Dong-Su Choi, and Jong-Myung Woo 397

Session 50: Electromagnetic Methods for Devices and Applications – 2
50-01 "Recent Developments in the Application of Contactless Inductive Flow Tomography"
Matthias Ratajczak, Thomas Wondrak, and Frank Stefani 399
50-02 "Simulation Model to Predict EM Scattering due to Different Parameters of Dust/Sand Storms"
Sharif Iqbal Mitu Sheikh and Mahfuz Ullah 401
50-03 "Examination on a Self-Mixing Circuit"
Congying Chen, Adalbert Beyer, Winfried Simon, Rudiger Follmann, Peter Waldow, and Dominique Schreurs 404

Session 51: Integral Equation Solvers for Real-Life Applications – 2
51-01 "Circulant Preconditioning in the Volume Integral Equation Method for Nanophotonics"
Samuel Groth, Jacob White, and Athanasios Polimeridis 406
51-02 "On Complexity Reduction in Solution of Scattering Problems on Well-Conducting 3D Objects With Surface-Volume-Surface EFIE"
Jamiu Mojolagbe, Reza Gholami, and Vladimir Okhmatovski 408
51-03 "Linear-Complexity Direct Integral Equation Solver with Explicit Accuracy Control for Large-Scale Interconnect Extraction"
Miaomiao Ma and Dan Jiao 410
51-04 "Optical Couplers for Sharply Bended Nanowires: Sensitivity to Coupler Nanoparticles"
Askin Altinoklu and Ozgur Ergul 412
51-05 "Analytical Evaluation of Matrix Elements of Electromagnetic Integral Equations with RWG basis Functions for Arbitrarily Oriented Pairs of Triangular Surface Elements"
Elizabeth Bleszynski, Marek Bleszynski, and Thomas Jaroszewicz 414

Session 52: Biomedical Applications
52-01 "Coupled Modeling and Experimental Investigation of RF-Induced Heating near Ablation Catheters under 1.5T MRI"
Qi Zeng, Jingshen Liu, Jianfeng Zheng, Tom Lloyd, Leonardo M. Angelone, Wolfgang Kainz, and Ji Chen 416
52-02 "Hyperthermia Study in Cancer Treatment"
H. F. Guarnizo Mendez, J. J. Pantoja, and M. A. Polochè Arango 418
52-03 "Co-simulation of a Reactor Assisted by Microwaves"
Carlos Rivera, John J. Pantoja, and Felix Vega 420

Session 54: Tunable RF Filters
54-01 "Simulation and Fabrication of BST FBAR Resonator"
Abdulhamid Matoug, Daw Asderah, and T. S. Kalkur 422

54-02 "A Tunable Microstrip Bandstop Filter Using Compact Spiral Folded Spurline For RF Microwave Systems"
Hamad G. Alrwuili and T. S. Kalkur 424
54-03 "A Balanced Dual-Band Tunable Bandpass Filter"
Dubari Borah and Thottam S. Kalkur 426
54-04 "UHF-Band Bandpass Filters With Fully-Reconfigurable Transfer Function"
Dakotah J. Simpson, Roberto Gómez-García, and Dimitra Psychogiou 428

Session 55: Devices and Applications
55-01 "Investigation of the RCS of Wind Turbine Rotor Blades"
Sebastian Hegler, Klaus Wolf, Christoph Statz, Niels Neumann, and Dirk Plettemeier 430
55-02 "Design of a Cost-Effective Analog Lock-In Amplifier Using Phase Sensitive Detector"
Fardin Humayun, Riasat Khan, Shatil Saadman, and Rezwanul Haque 432
55-03 "The Novel Adaptive Method for Interference Suppression"
Zhitao Yang and Guanglei Zhang 434
55-04 "Advanced Subspace Projection Method for Interference Suppression in Phase Array Radar"
Zhitao Yang and Guanglei Zhang 436
55-05 "The Adaptive Interference Suppression Method Based on Householder at Subarray Level"
Dan Wang and Guanglei Zhang 438

Session 56: Parallel and GPU EM Comput
56-01 "Massively Parallel Frequency Domain Electromagnetic Simulation Codes"
William L. Langston, Joseph Kotulski, Rebecca Coats, Roy Jorgenson, S. Adam Blake, Salvatore Campione, Aaron Pung, and Brian Zinser 440
56-02 "The Parallel Implementation and Accuracy of Matrix Compression in the Method of Moments code EIGER"
Joseph D. Kotulski 442
56-03 "HIPERCONE FDTD: Vectorized Highly Scalable Full-Wave Electromagnetic Solver"
Sergei Belousov, Sergey Khilkov, Vadim Levchenko, Anastasia Perepelkina, and Ilya Valuev 444

Session 57: Design Simulation and Build Microwave Devices using Sonnet Suites
57-01 "Dual Resonance Proximity Coupled Patch Antenna"
Bahadir Kilic, Taha Imeci, Oguzhan Salih Gungor, Mustafa Imeci, Negar Majidi, and Mohammad Rahim Sobhani 446
57-02 "Design of a Quad Element Patch Antenna at 5.8 GHz"
Negar Majidi, Goksen Goksenin Yaralioglu, Mohammad Rahim Sobhani, and Taha Imeci 448
57-03 "Design and Analysis of a Bandpass Hairpin Filter"
Rafsan Ahmed, Shpetim Emiri, and S. Taha Imeci 450
57-04 "Microstrip Patch Antenna with Triangular Slits"
Anil Elakas, Gurhan Ali Imrak, Mert Sencan, S. Taha Imeci, and Tahsin Durak 452
57-05 "Circular Shaped Microstrip Patch Antenna at 14.6 GHz"
Furkan Atalah, Mustafa Imeci, Oguzhan Gungor, S. Taha Imeci, and Tahsin Durak 454
57-06 "E-Shaped Patch Antenna at 4.87 GHz"
Ezgi Kucuk, Burak Bayram, S. Taha Imeci, and Tahsin Durak 456
57-07 "Roof Shaped Rectangular Slotted Patch Antenna at 18.3 GHz"
Melis Ecem Koca, Tahsin Durak, and S. Taha Imeci 458

Session 59: Uncertainty Quantification and Modeling for Complex Applications
59-01 "Effect of Random Antenna Element Displacements on Sparse-UCA-Root-MUSIC Direction-of-Arrival Estimation"
Veronique Inghelbrecht, Jo Verhaevert, Tanja Van Hecke, Dries Vande Ginste, Hendrik Rogier, Marc Moeneclaey, and Herwig Bruneel 460
59-02 "Designing Experiments to Reduce Uncertainty in Point Source Locations in the Helmholtz Equation"
Troy Butler 462

59-03 "Accurate and Efficient Bayesian Parameter Inversion Based on Low-Fidelity Model Solutions"
Yaning Liu 464
59-04 "Multi-Fidelity Approach for Polynomial Chaos Based Statistical Analysis of Microwave Networks"
Aditi K. Prasad and Sourajeet Roy 466
59-05 "Augmented Surrogates for Predictive Extrapolation in Electromagnetics"
Varis Carey 468
59-06 "Vector Parabolic Equation Modeling of Wireless Propagation in Tunnels with Statistically Rough Surface Walls"
Xingqi Zhang and Costas D. Sarris 470
59-07 "Ridge Approximation and Dimension Reduction for an Acoustic Scattering Model"
Paul G. Constantine, Jeffrey M. Hokanson, and Drew P. Kouri 472
59-08 "Wavelet Model of Multivariate Prior Covariance"
Aime Fournier 474

Session 60: Numerical Methods for Analysis, Design and Measurement of Antennas – 2
60-01 "A Cost-Effective Far-Field Antenna Pattern Measurement System"
Kyle Patel, Robert Jones, and Atef Elsherbeni 476
60-02 "Efficient Modeling of Antennas with Finite Conductivity using Calderon Preconditioning"
Michiel Gossye, Dries Vande Ginste, Daniel De Zutter, and Hendrik Rogier 478
60-03 "Domain Decomposition Method for Scattering from an Aircraft with Jet Engine Inlet Cavity"
Miodrag Tasic, Branko Kolundzija, and Tomislav Milosevic 480
60-04 "Improved Shaping of Reflector Antennas using a New Minimax Initialization Strategy"
Anders Eltved, Martin S. Andersen, and Oscar Borries 482
60-05 "Fast and Rigorous Method for Solving Low-Frequency Breakdown in Full-Wave Finite-Element-Based Solution of General Lossy Problems"
Li Xue and Dan Jiao 484
60-06 "Design and Optimization of Two-Dimensional Nano-Arrays for Beam Steering"
Askin Altinoklu, N. Rasoolzadeh, and Ozgur Ergul 486

Session 61: Antenna Arrays
61-01 "Pattern Synthesis of Irregular Antenna Arrays with Small Element-Counts"
Robert P. Scheeler, James L. McDonald, Arian C. Lalezari, and Joseph R. Mruk 488
61-02 "The General Sidelobe Cancellation Based on Linear Minimum Variance at Subarray Level"
Dan Wang and Guanglei Zhang 490
61-03 "Design Concepts for Broadband Antenna Arrays with Constant Half-Power Beamwidth"
Christopher Gay, Matthew Cullen, and Dimitra Psychogiou 492
61-04 "Comparison of an Isotropic Point Source and a Spherically Distributed Antenna Array"
Kristopher Buchanan, Timi Adeyemi, Carlos Flores-Molina, Sara Wheeland, and Steven Weiss 494