
**ELECTROMAGNETIC
WAVES** **PIER 136**

Progress

In

Electromagnetics

Research

© 2013 EMW Publishing. All rights reserved.

No part of this publication may be reproduced. Request for permission should be addressed to the Publisher.

All inquiries regarding copyrighted material from this publication, manuscript submission instructions, and subscription orders and price information should be directed to: EMW Publishing, P. O. Box 425517, Kendall Square, Cambridge, Massachusetts 02142, USA.

ISSN 1070-4698

E-ISSN 1559-8985

**ELECTROMAGNETIC
WAVES** **PIER 136**

Progress

In

Electromagnetics

Research

Chief Editor: Weng Cho Chew

EMW Publishing

Cambridge, Massachusetts, USA

CONTENTS

NOVEL COMPACT WAVEGUIDE DUAL CIRCULAR POLARIZER*Chao Chang, Sami Tantawi, Sarah Church, Jeffery Neilson and Patricia V. Larkoski*

1	Introduction	1
2	Analysis and Optimization of a Turnstile Polarizer	2
3	The Four-port Dual Circular Polarizer	8
4	Manufacture and Test	12
5	Conclusions	14

FINITE-BOUNDARY BOWTIE APERTURE ANTENNA FOR TRAPPING NANOPARTICLES*Huapeng Ye, Haifeng Wang, Swee Ping Yeo, and Chengwei Qiu*

1	Introduction	17
2	Antenna Model and Computational Approach	19
3	Simulation Results and Discussion	19
4	Conclusion	24

SYNTHESIS OF LARGE PLANAR THINNED ARRAYS USING IWO-IFT ALGORITHM*Xinkuan Wang, Yongchang Jiao, Yan Liu, and Yanyan Tan*

1	Introduction	29
2	Description of the IWO-IFT Method	31
3	Numerical Examples	34
4	Conclusion	40

RADIATION ANALYSIS OF LARGE ANTENNA ARRAY BY USING PERIODIC EQUIVALENCE PRINCIPLE ALGORITHM*Kaizhi Zhang, Jun Ouyang, Feng Yang, Chuan Wu, Yan Li and Jian Zhang*

1	Introduction	43
2	Periodic Green's Function	45
3	Equivalence Principle Algorithm	47
4	Periodic Equivalence Principle Algorithm	49

5	Numerical Results	51
6	Conclusion	56

**COMPUTATIONAL PERFORMANCE OF A WEIGHTED
REGULARIZED MAXWELL EQUATION FINITE
ELEMENT FORMULATION**

*Ruben Otin, Luis E. Garcia-Castillo, Ignacio Martinez-Fernandez
and Daniel Garcia-Doñoro*

1	Introduction	61
2	Weighted Regularized Maxwell Equation with nodal Elements	62
3	Curl-curl Maxwell Equation with Edge Elements	66
4	Numerical Experiments	66
5	Summary	71
6	Conclusion	73

**AN ADVANCED UWB CHANNEL MODEL FOR BODY-
CENTRIC WIRELESS NETWORKS**

*Raffaele Di Bari, Qammer H. Abbasi, Akram Alomainy
and Yang Hao*

1	Introduction	80
2	Measurement Settings	81
3	Results	86
4	Conclusions	93

**THEORY AND REALIZATION OF SIMPLE BANDPASS
FILTERS WITH ANTIPARALLEL CONFIGURATION**

Sinisa Jovanovic, Bratislav Milovanovic, and Miodrag Gmitrovic

1	Introduction	102
2	Analysis of the Filter Circuit	103
3	Filter Realization	113
4	Measured Results	119
5	Conclusion	120

**A DUAL-BAND IMPEDANCE TRANSFORMING
TECHNIQUE WITH LUMPED ELEMENTS FOR
FREQUENCY-DEPENDENT COMPLEX LOADS**

Byeong-Taek Moon and Noh-Hoon Myung

1	Introduction	123
2	Input Impedance for Complex Impedance Transforming	125

3	Dual-band Impedance Transforming Technique	127
4	Numerical Examples	133
5	Conclusion	137

ELECTROMAGNETIC DESIGN BASED ON HYBRID ANALYTICAL AND 3-D FINITE ELEMENT METHOD FOR NOVEL TWO LAYERS BLDC MACHINE

Hassan M. Cheshmehbeigi and Ebrahim Afjei

1	Introduction	141
2	Novel Structure and Principle Operation	142
3	Numerical Analysis of Magnetic Field for BLDC Machine . . .	144
4	Analytical Analysis	144
5	Simulation Results	146
6	Hybrid Magnetic Optimized Design Methodology	149
7	Methodology Evaluation for Flux Density Distribution	150
8	Experimental Results	151
9	Conclusion	153

DESIGN OF A COMPACT ULTRAWIDEBAND META-MATERIAL ANTENNA BASED ON THE MODIFIED SPLIT-RING RESONATOR AND CAPACITIVELY LOADED STRIPS UNIT CELL

Mimi A. W. Nordin, Mohammad T. Islam, and Norbahiah Misran

1	Introduction	157
2	The LHM Unit Cell	159
3	The MTM Antenna	163
4	The Ultrawideband MTM Antenna	166
5	Conclusions	170

LINEAR POLARIZATION SUM IMAGING IN PASSIVE MILLIMETER-WAVE IMAGING SYSTEM FOR TARGET RECOGNITION

Won-Gyum Kim, Nam-Won Moon, Hwang-Kyeom Kim and Yong-Hoon Kim

1	Introduction	176
2	Linear Polarization Sum Imaging in PMMW Imaging System .	177
3	PMMW Quasi-optical Imaging System Design	179
4	Measurement Results of Linear Polarization Sum Imaging . . .	182
5	Conclusions	191

A NOVEL FAST SOLVER FOR POISSON’S EQUATION WITH NEUMANN BOUNDARY CONDITION

Zuhui Ma, Weng Cho Chew, and Lijun Jiang

1	Introduction	195
2	Electrostatic Boundary Value Problem	197
3	Solution Method	199
4	Numerical Examples	203
5	Conclusions	207

DESIGN OF A MINIATURIZED DUAL-BAND DOUBLE-FOLDED SUBSTRATE INTEGRATED WAVEGUIDE BANDPASS FILTER WITH CONTROLLABLE BANDWIDTHS

Qiaoli Zhang, Bingzhong Wang, Wenyan Yin, and Linsheng Wu

1	Introduction	212
2	Analysis and Design	213
3	Results and Discussions	219
4	Conclusion	220

COVERED IMAGE OF SUPERLENS

Yuan Zhang and Michael A. Fiddy

1	Introduction	225
2	The Depth of Focus of Planar Superlens	226
3	Subwavelength Image of Scattering Dielectric Surface	231
4	Conclusion	235

A NOVEL MINEFIELD DETECTION APPROACH BASED ON MORPHOLOGICAL DIVERSITY

Yuming Wang, Qian Song, Tian Jin, Xiaotao Huang and Hanhua Zhang

1	Introduction	239
2	Speckle Suppression	241
3	Analysis of Landmine Morphological Characteristics	242
4	Minefield Detection Approach Based on Morphological Diversity	245
5	Experimental Results	250
6	Conclusion	251

A FUNCTIONAL MICROSTRIP CIRCUIT MODULE FOR ANNULAR SLOT ANTENNA

*Yu-Ming Lee, Shuming T. Wang, Hsien-Chiao Teng
and Shen Cherng*

1	Introduction	255
2	Antenna Configuration	256
3	Measurements and Simulations	261
4	Conclusion	265

ENHANCED NONLINEARITIES IN DOUBLE-FISHNET NEGATIVE-INDEX PHOTONIC METAMATERIALS

Jun Guo, Yuanjiang Xiang, Xiaoyu Dai, and Shuangchun Wen

1	Introduction	269
2	Proposed Structure and Simulation Method	270
3	Results and Discussion	274
4	Conclusion	279

MAGNETIC FIELD OF TUBULAR LINEAR MACHINES WITH DUAL HALBACH ARRAY

*Liang Yan, Lei Zhang, Tianyi Wang, Zongxia Jiao, Chin-Yin Chen
and I-Ming Chen*

1	Introduction	283
2	Structure and Working Principle	284
3	Governing Equations of Flux Field	285
4	General Solutions to Magnetic Field	287
5	Numerical Simulation and Experiments	292
6	Conclusion	297

MOVING-TARGET VELOCITY ESTIMATION IN A COMPLEX-VALUED SAR IMAGERY

Yuan Li, Gaohuan Lv, and Xingzhao Liu

1	Introduction	301
2	Fundamentals	304
3	Range Velocity Estimator	307
4	An Azimuth Velocity Estimator Based on Symmetric Defocus Filter Bank	310
5	An Azimuth Velocity Estimator Based on Phase Gradient	313
6	Experiments and Results	316

7	Conclusion	322
---	----------------------	-----

DESIGN OPTIMIZATION AND ANALYSIS OF AFPM SYNCHRONOUS MACHINE INCORPORATING POWER DENSITY, THERMAL ANALYSIS, AND BACK-EMF THD

*Solmaz Kahourzade, Amin Mahmoudi, Ali Gandomkar
Nasrudin Abd Rahim, Wooi Ping Hew, and Mohammad N. Uddin*

1	Introduction	328
2	Sizing Equation	330
3	Genetic Algorithm and Optimization	333
4	Finite Element Analysis (FEA)	338
5	Finite Volume Analysis (FVA)	340
6	Design Comparison	345
7	Electromagnetic Field Analysis	347
8	Thermal Field Analysis	353
9	Performance Analysis	359
10	Conclusion	360
	Appendix A.	361

THRESHOLD-BASED RESAMPLING FOR HIGH-SPEED PARTICLE PHD FILTER

Zhiguo Shi, Yunmei Zheng, Xiaomeng Bian, and Zhengde Yu

1	Introduction	370
2	High-speed Particle PHD Filter	371
3	Tracking Performance Evaluation	377
4	Discussions	380
5	Conclusion	381

SAR TARGET CLASSIFICATION USING BAYESIAN COMPRESSIVE SENSING WITH SCATTERING CENTERS FEATURES

Xinzheng Zhang, Jianhong Qin, and Guojun Li

1	Introduction	385
2	Scattering Centers Features Extraction with Sparse Constraint	388
3	SAR Target Classification Using Compressive Sensing	391
4	Experiment Results	394
5	Conclusion	404

DESIGN OF A COMPACT UWB ANTENNA INTEGRATED WITH GSM/WCDMA/WLAN BANDS

*Guihong Li, Huiqing Zhai, Tong Li, Xiaoyan Ma
and Changhong Liang*

1	Introduction	409
2	Antenna Design and Analysis	411
3	Simulation Result Discussion and Experimental Verification	414
4	Conclusion	418

MEASUREMENT UNCERTAINTY OF COMPLEX- VALUED MICROWAVE QUANTITIES

Yu Song Meng and Yueyan Shan*

1	Introduction	421
2	Theoretical Background and Problem Formulation	423
3	Case Studies and Analysis	424
4	Conclusions	432

THREE-DIMENSIONAL LOCALIZATION ALGORITHM FOR MIXED NEAR-FIELD AND FAR-FIELD SOURCES BASED ON ESPRIT AND MUSIC METHOD

Jiajia Jiang, Fajie Duan, and Jin Chen

1	Introduction	435
2	3-D Mixed Signal Model	437
3	Proposed Algorithm	439
4	Simulations and Experiment	444
5	Conclusion	453

RECONSTRUCTION OF FAULTY CABLE NETWORK USING TIME-DOMAIN REFLECTOMETRY

Xiaolong Zhang, Minming Zhang, and Deming Liu

1	Introduction	457
2	Theory of the Proposed Method	459
3	Numerical and Experimental Results	468
4	Conclusion	476

ON THE EFFICIENCY AND GAIN OF ANTENNAS

Anders Karlsson

1	Introduction	479
---	------------------------	-----

2	Prerequisites	480
3	General Antennas	481
4	Optimization of Efficiency	483
5	Gain	485
6	Examples	486
7	Concluding Remarks	489
	Appendix A. Vector waves and Green Dyadic	489
	Appendix B. A Proof	491
	Appendix C. Optimal Gain of an Electric or Magnetic Antenna of Order l_{\max}	492

**TWO DIMENSION DIGITAL BEAMFORMING
PREPROCESSING IN MULTIBEAM SCANSAR**

Pingping Huang, Wei Xu, and Weikong Qi

1	Introduction	495
2	Multibeam ScanSAR	497
3	Azimuth Data Processing Approach	499
4	Simulation Experiment	504
5	Conclusion	505

**SECOND-ORDER FORMULATION FOR THE QUASI-
STATIC FIELD FROM A VERTICAL ELECTRIC DIPOLE
ON A LOSSY HALF-SPACE**

Mauro Parise

1	Introduction	509
2	Theory	510
3	Results and Discussion	515
4	Conclusion	519

**RANGE ALIGNMENT AND MOTION COMPENSATION
FOR MISSILE-BORNE FREQUENCY STEPPED CHIRP
RADAR**

Bo Liu and Wenge Chang

1	Introduction	523
2	Problem Statement	525
3	Velocity Estimation and Motion Compensation	531
4	Performance Assessment	535
5	Conclusion	538

ANALYSIS OF TRANSIENT ELECTROMAGNETIC SCATTERING USING TIME DOMAIN FAST DIPOLE METHOD

Ji Ding, Changqing Gu, Zhuo Li, and Zhenyi Niu

1	Introduction	543
2	Basic Principle of the TD-EDM Method	545
3	Time Domain Fast Dipole Method	546
4	Numerical Results	552
5	Conclusions	556

DESIGN AND ANALYSIS OF MULTICHANNEL TRANSMISSION FILTER BASED ON THE SINGLE-NEGATIVE PHOTONIC CRYSTAL

Chienjang Wu, Minhung Lee, and Junzhe Jian

1	Introduction	561
2	Basic Equations	563
3	Numerical Results and Discussion	565
4	Conclusion	574

A FAMILY OF ULTRA-THIN, POLARIZATION-INSENSITIVE, MULTI-BAND, HIGHLY ABSORBING METAMATERIAL STRUCTURES

*Theofano M. Kollatou, Alexandros I. Dimitriadis
Stylianos D. Assimonis, Nikolaos V. Kantartzis
and Christos S. Antonopoulos*

1	Introduction	579
2	Absorber Design and Characterization	581
3	Absorption Mechanism Interpretation	583
4	Experimental Realization and Measurement Setup	585
5	Design of Bandwidth-enhanced Absorbers	586
6	Conclusions	591

A NOVEL DUAL MODE SUBSTRATE INTEGRATED WAVEGUIDE FILTER WITH MIXED SOURCE-LOAD COUPLING (MSLC)

Ziqiang Xu, Yu Shi, Congyu Xu, and Peng Wang

1	Introduction	595
2	Filter Analysis and Design	597
3	Experimental Results	603

4 Conclusion 604

STRUCTURE ANALYSIS OF SINGLE- AND MULTI-FREQUENCY SUBSPACE MIGRATIONS IN INVERSE SCATTERING PROBLEMS

Young-Deuk Joh, Young Mi Kwon, Joo Young Huh and Won-Kwang Park

1 Introduction 607
 2 Review on Imaging Function 608
 3 Structure Analysis of Imaging Functions 611
 4 Numerical Experiments and Discussions 616
 5 Conclusion 619

A CPW-FED DUAL BAND-NOTCHED UWB ANTENNA WITH A PAIR OF BENDED DUAL-L-SHAPE PARASITIC BRANCHES

Xianglong Liu, Yingzeng Yin, Pingan Liu, Junhui Wang, and Bin Xu

1 Introduction 623
 2 Antenna Configuration and Analysis 625
 3 Antenna Evolution, Discussions and Results 627
 4 Conclusion 632

THE SERIAL RESONANT ANTENNA FOR THE LARGE FIELD OF VIEW MAGNETIC RESONANCE IMAGING

Bo Zhu, Ed Xuekui Wu, Patrick Peng Gao, Peng Cao and Lijun Jiang

1 Introduction 635
 2 Structure and Theoretical Analysis 637
 3 Full Wave Simulation 639
 4 Fabrication and Experiment 641
 5 Conclusion 644

MAGNETIC FIELD SHIELDING BY METAMATERIALS

Mustafa Boyvat and Christian Hafner

1 Introduction 647
 2 Shielding Principle of a Magnetic Meta-atom 649
 3 Improved Meta-atom with Active Circuits 652
 4 Improved Meta-atom with Advanced Passive Circuitry 652
 5 Experimental Demonstration of Shielding by Metamaterials 654

6	Conclusion	662
---	------------------	-----

ROBUST SUPERDIRECTIVE BEAMFORMING FOR HF CIRCULAR RECEIVE ANTENNA ARRAYS

Qingchen Zhou, Huotao Gao, Huajun Zhang, and Fan Wang

1	Introduction	665
2	Problem And Relate Methods	667
3	Proposed Algorithm	669
4	Numerical Results	672
5	Conclusion	677

REFLECTION AND TRANSMISSION FROM BIAXIALLY ANISOTROPIC — ISOTROPIC INTERFACES

Jennifer W. Graham and Jay K. Lee

1	Introduction	681
2	Half Space Reflection and Transmission Coefficients	684
3	Two Layer Coefficients	695
4	Conclusions	699

A MULTI-GPU SOURCES RECONSTRUCTION METHOD FOR IMAGING APPLICATIONS

Miguel López-Portugués, Yuri Álvarez, Jesús A. López-Fernández Cebrián García, Rafael G. Ayestarán, and Fernando Las-Heras*

1	Introduction	703
2	Methodology	705
3	Parallel Algorithm for Multiple GPUs	710
4	Application Example	713
5	Experimental Validation	718
6	Conclusions	720

PRINTED ANTENNA FOR PENTA-BAND WWAN TABLET COMPUTER APPLICATION USING EMBEDDED PARALLEL RESONANT STRUCTURE

Zhi Chen, Yongling Ban, Sicheng Sun, and Joshua Le-Wei Li

1	Introduction	725
2	Proposed Antenna Design and Parametric Study	726
3	Results and Discussion	733
4	Conclusion	735

A NEW METHOD FOR BROADENING BANDWIDTHS OF CIRCULAR POLARIZED MICROSTRIP ANTENNAS BY USING DGS & PARASITIC SPLIT-RING RESONATORS

Zhaobin Deng, Wen Jiang, Shuxi Gong, Yunxue Xu, and Yang Zhang

1	Introduction	739
2	Antenna Structure and Design	741
3	Experimental Verification	745
4	Parametric Studies	749
5	Conclusion	749

COHERENT PHASE COMPENSATION METHOD BASED ON DIRECT IF SAMPLING IN WIDEBAND RADAR

Qianqiang Lin, Zengping Chen, Yue Zhang, and Jianzhi Lin

1	Introduction	753
2	DCT Algorithm and Its Limitation	754
3	Phase Compensation Method Based on the Coherence of Echo Pulses	755
4	Experimental Verification and Analysis	759
5	Conclusions	762

NOVEL NESTED SPLIT-RING-RESONATOR (SRR) FOR COMPACT FILTER APPLICATION

Yong Liu, Xiaohong Tang, Zhongrun Zhang, and Xiaolong Huang

1	Introduction	765
2	The Nested Split-ring Resonator	766
3	Compact Band-pass Filter Based on Nested SRR	769
4	Conclusion	771