

## CONTENTS

CONTRIBUTORS . . . . .	ix
PREFACE . . . . .	xi
FUTURE CONTRIBUTIONS . . . . .	xiii

### **Evanescence Waves in the Near and the Far Field**

HENK F. ARNOLDUS

I. Introduction . . . . .	1
II. Solution of Maxwell's Equations . . . . .	4
III. Green's Tensor and Vector . . . . .	6
IV. Electric Dipole . . . . .	8
V. Angular Spectrum Representation of the Scalar Green's Function . . . . .	10
VI. Angular Spectrum Representation of Green's Tensor and Vector . . . . .	11
VII. Traveling and Evanescence Waves . . . . .	12
VIII. The Auxiliary Functions . . . . .	14
IX. Relations Between the Auxiliary Functions . . . . .	17
X. The Evanescence Part . . . . .	18
XI. The Traveling Part . . . . .	20
XII. The $z$ -Axis . . . . .	21
XIII. The $xy$ -Plane . . . . .	23
XIV. Relation to Lommel Functions . . . . .	26
XV. Expansion in Series with Bessel Functions . . . . .	27
XVI. Asymptotic Series . . . . .	29
XVII. Evanescence Waves in the Far Field . . . . .	31
XVIII. Uniform Asymptotic Approximation . . . . .	33
XIX. Traveling Waves in the Near Field . . . . .	45
XX. The Coefficient Functions . . . . .	47
XXI. Integral Representations . . . . .	51
XXII. Evanescence Waves in the Near Field . . . . .	53
XXIII. Integral Representations for Evanescence Waves . . . . .	55
XXIV. Conclusions . . . . .	60
Appendix A . . . . .	60
Appendix B . . . . .	63
References . . . . .	65

<b>Symmetry and the Karhunen–Loève Decomposition</b>	
BRIGITTE LAHME	
I. Introduction . . . . .	70
II. The Karhunen–Loève Decomposition . . . . .	71
III. Basics from the Group Representation Theory . . . . .	79
IV. KL Decomposition and Symmetry . . . . .	84
V. Applications . . . . .	91
VI. Conclusion . . . . .	105
References . . . . .	105

**Analysis of Irregularly Sampled Data: A Review**

ROBERTA PIRODDI AND MARIA PETROU

I. Introduction . . . . .	109
II. Application Areas . . . . .	111
III. Noniterative Methods . . . . .	113
IV. Iterative Methods . . . . .	133
V. Incorporating the Uncertainty of the Data: Normalized and Differential Convolution . . . . .	136
VI. A Comparative Study in 1D . . . . .	148
VII. Survey of State of the Art . . . . .	157
VIII. Conclusions . . . . .	162
References . . . . .	163

**Recent Developments in the Microscopy of Ceramics**

W. MARK RAINFORTH

I. Introduction . . . . .	168
II. High-Resolution Microscopy of Ceramics . . . . .	168
III. Electron Energy-Loss Spectroscopy of Ceramics . . . . .	189
IV. Energy-Filtered TEM (EFTEM) . . . . .	227
V. Concluding Comments . . . . .	238
References . . . . .	240

**Five-Dimensional Hamilton–Jacobi Approach to Relativistic  
Quantum Mechanics**

H. ROSE

I. Introduction . . . . .	247
II. Covariant Hamilton Formalism for Spin-1/2 Particles . . . . .	248
III. Spin Precession . . . . .	253
IV. Reduced Relativistic Lagrangian and Hamiltonian . . . . .	256

V. Properties of the Action Function . . . . .	260
VI. Self-Action . . . . .	261
VII. Multi-Particle System . . . . .	266
VIII. Quantization of the Five-Dimensional Hamilton–Jacobi Equation . . . . .	268
IX. Free-Particle Solutions . . . . .	272
X. Integral Equation and Path Integral . . . . .	275
XI. Eikonal Approximation of the Relativistic Propagator . . . . .	280
XII. Conclusion . . . . .	283
References . . . . .	284

**Redundant Multiscale Transforms and Their Application for  
Morphological Component Separation**

JEAN-LUC STARCK, MICHAEL ELAD, AND DAVID DONOHO

I. Introduction . . . . .	288
II. Background. Part I: Wavelet . . . . .	290
III. Background. Part II: From Wavelets to Curvelets . . . . .	307
IV. Background. Part III: Sparsity in Transforms . . . . .	320
V. Morphological Component Analysis . . . . .	330
VI. Conclusion . . . . .	342
References . . . . .	345
INDEX . . . . .	349