

# **Contents**

## ***Invited papers***

### **1. Measurements of non-linear sub-THz quasi-optical devices**

Rostyslav F. Dubrovka, Oleksandr Sushko, Melusine Pigeon, Peter Lawrence Alizadeh, Andre Sarker Andy, Robert Donnan, Clive Parini, James W.E. Kneller, Theo Kreouzis 9

### **2. Two approaches to solving the antenna synthesis problems according to the amplitude radiation pattern**

Mykhailo I. Andriychuk 14

### **3. Ultrawideband tapered slot, waveguide and dipole antenna arrays**

F. F. Dubrovka, Sergiy Ye. Martynyuk, D. O. Vasylenko, O. S. Postulga 20

### **4. Introducing quasi-optical terahertz circular dichroism spectroscopy**

Junyi Qui, Oleksandr Sushko, Yang Zeng, Bin Yang, Richard Pickersgill, Robert S. Donnan 26

### **5. Recent advances in computational electromagnetics for microwaves in IRE NASU**

Anatoliy A. Kirilenko, S. A. Steshenko, L. P. Mospan, D. Yu. Kulik, A. O. Perov 30

### **6. Antenna pattern measurements: UWB impulse and multifrequency signals comparison**

G. P. Pochanin, O. A. Orlenko, V. P. Ruban, V. G. Korzh, M. V. Andreev, Oleg O. Drobakhin 36

### **7. Tuning range of microwave devices with micromechanical control**

Victor Kazmirenko, Yuriy V. Prokopenko, Yuriy Poplavko 40

### **8. Millimeter-range radiometric system for perspective problems of meteorology and telecommunication**

V. V. Pavlikov, N. V. Ruzhentsev, A. D. Sobkolov, A. I. Tsopa, D. S. Sal'nikov 46

### **9. Adaptive methods of control for signals in the digital channels of the troposphere communication**

Volodymyr I. Rudakov 52

### **10. Achievements in antennas research at Lviv polytechnic national university**

Viktor V. Hoblyk, V. A. Pavlysh, N. M. Hoblyk, Ye. I. Yakovenko, O. M. Liske, I. V. Nychai, D. V. Nevinskyi, D. A. Nikolayev, I. Yu. Teplakov 58

### **11. Radome integrated slotted waveguide antennas**

Stanislav S. Sekretarov, D. M. Vavriv 64

**12. Modeling and optimization of microwave heating in cylindrical volumes**

Gennadiy A. Morozov, Vladimir I. Anfinogentov, Oleg G. Morozov, Sergey V. Smirnov, Svetlana R. Ganieva 68

**13. Nonlinear composite media on opal matrixes and metallocarbon nanostructures**

Gennady P. Sinyavsky, Dmitry A. Bezuglov, Larissa V. Cherckesova, Georgy N. Shalamov 74

**14. X-ray optics: Transmission diffractive patterns of large microchannel plates**

Aleksander M. Lerer, M. I. Mazuritskiy 81

***General antenna theory, propagation, numerical and analytical methods*****15. Numerical solution of nonlinear spectral problems in synthesis theory of antennas with flat aperture**

Petro O. Savenko, Myroslava Tkach 84

**16. Near-field calculation for reflector antenna with shape of asymmetrical cutting from a paraboloid of revolution**

Sergey V. Nechitaylo, Oleg I. Sukharevsky, Vitaly A. Vasilets 88

**17. Radiation Fields of a Radial Dipole Located on a Metal Sphere Coated by a Layer of Metamaterial**

Yuriy M. Penkin, Victor A. Katrich, Mikhail V. Nesterenko, Sergey L. Berdnik, Svetlana V. Pshenichnaya 92

**18. Electromagnetic near-field of circumferential slot cut in coaxial line shield**

V. A. Lyashchenko, N. V. Medvedev, A. V. Olefir 96

**19. Electromagnetic Fields in the Near Zone of Aperture Antennas with Round Opening**

Nikolay N. Gorobets, Ye. Ye. Ovsyannikova 100

**20. Directional properties of linear and V-antennas**

Boris Levin 104

**21. Director Antenna with In-Phase Currents**

Boris M. Levin 110

**22. Log-periodic antennas with in-phase currents**

Boris M. Levin 114

**23. Artificial Neural Networks in Time Domain Electromagnetics**

Oleksandr M. Dumin, S. Khmara, D. Shyrokorad 118

**24. Airy pulse transformation on time-spatial jumps of refractive index**

Alexander G. Nerukh, O. V. Kuryzheva 122

**25. Excitation of the nonmagnetic isotropic media with linear dependence characteristic impedance along the direction of plane wave propagation**

O. Sh. Dautov 125

**26. Analysis of Axially Symmetric Diffraction Grating**

Maxim N. Legenkiy 128

**27. Performance Evaluation of an Improved ITU-R rain attenuation prediction model over Malaysia Equatorial Region**

Folasade Abiola Semire, Rosmiwati Mohd-Mokhtar, Isaac Akinwale Akanbi 132

**28. Active and Reactive Energy of Electromagnetic Waves**

Victor I. Naidenko 135

***Antenna arrays, adaptive and smart antennas***

**29. Odd Symmetry of Weights Vector in Linearly-Constrained Adaptive Arrays with Desired Signal**

Victor I. Djigan 140

**30. Analysis and optimization of the decoupling in antenna systems consisting of antenna arrays**

Vladimir N. Lavrushev, A. I. Murtazina 145

**31. Frequency and Pattern Reconfigurable Antenna Array Based on Liquid Crystal Technology**

Yi-Zhe Zhao, An-Yong Qing 148

**32. Radiation, scanning and matching characteristics of the new design of phased antenna array of printed bow-tie dipoles**

F. F. Dubrovka, Oleg E. Vydalko, V. I. Gouz 151

**33. Cylindrical antenna array development and measurements for DOA-estimation applications**

Yu. B. Nechaev, Ilia W. Peshkov, N. A. Fortunova 155

**34. Random incoherent antenna arrays focused in the near field zone**

Denis A. Vedenkin, Aydar R. Nasybullin, Yuri E. Sedelnikov 159

- 35. Mutual coupling influence on parameters of arc E-plane antenna array of vibrator radiators**  
Siarhei Zavadski 162
- 36. Radiation pattern of linear antenna array with control of directivity and supper-selectivity properties**  
V. M. Koshevyy, Anna A. Shevchenko 165
- 37. Planar Ku band antenna for perspective telecommunication facilities**  
Viktor I. Klassen, Evgeniy Yu. Oleinik, Yuri E. Sedelnikov, Mokhamed Shaaban 169
- 38. W Band Patch Antenna Array for Maglev Smart Grid Technology**  
Alexey B. Gnilenko, Sergey V. Plaksin 171
- 39. Evaluating the influence of intrasystem perturbations of the observations covariance matrix on the DF response of adaptive antenna array**  
Valery V. Skachkov, Victor V. Chepkyi, Alexander N. Efymchykov, Hennadii D. Bratchenko, Vladislav I. Pavlovich 174
- 40. Spatial Distribution of the Amplitude of Electromagnetic Waves in the Near Zone of Linear and Flat Antenna Arrays**  
Nikolay N. Gorobets, A. S. Lebedev, A. A. Elizarenko 180
- 41. Electrodynamics algorithm of calculation of horns phased antenna array**  
V. Morozov, V. I. Magro, M. Hnatyuk 183
- 42. Effect of the Ground Screen on Sensitivity of Low-Frequency Radio Telescope Array Element**  
Peter L. Tokarsky, Alexander A. Konovalenko, Serge N. Yerin 186
- 43. Array of the two arc monopoles on a sphere with surface impedance**  
V. M. Dakhov, S. L. Berdnik, N. K. Blinova, Yu. M. Penkin 190
- 44. Features of photonic beamformer model based on DWDM approach and fiber dispersion**  
S. I. Ivanov, A. P. Lavrov, Igor I. Saenko 194
- 45. Choice of number, structure and placement of compensation modules in the radar with planar PAA**  
V. P. Riabukha, D. I. Lekhovytskiy, A. V. Semeniaka, Y. A. Katiushyn 197
- 46. Origins of the digital antenna array theory**  
Vadym I. Slyusar 199

## ***UWB, low-gain, communication and printed antennas***

### **47. Variants of the double-frequency GPS antennas**

A. A. Galischuk, V. M. Maslyey, O. L. Ol'shevs'kiy, Y. D. Romanenko, V. V. Zaznabin 202

### **48. Near field zone of the UWB bow-tie dipoles**

A. A. Olenko, L. A. Varianytsia-Roshchupkina 206

### **49. Combining electric and magnetic dipoles in the construction of antennas**

V. A. Katrich, A. I. Karpov, S. A. Yarmolchuk, N. A. Syvozalizov, Ye. Antonenko 210

### **50. Modeling of ultra-wideband antennas for multi-purpose broadband systems**

S. V. Bukharov, V. D. Ryabchiy 213

### **51. Active loop sensor for receiving pulse magnetic fields of nanosecond duration**

P. V. Kholod, T. N. Ogurtsova 221

### **52. SNRs of Two Active Antenna Designs: Inverted V vs Horizontal Dipole**

Alexander A. Konovalenko, Peter L. Tokarsky, Igor N. Bubnov, Serge N. Yerin 224

### **53. Active antenna with switchable beams for wireless sensor networks and IoT**

J. M. Rigelsford, H. Hussein, Radhwan J. Alkhudhairi 228

### **54. Large Current Radiator for Long Range GPR Applications**

Vladimir G. Sugak, Fang Gyfang 232

### **55. Study of perturbing factors effect on the performance data of antennas focused in the near-field zone for microwave application problems**

Yu. E. Sedelnikov, Olga V. Potapova, D. V. Nikishina 236

### **56. Using of Printed Antennas to Evaluate the Permittivity of Materials**

S. V. Bukharov, Leonid A. Filins'kyy 239

### **57. Investigation of the electrodynamic characteristics of fractal double-ring antenna**

T. A. Tsaliev, Kirill V. Kutsuk 242

### **58. Microwave irradiator in the form of a piece of rectangular waveguide with dielectric insertion and narrow slot**

Natalya K. Blinova, Ludmila P. Yatsuk, Andrey V. Selutin 246

**59. Characteristics of Directivity of Vibrator Antennas Placed Parallel to Flat Screen**

A. A. Bulgakova, Nikolay N. Gorobets, V. A. Lyashchenko 250

**60. Microstrip Antenna with Complex Configuration of Radiators**

Leonid N. Lytvynenko, Sergey A. Pogarsky, Dmitriy V. Mayboroda, Artem V. Poznyakov 254

**61. Miniaturized Broadband Printed Unidirectional Antenna with Parasitic Slots for Indoor Wireless Applications**

Ali Houssein Harmouch, Rayane Mourad 257

**62. Modeling Microstrip Antennas for UHF RFID Tags**

Dmitry N. Borisov, Sergey A. Zuev 261

**63. Methods for calculating electrically small wire antennas**

Victor V. Ovsyanikov, Elena R. Beznosova, Victoria A. Barma, Sergei I. Veklich 264

**64. Two-band circular polarization antenna for Argos-3**

Alexandr A. Bezgin, Alexandr A. Savochkin 267

**65. Optimization of Circularly Polarized Radiation of Inphase Crossed Impedance Dipoles with Screen**

Alexey N. Gorobets, N. P. Yeliseyeva, V. A. Katrich, M. V. Nesterenko 270

***Microwave components and feeds***

**66. Compact polarization plane rotator for arbitrary angle**

Dmitry Y. Kulik, S. O. Steshenko, A. A. Kirilenko 273

**67. Novel high performance coherent dual-wideband orthomode transducer for coaxial horn feeds**

Fedor F. Dubrovka, Stepan I. Piltyay 277

**68. Dual band feed horn for mm-wave applications**

Mykola M. Lytvyn, Serhiy M. Lytvyn, Oleksandr Yu. Sushko, Yuriy A. Ovsianyk 281

**69. High Performance Extended C-Band 3.4–4.8 GHz Dual Circular Polarization Feed System**

Stepan I. Piltyay 284

**70. Use of structure symmetry for the design of passive microstrip devices**

Valeriy I. Oborzhitskyy, Ivan Prudyus 288

**71. Forming the sensitive area of microwave motion sensor**

Ivan N. Prudyus, V. G. Storozh, N.-V. I. Naida 291

**72. Investigation of 3D Printed Dielectric Structure for Microwave Lens Prototyping**

Grigory K. Uskov, P. A. Kretov, V. A. Stepkin, N. S. Sbitnev, A. M. Bobreshov 294

**73. Tunable RX filter with Ferroelectric Capacitors for DCS, PCS and IMT Communication Systems**

Alexander V. Zakharov 297

**74. Unconventional Connection of Ferroelectric Capacitors to Resonators in Tunable Filters**

Alexander V. Zakharov 301

**75. Fabry-Perot Resonator with Evanescent Coaxial-Sector Holes**

Yulia V. Antonenko, A. V. Gribovsky 309

**76. Bragg Structures with Thin Lossy Layers**

M. V. Andreev, Valentin F. Borulko, O. O. Drobakhin, D. V. Sidorov 312

**77. Packet Suppression of a Leakage of Microwave Power from Industrial Heating Systems via the Higher Modes of Open Waveguide Ports**

Lyudmila P. Mospan, Anatoly A. Kirilenko 315

**78. Adaptive Control of Hybrid Modes in a Longitudinally Magnetized Gyroelectromagnetic Circular Waveguide**

Illia V. Fedorin, Volodymyr I. Fesenko, Vladimir R. Tuz 318

**79. Coupling of waveguide with resonator through diaphragm with slot with dielectric slab**

A. F. Lyakhovsky, L. P. Yatsuk, A. A. Lyakhovsky 321

**80. Features of the dispersion characteristics of planar dielectric waveguide-grating system**

Anatolii V. Hnatovskyi, S. A. Provalov 325

**81. Helicon isolator with quarter-wave nonreciprocal transformer**

Vladimir S. Vountesmery, Youry V. Vountesmery 328

**82. Autodyne Effect Application for Stability Analysis of the Steady-State Mode of UHF Oscillating Systems**

Gennadiy P. Ermak, A. S. Vasiliev, V. Ya. Noskov, K. A. Ignatkov, A. P. Chupahin, S. M. Smolskiy 332

**83. Signal Analysis of Double-Diode Autodyne**

Gennadiy P. Ermak, A. S. Vasiliev, V. Ya. Noskov, K. A. Ignatkov, A. P. Chupahin, S. M. Smolskiy 338

**84. Radiofrequency Deterministic Chaos Oscillator Based on Transistor Structure with Negative Resistance. Numerical Researching**  
Andriy O. Semenov 343

**85. Influence of the Autodyne Oscillator Coupling Degree with Antenna upon Its Transfer and Noise Characteristics**  
Gennadiy P. Ermak, A. S. Vasiliev, V. Ya. Noskov, K. A. Ignatkov, A. P. Chupahin, S. M. Smolskiy 348

**86. Coaxial Horn Antenna and Its Usage Perspectives in Ground-Penetrating Radar Systems**  
Vitalyi D. Sakhatsky, Sergii Ianushkevych 354

***Remote sensing antennas, signal processing and communications***

**87. Equipment Optimization for Weather Balloon and Ground-Based Weather Stations Using GNSS**  
Anatolii G. Laush 357

**88. Analytical Description of Polar Coordinates of Random Vectors in Case of Arbitrary Fluctuations of Its Cartesian Coordinates**  
Shamil M. Chabdarov, Alexey A. Korobkov 360

**89. Segmentation for Detecting Buildings in Infrared Space Images**  
Alexey N. Gorobets 364

**90. DOA Estimation Using Beamspace Root-MUSIC Based Estimator Bank**  
V. I. Vasylyshyn 367

**91. Remote Sensing of Plane-Layered Media with Losses Using UWB Signals**  
Dmitry O. Batrakov, Mariya S. Antyufeyeva, Alexandr V. Antyufeyev, Angelika G. Batrakova 370

**92. Radiophotonic Method for Spectrum Analysis of SHF-Band Signals Based on Stimulated Mandelstam-Brillouin Scattering**  
Daniil S. Dmitriev, Oleg G. Morozov, Lutsiya M. Sarvarova, Pavel V. Gavrilov, Igor A. Makarov, Anvar A. Talipov 374

**93. Identification Approach for Defining Radiosignal Frequency**  
Dmytro P. Kucherov, A. L. Berezkin 378

**94. Radio Signal Distortion Assessment by non Directional Antennas of the Helicopter**  
Vladimir A. Ivanov, Olexandr S. Zadorozhniy 382

**95. Method of Adaptive Selection of Channel Number in MIMO System**

Andrei V. Shyshatskyi, A. G. Zhuk, S. N. Petruk 385

**96. Experimental Evaluation of the Shading Effect of Accelerating Lens in Azimuth Plane**

V. M. Astapenya, V. Yu. Sokolov 388

**97. Combined Antenna of Unmanned Aircraft Vehicle for Early Warning System Against Dangerous Wind Shears**

Yurii N. Ulianov, Vitalii L. Misailov 391

**98. Quasi-Optical Approach to the Analysis of the Energy Model of Millimeter Wave Propagation and Antenna Characteristics**

Yana A. Kremenetskaya, Igor O. Liskovskiy, Elena R. Zhukova 394

***Measurements and applications of microwave technologies*****99. Frequency Domain Measurement of Permeability of M400HH Ferrite Rods in the VHF Range**

T. N. Ogurtsova, P. Kholod, G. Klochko, G. Pochanin, S. Berdnik, O. Dumin 398

**100. Estimation of Clutters from Aircrafts during Ionospheric Measurements using Incoherent Scatter Radar with 100-meter Two-Mirror Antenna**

Yakiv Chepurnyy, Leonid Emelyanov, Dmytro Iskra, Maryna Shulga 401

**101. Studying the Properties of Different Materials Using Terahertz 3D Imager Radar**

Mykola A. Kosovets, O. I. Pavlov, L. Tovstenko 406

**102. Two-Frequency Method for Probing of Ionospheric Resonance Inhomogeneities**

A. R. Nasibullin, D. A. Vedenkin 411

**103. Measurement Method of the Object Surface Deflections Using Antennas Theory**

O. V. Poliarus, E. O. Poliakov, Ya. S. Brovko 414

**104. Parameters of Foam Layers Definition for Calculation of Reflection Coefficients**

Leonid A. Filins'kyy 417

**105. Investigation of Reflection in the Foamed Structures**

Leonid A. Filins'kyy, V. M. Morozov 421

**106. Radiophotonic Method for Instantaneous Frequency Measurement Based on Principles of “Frequency-Amplitude” Conversion in Fiber Bragg Grating and Additional Frequency Separation**

Alexander A. Ivanov, Oleg G. Morozov, Vladimir A. Andreev, Artem A. Kuznetsov, Lenar M. Faskhutdinov 425

**107. Effect of the Low Energy Electromagnetic Radiation of Cell Phone Frequency (1.8 GHz, 2.4 GHz) on the Chromatin State in Cells of Human Buccal Epithelium**

Andrey Y Mudrak, Alexey A Demchenko, Nikolay N Kolchigin, Yuriy G. Shckorbatov 429

**108. Optimization of Microwave Heating of Dielectrics Taking into Account the Errors of the Amplitudes of the Excitation Electromagnetic Field Emitters**

Vladimir I. Anfinogentov, Gennadiy A. Morozov, Nataliya E. Stakhova, Sergey V. Smirnov, Svetlana R. Ganieva 433

**109. Investigation of Processing of Dense Oily Sludge Using Microwave Energy**

Denis A. Vedenkin, Dmtry E. Sharonov 437

**110. Retrieving the Reflection Coefficient of a Sample from the Frequency Response of a Special Open Resonator**

Yu. I. Choni, A. G. Romanov, V. N. Lavrushev 440

**111. Technology of Wireless Transmission of Energy to Remote Objects Based on Multi-Frequency System of Transmitters**

Igor Yurievich Grishin, Rena R. Timirkaleeva, Sergey Vl. Titov, Yelena V. Titova 443

***Author Index***

***Contents***