
**ELECTROMAGNETIC
WAVES** **PIER 25**

**Progress
In
Electromagnetics
Research**

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

© 2000 EMW Publishing

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. FAX: 1-617-354-9597. For up-to-date information, visit web site at <http://www.emwave.com>

This publication is printed on acid-free paper.

ISSN 1070-4698

Manufactured in the United States of America

**ELECTROMAGNETIC
WAVES** **PIER 25**

Progress
In
Electromagnetics
Research

Chief Editor: J. A. Kong

EMW Publishing
Cambridge, Massachusetts, USA

CONTENTS

Chapter 1	TVFEM ANALYSIS OF PERIODIC STRUCTURES FOR RADIATION AND SCATTERING <i>Y. Zhu and R. Lee</i>	
	1. Introduction	1
	2. General Formulation	3
	3. Discretization and Basis Functions	5
	4. Imposition of the Periodic Boundary Condition	8
	5. Upper and Bottom Boundary Truncation: PML	11
	6. Numerical Results	12
	7. Summary and Discussion	20
	References	21
Chapter 2	COUPLED-MODE ANALYSIS OF A GATING-ASSISTED DIRECTIONAL COUPLER USING SINGULAR PERTURBATION TECHNIQUE <i>K. Watanabe, J. Ishihara, and K. Yasumoto</i>	
	1. Introduction	23
	2. Formulation	25
	3. Numerical Examples	34
	4. Conclusions	36
	References	36
Chapter 3	EXTINCTION BEHAVIOR OF DRY SNOW AT MICROWAVE RANGE UP TO 90 GHZ BY USING STRONG FLUCTUATION THEORY <i>H. Wang, J. Pulliainen, and M. Hallikainen</i>	
	1. Introduction	39
	2. Extinction Coefficients Using Phase Matrix in Strong Fluctuation Theory	40
	3. Hallikainen et al.'s Extinction Coefficient Model	44
	4. Comparison of Calculated Extinction Coefficients with Data	44
	5. Conclusions	46
	Appendices	46
	References	50

Chapter 4 EFFICIENT FAULTY ELEMENT DIAGNOSTICS OF
LARGE ANTENNA ARRAYS BY DISCRETE MEAN
FIELD NEURAL NETS

G. Castaldi, V. Pierro, and I. M. Pinto

1.	Introduction	53
2.	Antenna Array Diagnostics from Linear and Non-Linear Measurements	55
3.	Neural Network Properties	57
4.	Discrete Implementation	62
5.	Implementation Hints	63
6.	Numerical Results	65
7.	Conclusions - Hints for Future Research	69
	Appendices	70
	References	75

Chapter 5 THE USE OF TRANSFINITE ELEMENTS IN THE
METHODS OF MOMENTS APPLIED TO
ELECTROMAGNETIC SCATTERING BY
DIELECTRIC CYLINDERS

Ph. De Doncker

1.	Introduction	77
2.	The Transfinite Elements	80
3.	The Results	85
4.	Conclusion	92
	Appendix	92
	References	93

Chapter 6 COUPLED-MODE ANALYSIS OF COUPLED
MICROSTRIP TRANSMISSION LINES USING A
SINGULAR PERTURBATION TECHNIQUE

K. Watanabe and K. Yasumoto

1.	Introduction	95
2.	Formulation of the Problem	96
3.	Coupled-Mode Equations	99
4.	Numerical Examples	104
5.	Concluding Remarks	108
	Appendix	109
	References	110

**Chapter 7 RECTANGULAR CONDUCTING WAVEGUIDE
 FILLED WITH UNIAxIAL ANISOTROPIC MEDIA:
 A MODAL ANALYSIS AND DYADIC GREEN'S
 FUNCTION**

S. Liu, L.W. Li, M. S. Leong, and T. S. Yeo

1.	Introduction	111
2.	Basic Formulation of the Problem	113
3.	Fields in Source-free Rectangular Waveguides	114
4.	Dyadic Green's Functions	117
5.	Applications of Dyadic Green's Functions	125
6.	Conclusions	126
	References	127

**Chapter 8 SCATTERING FROM AXISYMMETRIC
 SCATTERERS: A HYBRID METHOD OF SOLVING
 MAUE'S EQUATION**

J. G. Fikioris and A. N. Magoulas

1.	Introduction	131
2.	Evaluation of the Surface "Patch" Integrals	135
3.	Application to Specific Scatterers	143
4.	Conclusions	159
	References	164

**Chapter 9 EVALUATION OF BISTATIC FAR-FIELD
 QUANTITIES FROM NEAR-FIELD
 MEASUREMENTS**

J. L. Leou and H. J. Li

1.	Introduction	167
2.	Formulation of the Integral Equations	169
3.	Numerical Solution of Integral Equation	172
4.	Results and Observations	177
5.	Conclusions	187
	References	187

Chapter 10	A STUDY OF FRESNEL SCATTERED FIELD FOR NON-SPHERICAL DISCRETE SCATTERERS <i>H. T. Ewe and H. T. Chuah</i>	
	1. Introduction	189
	2. Formulation	191
	3. Theoretical Analysis	204
	4. Comparisons with Measurement Data	213
	5. Conclusion	217
	Appendix	217
	References	221
Chapter 11	FRACTIONAL DUAL SOLUTIONS AND CORRESPONDING SOURCES <i>Q. A. Naqvi and A. A. Rizvi</i>	
	1. Introduction	223
	2. TEM Plan Wave Propagating in An Arbitrary Direction	226
	3. Spectrum of TEM Plane Waves	230
	4. Source Distribution	231
	5. Intermediate Fractional Dual Solutions to the Helmholtz's Equation	234
	References	237
Chapter 12	THE NEAR- AND FAR-ZONE FIELDS OF PERIODIC SPHERICAL ARRAYS OF DIPOLE ANTENNAS ON SPHERICAL CHIRAL SUBSTRATES <i>W. -Y. Yin, L.-W. Li, and M.-S. Leong</i>	
	1. Introduction	239
	2. Geometries of the Problem	240
	3. Field Distributions	242
	4. Numerical Results	252
	5. Conclusions	254
	Appendices	255
	References	258

Chapter 13	A QUEST FOR SYSTEMATIC CONSTITUTIVE FORMULATIONS FOR GENERAL FIELD AND WAVE SYSTEMS BASED ON THE VOLTERRA DIFFERENTIAL OPERATORS <i>D. Censor</i>	
1.	Introduction	261
2.	Linear Homogeneous Media	263
3.	Linear Inhomogeneous Media	269
4.	Nonlinear Homogeneous Media	275
5.	Nonlinear Inhomogeneous Media	277
6.	Special Relativity and Minkowski's Constitutive Theory	279
7.	Summary and Concluding Remarks	282
	Reference	283
Chapter 14	ELECTROMAGNETIC INTERACTION OF PARALLEL ARRAYS OF DIPOLE SCATTERERS <i>V. Yatsenko, S. Maslovski, and S. Tretyakov</i>	
1.	Introduction	285
2.	Calculation of Local Field	287
3.	Approximate Analytical Formula	293
4.	Numerical Examples	293
5.	Arrays of Magnetic Dipole Scatterers	301
6.	Conclusions	304
	Appendix	305
	References	307
Chapter 15	CONCISE SPECTRAL FORMALISM IN THE ELECTROMAGNETICS OF BIANISOTROPIC MEDIA <i>E. L. Tan and S. Y. Tan</i>	
1.	Introduction	309
2.	Source-incorporated 4×4 Matrix Formalism	311
3.	Dyadic Green's Functions	316
4.	Reciprocity Theorems	321
5.	Conclusion	327
	References	328