Andrew Seagar

Application of Geometric Algebra to Electromagnetic Scattering

The Clifford–Cauchy–Dirac Technique

Springer

And Application Geometric Algebra Electromagnetic Scattering

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Application of Geometric Algebra to Electromagnetic Scattering Andrew Seagar,2015-11-12 This work presents the Clifford Cauchy Dirac CCD technique for solving problems involving the scattering of electromagnetic radiation from materials of all kinds It allows anyone who is interested to master techniques that lead to simpler and more efficient solutions to problems of electromagnetic scattering than are currently in use The technique is formulated in terms of the Cauchy kernel single integrals Clifford algebra and a whole field approach This is in contrast to many conventional techniques that are formulated in terms of Green s functions double integrals vector calculus and the combined field integral equation CFIE Whereas these conventional techniques lead to an implementation using the method of moments MoM the CCD technique is implemented as alternating projections onto convex sets in a Banach space The ultimate outcome is an integral formulation that lends itself to a more direct and efficient solution than conventionally is the case and applies without exception to all types of materials On any particular machine it results in either a faster solution for a given problem or the ability to solve problems of greater complexity The Clifford Cauchy Dirac technique offers very real and significant advantages in uniformity complexity speed storage stability consistency and accuracy **Understanding Geometric Algebra for Electromagnetic Theory** John W. Arthur,2011-09-13 This book aims to disseminate geometric algebra as a straightforward mathematical tool set for working with and understanding classical electromagnetic theory It s target readership is anyone who has some knowledge of electromagnetic theory predominantly ordinary scientists and engineers who use it in the course of their work or postgraduate students and senior undergraduates who are seeking to broaden their knowledge and increase their understanding of the subject It is assumed that the reader is not a mathematical specialist and is neither familiar with geometric algebra or its application to electromagnetic theory The modern approach geometric algebra is the mathematical tool set we should all have started out with and once the reader has a grasp of the subject he or she cannot fail to realize that traditional vector analysis is really awkward and even misleading by comparison Professors can request a solutions manual by email pressbooks ieee org **Numerical Calculations in Clifford Algebra** Andrew Seagar,2023-05-25 NUMERICAL CALCULATIONS IN CLIFFORD ALGEBRA An intuitive combination of the theory of Clifford algebra with numerous worked and computed examples and calculations Numerical Calculations in Clifford Algebra A Practical Guide for Engineers and Scientists is an accessible and practical introduction to Clifford algebra with comprehensive coverage of the theory and calculations The book offers many worked and computed examples at a variety of levels of complexity and over a range of different applications making extensive use of diagrams to maintain clarity The author introduces and documents the Clifford Numerical Suite developed to overcome the limitations of existing computational packages and to enable the rapid creation and deployment of sophisticated and efficient code Applications of the suite include Fourier transforms for arrays of any types of Clifford numbers and the solution of linear systems in which the coefficients are Clifford numbers of particular types

including scalars bicomplex numbers quaternions Pauli matrices and extended electromagnetic fields Readers will find A thorough introduction to Clifford algebra with a combination of theory and practical implementation in a range of engineering problems Comprehensive explorations of a variety of worked and computed examples at various levels of complexity Practical discussions of the conceptual and computational tools for solving common engineering problems Detailed documentation on the deployment and application of the Clifford Numerical Suite Perfect for engineers researchers and academics with an interest in Clifford algebra Numerical Calculations in Clifford Algebra A Practical Guide for Engineers and Scientists will particularly benefit professionals in the areas of antenna design digital image processing theoretical physics and geometry **Spectral Geometry and Inverse Scattering Theory** Huaian Diao,Hongyu Liu,2023-09-29 Inverse scattering problems are a vital subject for both theoretical and experimental studies and remain an active field of research in applied mathematics This book provides a detailed presentation of typical setup of inverse scattering problems for time harmonic acoustic electromagnetic and elastic waves Moreover it provides systematical and in depth discussion on an important class of geometrical inverse scattering problems where the inverse problem aims at recovering the shape and location of a scatterer independent of its medium properties Readers of this book will be exposed to a unified framework for analyzing a variety of geometrical inverse scattering problems from a spectral geometric perspective This book contains both overviews of classical results and update to date information on latest developments from both a practical and theoretical point of view It can be used as an advanced graduate textbook in universities or as a reference source for researchers in acquiring the state of the art results in inverse scattering theory and their potential applications *The Cell Method* Elena Ferretti,2014-02-02 The Cell Method CM is a computational tool that maintains critical multidimensional attributes of physical phenomena in analysis This information is neglected in the differential formulations of the classical approaches of finite element boundary element finite volume and finite difference analysis often leading to numerical instabilities and spurious results This book highlights the central theoretical concepts of the CM that preserve a more accurate and precise representation of the geometric and topological features of variables for practical problem solving Important applications occur in fields such as electromagnetics electrodynamics solid mechanics and fluids CM addresses non locality in continuum mechanics an especially important circumstance in modeling heterogeneous materials Professional engineers and scientists as well as graduate students are offered A general overview of physics and its mathematical descriptions Guidance on how to build direct discrete formulations Coverage of the governing equations of the CM including nonlocality Explanations of the use of Tonti diagrams and References for further reading *Spectral Theory of Localized Resonances and Applications* Youjun Deng,Hongyu Liu,2024-03-22 This book is devoted to the spectral theory of localized resonances including surface plasmon polariton resonances atypical resonances anomalous localized resonances and interior transmission resonances Those resonance phenomena arise in different physical contexts but share similar features They form the fundamental basis

for many cutting edge technologies and applications including invisibility cloaking and super resolution imaging The book presents a systematic and comprehensive treatment on these resonance phenomena and the associated applications in a unified manner from a mathematical and spectral perspective covering acoustic electromagnetic and elastic wave scattering The book can serve as a handy reference book for researchers in this field and it can also serve as a textbook or an inspiring source for postgraduate students who are interested in entering this field **Mathematical Reviews** ,2005 **Handbook of Optics, Third Edition Volume I: Geometrical and Physical Optics, Polarized Light, Components and Instruments(set)** Michael Bass,Casimer DeCusatis,Jay M. Enoch,Vasudevan Lakshminarayanan,Guifang Li,Carolyn MacDonald,Virendra N. Mahajan,Eric Van Stryland,2009-10-06 The most comprehensive and up to date optics resource available Prepared under the auspices of the Optical Society of America the five carefully architected and cross referenced volumes of the Handbook of Optics Third Edition contain everything a student scientist or engineer requires to actively work in the field From the design of complex optical systems to world class research and development methods this definitive publication provides unparalleled access to the fundamentals of the discipline and its greatest minds Individual chapters are written by the world s most renowned experts who explain illustrate and solve the entire field of optics Each volume contains a complete chapter listing for the entire Handbook extensive chapter glossaries and a wealth of references This pioneering work offers unprecedented coverage of optics data techniques and applications Volume I covers geometrical and physical optics polarized light components and instruments *Handbook of Optics Third Edition, 5 Volume Set* Optical Society of America,2010-05-18 The most comprehensive and up to date optics resource available Prepared under the auspices of the Optical Society of America the five carefully architected and cross referenced volumes of the Handbook of Optics Third Edition contain everything a student scientist or engineer requires to actively work in the field From the design of complex optical systems to world class research and development methods this definitive publication provides unparalleled access to the fundamentals of the discipline and its greatest minds Individual chapters are written by the world s most renowned experts who explain illustrate and solve the entire field of optics Each volume contains a complete chapter listing for the entire Handbook extensive chapter glossaries and a wealth of references This pioneering work offers unprecedented coverage of optics data techniques and applications Volume I covers geometrical and physical optics polarized light components and instruments Volume II covers design fabrications testing sources detectors radiometry and photometry Volume III all in full color covers vision and vision optics Volume IV covers optical properties of materials nonlinear optics and quantum optics Volume V covers atmospheric optics modulators fiber optics and x ray and neutron optics Visit www HandbookofOpticsOnline com to search all five volumes and download a comprehensive index **Electromagnetic Scattering** Piergiorgio Uslenghi,2012-12-02 Electromagnetic Scattering is a collection of studies that aims to discuss methods state of the art applications and future research in electromagnetic scattering The book covers topics related to the

subject which includes low frequency electromagnetic scattering the uniform asymptomatic theory of electromagnetic edge diffraction analyses of problems involving high frequency diffraction and imperfect half planes and multiple scattering of waves by periodic and random distribution Also covered in this book are topics such as theories of scattering from wire grid and mesh structures the electromagnetic inverse problem computational methods for transmission of waves and developments in the use of complex singularities in the electromagnetic theory Engineers and physicists who are interested in the study developments and applications of electromagnetic scattering will find the text informative and helpful

Electromagnetic and Acoustic Scattering by Simple Shapes J. S. Asvestas,1970 The book represents an exhaustive study of the scattering properties of acoustically soft and hard bodies and of perfect conductors presented for 15 geometrically simple shapes Such shapes are important in their own right and as a basis for synthesizing the radiation and scattering properties of more complex configurations Each shape is treated in a separate chapter whose contents are presented in stylized format for easy reference Emphasis is placed on results in the form of formulae and diagrams Although no detailed derivation are included an outline of methods in scattering theory is given in the Introduction Author **Modern Electromagnetic Scattering Theory with Applications** Andrey V. Osipov,Sergei A. Tretyakov,2017-01-20 This self contained book gives fundamental knowledge about scattering and diffraction of electromagnetic waves and fills the gap between general electromagnetic theory courses and collections of engineering formulas The book is a tutorial for advanced students learning the mathematics and physics of electromagnetic scattering and curious to know how engineering concepts and techniques relate to the foundations of electromagnetics High-order Integral Equation Methods for High-frequency Rough Surface Scattering Applications Catalin Turc,2005 *Physics Briefs* ,1993 Elements of Applied Bifurcation Theory I︠U︡riĭ Aleksandrovich Kuznet︠s︡ov,1995-06-13 A solid basis for anyone studying the dynamical systems theory providing the necessary understanding of the approaches methods results and terminology used in the modern applied mathematics literature Covering the basic topics in the field the text can be used in a course on nonlinear dynamical systems or system theory Special attention is given to efficient numerical implementations of the developed techniques illustrated by several examples from recent research papers A moderate mathematical background is assumed and whenever possible only elementary mathematical tools are used making this book suitable for advanced undergraduate or graduate students in applied mathematics as well as for researchers in other disciplines who use dynamical systems as model tools in their studies
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