

# IEEE TRANSACTIONS ON ANTENNAS AND PROPAGATION

A PUBLICATION OF THE IEEE ANTENNAS AND PROPAGATION SOCIETY



JUNE 2023

VOLUME 71

NUMBER 6

IETPAK

(ISSN 0018-926X)

## PAPERS

### Antennas

- [Pattern Synthesis for Lossy Antennas Based on  \$N\$ -Port Characteristic Mode Analysis](#) . . . . . *H. Li, W. Zheng, Q. Wu, and G.-L. Liu*
- [Finite Element Analysis and Optimization of Acoustically Actuated Magnetolectric Microantennas](#) . . . . .  
. . . . . *X. Cai, K. Zhang, T. Zhao, Z. Yu, J. Liang, Y. Zhang, H. Wang, H. Jin, S. Dong, W. Xuan, Y. Ma, A. J. Flewitt, and J. Luo*
- [Design of Dual-Band Antenna for Metal-Bezel Smartwatches With Circular Polarization in GPS Band and Low Wrist Effect](#) . . . . . *Z. Xu and Y. Wang*
- [A General Optimization Method for Complex Requirements Antenna Based on Balanced Demotion MOEA](#) . . . . . *F. Peng and X. Chen*
- [Millimeter-Wave Co-Polarized In-Band Full-Duplex Antenna Based on a Mode Superposition Method](#) . . . . . *C. J. Ma, S. Y. Zheng, and Y. M. Pan*
- [Mutual Coupling Suppression Between Two Closely Placed Patch Antennas Using Higher-Order Modes](#) . . . . .  
. . . . . *J.-F. Qian, S. Gao, B. Sanz-Izquierdo, H. Wang, H. Zhou, and H. Xu*
- [Sparse Antenna Array With Flat-Top and Sharp Cutoff Radiation Patterns](#) . . . . . *M. Xu, C. Zhang, H. Qiao, Q. Zhang, C. Deng, and W. Yu*
- [Miniaturized Pattern-Reconfigurable Multimode Antennas With Continuous Beam-Steering Capability](#) . . . . . *T. Liang, Y. Pan, and Y. Dong*
- [Assessment of the Robustness of Flexible Antennas to Complex Deformations](#) . . . . . *E. Altinozen, A. Vukovic, and P. Sewell*
- [Printed Metasurface Leaky Wave Antennas Based on Penetrable Aperture Field Synthesis](#) . . . . . *H. Lee and D.-H. Kwon*
- [Chiral Metasurface Enabled Circularly Polarized OAM-Generating Folded Transmitarray Antenna With High-Gain Low-Profile and  
Broadband Characteristics](#) . . . . . *D. Liao, X. Ren, L. Jing, M. Li, H. Chen, and Z. Wang*
- [An Effective Method for Antenna Radiation Pattern Reconstruction Based on Phaseless Measurement in a Reverberation Chamber](#) . . . . .  
. . . . . *F. Peng, X. Liu, J. Zheng, R. Chen, S. Zhu, and X. Chen*
- [A Compact Dual-Band Implantable Antenna for Wireless Biotelemetry in Arteriovenous Grafts](#) . . . . .  
. . . . . *J. Zhang, R. Das, D. Hoare, H. Wang, A. Ofiare, N. Mirzai, J. Mercer, and H. Heidari*
- [Shared Aperture 4G LTE and 5G mm-Wave Antenna in Mobile Phones With Enhanced mm-Wave Radiation in the Display Direction](#) . . . . .  
. . . . . *Y. Wang and F. Xu*
- [Modal Expansion Analysis, Inverse Design, and Experimental Verification of a Broadband High-Aperture Efficiency Circular Short Backfire  
Antenna Loaded With Anisotropic Impedance Surfaces](#) . . . . . *M. Bie, M. Peng, Z. H. Jiang, and D. H. Werner*
- [Wideband Shared-Radiator Four-Element MIMO Antenna Module for 5G Mobile Terminals](#) . . . . . *X. Tian and Z. Du*
- [A CRLH-TL Inspired Dual-Band Antenna With Polarization Diversity for Wrist-Worn Wireless Body Area Network Devices](#) . . . . .  
. . . . . *B. Wang, S. Yan, and Y. He*
- [Circularly Polarized Metasurface Phased Array Antenna System With Wide Axial-Ratio Beamwidth for LEO Mobile Satellite Communication](#) . . . . .  
. . . . . *Y. Zhang, W. Hong, Z. Ding, L. Yang, C. Zhu, and Y. Hu*
- [Code-Dependent Beam Shaping and Polarization Control by Binary Transmitarray](#) . . . . .  
. . . . . *X. Wan, B. Y. Li, W. H. Wang, Z. A. Huang, J. W. Wang, X. J. Wang, Q. Cheng, and T. J. Cui*
- [A Leaky Wave Antenna With Dielectric Superstrate on Perforated Dielectric Spacer](#) . . . . .  
. . . . . *T. Kaji, H. Sato, Q. Chen, S. Nagae, A. Kumagai, and O. Kagaya*
- [A Triple-Band Uni-Cavity Fabry-Perot Cavity Antenna With Hybrid Excitation Modes](#) . . . . . *Q. Wang, J. Qi, and A. Sihvola*
- [Beamforming Network Design Utilizing Node Microstrip Architectures for Dual-Polarized Endfire Millimeter-Wave Antenna Arrays](#) . . . . .  
. . . . . *S. Tang, Y. Zhang, J. Rao, Z. Han, C.-Y. Chiu, and R. Murch*
- [A Wideband and High-Gain Circularly Polarized Antenna Array for Radio-Frequency Energy Harvesting Applications](#) . . . . .  
. . . . . *J. Sang, L. Qian, M. Li, J. Wang, and Z. Zhu*

[Current Based Automated Design of Realizable Metasurface Antennas With Arbitrary Pattern Constraints](#) ..... M. Zucchi, F. Verni, M. Righero, and G. Vecchi

### Arrays and Periodic Structures

[Optimal Amplitude–Density Synthesis of Linear Aperiodic Arrays](#) ..... P. Angeletti and G. Toso

[Synthesis of Near-Field Arrays Based on Electromagnetic Inner Products](#) ..... F. Lisi, A. Michel, and P. Nepa

[A Broadband Low-Profile Dual-Circularly Polarized Reflect-Array Based on a Single-Layer Microstrip Patch for Ka-Band Application](#) ..... X. W. Dai, Y. H. Zhang, W. Yu, L. Liu, and G. Q. Luo

[SASA: Super-Resolution and Ambiguity-Free Sparse Array Geometry Optimization With Aperture Size Constraints for MIMO Radar](#) ..... M. Huan, J. Liang, Y. Wu, Y. Li, and W. Liu

[An Integrated Dual-Band Dual-Circularly Polarized Shared-Aperture Transmit-Array Antenna for K-/Ka-Band Applications Enabled by Polarization Twisting Elements](#) ..... X. Tong, Z. H. Jiang, Y. Li, F. Wu, J. Wu, R. Sauleau, and W. Hong

[Efficient Synthesis of Concentric-Rings Plane Wave Generators](#) ..... D. Pinchera and M. D. Migliore

[Homogenization of Periodic Structures Using the Multimodal Transfer Matrix Method](#) ..... A. C. Escobar, F. Mesa, O. Quevedo-Teruel, and J. D. Baena

[Multiple Scattering Model for Beam Synthesis With Reconfigurable Intelligent Surfaces](#) ..... T. E. Rimpiläinen and R. Jäntti

[Collective-Coupling Enhanced Ultrabroadband Linear Polarization Conversion on Zigzag-Split Metasurfaces](#) ..... M. Yang, F. Lan, Y. Zhang, L. Qi, G. He, Y. Pan, T. Song, L. Wang, P. Mazumder, H. Zeng, and Z. Yang

[Hybrid SRR-Based Stacked Metamaterial for Miniaturized Dual-Band Wireless Power Transfer System](#) ..... X. Jiang, R. K. Pokharel, A. Barakat, and K. Yoshitomi

[Waveguide Antenna Topologies for Distributed High-Frequency Near-Field Communication and Localization](#) ..... A. Voronov, O. Sydoruk, and R. R. A. Syms

[Full-Range Amplitude–Phase Metacells for Sidelobe Suppression of Metalens Antenna Using Prior-Knowledge-Guided Deep-Learning-Enabled Synthesis](#) ..... P. Liu and Z. N. Chen

[Filtenna-Filter-Filtenna-Based FSS With Simultaneous Wide Passband and Wide Out-of-Band Rejection Using Multiple-Mode Resonators](#) ..... H. Lin, S.-W. Wong, K.-W. Tam, Y. Li, K. Ngai, C.-H. Chio, and Y. He

[Low-Scattering Phased Arrays With Reconfigurable Scattering Patterns Based on Independent Control of Radiation and Scattering](#) ..... Z. Zhang, S. Yang, F. Yang, Y. Chen, S.-W. Qu, and J. Hu

[Scalable 3-D-Printable Antenna Array With Liquid Cooling for 28 GHz](#) ..... J. Haarla, J. Ala-Laurinaho, and V. Viikari

[Can Perfectly Electric Conducting Obstacles Modify the Permeability of Metamaterial? An Investigation Using Lorentz, Floquet, and Full-Wave Models](#) ..... A. K. Bhattacharyya

[Support Vector Regression Models of Reflectarray Unit Cell in a Geometrical 4-D Parallelepiped Domain Around a Rectangle of Stability](#) ..... D. R. Prado, J. A. López-Fernández, and M. Arrebola

[A Solution to the Dilemma for FSS Inverse Design Using Generative Models](#) ..... Z. Gu, D. Li, Y. Wu, Y. Fan, C. Yu, H. Chen, and E.-P. Li

### Numerical Methods

[Microwave Imaging of 3-D Dielectric–Magnetic Penetrable Objects Based on Integral Equation Method](#) ..... Y. He, L. Zhang, and M. S. Tong

[Unified Formulation of Leapfrog Complying Divergence Implicit FDTD Method for Lossy Media](#) ..... S. Liu, E. L. Tan, L. Zhang, and B. Zou

[A Domain-Decomposition-Based Surface Integral Equation Simulator for Characterizing EM Wave Propagation in Mine Environments](#) ..... W. Sheng, A. C. Yucel, Y. Liu, H. Guo, and E. Michielssen

[On the Surface Plasmonic Waves Excited by a Dipole Above Anisotropic and Spatially Dispersive Two-Dimensional Surfaces of Infinite Extent in Planarly Layered Media](#) ..... M. Gu and K. A. Michalski

[A Reduced-Order PCE-Based Time-Domain Method for Large Uncertainties](#) ..... K. Ravindran and K. J. Vinoy

[A Numerical Mode Matching \(NMM\) Method for Optical Fibers With Kerr Nonlinearity](#) ..... X. L. Wu, J. Dai, J. Liu, J.-H. Chen, and Q. H. Liu

[Numerically Stable Calculations of the Spherically Layered Media Theory](#) ..... H. Y. Yuan, W. Zhu, and B. O. Zhu

[A Short-Term Forecast Method of Maximum Usable Frequency for HF Communication](#) ..... J. Wang, Y. Shi, C. Yang, Z. Zhang, and L. Zhao

[Antenna Array Analysis by Iterative DGFM-Based Local Solutions](#) ..... A. S. Conradie, M. Chose, P. I. Cilliers, and M. M. Botha

[A 3-D Hybrid Maxwell’s Equations Finite-Difference Time-Domain \(ME-FDTD\)/Wave Equation Finite-Element Time-Domain \(WE-FETD\) Method](#) ..... J. Wang and Q. Ren

### Wave Propagation and Scattering

[Multifrequency Wireless Channel Measurements and Characterization in Large Indoor Office Environments](#) ..... L. Zhang, C.-X. Wang, Z. Zhou, X. Chen, J. Huang, C. Pan, E.-H. M. Aggoune, and Y. Miao

[UTD-Based Ray-Tracing MIMO Channel Modeling for the Next-Generation Communications Within Underground Tunnels](#) ..... M. Ghaddar, J.-M. Molina-García-Pardo, I. B. Mabrouk, M. Lienard, and P. Degauque

[Wideband Linear-to-Multi-Polarization Converter Based on Active Metasurface](#) ..... H. Zhou, X. Yu, P. Wang, Y. Wang, and Z. Yan

[Multimode OAM Convergent Transmission With Co-Divergent Angle Tailored by Airy Wavefront](#) ..... Y. Zhao, Z. Wang, Y. Lu, and Y. L. Guan

[Wigner–Smith Time Delay Matrix for Electromagnetics: Systems With Material Dispersion and Losses](#) ..... Y. Mao, U. R. Patel, and E. Michielssen

[Simple Link-Budget Estimation Formulas for Channels Including Anomalous Reflectors](#) ..... S. Kosulnikov, F. S. Cuesta, X. Wang, and S. A. Tretyakov

[A Reconfigurable Over-the-Air Chamber for Testing Multi-Antenna Wireless Devices](#) ..... M. D. Arnold, M. A. Jensen, and R. Mehmood

[Fading of Wideband Signals Due to Propagation Through Equatorial Plasma Bubbles and Diversity Mitigation Effects](#) ..... E. Costa, C. Huang, R. G. Caton, and P. A. Roddy

[Single-Cut Scattered Field Transformation Applicable for Differences in the Radar Ranges of Transmitter and Receiver](#) ..... Y. Akamine, T. Tomura, and J. Hirokawa

[Observed Over-the-Horizon Propagation Characteristics and Evaporation Duct Inversion During the Entire Process of Tropical Cyclone Mulan \(202207\)](#) ..... S. Wang, K. Yang, Y. Shi, F. Yang, and H. Zhang

[On Dynamic Ray Tracing and Anticipative Channel Prediction for Dynamic Environments](#) ..... D. Bilibashi, E. M. Vitucci, and V. Degli-Esposti

[A Non-Kronecker Structured PFS Method for Channel Emulation in Multiprobe OTA Setups](#) ..... L. Xin, Y. Li, H. Sun, and G. Wei

*Other Topics*

[Multimode and Reconfigurable Phase Shifter of Spoof Surface Plasmons](#) ..... X. Gao, W. Y. Cui, Z. Gu, J. Zhang, Y. Ren, Q. Ma, and T. J. Cui

[Over-the-Air Noise Temperature Measurement](#) ..... H. Chen, S. Wang, H. Huang, W. Lin, W. Che, and Q. Xue

[A Convolutional Neural Network for Parameter Estimation of the Bi-GTD Model](#) ..... X.-Y. Xing, H. Yan, H.-C. Yin, and C.-Y. Huo

COMMUNICATIONS

[Three-Port Pattern- and Polarization-Diversity Rectangular Dielectric Resonator Antenna](#) ..... B. Zhang, J. Ren, T. Yang, Y.-T. Liu, Z. Zhao, J. Zhao, Y. Liu, and Y. Yin

[Frequency- and Pattern-Reconfigurable Antenna Array With Broadband Tuning and Wide Scanning Angles](#) ..... C. J. You, S. H. Liu, J. X. Zhang, X. Wang, Q. Y. Li, G. Q. Yin, and Z. G. Wang

[A Wideband Differential-Fed Microstrip Patch Antenna Based on Quad-Mode Resonance With Radiation Patterns Correction](#) ..... S. Feng, L. Zhang, Z. Weng, and Y.-C. Jiao

[Metasurface-Covered Planar Endfire Antenna With Vertical Polarization](#) ..... Y.-F. Cheng, Z.-H. Gao, W.-J. Chen, C. Liao, and X. Ding

[Analysis of a Strip Antenna Located at a Plane Interface of Uniaxial Metamaterials](#) ..... A. S. Zaitseva, A. V. Kudrin, and T. M. Zaboronkova

[A Novel Wideband Tightly Coupled Dual-Polarized Reflectarray Antenna](#) ..... W. Li, H. Tu, Y. He, L. Zhang, S.-W. Wong, and S. Gao

[Low-Profile Polarization-Twisting Cassegrain Antenna for Generating Dual Circularly Polarized Multibeam Radiation in Ku-Band](#) ..... P. Yang, B. Dang, Z. Ren, and R. Dang

[A Broadband Fixed-Beam Leaky-Wave Antenna](#) ..... H. Du, Z. Li, M. Chen, and J. Wang

[Broadband, Low-Profile, Planar Reflectarray Antenna Based on an Achromatic Metasurface](#) ..... J. Yang, H. Xin, and M.-C. Tang

[Control of Time-Reversal Aperture by High-Precision Phase-Modulated and Dual-Polarized Metasurface](#) ..... X. Han, S. Ding, Q.-S. Jia, W.-H. Zhang, H. Tang, Z. Zhang, X. Wang, Y. Zhou, Y.-M. Huang, and B.-Z. Wang

[Fully Analytical Design of Dual-Wire PCB Metagratings for Beam Steering and Splitting](#) ..... Z. Tan, J. Yi, X. Chen, M. Lin, Z. H. Jiang, D. H. Werner, and S. N. Burokur

[Rotated Feed-Combined Reconfigurable Transmit RIS With Disparate Deployment of 1-bit Hybrid Units for B5G/6G](#) ..... J. Kim, J. Kim, J. H. Oh, S.-H. Wi, and J. Oh

[Millimeter-Wave Wide-Angle Scanning Phased Array Antenna Based on Heterogeneous Beam Elements](#) ..... G. Jin, Y. Sun, S. Liao, and Q. Xue

[Wideband Dual-Polarized Endfire Phased Array Antenna With Small Ground Clearance for 5G mmWave Mobile Terminals](#) ... Y. Zhu and C. Deng

[A Wideband 1-bit Reconfigurable Electromagnetic Surface for Monopulse Radar Applications](#) ..... X. Ma, J. Han, G. Li, M. Chang, Y. Tian, S. Chen, H. Liu, L. Li, and T. J. Cui

[Electromagnetic Transmit Array With Optical Control for Beamforming](#) ..... W. Zhang, J. Meiguni, Y. Sun, M. Ouyang, X. Yan, X. Wang, R. Yazdani, D. Beetner, D. Kim, and D. Pommerenke

[Wideband Sherman–Morrison–Woodbury Formula-Based Algorithm for Electromagnetic Scattering Problems](#) ..... X. Chen, L. Zhang, C. Gu, and Z. Li

[On Preconditioners of the FFT-JVIE for Inhomogeneous Dielectric Objects](#) ..... S.-Z. Gu, L. Zhang, D.-M. Yu, K.-W. Xu, L.-M. Si, and X.-M. Pan

[A Surrogate Modeling Approach for Frequency-Reconfigurable Antennas](#) ..... Y. Bai, P. Gardner, Y. He, and H. Sun

[Intelligent Prediction for Scattering Properties Based on Multihead Attention and Target Inherent Feature Parameter](#) ..... D.-H. Kong, W.-W. Zhang, X.-Y. He, and M.-Y. Xia

[A Simple Way of Applying the Calderón Preconditioner to a Finite-Element Boundary-Integral Method](#) ..... Y. Mao, Y. Zhong, Q. Zhan, D. Wang, and Q. H. Liu

[Sliding Scattering Center Extraction for Streamlined Radar Targets](#) ..... K. Wu, W. Cui, and X. Xu

[Enhanced Misalignment Estimation of Orbital Angular Momentum Signal Based on Deep Recurrent Neural Networks](#) ..... J.-J. Sun, S. Sun, L.-J. Yang, and J. Hu

ANNOUNCEMENTS

[CALL FOR PAPERS—Measurement Technologies for Emerging 5G and Beyond Channel Characterization and Antenna Systems](#)